SRC DOCUMENT 34

RESEARCH AND DEVELOPMENT PROJECTS RELEVANT TO THE WORK PROGRAMME OF THE SAFETY REGULATION COMMISSION

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Abstract
This document collates all EUROCONTROL safety related studies in ATM research and development which are of relevance to the Safety Regulation Commission’s (SRC) Work Programme. It focuses on all research and development safety activities collated in the 1999 to 2004 ARDEP (Analysis of Research and Development in European Programmes) campaigns.

Keywords
Research and Development, ARDEP, SRC, Work Programme

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<th>Distribution</th>
<th>Category</th>
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</thead>
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<td>(Peter STASTNY)</td>
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<th>EDITION DATE</th>
<th>REASON FOR CHANGE</th>
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### CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.5</td>
<td><strong>CONTENTS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Foreword</strong></td>
<td></td>
</tr>
<tr>
<td>F.1</td>
<td>Title Page</td>
<td>1</td>
</tr>
<tr>
<td>F.2</td>
<td>Document Characteristics</td>
<td>2</td>
</tr>
<tr>
<td>F.3</td>
<td>Document Approval</td>
<td>3</td>
</tr>
<tr>
<td>F.4</td>
<td>Document Change Record</td>
<td>4</td>
</tr>
<tr>
<td>F.5</td>
<td>Contents</td>
<td>5</td>
</tr>
<tr>
<td>F.6</td>
<td>Executive Summary</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>SRC Document 34 – Research and Development Projects Relevant to the Work Programme of the Safety Regulation Commission</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td><strong>Introduction</strong></td>
<td>8</td>
</tr>
<tr>
<td>1.1</td>
<td>Purpose</td>
<td>8</td>
</tr>
<tr>
<td>1.2</td>
<td>2005 Update – What's New?</td>
<td>8</td>
</tr>
<tr>
<td>1.3</td>
<td>Scope</td>
<td>9</td>
</tr>
<tr>
<td>1.4</td>
<td>The ARDEP Data Repository</td>
<td>10</td>
</tr>
<tr>
<td>1.5</td>
<td>Identification of Safety-Related Projects</td>
<td>11</td>
</tr>
<tr>
<td>1.6</td>
<td>Classification of Safety-Related Activities</td>
<td>12</td>
</tr>
<tr>
<td>1.7</td>
<td>Presentation of the Selected Projects</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td><strong>Results: Safety-Related R&amp;D Projects</strong></td>
<td>14</td>
</tr>
<tr>
<td>3.</td>
<td><strong>Additional Activities from Other Sources</strong></td>
<td>17</td>
</tr>
<tr>
<td>4.</td>
<td><strong>Conclusions</strong></td>
<td>19</td>
</tr>
<tr>
<td></td>
<td><strong>Appendices</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Summary of Project Selection Results</td>
<td>21</td>
</tr>
<tr>
<td>2.</td>
<td>Details of Safety-related R&amp;D Projects</td>
<td>71</td>
</tr>
<tr>
<td>3.</td>
<td>Validation Level Definitions</td>
<td>226</td>
</tr>
<tr>
<td>4.</td>
<td>Safety-Related Activities in VDR</td>
<td>227</td>
</tr>
</tbody>
</table>
F.6 EXECUTIVE SUMMARY

This document collates European safety-related studies in ATM research and development (R&D) which are of relevance to the Safety Regulation Commission’s (SRC) Work Programme.

The main source of information used was the ARDEP\(^1\) repository, as updated in early 2005. In all, of the 1406 R&D projects held in the ARDEP data repository, 682 were master projects active in the period 1999-2004. These were analysed and 145 R&D projects were found that had some identifiable relationship to safety issues.

Of these 145 projects, only 6 were found to be related to safety regulation topics, whilst 139 related to safety management topics.

The lack of projects dealing with safety regulation issues can partly be explained by the fact that the organisations participating in ARDEP are mainly ATS providers or R&D centres, whilst the ATM safety regulatory bodies have not yet established interfaces with the national ARDEP focal points, for the purpose of participating in the annual ARDEP campaigns.

The relatively large number of projects addressing safety management issues is traceable to the fact that many projects that are developing new technologies, systems or procedures include a safety assessment work package. In all, 145 projects were identified as having relationships to Safety regulatory material, especially ESARRs. Of these, 129 are associated with carrying out safety-related assessments (c.f. ESARR 4). Because these projects are dealing with future technologies, procedures and systems, there is an opportunity to monitor and, where appropriate intercept, the safety activities at an early stage in the validation lifecycle.

There are a smaller number of projects that are carrying out research directly on safety issues, e.g. 23 projects on safety methodology and 25 projects addressing other safety regulation and management topics, such as safety culture, safety metrics, etc. By identifying these projects, there is the opportunity to monitor their progress, and where appropriate collaborate with them, in the expectation that they may generate a variety of useful knowledge that can be exploited in the SRC’s work.

The table below gives the results for the linkages between R&D projects and specific ESARRs.

<table>
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<tr>
<th>ESARR</th>
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<th>No. of related projects found</th>
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<td>7</td>
</tr>
<tr>
<td>ESARR 2</td>
<td>Reporting and Assessment of Safety Occurrences in ATM</td>
<td>35</td>
</tr>
<tr>
<td>ESARR 3</td>
<td>Use of Safety Management Systems by ATM Service Providers</td>
<td>13</td>
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<td>ESARR 4</td>
<td>Risk Assessment and Mitigation in ATM</td>
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<td>Safety Regulatory Requirement for ATM Services' Personnel</td>
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<tr>
<td>ESARR 6</td>
<td>Safety Regulatory Requirement for Software in ATM Systems</td>
<td>7</td>
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</table>

\(^1\) ARDEP: Analysis of Research and Development in European Programmes
Some projects have links to more than one ESARR. It is noted that only 3 projects (DNA186, EUR230, EUR235) explicitly mention ESARRs in their descriptions. Finally, ARDEP has proven to be a useful source of information about R&D activities which relate to safety regulatory and, particularly, safety management issues. This year, the analysis has also been extended to identify the projects for which additional validation-related information is held in the Validation Data Repository (VDR).
1 INTRODUCTION

1.1 Purpose

The purpose of this document is to collate, for the EUROCONTROL Safety Regulation Commission (SRC), safety-related studies in ATM R&D which are of relevance to the SRC Work Programme.

The SRC’s objective is to be aware of initiatives which would help support the implementation of EUROCONTROL Safety Regulatory Requirements (ESARRs), in order to be in a position to access related outcomes and avoid duplication of effort. It is also the intention of the SRC to share related results across European safety regulatory bodies and this report is one part of the response to this objective.

1.2 2005 Update – What’s New?

This edition of the document has been updated to take account of the results of the ARDEP 2004 campaign that was published in September 2005.

Some changes have been made to improve the content and presentation of the material:

- The set of projects considered in the analysis has been extended to cover those that were active during a six-year period, from 1999 through 2004
- Sub-projects have been consolidated into their parent projects. This is particularly the case with the project of the European Commission which typically involve a number of partner organisations, many of which report their own sub-projects to ARDEP
- The analysis has been extended to identify the projects that are also in the Validation Data Repository (VDR). The VDR contains descriptions of the various validation exercises that have been carried out by reporting projects, together with the results of those exercises. (See Appendix 4)
- For the 2004 campaign, partly in response to the needs of the analysis presented in this document, ARDEP reorganised its classification of projects under the old Capacity, Safety and Efficiency Studies (CSES) sub-domain. This sub-domain has been split and extended, so that there is now a discrete Safety (SAF) domain and Safety Studies (SAFS) Sub-domain. This makes it simpler to identify and monitor the safety-related activities that are no longer mixed with projects dealing with capacity, efficiency and other issues.

1.3 Scope

The data collection exercise which led to the production of this report focused on all R&D safety activities of direct or indirect relevance to the SRC’s Work Programme.

This exercise was limited to analysing the contents of the ARDEP data repository as well as some related information in the VDR.

All the projects that are addressed in this document are listed in Appendix 1. The reader may find further details of these and other projects on the ARDEP website at www.eurocontrol.int/ardep.
1.4 The ARDEP Data Repository

Since 1994, organisations involved in ATM R&D within the EUROCONTROL Member States have been invited each year to provide EUROCONTROL with technical and financial data concerning the R&D projects they are undertaking. This data is collated into a central ARDEP data repository and analysed by the EUROCONTROL ARDEP team, in conjunction with the co-ordinators from the participants.

The version of the ARDEP dataset used here was the one prepared during the 2004 ARDEP campaign, which contains data on R&D projects which were "active" in 2004 and preceding years.

In 2004, ARDEP received project information directly from the following organisations:

- France: DSNA
- Germany: DFS and DLR
- Italy: ENAV and SICTA
- Netherlands: LVNL and NLR
- Spain: AENA
- Sweden: SCAA/LFV
- United Kingdom: NATS
- EUROCONTROL Agency: HQ Brussels, EEC Brétigny, CRDS Budapest, MUAC Maastricht
- European Commission: DG-TREN - Directorate-General Energy and Transport; DG-RTD - Directorate-General Research and Technological Development

It should be noted that research in the ARDEP context includes work that is directly or indirectly funded by revenues from taxpayers (national or European) or ATC route charges (national ANSP or Eurocontrol). Investments in ATM R&D by ATM Service Providers are regarded as being essentially non-commercial, whatever the actual status of the institutional structure, ownership, incorporation and governance arrangements of the organisation concerned. Privately funded research, e.g. that which is carried out at their own cost by commercial organisations and industrial companies, is not reported directly to ARDEP; indeed information about it is generally regarded as commercially sensitive and details about it are therefore generally kept confidential by the organisations concerned.

ARDEP classifies R&D projects in a number of ways, including:

- ARDEP R&D Domains and Sub-domains, which provide a stable, objective, and mainly technical, view of the subject matter of R&D from 1995 to the present.
  
  _In particular there is an ARDEP Sub-domain for Safety Studies (SAFS) that contains most of the projects that are of interest here._

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3 _The ARDEP repository contains projects from previous campaigns, stretching back to 1995, including projects reported by organisations that did not participate in 2003, notably DARA, DERA, ESA and RLD._
ATM Strategy 2000+ items, comprising operational improvements, enablers and horizontal issues.

*In particular, there is a Horizontal Issue for Safety Assessment that contains a number of projects that are of interest here.*

ACARE and its Strategic Research Agenda, versions 1 and 2.

*Although ACARE is of considerable strategic importance in setting the R&D agenda, it has not been extensively consulted in the analysis reported here.*

### 1.5 Identification of Safety-Related Projects

In order to extract the projects in the ARDEP repository that are directly related to safety issues, the following method was used:

**First pass (long-listing)**

Extract all projects that were:

- Identified in the previous edition of this report;
- Included in the SAFS sub-domain;
- Included in the Safety Assessment Horizontal Issue;
- Found using a number of specially targeted cumulative keyword searches;
- Active in 1999 or later;
- Master projects, as opposed to sub-projects.

**Second Pass (short-listing)**

- Scrutinise the description of each long-listed project to ensure it is directly safety-related
- Extract descriptions of safety-related activities and safety objectives of the projects;
- Reject long-listed projects that are not directly safety-related;
- Classify short-listed projects by Category and Topic as described in 1.5 below;
- Identify any related ESARRs.

The results of the long-listing and short-listing selection processes are summarised in Appendix 1, with traceability of rationale for inclusion/exclusion. Details of the short-listed projects are presented in Appendix 2.

### 1.6 Classification of Safety-Related Activities

**Categories**

The safety-related activities addressed in this document have been classified into two main categories:

- **Safety Regulation** is the process applied by States, within national legislative frameworks, for establishing, overseeing and enforcing minimum safety levels in the public interest. It includes rulemaking, usually in the form of safety regulatory requirements, together with a means for ensuring compliance by those subject to safety regulation (safety oversight);
Safety management is the process used by organisations providing safety related services or products to ensure that all safety aspects of that provision have been adequately addressed. The process includes the setting of organisational safety policies and standards (which meet, as a minimum, the provisions of regulatory requirements), a means for measuring safety achievement and a mechanism for the rectification of deficiencies.

Topics
In addition, each project that has been found to have a relationship with safety has been classified according to the main safety topic that it addresses:

- **Assessment of new system/procedure**: work involving safety, hazard or risk assessment of new or upgraded ATM systems and procedures.
- **Certification of ATM Systems**: work in preparation for the safety certification of new ATM technologies or systems.
- **Human Resources**: work addressing human resources or human factors aspects of ATM safety, including training.
- **Methodology Development**: work developing methodologies or tools for measuring, modelling, assessing and managing ATM safety.
- **Regulatory Mechanism**: work aimed at developing safety regulatory mechanisms, e.g. in relation to the introduction of new ATM technologies.
- **Safety Culture**: work investigating safety cultures in ATM-related contexts or organisations.
- **Safety Event Monitoring**: systems and procedures for monitoring ATM safety-related incidents, errors, system events, etc., in ATM operations.
- **Safety Management System**: work on safety management systems for ATM.
- **Safety Metrics**: work identifying, quantifying or calibrating ATM safety metrics and performance indicators, including Target Levels of Safety.
- **Safety Standards**: work relating to setting appropriate safety standards for new ATM technologies, systems or procedures.
- **Thematic Network**: a forum for exchanging information, ideas and research results on a given theme, in this case ATM safety.

1.7 Presentation of the Selected Projects
Appendix 1 presents a summary of results for each selected project while Appendix 2 presents details of the short-listed projects according to a consistent template format that has two sections per project:

**Appendix 1: first section and Appendix 2 second section**

**Safety related projects selection criteria**
In this section, the results of the analysis of safety relevance are presented for each project:

- **Source of the selection**
  *This is represented by check boxes for each of the selection criteria used for long-listing: New This Year; Included in the SAFS Sub-domain, Included in the Safety Assessment Horizontal Issue*

- **VDR Link**
  *Identifies whether details of the validation exercises and results of the project have been entered into VDR.*
Keyword Hits
These are the sets of keywords and keyword combinations that produced 'hits' during the cumulative keyword searches.

Links to ESARRs
These are the related ESARRs that have been identified on the basis of the project descriptions and the classification into safety Categories and Topics.

Category
See section 1.5.

Topic
See section 1.5.

Appendix 1, second section – safety-related activities
The second section of Appendix 1 extracts from the project descriptions material describing:

- Safety Activities
- Safety Objectives
- Safety Management activities

Appendix 2, first section: project details
In this section, summary details of the project have been extracted from the ARDEP repository. They include:

- Project ID and Name
- Project Start Date and Finish Date
- Project Description
  This is presented under the sub-headings: Objectives, Approach and Expected Results.
- Applicability Timeframe
  This is the estimated timeframe when the results of the R&D are likely to be used in operational ATM.
- Current and Target Validation Levels (see Appendix 3 for details).
  These are the estimated validation status of the matter under investigation at the outset of the project and when the project has been completed. This classification uses the EATM validation lifecycle steps.
- Parent project
- Sub-projects
- Sponsors
- Partners

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2. RESULTS: SAFETY-RELATED R&D PROJECTS

In all, 1,406 R&D projects held in the ARDEP data repository were analysed. Of these, a long list of 682 were master projects active in the years 1999 to 2004 (49% of all projects).

The description of each project on the ‘long list’ was then scrutinised in detail and a short list of 145 projects met one or more of the following criteria:

- Included in the last edition of this report;
- Included in the ARDEP SAFS sub-domain;
- Included in the ARDEP S2k+ Horizontal Issue for Safety;
- Identified by specific keyword search;

and were judged to be relevant in the present context. These R&D projects represent 10% of the total ARDEP repository and had some identifiable relationship to safety issues\(^5\). These were then placed on the ‘short list’ and classified by Category and Topic, as shown in Table 1 below:

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<td>Certification of ATM Systems</td>
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<td>Methodology Development</td>
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<td>Regulatory Mechanism</td>
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<td><strong>Totals</strong></td>
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<td><strong>139</strong></td>
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</table>

*Table 1: Safety Activities*

The overwhelming R&D focus is on safety management rather than safety regulation and, within that category, the ‘Assessment of New System/Procedure’ is the dominant topic, followed by ‘Methodology Development’. This is consistent with the observation that many projects include a safety assessment task as part of their overall activity to research new systems.

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\(^5\) The three most common reasons for excluding projects during the short-listing process were: if there were sub-projects of others in the list; if they had insufficient safety focus; or were too old (completed pre-1999).
Otherwise, there are a small number of projects that investigate specific safety issues, such as Safety Culture for instance.

It is noted that the information provided by ARDEP comes almost entirely from the R&D departments of the contributing organisations, not from their safety departments. It is entirely possible, therefore, that there are unreported safety regulatory studies that do not appear here. Despite the request from the SRC for organisations to report their safety activities to ARDEP, there is no evidence that this has happened during the 2004 data collection.

Table 2 below gives the results for the linkages between R&D projects and specific ESARRS.

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<th>No. of related projects found</th>
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</table>

*Table 2: Links to ESARRS*

Some projects have links to more than one ESARR.

It is noted that only 3 projects (DNA186, EUR 230, EUR235) explicitly mention ESARRs in their descriptions. This may be indicative of a low level of awareness of ESARRs in the research community.
The distribution of projects by organisation is presented in Table 3:

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Table 3: Numbers of projects by organisation by topic

It should be noted that ARDEP does not cover all safety activities carried out in Europe in the ATM domain, mainly because:

- There are only a limited number of surveyed organisations, and a limited number of States that are represented,
- The surveyed organisations are essentially ATS providers and R&D centres (no direct and systematic participation of regulatory authorities, when separate from the ATS providers),
- The scope of ARDEP is limited to R&D.

**Important note:** for this year’s analysis only master projects have been included, to avoid duplication. Those organisations that show no projects in Table 3 (e.g. AENA, SICTA) or few projects (e.g. LFV, NLR) are in fact be involved in numerous sub-projects in the various categories. For more information, see the partner lists in Appendix 2.
3. **ADDITIONAL ACTIVITIES FROM OTHER SOURCES**

At the request of the SRC, investigations were conducted on two specific activities which are not described in ARDEP. The results of these investigations have been retained below, but they have not been investigated further:

**ACTIVITY 1**

**Organisation:**
UK CAA (SRG)

**Activity Title:**
Risk-based Regulatory System for Air Traffic Management.

**Start Date / End Date:**

**General Description:**

**Objective:** To establish a framework for setting objective risk-based safety regulations and for objectively assessing claims of compliance

Phase 1 deliverable: A model for identifying and apportioning risks (April 2004).

**Background:** Air Traffic Management (ATM) systems, comprising people procedures and equipment, can potentially cause or contribute to aircraft accidents. EUROCONTROL has identified the overall target level of safety for ECAC airspace. The absence of a common, consistent and coherent method of apportioning ATM risks is posing difficulties to both provider and regulator. In conclusion, despite increased reliance on ATM systems, there is no commonly accepted formal methodology for setting individual ATM (System, subsystem and control elements) regulatory criteria by breaking down the total ECAC airspace safety target. This process requires consideration of the apportionment of the risks between the equipment, the procedures and the human factors associated with the operation of ATM services.

This project addresses these issues through the following sub objectives;

To establish a coherent methodology for:

- Establishing the risks caused by the equipment, procedures and people internal to the ATM system.
- Determining the total risk posed by an ATM service through consideration of its parts and their interactions.
- Showing how the totality of UK ATM services contributes to the ECAC target level of safety.
- Demonstrating that the predictions of risk made during design are borne out in practice.

**Safety Objective:**
To perform the groundwork on TLS apportionment in UK ATM services.

**Associated Regulation:**
ESARR 4.
ACTIVITY 2

Organisation:
LFV (Swedish CAA).

Activity Title:
Study on national safety goals in terms of maximum tolerability for ATM contribution to different kinds of occurrences.

Start Date / End Date:
1996.

General Description:
Objective: to define the outlines of the Safety Management System.

Approach:
1) Definition of Safety goals for a catastrophe, a very serious incident, a serious incident and a minor occurrence,
2) Description of the consequences of previous events,
3) Definition of methodological guidelines for Safety analysis,
4) Overview of the general approval process for equipment and methods,
5) Description of the application to be made for an Entry control,
6) Description of the principles for an evaluation process, named Entry control.

Safety Objectives:
To perform the groundwork in order to implement the Safety Management System.

Associated Regulations:
ESARR 3.
4. CONCLUSIONS

ARDEP provides a useful source of information concerning R&D activities which relate to safety regulatory and, particularly, safety management issues. Considerable programmatic information is available for each project. Details may be viewed at www.eurocontrol.int/ardep.

For those projects that have also been entered into the Validation Data Repository (VDR), further details are available at www.eurocontrol.int/eatmp/vdr about the validation exercises that have been carried out.

The analysis reported here has identified that there are a large number of ATM R&D projects that have a safety dimension, particularly in the safety assessment (ESARR 4) context. Because these projects are dealing with future technologies, procedures and systems, there is an opportunity to monitor and, where appropriate, intercept the safety activities at an early stage in the validation lifecycle.

Indeed, safety considerations should arguably be addressed right from the outset of a new research topic, something that is fully consistent with the European Operational Concept Validation Methodology (OCVM). The Joint Programme Board (JPB) of the European Commission and EUROCONTROL has ratified the use of the OCVM by all R&D projects.

There are a smaller number of projects that are carrying out research directly on safety issues, e.g. safety methodology, safety culture, etc. and by identifying them there is the opportunity for SRC to monitor their progress and where appropriate collaborate with them, in the expectation that they may generate a variety of useful knowledge that can be exploited in the SRC’s work.

However, in the majority of cases, there is no explicit reference to ESARRs in the project descriptions. This leads to a concern about awareness in the R&D community regarding safety initiatives in general and ESARRs in particular. There is scope for an action to test, and if necessary address, the level of awareness among researchers. Until the awareness can be raised and explicit responses are made to address ESARRs at the R&D stage, it is difficult to gauge the extent of overlaps in the work that is taking place. Having said that, the amount of R&D activities which appear to be related to ESARR 4 suggest that it is implicitly well covered and it is quite possible that there are overlaps in that coverage.

Regarding the other ESARRs, in particular ESARRs 1 and 5, it has to be considered whether they in fact fall outside the normal remit of ATM R&D for the organisations that contribute to ARDEP.

However, the SRC has expressed a requirement for its Member States to report their safety activities to ARDEP\(^6\). A presentation was made by SRU to the ARDEP ISN\(^7\) Co-ordinators on 26 October 2004 to increase their awareness of the SRC’s requirement and encourage them to co-ordinate with their colleagues working in the safety domain. However, the mechanisms to achieve this were evidently still not in place by the end of the 2004 ARDEP campaign, so the available data was limited to the more traditional R&D activities. Additional follow-up by SRC may be needed directly with the relevant States’ safety organisations.

\(^6\) At the 15th meeting of the SRC on 24-25 September 2002 the SRC asked Eurocontrol SRC Commissioners to transmit through national ARDEP focal points all the data concerning the safety related projects that are carried out by national ATM Safety Regulatory bodies. SRU was asked to identify the ARDEP projects of direct relevance to ATM safety and to the SRC Work Programme and report the findings at SRC17.

\(^7\) ISN stands for Information Support Network and comprises the group of co-ordinators who represent each of the ARDEP contributing organisations.
It is noted that only the Member States and organisations that have significant ATM R&D activities are currently participants in ARDEP. There may consequently be additional States and safety organisations that are active in safety matters, which would need to become participants in ARDEP, something which they are welcome to apply to do.
## Appendix 1: Summary of Results

### CEC046: MFLAME - Multifunction Future Laser Atmospheric Measurement Equipment

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<td>hazard, certification AND safety</td>
<td>Safety Management</td>
<td>Assessment of new system/procedure</td>
<td>Implicitly related to ESARR 4</td>
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**Safety Activities**

To investigate operational aspects such as integration into the avionics system, certification issues and links with Air Traffic Management of systems for wake vortex detection, dry windshear predictive detection, and to assess the predictive detection capabilities in areas such as clear air turbulence, volcanic ash, gust alleviation, mountain rotors and dry hail.

**Safety Objective**

Detection of atmospheric hazards for aircraft in flight

**Safety Mgt. Activities**

Development and demonstration of the core technologies and techniques

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### CEC054: MANTEA - MANagement of surface Traffic in European Airports

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<td>regulation AND safety</td>
<td>Safety Management</td>
<td>Assessment of new system/procedure</td>
<td>Implicitly related to ESARR 4</td>
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**Safety Activities**

The objective of the MANTEA project is to develop decision support tools for improving surface traffic management in airports. In the safety domain, the introduction of better conflict detection represents an important advance. Detection and resolution of runway incursion will be a priority in part I of MANTEA.

**Safety Objective**

Better conflict detection. Detection and resolution of runway incursion.

**Safety Mgt. Activities**

Two independent demonstrators will be built, to show the complete process of arriving at decisions. They will be validated with real-life examples drawn from current situations at Schipol, Aeroports de Paris and Milan.

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### CEC056: TELSACS - TELematics for SAfety Critical Systems

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<td>Safety Management</td>
<td>Safety Standards</td>
<td>Implicitly related to ESARR 4</td>
<td>Quite old but relevant</td>
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</table>

**Safety Activities**

The research in this project addresses the airspace users needs for safety in Europe's crowded skies by examining the shortcomings in current technology with its non-cooperative collision-avoidance systems and sensors and ground-based, short-term conflict alerting systems. It will demonstrate a new high-integrity ATM environment, characterized by co-operative ACAS and STCA systems and improved precision navigation, on an experimental platform.

**Safety Objective**

Define recommendations for standards of safety systems - ACAS and STCA
### CEC069: PROCTOR - PROtotyping and validation exercise with evaluation of Concepts TO meet the user Requirements

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<td>risk AND safety, validation AND safety</td>
<td>Safety Management</td>
<td>Methodology development</td>
<td>Implicitly related to ESARR 4</td>
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**Safety Activities**

A prototyping and concept validation exercise suitable for the validation of concepts and to develop a validation methodology suitable for the validation of concepts at sub-system level for a chosen satellite application. To achieve these aims, the participants will take advantage of existing material relating to functional concepts, validation methodologies, user requirements and the determination of ATM system safety, capacity and efficiency.

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<td>validation AND safety</td>
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<td>Implicitly related to ESARR 4</td>
<td>Marginally relevant and fairly old, see also later work in this field.</td>
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**Safety Objective**

The main aims of this work are to define a prototyping and concept validation exercise suitable for the validation of concepts and to develop a validation methodology suitable for the validation of concepts at sub-system level.

**Safety Mgt. Activities**

Methodology development and testing.

### CEC071: DADI: Data linking of Aircraft Derived Information

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**Safety Activities**

The work includes safety assessment of datalinking of aircraft derived information.

### CEC072: FARAWAY II: Fusion of ADS and RAdar Data through two-WAY data link

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**Safety Activities**

Secure interoperability of FarAway and NEAN systems and Flight Management functions through the constitution of a pre-operational scenario adopting compatible technologies

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<td>certification</td>
<td>Safety Management</td>
<td>Certification of ATM Systems</td>
<td>Providing inputs to on-going standardization and certification initiatives</td>
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**Safety Objective**

Develop a set of advanced Validation Tools as part of a certification as safe for use process

**Safety Mgt. Activities**

Providing inputs to on-going standardization and certification initiatives
<table>
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<tr>
<th>CEC075: ARIBA - ATM system safety criticality Raises Issues in Balancing Actors responsibility</th>
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**Safety Activities**
ARIBA will keep things practical by focusing its attention around the following major technological ATM enhancements:
- space-based navigation and surveillance,
- advanced ATC automation support tools,
- flight plan exchange through air/ground data link.
For each of those enhancements two distinct but inter-related issues need to be solved prior to operational introduction: system safety validation and arrangement of responsibilities.

**Safety Objective**
The aim of ARIBA is to develop a cost-effective and practical way out of the paradox in human responsibility increasing with traffic volume versus controllers’ distrust of automation.

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<th>CEC087: EMERTA - EMERging Technologies opportunities, issues and impact on ATM</th>
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**Safety Activities**
Safety study of NGSS and ADS-B/ASAS technologies

**Safety Objective**
To investigate the opportunities, benefits and issues offered by selected emerging technologies to meet the safety-dominated requirements of the European Air Traffic Management (EATMS).

**Safety Mgt. Activities**
The safety study for both technology strands will utilize the NLR (National Aerospace Laboratory) TOPAZ tool.

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<th>CEC090: ISAWARE - Increasing Safety Through Collision Avoidance Warnings Integration</th>
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**Safety Activities**
ISAWARE is aimed at defining human-machine interface which merges data from the following safety systems:
- ACAS;
- GPWS;
- weather and windshear radar;
- radar and infrared radar;
- FMS;
- uplinked messages from the ATN and from the SMGCS.

**Safety Objective**
The project will focus on the improvement of the flight safety on all phases of the flight, from gate to gate.

**Safety Mgt. Activities**
Flight safety assessment
CEC096: ASTER: Aviation Safety Targets for Effective Regulation

Safety Activities

In order to evaluate the cost-benefit aspect of projects aimed at safety improvements, the Target Level of Safety is investigated in order to have the best cost/safety benefit.

Safety Objective

An overview of strength and weaknesses of current methods for CBA in air transport safety.

Cost taxonomies, which include generic cost levels for direct and indirect effects of unsafety and the cost of implementation of safety measures.

A methodology for predicting benefits from safety enhancing measures.

An assessment of the current distribution of safety levels and safety targets and proposal for a more cost-effective distribution.

CEC099: GALA: Galileo overall architecture definition

Safety Activities

Assessment of the GALILEO architecture

Safety Objective

Safety validation of the GALILEO architecture.

Safety Mgt. Activities

RAM and safety analyses

CEC103: DADI-2: Datalinking of Aircraft Derived Information 2

Safety Activities

The main objective of the project is to pave the road for future deployment of ATM services in relation to DAP. The benefits of related services are several and will be quantified further in the context of En-route and Approach phases of flight.

Safety Objective

The data-link technologies allow today redundancy of the Air/ground related functions. To define how they will interact and co-operate for the purpose of safety is amongst the objectives of DADI-2. Various communication means will be addressed (ATN, Mode-S specific services, ACARS, VDL-4/STDMA) in terms of performance and safety, against the requirements identified in the operational concept associated with each tool.
### CEC105: AFAS: Aircraft in the Future ATM System

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<td>Assessment of new system/procedure</td>
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**Safety Activities**

High level safety assessment of the avionics package meeting upcoming CNS 2005 functionalities. The result of this project will be a validated CNS avionics package ready for certification process, and an assessment of the impact of future requirements on current airborne systems that will help airframe manufacturers to integrate these systems in the cockpit, as well airworthiness authorities in charge of certifying CNS systems and aircraft.

### CEC106: MA-AFAS - More Autonomous Aircraft in the Future ATM System

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**Safety Activities**

The following will be specifically addressed:
- validation of GNSS (with ground- and space-based augmentation) procedures for approach using 4D flight path control;
- evaluation of airborne 4D flight path generation for integration with ground-based flight path planning;
- validation of ADS-B (using VDL Mode 4) with airborne display of traffic (CDTI) and separation assurance algorithms;
- integration of airborne taxiway map and data-linked clearances;
- evaluation of flight deck HMI improvements to support 4D flight path generation and monitoring in a more autonomous environment;
- integration of the full ATN stack/VDL mode 2 in the airborne environment to support AOC and ATC communications using ODIAc defined standards.

**Safety Objective**

Establishment of a safe strategy for implementation

**Safety Mgt. Activities**

Operational Support will be used to identify the steps required to transition from the trials demonstration of the avionics package to in-service pre-operational validation, by providing cost benefit analysis, operational procedures, new and modified standards, and implementation, exploitation and certification plans.
### CEC107: S-Wake - Assessment of Wake Vortex Safety

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**Safety Activities**

Development of a probabilistic safety assessment method. Gathering of a large amount of flight recording data of aircraft at approach and landing to compare the results with actual wake vortex incidents (to be consistent with ESARR 2 definitions) data.

**Safety Objective**

Safety Assessment (of the hazard 'wake turbulence that can lead to loss of control').

### CEC110: THEATRE - Thematic Network on Air Transport for ATM Validation Activities

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**Safety Activities**

Creation of a pool of European validation experts providing co-ordination and consultation between the policy makers and air transport stakeholders on 3 different areas (one is named 'Validation and Safety').

**Safety Objective**

Exchanges on validation field between validation experts and policy makers (one area concerns 'Validation and Safety').

### CEC111: THENA - THEmatic Network on Airport Activities

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**Safety Activities**

Creation of a co-ordination and collaboration environment for airport activities, dividing the work into 6 different relevant area, according to group members experience and expertise: 'Safety' and 'Policy and regulation' were 2 of the 6 area. Expected result is an airport state of the art repository on each thematic network.

**Safety Objective**

Co-ordination of airborne activities.
### CEC113: INTENT- the Transition towards Global Air and Ground Collaboration in Traffic Separation Assurance

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**Safety Activities**
The main project output will consist of quantified results from the compressed-time simulations, translated into INTENT’s main deliverable, a technology roadmap for airborne and ground based equipment to increase airspace capacity. A second major result of the project would be a research method using compressed-time simulations with modelled human characteristics.

**Safety Objective**
To answer INTENT’s research question “how does the level of aircraft intent information, shared among ATM users and actors, relate to the air traffic system capacity, the avionics system design and ATM system design?”

**Safety Mgt. Activities**
Compressed-time simulations will include air traffic controller characteristics and pilot characteristics derived from real-time human-in-the-loop part task simulations. The compressed-time simulations will collect data on workload, safety, efficiency and capacity metrics, new to be developed during the INTENT project.

### CEC115: MFF - Mediterranean Free Flight

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**Safety Activities**
A safety case is in construction concerning MFF activities following ED 78-A methodology. The OSED has been defined and the OHA phase is initiated. This safety case will be achieved by the ASOR step.

**Safety Objective**
Safety assessment (ED 78-A).

**Safety Mgt. Activities**

### CEC117: ADS-MEDUP - ADS Mediterranean Upgrade Programme

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**Safety Activities**
Feasibility verification of capacity increase and flexibility of access to air space, for the Mediterranean homogeneous area, by large scale deployment of VDL Mode 4 infrastructure for ADS-B and D/L communication applications.

**Safety Objective**
Assure safety of planned datalink applications.

**Safety Mgt. Activities**
Survey of institutional and safety issues. Large scale pre-operational experimentation in shadow mode ATC Centres using a small number of equipped a/c.
| CEC118: APPROVE - Advanced airport aProach PROc edures including Validation and Elaboration |
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| ✓ | ☐ | ☐ | ☑ | airworthiness | Safety Management | Assessment of new system/procedure | Implicitly related to ESARR 4 |

**Safety Activities**

No detail is provided about the safety assessment that was performed.

| CEC121: SOURDINE II - Study of Optimisation procedURes for Decreasing the Impact of NoisE around airports II |
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| ☐ | ☐ | ☐ | ☐ | validation AND safety | Safety Management | Assessment of new system/procedure | Implicitly related to ESARR 4 |

**Safety Activities**

A solution to noise reduction around an airport is the definition of new approach and departures procedures. The SOURDINE II project is proposing to develop enabling technologies, tools and methods to ensure the safe, efficient and economic operation of new noise abatement procedures.

| CEC122: Benchmarking for best practises in ATM (European Community) |
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| ☐ | ☐ | ☐ | ☐ | | Safety Regulation | Safety Metrics | Implicitly related to ESARR 2 |

**Safety Activities**

identification of benchmarks and best practices and requirements for continued assessment

| CEC126: Benchmarking for best practices in ATM (EU candidate countries) |
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| Included in SAFS Subdomain | Included in Safety HI | New in current year | Details in VDR | Keyword Hits | Category | Topic | Links to ESARRs |
| ✓ | ☐ | ☐ | ☐ | | Safety Regulation | Safety Metrics | Implicitly related to ESARR 2 |

**Safety Activities**

assessment of key practices and identification of key indicators of performance
CEC127: GIFT - GNSS Inertial Future landing Techniques

**Safety Activities**

WP2 is dedicated to system studies: performance criteria for certification will be reviewed, in order to allocate requirements applicable to navigation (positioning) parameters for Cat1 autoland, and for Cat2/Cat3 precision approach and landings. Starting from existing architectures on AIRBUS aircraft, one will analyse how they would have to be modified, within the frame of a positioning and guidance system no more based on one single sensor (typically ILS), but combining different sensors (hybridisation concept).

**Safety Objective**

This architecture study will be safety oriented, and will conclude by allocating requirements (accuracy, integrity, safety) to the navigation subsystem components.

**Safety Mgt. Activities**

A detailed safety analysis will then refine these objectives on the different system components.

CEC128: ISAWARE II - Increasing Safety Through Collision Avoidance Warnings Integration II

**Safety Activities**

ISAWARE II is a major contribution to solve the issue of improving both safety and efficiency of flight operations. It consists of a new and unique way to present to the pilots terrain, surrounding traffic, weather and airport information consistent with their natural perception.

**Safety Objective**

ISAWARE II project is aimed at improving the safety level as referenced for 2010, by bringing down the current CFIT related Approach-and-Landing Accident rate for civil transport aircraft with about 5% per year.

**Safety Mgt. Activities**

Technical innovations will be developed and evaluated by airline pilots on flight simulators during ISAWARE II on a fixed base flight simulator with test pilots to have a first evaluation of the work and to test the various HMI and other system options available. Finally, the mock-up will be installed on a moving base flight simulator to be evaluated by airline crews.

CEC129: I-WAKE: Instrumentation Systems for On-board Wake Vortex and Other Hazards Detection Warning and Avoidance

**Safety Activities**

Overall objective is to improve air transport operational capacity and safety by developing on-board integration of a system for remote detection, warning and avoidance of wake-vortices and other atmospheric hazards (dry wind-shear, clear air turbulence, volcanic ashes). In this way, the required level of safety can be guaranteed during approaches with reduced separation distances or behind a very large transport aircraft without the need to apply extended separation, while autonomously flown by the pilot.

**Safety Objective**

WP 1000 "System Definition" is dedicated to define the airborne I-WAKE system and its integration in aircraft, including system safety and benefits assessment.
### CEC130: C-WAKE: Wake Vortex Characterisation and Control

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**Safety Activities**

No direct safety activities but C-Wake results are intended to contribute to flight safety.

**Safety Objective**

Safety Prediction.

**Safety Mgt. Activities**


### CEC131: SHINE - Smart Hybrid Integrated Navigation Equipment

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**Safety Activities**

The project aims to define, manufacture and test in flight an airborne prototype equipment based on this new concept, to assess what performance can be achieved. The project also aims to define the future product, with preliminary safety, certification analysis and analysis of user requirements.

**Safety Objective**

**Safety Mgt. Activities**


### CEC132: ASAS TN: ASAS Thematic Network

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**Safety Activities**

The main goal of the ASAS Thematic Network (ASAS-TN) is to accelerate the implementation of ASAS applications in the European Airspace taking global applicability in order to increase airspace capacity and safety.

**Safety Objective**

To develop guidelines and recommendations for standardisation, certification and implementation of ASAS applications.

**Safety Mgt. Activities**

The main project objective is to ease the transfer and comparison of information and results on ASAS research in order to improve the research strategy, in particular thanks to the production of recommendations.
This project is aimed at studying the operational, institutional and economic issues of adopting the fully-fledged GNSS (consisting of GPS, Galileo and their augmentations) as the sole navigation service provided to civil aviation in Europe. This study calls for investigations to be conducted in two key areas: the cost-benefit assessment of the GNSS Sole Service strategy, and the safety issues that could be raised by that notion of sole service.

Safety Activities

Safety Objective

Safety Management Assessment of new system/procedure

Safety Issues

The main safety related activity of the project is to quantify and evaluate possible safety improvements (tactical and strategic benefits) when using the platform.

Safety Improvement assessment.

Safety Management Assessment of new system/procedure

Safety Issues

Implicitly related to ESARR 4
CEC136: HYBRIDGE - Distributed Control and Stochastic Analysis of Hybrid Systems

**Safety Activities**

The HYBRIDGE project builds the necessary bridge between control theory and stochastic analysis of hybrid systems on one hand and the design of real-time distributed control systems for safety critical operations on the other hand, and demonstrates this for advanced design of air traffic management.

**Safety Objective**

To lay the foundations for a systems theory for safety critical complex uncertain systems

**Safety Mgt. Activities**

Implicitly related to ESARR 2 and ESARR 4

CEC137: OPTIMAL - Optimised Procedures and Techniques for IMprovement of Approach and Landing

**Safety Activities**

The work to be conducted during the 4-year project is ranging from the elaboration of the operational concept up to simulations and pre-operational flight trials implying effective modifications of avionics onboard aircraft and rotorcraft and ground systems. On the ground side system special attention will be placed on the new tools which will be necessary for Air Traffic Controller to efficiently and safely manage the OPTIMAL procedures. The goal is to minimise external aircraft/rotorcraft noise nuisance and increase the ATM capacity while maintaining and even improving safety.

**Safety Objective**

Safety improvement achievement will be enabled by new precision approach landing aids (MLS, SBAS, GBAS), more accurate navigation means (RNP 0.1) and enhanced airborne system, such as FLS, for Non-Precision Approaches

**Safety Mgt. Activities**

1. Validation of innovative approach and landing procedures, 2. Validation of modifications of airborne and ground systems
## CEC138: IFATS: Innovative Future Air Transport System

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### Safety Activities

IFATS proposes a revolutionary concept for a future air transportation system by adding as much onboard autonomy to the aircraft as necessary to fulfill the overall requirements of improved efficiency and safety of air transportation.

### Safety Objective

- to determine the minimum requirements and functionality of the on-board system, to ensure safe operation in the case of communication loss with the ground control system;
- to perform safety analysis of the IFATS concepts and provide guidelines to certification issues

### Safety Mgt. Activities

## CEC142: EMMA - European airport Movement Management by A-SMGCS

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### Safety Activities

Airports have been identified as the future bottlenecks of air transport. The A-SMGCS project EMMA aims to become the most significant R&D contribution to solve this problem by maturing and validating the A-SMGCS concept as an integrated air-ground system, seamlessly embedded in the overall ATM system.

### Safety Objective

- common safety requirements

### Safety Mgt. Activities

Validation of operations

Guidelines and recommendations to common technical and operational system performance, safety requirements, certification aspects, and procedures for the transition phase

## CEC143: CAATS - Co-operative Approach to Air Traffic Services

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### Safety Activities

The objective of the proposed Cooperative Approach to Air Traffic Services (CAATS) coordination action is to manage, consolidate and disseminate the knowledge produced in the European Commission’s FP6 ATM-related projects. The focus will be in three areas: the knowledge produced in the areas of safety, human factors and validation.

### Safety Objective

Best practice manuals will be produced in the areas of safety, human factors and validation
### CEC146: B-VHF: Broadband VHF Aeronautical Communication Systems based on MC-CDMA

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**Safety Activities**

B-VHF is neither another VDL mode nor a new flavour of CDMA, but a highly innovative, high capacity communication system based on MC-CDMA, a modern communications technology also discussed for fourth generation (4G) mobile communications systems. MC-CDMA exploits the mobile aeronautical channel better than any known broadband VHF alternative. It increases the voice and data capacity and addresses security and safety issues with a service level unknown to the aeronautics users today.

### CEC151: SEAP - large Scale European ADS Pre-implementation programme

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**Safety Activities**

Equip a high number of aircraft with ADS-B avionics, which will be completely certified following conventional procedures and involving the Industry and national-international standardisation organisations.

**Safety Objective**

Prove, on a large scale basis, ADS-B/C services which are likely to provide the biggest benefits in terms of costs, safety and capacity, and validate the system in terms of performance and benefits.

Clear validation objectives as well as a Validation Plan will be defined.

### DFS032: NESS - New SID's, STAR's

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**Safety Activities**

Adapt the currently existing approach and departure procedures to the technical possibilities of FMS. Optimise Arrival and Departure Procedures using airborne flight management systems.

**Safety Objective**

Improved flight safety (cockpit workload reduction; improved situational awareness)
### DFS042: WVWS - Wake Vortex Warning System

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**Safety Activities**

Risk analysis performed in 1995-1996 and recommendation of a procedure based on the hazard (due to the vortex) prediction.

**Safety Objective**

**Safety Mgt. Activities**

Risk analysis (this risk analysis has been the initiation of the project finished).

### DFS046: HALS - Phase I

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**Safety Activities**

The High Approach Landing System (HALS) is part of the capacity enhancement program of Frankfurt Airport

**Safety Objective**

The effect is the reduction of wake vortex hazards which gives the opportunity to enhance capacity by reducing the separation between aircraft.

**Safety Mgt. Activities**

To ensure safety of the new procedures a safety assessment is conducted.

### DFS058: EGNOS Pre-Operational Data Gathering to Support Multi-Modal SBAS Certification and Other Related Issues

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**Safety Activities**

SBAS evaluation with EGNOS

**Safety Objective**

1) Develop and validate operational procedures using satellite based navigation signals and associated augmentation for multi-modal applications;

2) consider the best configuration to support multi-modal applications;

3) availability of results to international organisations such as ICAO and IMO, to help generate the required international standards for system and procedural operations.

**Safety Mgt. Activities**

Preliminary risk assessment, mitigation and backup procedures
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<th><strong>DFS064: Kooperatives ATM (LUFO III)</strong></th>
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<td>KATM will investigate safety aspects in the context of safety nets distributed between aircraft and ground</td>
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<td>May be too old now, but otherwise relevant.</td>
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<td><strong>Safety Activities</strong></td>
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<td>Implementation of reduced vertical separation above FL290.</td>
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<th><strong>DLR029: MOSES: More Operational flight-Safety by Enhanced Situation awareness</strong></th>
<th><strong>Category</strong></th>
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<th><strong>Links to ESARRs</strong></th>
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<td>Published study, containing Safety critical scenarios development and pilots behaviour measurements in Safety critical scenarios.</td>
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<td>Safety Management</td>
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**Links to ESARRs**
- Implicitly related to ESARR 2, ESARR 4, and ESARR 5.
| DLR031: ADVISE-PRO: Advanced Visual System for Situation Awareness Enhancement - Prototype |
|---|---|---|---|---|---|---|---|
| Included in SAFS Subdomain | Included in Safety HI | New in current year | Details in VDR | Keyword Hits | Category | Topic | Links to ESARRs | Comment |
| ☐ | ☑ | ☐ | ☐ | flight safety | Safety Management | Assessment of new system/procedure | Implicitly related to ESARR 4 | No explicit safety focus but a strong implicit safety context |

**Safety Activities**
Adverse weather conditions affect flight safety as well as efficiency of airport operations. The problem becomes evident in critical flight phases such as approach, landing, take-off, and taxiing so that the nominal airport capacity has to be reduced during low visibility conditions due to safety concerns. Hence, a lot of research work is done to overcome these problems by improving pilot’s visual perception. The design and development of a complete ESV-system is within the scope of this project.

**Safety Objective**

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| DNA011: ACAS (Airborne Collision Avoidance Systems) impact on ATC |
|---|---|---|---|---|---|---|---|
| Included in SAFS Subdomain | Included in Safety HI | New in current year | Details in VDR | Keyword Hits | Category | Topic | Links to ESARRs | Comment |
| ☐ | ☐ | ☐ | ☐ | risk AND safety, flight safety | Safety Management | Assessment of new system/procedure | Implicitly related to ESARR 4 | |

**Safety Activities**
The objective of the project is to evaluate the impact of ACAS on the present and future ground ATC system so as to allow a seamless integration of ACAS. International standardisation of ACAS by ICAO as well as the definition of technical standards (RTCA MOPS) for TCAS is considered.

**Safety Objective**
The objective is to improve flight safety.

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| DLR032: Human Centered Automation |
|---|---|---|---|---|---|---|---|
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| ☐ | ☑ | ☐ | ☐ | ☐ | Safety Management | Assessment of new system/procedure | Implicitly related to ESARR 4 | No explicit safety focus but a strong implicit safety context |

**Safety Activities**
Human Factors research for application in ATM and Flight Guidance, in order to provide consulting and methods for Human / Machine Interface design and evaluation. Support the development of automated pilot and controller assistance tools, conduct validation exercises in Real Time Simulations, Field Tests and In-Flight Demonstrations.

**Safety Objective**

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**Safety Mgt. Activities**

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| DNA011: ACAS (Airborne Collision Avoidance Systems) impact on ATC |
|---|---|---|---|---|---|---|---|
| Included in SAFS Subdomain | Included in Safety HI | New in current year | Details in VDR | Keyword Hits | Category | Topic | Links to ESARRs | Comment |
| ☐ | ☐ | ☐ | ☐ | ☐ | Safety Management | Assessment of new system/procedure | Implicitly related to ESARR 4 | |

**Safety Activities**
The objective of the project is to evaluate the impact of ACAS on the present and future ground ATC system so as to allow a seamless integration of ACAS. International standardisation of ACAS by ICAO as well as the definition of technical standards (RTCA MOPS) for TCAS is considered.

**Safety Objective**
The objective is to improve flight safety.

**Safety Mgt. Activities**
Evaluation reports on TCAS II events reported in France by pilots and controllers and evaluate the impact of ACAS on the present and future ground ATC system so as to allow a seamless integration of ACAS.
DNA043: Global Dependability Analysis

Studies have been conducted on the certification of ground systems, human reliability, software reliability and dependability of Human/Machines Interface (HMI) in order to define new generic approaches and methodologies suitable for this domain. Guidance material has been issued.

DNA044: Dependability of ATC Systems

The aim of ATC is to handle traffic in a safe and efficient way. Since the systems operate 24 hours per day, reliability and availability are of great importance to minimise the risk of collision and maximise the capacity of ACC's. Systems concerned by these studies are, for instance:
- ODS-France (operational display system including LAN)
- Voice and Communication Switching system,
- Data-Link application,
- Controller Assistance tools (ERATO),
- ARTAS,
- eFDP (European flight plan data processing).

DNA066: Human Factors in ATM

Interesting: understanding of the safety culture in air navigation services and of the role of the procedures in the Safety.
### DNA086: ECAC RVSM: Implementation of the Reduced Vertical Separation Minima within ECAC airspace

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**Safety Activities**
- Develop implementation scenarios
- Develop and refine ATC and ASM operational procedures
- Ensure that automated ATM systems and ACAS software is modified to accommodate RVSM

**Safety Objective**

**Safety Mgt. Activities**
- RVSM safety assessment.

### DNA091: Wake Vortex

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<td>Implicitly related to ESARR 4</td>
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**Safety Activities**
- Development of a tool allowing to apply the correct separation minima in accordance with the current and the near term wind conditions, allowing to increase the arrival safety.

**Safety Objective**

**Safety Mgt. Activities**
- The aim of this study is to define one system and some ATC procedures in order to optimise the separations between aircrafts but also to increase the safety.

### DNA130: Mode S Station Industrialisation - POEMS

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**Safety Activities**
- Safety aspects for the POEMS development are ensured by a STNA expert. Participation to standardisation groups or to EATMP working structure.

**Safety Objective**

**Safety Mgt. Activities**
- Safety Assessment.
### DNA152: Safety and Human factors

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<td>Safety Management</td>
<td>Methodology development</td>
<td>Implicitly related to ESARR 2</td>
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**Safety Activities**

Enhancement of the human factors integration into safety roles. They propose a 'modelling of error management processes and taxonomy of incidents (ESARR 2)' and to define 'incident analysis method and grid (ESARR 4)'.

**Safety Objective**

Metrics construction.

**Safety Mgt. Activities**

Reinforce the positive human role on safety: as stated in most high risk situations analysis, one of the most promising line of actions to manage safety is to implement an efficient experience feedback process. We need new concepts to assess error managements in ATM and to extract a taxonomy of incidents, and we need to build up confidence among the different actors so that everyone feels concerned with safety issues.

### DNA163: Link2000+ France (ex-EOLIA CAUTRA INTEGRATION)

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<td>Implicitly related to ESARR 4</td>
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**Safety Activities**

Safety assessment (functional architecture level) of the integration of data-link server and of the modification of ODS France HMI and of STPV following data-link services (identified in the Eurocontrol program "Link 2000+") integration.

**Safety Objective**

The aim is to generate all activities (testing, training, hazard analysis) that will ensure the correct and safe operation of these three systems.

**Safety Mgt. Activities**

Safety Assessment.

### DNA168: SDF CNS/ATM Safety Analysis linked to the implementation of CNS/ATM technologies

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<td>Declared as in close co-ordination with certification authorities (SFACt, JAA, EASA, SRC) and manufacturers will enable to ease the introduction of these concepts by gaining certification credit and be sure industrial developments could be used.</td>
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**Safety Activities**

A STNA methodological guide for conducting safety analyses linked with the development of CNS/ATM technologies has been produced, dealing mainly with ground applications aspects and taking into account the constraints led by aircraft certification and future air-ground services certification.

**Safety Objective**

Conduct safety analyses. A close coordination with certification authorities (SFACt, JAA, EASA, SRC) and manufacturers will enable to ease the introduction of these concepts by gaining certification credit and be sure industrial developments could be used.

**Safety Mgt. Activities**

A methodological guide for conducting safety analyses linked with the development of CNS/ATM technologies.
### DNA185: MEFISTO - Modeling, Evaluating and Formalising Interactive System using Tasks and interaction Object

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<td>Methodology development</td>
<td>Implicitly related to ESARR 4</td>
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**Safety Activities**
Le projet MEFISTO est un projet européen (DGIII) dont le but est de déterminer une méthode de spécifications formelles d'interface d'application critique sur le plan de la sécurité et de développer un ensemble d'outils permettant de vérifier a priori les performances de l'IHM spécifiée.

**Safety Objective**
Déterminer une méthode de spécifications formelles d'interface d'application critique sur le plan de la sécurité

**Safty Mgt. Activities**
Une méthode de spécifications formelles d'interface d'application critique sur le plan de la sécurité et de développer un ensemble d'outils permettant de vérifier a priori les performances de l'IHM spécifiée.

### DNA186: Safety studies guide

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<td>ESARR, safety case, safety manag</td>
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<td>Declared as related to ESARR 3, implicitly related to ESARR 4.</td>
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**Safety Activities**
In order to make the different entities of the French ATS providers (DNA, STNA, SCTA) and its partner ADP (Aéroports de Paris) take into account Safety in the very earliest stages of their studies, several documents have been produced: a report describing conformance of Safety Management System to ESARR 3; first versions of guidance Materials for STNA and SCTA; dependability studies and Safety cases performed on the most critical systems.

**Safety Objective**
To modify or to put into service ATC systems safely

**Safty Mgt. Activities**
This activity provides a support in describing or performing the safety studies required to develop, implement or modify safely ATC systems.

### DNA189: GNSS studies

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**Safety Activities**
Realisation of a Safety Case for Non precision approach.

**Safety Objective**

**Safty Mgt. Activities**
Safety cases
### DNA244: MSAW: Minimum Safe Altitude Warning, STCA: Short Term Conflict Alert

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#### Safety Activities

The MSAW function allows to prevent accidents of a CFIT type (Controlled Flight Into Terrain). The STCA function allows to prevent collisions and losses in separation between aircraft.

#### Safety Objective

The objective of the study is to assign to the safety net a function of resolution in order to propose a strategy of avoidance, as TCAS orders resolutions to the pilot.

### ENA011: MEFISTO - Modeling, Evaluating and Formalising Interactive System using Tasks and interaction Object - LTR 24963

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#### Safety Activities

Objective of this contract is to capture usability and safety requirements for ATC applications and to show that it is possible to check their satisfaction at both formal specification and implementation level.

#### Safety Objective

To develop a method, and related tools, which allows designers to apply formal methods in order to perform usability and safety evaluation over the formal specification of the system.

### ENA027: GBAS ENAV Programme - GBAS flight trials in an Italian airport (GFTI)

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#### Safety Activities

The main aim of the GFTI project is to contribute to the validation of ground-based augmentation systems for CAT I approaches, in compliance with ICAO SARPS.

#### Safety Objective

Contribution to validation of the SARP’s ICAO for GBAS CAT I and assessment of both safety and business case.

#### Safety Mgt. Activities

- Safety Cases. Safety assessment according to EUROCONTROL methodology and guidelines.
### EUR059: Operational Development of Integrated Air/Ground Data Communications and Surveillance Services

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<td>Marginal concerning safety focus, but it is implied.</td>
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#### Safety Activities

Validation of the operational concept and requirements of the air/ground data communications services and contribution to the specifications for prototyping, HMI, simulations and trials

#### Safety Objective

Validate and refine the requirements for air/ground data communications services and the requirements specification methodology.

#### Safety Management Activities

### EUR071: CARE innovative ATM Research

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#### Safety Activities

The task is an initiator for further research or development. It is aimed at identifying the new opportunities that may help to improve ATM performance in all aspects, or speed up its development, possibly as a break through of the current line of thought. Project stopped in 2001 and replaced by four separate projects (one for each study).

#### Safety Objective

Whole airspace ATM system safety case

### EUR081: ADS Programme

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#### Safety Activities

A safety assessment is performed for the ADS-B data-link in the ADS WP 2.4 'Safety (PSSA)'.

#### Safety Objective

Development of the various components of a Package I Safety Case.

#### Safety Management Activities

Safety Assessment (Eurocontrol SAM).
### EUR096: Freer Flight

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**Safety Activities**

The objective of CoSpace is to determine the operational feasibility and potential benefits of the use of spacing instructions (airborne spacing). CoSpace covers concept definition up to validation aspects through human-in-the-loop and model-based simulations.

**Safety Objective**

Assess safety of ASAS applications

**Safety Mgt. Activities**

- Validation: start assessing usability (e.g. concept, procedures, interface) and progressively address impact on user activity (controller, pilot) and eventually on the ATC system (e.g. quality of control/flying, safety, efficiency)

### EUR106: SkyTools

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<td>EASA, accident, safety AND culture</td>
<td>Safety Management</td>
<td>Assessment of new system/procedure</td>
<td>Implicitly related to ESARR 4</td>
<td>Marginal but does have a safety aspect</td>
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</table>

**Safety Activities**

The SkyTools project shall evaluate and demonstrate the state of the art benefits for the Controller Working Position of the future.

**Safety Objective**

The paradoxes of human factor’s safety aspect for almost totally safe systems (civil air traffic has actually 10^-6 accidents per year) should influence SkyTools concept development and especially the evaluation.

**Safety Mgt. Activities**

- Build a prototype to demonstrate and experiment the technical and operational feasibility
- Make extensive experimentations to validate some operational issues through the LOOK project

### EUR110: SATNAV / GNSS

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**Safety Activities**

The regulatory mechanism for GNSS was agreed during this project.

**Safety Objective**

**Safety Mgt. Activities**

Safety plan production.
EUR133: ASMT - ATM Safety Monitoring Tool

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<td>Safety Management</td>
<td>Methodology development</td>
<td>In relation to ESARR 2 (in a certain meaning: help to the incident reporting) and to a certain extent with ESARR 3 (the way to introduce safety monitoring).</td>
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</table>

**Safety Activities**

Project aiming to define methods to detect some safety occurrences by use of ATC surveillance data (application to different types of airspace). Expected results: ASMT tool developed during this project.

**Safety Objective**

Define methods to detect some safety occurrences by use of ATC surveillance data.

**Safety Mgt. Activities**

Safety monitoring results.

EUR134: SHIELD - Incident Reporting for Indicators

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<td>Safety Management</td>
<td>Safety Event Monitoring</td>
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**Safety Activities**

Definition of a classification of the causal factors appropriate for European Safety analysis. In a long term, this work should help the development of a global view of the European ATM system safety status, for the development of common safety indicators.

**Safety Objective**

Develop methods for supporting harmonised human incident reporting and exchange of safety information throughout Europe.

**Safety Mgt. Activities**

The first step of the project is the European harmonisation of definitions in ATM incidents, based on ICAO/ADREP2000, in 1999. The second step is the implementation of systems for reporting safety related occurrences from 2000 onwards.

EUR146: EOLIA - European pre-Operational data Link Applications

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<td>Safety Management</td>
<td>Assessment of new system/procedure</td>
<td>Implicitly related to ESARR 4</td>
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**Safety Activities**

Implementation of additional air/ground data link services, and conduct of the associated cost/benefit and safety analysis.

**Safety Objective**

Safety of datalink applications.

**Safety Mgt. Activities**

Safety analysis.
### EUR159: EATMS Verification and Validation

**Safety Activities**
- EATMS Validation Strategy;
- V&V Methodology;
- V&V Master Plan;
- Implementation of the V&V Master Plan;

**Safety Objective**
The EATMS requires a scheme of verification and validation (V&V), which will ensure that the necessary results are available in-time and in a form which is acceptable to safety regulators/certification bodies for their approval.

**Safety Mgt. Activities**
- EUR159: EATMS Verification and Validation

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<td>Safety Management</td>
<td>Methodology development</td>
<td>Implicitly related to ESARR 4</td>
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### EUR180: ASTER

**Safety Activities**
- In support of policymakers in air transport safety in general and the regulatory authorities in particular, the ASTER project develops a method and tools to define target levels of safety for the total air transport system and to support the identification of optimal safety improvement measures (through regulation) to achieve the target level of safety

**Safety Objective**
It holds for any system that to have good performance with regard to a particular property, this property must be part of the design requirements rather than a mere spin-off of the development process of the system. For this reason, aircraft speed and fuel-efficiency are design requirements instead of the coincidental outcome of the design. The same ‘design approach’ should be followed with regard to the safety of air transport in order to achieve a significant improvement in relative safety.

**Safety Mgt. Activities**
- EUR180: ASTER

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<th>Topic</th>
<th>Links to ESARRs</th>
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<td>Safety Regulation</td>
<td>Safety Metrics</td>
<td>Implicitly related to ESARR 2 and ESARR 4</td>
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</table>

### EUR183: CORA_2 - Conflict Resolution Assistant (ASA Programme)

**Safety Activities**
- "Produce relevant information in Business and Safety case supporting CORA-2."

**Safety Objective**
Activities are carried out to: review methods for setting Target Levels of Safety, to analyse current safety levels, to analyse cost effects of unsafety and costs of implementation of safety improvement measures, to analyse safety benefits in terms of reductions of unsafety, and to integrate these elements into an air transport safety optimisation methodology.

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<td>Assessment of new system/procedure</td>
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<td>Safety case supporting CORA 2.</td>
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### EUR184: ASA - Multi-Sector Planning (MSP)

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<td>Safety connection is implied, not explicit</td>
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**Safety Activities**

Included in the ASA Multi-Sector Planning project tasks, a Safety analysis will be performed.

**Safety Objective**

Safety analysis (no detailed information on what has been done exactly).

### EUR185: MA AFAS - AFAS

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**Safety Activities**

See CEC105

**Safety Objective**

Demonstrating the combined European strategy to future ATM gives benefits in terms of efficiency, capacity and safety.

### EUR192: FRAP - Eight States Free Route Project

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**Safety Activities**

One part of the study consisted in the 'safety case' development.

**Safety Objective**

Safety Management (safety case).
### EUR196: EATMP Human Resources

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<td>Human Resources</td>
<td>Implicitly related to ESARR 5</td>
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**Safety Activities**

This programme addresses the identified and agreed ANS Providers’ needs for timely availability of suitable people and will provide the framework and a series of ECAC wide accepted tools for human factors, manpower planning, selection and training.

**Safety Objective**

This will enable the achievement of effective human performance in Air Traffic Management and form a mandatory basis for the regulation of any safety related task in ATM and will contribute to aviation safety through consistent quality of service delivery by ATM staff and the best use of evolving technology within the current and future European ATM.

### EUR203: ACASA - Airborne Collision Avoidance System Analysis

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**Safety Activities**

This project provides studies results essential for ACAS implementation.

**Safety Objective**

Confirmation of the safety benefit expected to be provided by TCAS II Version 7

### EUR204: EMOTION7 - European Monitoring of TCAS II version 7.0

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<th>Category</th>
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| Safety Management | Assessment of new system/procedure | Implicitly related to ESARR 4 | Safety assessment.

**Safety Activities**

Identification of safety issues which may arise during the introduction of TCAS II version 7 and, where necessary, develop rectification change proposals for the CAS logic.
### EUR206: INTEGRA

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<td>Implicitly related to ESARR 2 and ESARR 4</td>
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#### Safety Activities

Metrics for Safety have been identified looking at agreed methodologies: Eurocontrol Safety Assessment Methodology (EATCHIP 3).

### EUR207: ADS-MEDUP - ADS Mediterranean Upgrade Programme

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#### Safety Activities

Utilisation of ADS MEDUP infrastructure (MEDUP network) to verify and validate, among others, safety issues.

### EUR212: MFF - Mediterranean Free Flight

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#### Safety Activities

### EUR222: LOOK

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**Safety Activities**

See CEC121. development and validation of new advanced, innovative, environmentally friendly approach and departure procedures - called Noise Abatement Procedures (NAP) - that have a positive impact on capacity, the environment and financial aspects whilst at least maintaining current safety levels.

### EUR222: SOURDINE II - Study of Optimisation procudURes for Decreasing the Impact of NoisE around airports II

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**Safety Activities**

See CEC Wake Vortext studies.

### EUR228: ATC Wake

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**Safety Activities**

See CEC Wake Vortext studies.

**Safety Objective**

Wake Vortex Safety and Separation Predictor

The impact of weather on wake vortex safety is a crucial aspect, and the uncertainty in predicting the behaviour of wake vortices in different weather conditions implies that continuous monitoring of both wake vortices and weather will be necessary. This will enable continuous verification of safe predictions of required aircraft spacing (separation minima).
Safety Activities

The Implicit study is proposing to investigate this problematic through the organisational and legal issues perspective, looking at the role, the use and the perception of the rules in ATM. The Emotional Management of Risk perception by the front-line operators appear as the key understanding of the balance between three contradictory constraints: safety, capacity and operator resources through the other normative-implicit axes. The Explorer study is proposing to investigate this problematic into the emotional domain. The basic principle of natural safety is that unanticipated events require operator adaptation. Where traditional approaches emphasise the anticipation using specification and normative approach, natural safety emphasises the need for adaptation in the design of controller tools for example, through emphasising the safety margins. The Natural Safety study is proposing to investigate this problematic into the cognitive domain.

Safety Objective

Safety prediction.
### EUR232: SAFBUILD - Building Safety into Design

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<td>Methodology development</td>
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<td>In relation to all ESARRs, but more specifically with ESARR 4.</td>
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**Safety Activities**

This entire project addresses safety aspects. The result will be guidelines for building safety in the design process of ATM systems – including the human aspects.

**Safety Objective**

Methodology clarification.

### EUR233: SADATAN - Safety Data Analysis

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**Safety Activities**

Analysis of how a meteorological forecast can influence accident rates analysing the Mandatory Occurrences Reports.

**Safety Objective**

Safety prediction.

### EUR234: SAFSIM

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<td>Methodology development</td>
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<td>In relation to ESARR 4.</td>
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**Safety Activities**

Safety related project – project trying to develop methodology to limit and keep the risk under control at the transition phase.

**Safety Objective**

Methodology enhancement. Determine needs and guidance for systems that will transition in the future. Related to SSA step of SAM methodology.
### EUR235: TRANSPAR - Organisational Transparency in ATM

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#### Safety Activities

Safety related project – See the general description.

#### Safety Objective

Methodology enhancement.

#### Safety Mgt. Activities

**Keywords**

- New in current year
- Included in SAFS Subdomain
- Included in Safety HI
- Details in VDR

**Links to ESARRs**

- Explicitly related to ESARR 2, implicitly related to ESARR 1, ESARR 3, ESARR 4, ESARR 5, ESARR 6.

### EUR246: ASAS - Airborne Separation Assurance Systems (CARE)

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#### Safety Activities

An OHA has been performed (influencing factors identification and severity determination).

#### Safety Objective

Safety assessment (ED 78-A).

#### Safety Mgt. Activities

**Keywords**

- New in current year
- Included in SAFS Subdomain
- Included in Safety HI
- Details in VDR

**Links to ESARRs**

- Implicitly related to ESARR 4

### EUR247: 3D Collision Risk Model Study

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#### Safety Activities

Production of a Software allowing to estimate collision risk, entering different parameters (traffic growth, system changes, etc.).

#### Safety Objective

Estimation of the collision risk (average per flight hour or per flight section).

#### Safety Mgt. Activities

**Keywords**

- New in current year
- Included in SAFS Subdomain
- Included in Safety HI
- Details in VDR

**Links to ESARRs**

- Implicitly related to ESARR 4
### EUR248: Route Spacing and Aircraft Separation for P-RNAV Operations

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<td>Implicitly related to ESARR 4</td>
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**Safety Activities**

Safety Objective

Safety Mgt. Activities

Aircraft separation is assessed in this project and in this context. Ability to assess system safety is also assessed; prioritisation of design features is set out according to features safety significance.

### EUR255: LINK 2000+ Real-time simulation (Eatchip III experiment 3Bbis)

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**Safety Activities**

Safety Objective

Safety Mgt. Activities

The L2KBC simulation was conceived in order to assist with the cost/benefit analysis associated with the datalink concept within the LINK 2000+ project.

The simulation highlighted the most serious safety issues as being:
1. Potential loss of situational awareness for controllers
2. The importance of not allowing the planning controller to perform inputs on behalf of the radar controller, or at least to define clear task allocations within the sector team.
3. The importance of only using the CPDLC message system for non time-critical instructions.

### EUR257: OATA - Overall ATM/CNS Target Architecture

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**Safety Activities**

Safety Objective

Safety Mgt. Activities

Contribution to Safety Methodology, Policy and Plan.
### EUR267: IAPA - for Implications on ACAS Performances due to co-operative ASAS implementation

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**Safety Activities**

The main objective is to: provide guidelines (on the ACAS and ASAS interaction issue) for the development of future co-operative ASAS applications in Europe.

**Safety Objective**

Address, before any European co-operative ASAS implementation, an open issue (ACAS & ASAS interaction) never thoroughly investigated

**Safety Mgt. Activities**

Safety case based on OSA methodology

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### EUR268: A-SMGCS (Advanced Surface Movement Guidance and Control System) development - APR Project 1

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**Safety Activities**

This Project will develop and address the implementation of several levels of A-SMGCS

**Safety Objective**

These procedures will aim at expediting the taxiing aircraft and other vehicles on the manoeuvring area while reducing the potential for ground movement incidents.

**Safety Mgt. Activities**

Validation

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### EUR272: RNAV Approaches with Vertical Guidance (WP05 of the Navigation Domain)

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**Safety Activities**

Safety Assessment and risk analysis on RNAV Approaches with Vertical Guidance. Moreover, proposed changes to JAA operational certification will be provided.

**Safety Objective**

Safety Assessment.

**Safety Mgt. Activities**

Safety Assessment.
### EUR273: Navigation Applications to ASMGCS - ACTION 6

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##### Safety Activities

- Develop safety policy material for proposed Navigation Applications conforming to EATMP Safety objectives. Further, specify and perform the Safety Assessment analysis necessary to support the implementation strategies.

### EUR284: WakeNet 2 Europe

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##### Safety Activities

- WakeNet2-Europe will enable the development of a shared view how to address the existing and foreseeable safety and capacity related problems caused by wake turbulence.

### EUR289: Safe Sound

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##### Safety Activities

- The SAFESOUND consortium is convinced that a large number of cockpit tasks could benefit from enhanced audio functionality. A potential realisation of enhanced audio functionality for some of these tasks would not fulfil all of SAFESOUND's fundamental requirements: safety gain, end user acceptability and certificability.

- The SAFESOUND project aims at improving safety and operational integration of CNS functions in the civil cockpit. Performing extensive human factors studies, and by validating the proposed concepts in a full-flight simulator.
### EUR297: SAND - Safety Assessment for New Designs

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**Safety Activities**

SAND aims at:

- Defining objectives for the safety assessment of ERC projects according to EATMP life-cycles definitions and activities covered by related projects or standardisation groups,
- Identifying EEC projects being candidates to safety assessment,
- Providing safety plan and initial safety assessment for some 'representative' ERC projects,
- Maintaining hazard logs database and evaluating hazard log tools,
- Providing Safety Summary for studied projects.

**Safety Objective**

Improve safety where possible, and record safety issues and insights for future potential implementation

**Safety Mgt. Activities**

- definition of objectives for safety assessment on 3 EEC projects
- safety plans for 3 EEC projects
- preliminary safety assessment for 3 EEC projects
- develop guidelines on how to perform safety assessment for various types of EEC projects
- integrate safety operational feedback, continuously monitor new methods' development and EEC projects needs
- assist and review safety assessment on all EEC projects and measure progress of 'safety culture' in EEC

### EUR298: Safety Learning

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**Safety Activities**

Together with the other SAF projects, SAFLearn aims at creating a learning process and to provide information that effectively helps design safety into systems at a very early stage. The lessons learned that SAFLearn will provide to ERC projects will be derived from safety occurrences.

**Safety Objective**

To learn from Incident data

**Safety Mgt. Activities**

A process needs to be created to collect and collate operational experience from different sources, and then deliver it to projects.
### EUR299: ECHOES: Phase 1

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#### Safety Activities

**Safety Objective**
The mission of the ECHOES project is to provide an effectively documented process for establishing the HMI requirements associated with evolving ATM functions, and develop, test and maintain good quality HMI solutions to support all phases of the development lifecycle.

**Safety Mgt. Activities**
A process for validating sound and safe HMI principles as the basis for operational improvements

### EUR304: OATA - Overall ATM/CNS Target Architecture

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#### Safety Activities

**Safety Objective**
See EUR257

**Safety Mgt. Activities**
Contribution to Safety Methodology, Policy and Plan

### EUR309: CAMES - Co-operative ATM Measures for a European Single Sky

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#### Safety Activities

**Safety Objective**
This study will identify candidate flows for the use of Traffic Synchronisation measures and, in addition, will provide indicators on the impact on the system of such measures in terms of safety, complexity and cost benefit.
**EUR326: Application of RNP RNAV in Medium-Term (WP03 of the Navigation Domain)**

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**Safety Activities**

The Operational Requirements for RNP RNAV are to improve the aircraft operational efficiency and support an increase in airspace capacity by enabling reductions in route spacing. This WP will investigate and quantify the potential improvements that can be achieved within the medium term by the availability of a total RNAV environment made possible by the use of RNP RNAV equipment in the aircraft.

**Safety Objective**

To demonstrate the safety benefits to be derived from a total RNAV environment.

**Safety Mgt. Activities**

To develop and validate standards, procedures and software tools necessary to achieve the above application.

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**EUR327: Long-Term Application of 4D RNAV (WP04 of the Navigation Domain)**

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**Safety Activities**

This WP will address the issues from an airborne perspective by initiating studies and trials to evaluate and quantify the benefits of 4D RNAV.

**Safety Objective**

To evaluate the potential benefits of 4D RNAV in an integrated ATM environment.

**Safety Mgt. Activities**

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**EUR328: Precision Approach and Landing (WP06 of the Navigation Domain)**

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**Safety Activities**

In line with the Navigation Strategy and confirmed in the recently endorsed 'Common Aviation Position Paper on GNSS' the long-term aim is for a transition to a GNSS based landing system. However, as identified in the Navigation strategy, ILS will be maintained for as long as practicable and where needed MLS would be introduced. The present pressure upon navigation radio frequencies and the need to provide stakeholders with data upon which they can make realistic plans, make it necessary to identify:
- the constraints upon ILS and hence when will the transition to a new PA aid be necessary;
- what are the advantages and limitations of the options for a future PA aid;
- implications of these considerations on the future PA environment ECAC wide and the timescales for its achievement.

**Safety Objective**

Safety targets for PA Operations in the ECAC environment.

**Safety Mgt. Activities**

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### EUR343: Integrated Risk Picture

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**Safety Activities**

A common Methodology on a gate to gate risk assessment for ATM. Quantified risk picture.

Pre-Concept Functional Hazard Assessment (FHA)

Human Factors Case (2005)

Integrated Risk Picture (IRP) for ATM 2012 (December 2005)

Integrated Risk Picture (IRP) for ATM 2020 (June 2006)

Roadmap (strategic planning for safety achievements) (December 2006)

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### EUR351: Enabling GNSS for all Phases of Flight (WP09 of Navigation domain)

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**Safety Activities**

This WP will provide the studies and trials needed to confirm GNSS capability and provide the data needed to support the system definitions and safety cases prepared in respect of GNSS use in the Navigation Applications of WPs 2-6.

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### EUR359: MANTAS - Maastricht New Tools and Systems

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**Safety Activities**

Validate and implement tools and concepts in conformance with EATM program and ATM2000+ strategy.

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### LFV013: PROVE/DUP (European ATC Pre-operational Validation & Experimental Trials Platform) DUP (ADS-B DSI Update Programme)

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**Safety Activities**

Under the provisions of NUP (NEANS Update Programme) it has been recognised that in order to validate the ADS-B related concepts defined in its programme that live trials involving Ground-based applications are required. PROVE provides a suitable infrastructure upon which such trials can be performed and DUP is a first step in supporting air/ground integrated "live" trials in ADS-B related applications. The output of DUP will be fed into EUROCONTROL, LFV and European Commission Programmes.

### LFV015: HUFA

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**Safety Activities**

A safety tool has been done to monitor and assess ATM safety culture (for ATCOs).

### LVN028: Improving Runway Crossing operations

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**Safety Activities**

At Amsterdam airport Schiphol the infrastructure is such there is a taxiway going around the southern end of runway 18/36C. So whenever a large aircraft crosses the imaginary extension of the runway centreline, the ICAO Obstacle Clearance area or the ILS basic services area is infringed. For certain inbound and outbound modes this situation may lead to a potential hazard.

**Safety Objective**

The objective of this project is to improve runway crossings procedures in order to increase safety levels.

**Safety Mgt. Activities**

Evaluation and validation of new developed procedures
**LVN029: Approaches on converging runways outside UDP**

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<td>Assessment of new system/procedure</td>
<td>Implicitly related to ESARR 4</td>
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</table>

**Safety Activities**

Change the procedures for approaching converging runways outside Universal Daylight Period (UDP) in such a way that the same runway capacity is achieved as the same operations within UDP.

**Safety Objective**

Fulfill the target level of safety requirements

**Safety Mgt. Activities**

Analyze the CONOPs on their impacts to safety

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**NAT004: Radar Separation Minima**

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**Safety Activities**

This work supports the Radar Separation Standards Working Group (RSSWG) in providing recommendations on safe separation minima for application in radar controlled airspace.

**Safety Objective**

Provision of radar accuracy assessments

**Safety Mgt. Activities**

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**NAT071: Wake Vortex Research**

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<td>Assessment of new system/procedure</td>
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**Safety Activities**

Spacing minima to guard against the possibility of wake vortex accidents are a constraint on the capacity of major airports. Reported wake vortex encounters are monitored and assessments of the impact of proposed changes in procedures are performed to ensure that the minimum wake vortex spacing consistent with safe operations are maintained.

**Safety Objective**

Ensure that the minimum wake vortex spacing consistent with safe operations is maintained

**Safety Mgt. Activities**

NATS maintains a unique database of pilot reported wake vortex encounters. It is used in analysing the safety of current and proposed future procedures and each year the collected reports are analysed and an R&D report is produced.
### NAT084: ATS Safety Analysis

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**Safety Activities**

- i) Development and maintenance of a preliminary database of SMF encounters and trend analysis of data.
- ii) Risk contour modelling for 20 airports to assist the DETR in the setting of PSZ zones.
- iii) Ad-hoc tasks at short notice.

### NAT085: North Atlantic Risk Monitoring

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<td>Assessment of new system/procedure</td>
<td>Implicitly related to ESARR 4</td>
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**Safety Activities**

Monitoring of the Safety performed continuously. 3 tasks: support on Mathematicians Working Group, Central Monitoring Agency database development and maintenance concerning height keeping performance, and monthly monitoring and annual risk assessments reports production.

### NAT086: UK and European RVSM

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<td>Assessment of new system/procedure</td>
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**Safety Activities**

Safety assessment of collision risk for UK RVSM.
### NAT119: ATMDC Human Factors Unit (HFU)

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**Safety Activities**

An incident analysis work is performed and investigations on failures and recovery mechanisms have been done about controller tools.

### NAT130: Safety Nets

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<td>Assessment of new system/procedure</td>
<td>Implicitly related to ESARR 4</td>
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</table>

**Safety Activities**

This item provides the technical support necessary to enable STCA to be maintained and, where economically sensible, to be improved. It also provides for the monitoring of TCAS in the UK to ensure that the introduction of version 7 does not adversely affect safety.

### NAT131: North Atlantic Future Developments

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<td>Methodology development</td>
<td>Implicitly related to ESARR 2</td>
<td></td>
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</table>

**Safety Activities**

Assessment of the Safety whilst improving the capacity in the NAT region (assessment of risk associated with planned reductions in separation, estimation of long risk based on a new data collection, analysis of data collected during FANS 1 trials).
## Safety Activities

### NAT134: SMF - Separation Monitoring Function

Complete the transfer of all SMF Design Authority responsibilities to NATS Software Services (NSS); continue to advise on the technical performance of all SMF systems; introduce the SMF systems at Swanwick into operational service.

**Safety Objective**

SMF alerts ATC supervisory staff to inadvertent breaches of separation criteria within 5 minutes of the event to enable immediate investigation to take place.

**Safety Mgt. Activities**

- **Keyword Hits**
  - Safety Management
  - Safety Event Monitoring

## Safety Activities

### NAT139: Future Area Control Tools Support (FACTS)

Work has been conducted on a safety analysis aimed at addressing safety aspects for operational implementation and identifying the safety benefits that FACTS provides.

**Safety Objective**

Safety analysis.

**Safety Mgt. Activities**

- **Keyword Hits**
  - safety analy, safety AND benefit

## Safety Activities

### NAT168: Future Concepts for ATC

Harmonisation of TC and Surface Management Tools. Research will investigate requirements to support concepts for tools to simplify ground movement operations, harmonised with planned arrival and departure management tools.

**Safety Objective**

- **Keyword Hits**
  - validation AND safety

**Safety Mgt. Activities**

- **Keyword Hits**
  - Safety Management
  - Assessment of new system/procedure
NAT171: Future Systems Research - Safety

<table>
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<tr>
<th>Category</th>
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<th>Links to ESARRs</th>
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<td>Assessment of new system/procedure</td>
<td>Implicitly related to ESARRs 2 and 4</td>
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</table>

Safety Activities

4ABL 14 - Safety Analysis Tool: Work was carried out by QinetiQ in FY 03-04 to investigate the feasibility of developing safety metrics particularly the incidence of altitude busts through retrospective analysis of radar data and the application of the metrics to simulation data. This work is to be concluded during the early part of FY 04-05. 4ABL 15 - Understanding Factors that Lead to Incidents: It is essential that NATS fully understands contributory factors to incidents to define the requirements for such systems. Activities to develop enhanced safety net systems and automation of ATC functions in support of enhanced safety will continue this year. Some work (e.g. TRACER) has already been performed by Human Factors. However, further investigation into contributory factors for incidents could help in the development of future safety nets and improvements in airspace and system design. 4ABL 16 - Use of Colour in ATC: Concerns have previously been raised about the use of colour in advanced ATC tools, and particularly the impact on the small proportion of controllers with a degree of blue/yellow colour blindness (currently an acceptable condition for ATCOs). An initial investigation assessed the risk for the first generation of ATC tools (e.g. iFACTS) as low. However, more general research is required to understand this issue in more detail for future generations of tools.

NAT174: Oceanic Concepts Research

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<th>Category</th>
<th>Topic</th>
<th>Links to ESARRs</th>
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<td>Safety Management</td>
<td>Assessment of new system/procedure</td>
<td>Implicitly related to ESARR 4</td>
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</table>

Safety Activities

4ABO 02 - Maintaining Safety in Future Oceanic Operations: During FY 03-04, a project was carried out to identify areas for potential safety improvements for future Oceanic ATS operations, by Helios Technology. Potential risks were identified, a risk mitigation strategy produced and areas of further work identified. Included were areas of risk associated with new avionics and their distribution, external factors, (principally the introduction of datalink and ADS-B based services), human factors and traffic growth predictions. 4ABO 03 - Oceanic Efficiency through Reduced Separation: The principal customer requirement for Oceanic ATS is for more fuel-efficient and time-efficient routings and profiles, to be realised by reductions in separation minima and increasing levels of flexibility underpinned by satellite surveillance and communications. Reduced vertical separation is not feasible and longitudinal separation reduction has previously failed to meet target level safety (TLS).
### NAT176: Operational Analysis and Support to Safety

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</table>

**Safety Activities**

4SOA - Operational Analysis and Support to Safety: This project provides safety monitoring, safety analysis, and human factors support to operational safety and safety improvements.

### NAT177: Operational Analysis and Support to Training

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</table>

**Safety Activities**

4TOA - Operational Analysis and Support to Training: Deliverables tend to occur at set intervals (e.g., safety performance monitoring reports delivered quarterly), or on an as agreed basis (e.g. HF input to Level Bust initiatives).

### NAT178: Operational Analysis and Support to Service Performance

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**Safety Activities**

Supporting the safe enhancement of NATS sector throughput capability

### NAT179: Operational Analysis and Support to Capacity

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**Safety Activities**

4COA - Operational Analysis and Support to Capacity: Deliverables tend to occur at set intervals (e.g., safety performance monitoring reports delivered quarterly), or on an as agreed basis (e.g. HF input to Level Bust initiatives).
**NLR003: DYNAMO (Dynamic-mathematical-ATM Models)**

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<td>Methodology development</td>
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**Safety Activities**

Tools and models to assess the safety and capacity of new ATM concepts.

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**NLR046: Phase II of TOSCA II (Testing Operational scenarios for concepts in ATM Phase II)**

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<td>Assessment of new system/procedure</td>
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**Safety Activities**

The objective of TOSCA-II is to assess, in a model and fast-time simulation environment, the impact of the introduction of a certain number of options in the EATMS concept onto the performance of ATM.

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**NLR049: TOPAZ - Traffic Organization and Perturbation AnalyZer**

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**Safety Activities**

Safety and efficiency assessment tool (RdP + …).

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**NLR059: EUSAR (EUROCONTROL Safety Assessment Reports)**

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**Safety Activities**

Providing mathematical/statistical input to EUROCONTROL for various programmes in which safety aspects of the application of separation minima play a role, particularly the European RVSM programme.
### NLR062: RESPECT - Rotorcraft Efficient and Safe Procedures for Critical Trajectories

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**Safety Activities**

The main objective of the RESPECT project is to develop improved terminal procedures and airfield operations (i.e., take-off and landing manoeuvres) for a wide spectrum of field configurations, including but not limited to airports (freeing-up valuable runway slots), city centre heliports and offshore platforms. The project will demonstrate the feasibility and safety of the proposed manoeuvres, with regard to the performance capabilities of existing helicopters, addressing in particular those critical flight conditions during which an engine failure could endanger the passengers and/or population on the ground.

### NLR079: VEMER support - Safety Efficiency Environment Effect Reporting support

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**Safety Activities**

Not enough information provided.
RLD034: RASMAR - Risk Analysis of Simultaneous Missed Approaches on Schiphol Runways 19R and 22

**Safety Activities**

The quantification and evaluation of the risks of simultaneous missed approach procedures on Schiphol runways 19R and 22, up to and including ILS CAT I circumstances.

In order to achieve the primary objective, the following project tasks are identified:

- development of a mathematical model for the uncertainties about the missed approach flight phase, taking into account the specific nature of the procedures and runway configuration of Schiphol runways 19R and 22;
- review of existing safety metrics and criteria for the collision risk between aircraft;
- quantification and evaluation of the collision risk related to simultaneous missed approaches at Schiphol runways 19R en 22 for the defined scenarios;
- execution of a sensitivity analysis of important missed approach procedure aspects;
- comparison of collision risk results against the objective safety criteria;
- provision of operational feedback to the RLD, concerning the (re)design of the proposed procedures at Schiphol runway 22; and,
- consolidation of the work undertaken, including conclusions and recommendations on the safety of the proposed procedures at Schiphol runways 19R and 22.

**Safety Objective**

To answer the following:

- Does the MOC (Minimum Obstacle Clearance) contain sufficient safety to tolerate the often small infringement caused by the height loss during the transition from approach- to missed approach path in the initial missed approach segment or is an additional margin required?
- And if so, which margin is required?
- Are all non-precision approach criteria equally applicable to the continuous descent non-precision approach procedures?
## Appendix 2: Analysis results: safety-related R&D projects

**Key to project IDs:**

- \( \text{AENxxx} = \text{AENA Spain} \)
- \( \text{CECxxx} = \text{European Commission} \)
- \( \text{DFSxxx} = \text{DFS Germany} \)
- \( \text{DLRxxx} = \text{DLR Germany} \)
- \( \text{DNAxxx} = \text{DSNA France} \)
- \( \text{ENAxxx} = \text{ENAV Italy} \)
- \( \text{EURxxx} = \text{Eurocontrol} \)
- \( \text{LFVxxx} = \text{LFV Sweden} \)
- \( \text{LVNxxx} = \text{LVNL Netherlands} \)
- \( \text{NATxxx} = \text{NATS UK} \)
- \( \text{NLRxxx} = \text{NLR Netherlands} \)
- \( \text{RLDxxx} = \text{RLD Netherlands} \)
- \( \text{SICxxx} = \text{SICTA Italy} \)

Further details of the projects listed here may be found on the ARDEP website at: www.eurocontrol.int/ardep

<table>
<thead>
<tr>
<th>Project</th>
<th>CEC046: MFLAME - Multifunction Future Laser Atmospheric Measurement Equipment</th>
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<tbody>
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<td>Start Date</td>
<td>01/05/1996</td>
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<tr>
<td>Finish Date</td>
<td>30/06/2000</td>
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<tr>
<td>Objectives</td>
<td>Major airports in Europe reach saturation traffic levels at peak times where the limiting factor is the need to impose aircraft separation distances in order to avoid hazard to following aircraft caused by the presence of wake vortices from preceding aircraft. A highly desirable alternative to building new airports or runways, with their attendant large environmental and financial costs, would be to reduce separations. This could be achieved without any reduction in safety standards if it were possible to reliably detect the presence of wake vortices from preceding aircraft. An airborne eye-safe LIDAR offers the means to do this with the required level of safety. In addition, an airborne remote sensing LIDAR Doppler anemometer offers the possibility of detecting other atmospheric hazards at long-range of which the most well-known is windshear. The current CEC FLAME project has demonstrated the viability of a LIDAR wake vortex detection system, including its operational aspects. This includes the development and demonstration of the core technologies and techniques for wake vortex detection, particularly the laser and signal/image processing technologies.</td>
</tr>
<tr>
<td>Approach</td>
<td>The MFLAME task objectives are:</td>
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<td>- to extend the multi-functions applications area of the MFLAME equipment to include, in addition to wake vortex detection, dry windshear predictive detection, and to assess the predictive detection capabilities in areas such as clear air turbulence, volcanic ash, gust alleviation, mountain rotors and dry hail;</td>
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<td>- to demonstrate wake vortex detection and windshear detection by means of a series of ground tests of a 2mm LIDAR system and to evaluate the other available multifunction capabilities;</td>
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<td>- to improve the techniques and technologies for a future cost-effective multi-function airborne equipment (Laser/optics, signal processing);</td>
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<td>- to investigate operational aspects such as integration into the avionics system, certification issues and links with Air Traffic Management;</td>
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<td>- the multifunction capability is very important to the MFLAME concept because it emphasizes aircraft safety at various flight phases - not just in the vicinity of crowded airports - making it much more financially attractive to potential end-users, such as airlines.</td>
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<td>Expected results</td>
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<td>Applicability Timeframe</td>
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<td>DLR: Deutsches Zentrum für Luft-und Raumfahrt</td>
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<td>GEC MARCONI: GEC MARCONI Avionics</td>
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<td>INESC: Inst de Engenharia de Sis e Computadores</td>
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<td>University of Hamburg</td>
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The objective of the MANTEA project is to develop decision support tools for improving surface traffic management in airports. Two integrated sets of tools will be developed, oriented to different types of user. The first set aims at providing automated assistance to airport authorities in their task of planning and simulating the development of airport infrastructure, so that they are able to utilize capacity fully and handle the increase of flights in Europe. The second set is directed at the tower controller. It will help him to make tactical decisions in traffic planning and monitoring, both under normal conditions and in critical situations like bad weather and strikes. Detection and resolution of traffic conflicts will also be handled. Particular attention will be paid to display and user interaction, as important to achieving final user acceptance. Two independent demonstrators will be built, to show the complete process of arriving at decisions. They will be validated with real-life examples drawn from current situations at Schiphol, Aeroports de Paris and Milan. The validation process will be led by Milan Linate, Roma-Fiumicino and Paris-Orly, which are part of the project consortium on their own premises.

During the timeframe of the project, MANTEA will cover analysis of market and user requirement, and specification, design, development and validation of decision support tools. The end products will be two validated prototypes and an updated exploitation plan for the two following years.

The use of decision tools for ground management makes better arrival and departure flow possible, thereby reducing taxiing and fuel consumption. The use of these tools will benefit the air carriers in terms of reduced delays and fuel costs, and will improve their image in the eyes of end users. This in turn will improve the profitability and competitiveness of the European carriers, helping them to face the challenge of the upcoming deregulation. In the safety domain, the introduction of better conflict detection represents an important advance. Detection and resolution of runway incursion will be a priority in part I of MANTEA.

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To meet increasing air traffic demand, a more automated Air Traffic Control environment is essential. The CNS/ATM (Communications, Navigation and Surveillance/Air Traffic Management) concept introduced by ICAO and based on new technologies - satellites and data link - will be able to solve the congestion problems. However, this increase in traffic must not be satisfied to the detriment of safety.

Today, aircraft operational regulations restrict traffic by means of vertical and horizontal separation standards, which have been derived from the limitation of CNS systems on the ground and safety requirements in the air. Improvements to CNS and airspace management will make possible the introduction of reduced separation to accommodate increased traffic. However even if the rate of accidents is maintained at the current level, such increased traffic will still lead to a higher number of accidents in absolute terms. Cooperative airborne and ground safety nets, i.e. ACAS (Airborne Collision Avoidance System) and STCA (Short Term Conflict Alert), will contribute significantly to the introduction of reduced separations without sacrificing safety.

The research in this project addresses the airspace users needs for safety in Europe’s crowded skies by examining the shortcomings in current technology with its non-cooperative collision-avoidance systems and sensors and ground-based, short-term conflict alerting systems. It will demonstrate a new high-integrity ATM environment, characterized by co-operative ACAS and STCA systems and improved precision navigation, on an experimental platform.

The consortium, which has been set up by combining manufacturers and suppliers of avionics and ground components with end users, i.e. airlines and controllers, is well suited to leading the TELSACS project. It has the objective of defining recommendations for standards of safety systems - ACAS and STCA - which will bring significant advantage to the European industry by the end of the century.

The work will be carried out in two parts. Part I will cover the definition of user and system requirements, enabling a demonstrator to be developed. Part II will validate the work and take it to recommendations for safety standards of ACAS and STCA systems.

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The work will be carried out in two parts. Part I will cover the definition of user and system requirements, enabling a demonstrator to be developed. Part II will validate the work and take it to recommendations for safety standards of ACAS and STCA systems.
The main aims of this work are to define a prototyping and concept validation exercise suitable for the validation of concepts and to develop a validation methodology suitable for the validation of concepts at sub-system level for a chosen satellite application. These aims are complementary in nature, one providing the breadth of understanding required for concept validation whilst the other provides the depth of understanding for a specific test case.

To achieve these aims, the participants will take advantage of existing material relating to functional concepts, validation methodologies, user requirements and the determination of ATM system safety, capacity and efficiency.

This project provides an opportunity to bring together the results of the more detailed development of a validation methodology for a chosen satellite application and the more generic findings of the validation exercise, enabling an analysis of the applicability of different validation methodologies across a range of functional concepts.

This project concludes with the development of an outline business plan to enable the ATM provider to assess the technical as well as commercial risks associated with any proposals for a full validation of concepts.
Objectives

DADI will explore the general concept of the «Datalinking of Aircraft-Derived Information» (DADI) to ensure it meets the user requirements of ATC providers, airlines and other airspace users. The improvements to be provided by the datalinking of aircraft-derived information will have a major impact on situational awareness and conflict management within continental airspace. These improvements will reduce controller workload and will enable a significant increase in the ATM capacity while maintaining safety.

Approach

DADI will concentrate on the type of information needed to be exchanged between the ground and air systems and subsequently a comparative analysis will be undertaken to demonstrate the capability of the pre-operational technologies and data link services to provide the information. Complementary pre-operational trials are proposed to demonstrate the user benefits, and to address the implementation choices to be made within the framework of transition of telematics usage in various air spaces in Europe (core area, remote areas, oceanic areas). In these trials existing pre-operational system components will be used and will be integrated into an ATC site and into an ATC simulator. The trials will be organized using a validation test plan, and will operate with real equipped aircraft (commercial and research aircraft) and helicopters. Demonstrators will be used at two ATC sites, in France and Norway respectively. Another demonstrator will be a research ATC simulator operating with real and simulated aircraft in a representative ATC environment, and supported by a state-of-the-art evaluation facility to assess the feasible increase in ATM capacity and safety.

Expected results

The results of the proposed project including the demonstrations will directly be applicable for making implementation choices in the framework of transition to telematics-based ATM in various air spaces in Europe (core area, remote areas, oceanic areas).
**Objectives**

This project extends the scope of work presently underway within Contract TR 1025, with an overlap of phases to secure continuity of action and continued exploitation of the test facilities implemented in the first phase. A general goal is that of achieving an industrialized standard of equipment developed in FARAWAY I. The main theme proposed is that of transporting ATM functions onto the VDL Mode 4 infrastructure and to proceed with project Fusion of Ads and RAdar data through two WAY data-link, as in the standing project but with enhancement of scope.

**Approach**

The enhancement of scope means to:
- extend the coverage of the ICAO VHF Mode 4/STDMA two way data-link into the NEAN airspace and down to that of Brindisi. As a complement an exploratory study on possible aeronautical application in the domain of low-cost Satellite Communications using LEO/GEO constellations will be conducted, as elicited by the ESA Artes 5;
- provide co-ordination with selected ADS trials conducted under National or European Projects, such as the Eurocontrol ADS Mediterranean Trials, PETAL II, NEAN/NEAP, SUPRA, Regional ADS projects by ENAV and other supported by the European Commission;
- secure interoperability of FarAway and NEAN systems and Flight Management functions through the constitution of a pre-operational scenario adopting compatible technologies, providing inputs to on-going standardization and certification initiatives;
- develop a set of advanced Validation Tools as part of a certification as safe for use process of the different technological domains covered by the trials.

**Expected results**

**Start Date** 01/01/1998  **Finish Date** 30/11/2000

**New This Year**  
**Included in Safety Hi**  
**Included in SAFS**  
**Results in VDR**  

**Key Features**

- Certification

**Category**  Safety Management  **Topic**  Certification of ATM Systems
**Objectives**

At present, all ATM responsibilities end up with the last human element in the responsibility chain, i.e. the air traffic controller. This forms a well understandable reason for controllers to reluctantly accept any new system or procedure which potentially reduces their controllability of various non-nominally evolving traffic situations while at the same time their responsibility increases with traffic volume. The aim of ARIBA is to develop a cost-effective and practical way out of this paradoxical development.

**Approach**

ARIBA will keep things practical by focusing its attention around the following major technological ATM enhancements:
- space-based navigation and surveillance,
- advanced ATC automation support tools,
- flight plan exchange through air/ground data link.

For each of those enhancements two distinct but inter-related issues need to be solved to prior operational introduction: system safety validation and arrangement of responsibilities.

**Expected results**

- **Start Date**: 01/01/1998
- **Finish Date**: 31/08/1999
- **New This Year**: Included in SAFS
- **Keywords hits**: safety valid, validation AND safety
- **Link to ESARRs**: Indirectly related to ESARR 4
- **Category**: Safety Management

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### Project Details

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<td>01/01/1998</td>
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<tr>
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<td>Sub-projects</td>
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<td>NLR045: ARIBA - ATM system safety criticality Raises Issues in Balancing Actors responsibility</td>
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<td>LFV: Luftfartsverket (Swedish CAA)</td>
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<td>NLR: Nationaal Lucht&amp; Ruimtevaartlaboratorium</td>
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<tr>
<td>Topic</td>
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The objective of project EMERTA is to investigate the opportunities, benefits and issues offered by selected emerging technologies to meet the safety-dominated requirements of the European Air Traffic Management (EATMS). The two selected technologies are Next Generation Satellite System (NGSS) technology, and emerging ADS-B technologies. The associated Airborne Separation Assurance (ASAS) operational concepts will be addressed.

The NGSS technology study will make use of key selected application scenarios for air-ground and air-air aeronautical communications in European airspace. It will review material produced by a variety of fora in the domain, and make use of strong contacts within the IRIDIUM and GLOBALSTAR providers. The ADS-B/ASAS technologies are already being studied by the CEC/DG VII funded project EMERALD. EMERALD will produce a detailed Research & Technological Development (RTD) plan. EMERTA proposes to take up some specific aspects of that RTD plan and develop the further work. The EMERTA consortium is well-placed to do this as it is composed of members of the EMERALD team.

The safety study for both technology strands will utilize the NLR (National Aerospace Laboratory) TOPAZ tool.

Expected results

Applicability Timeframe => 2006 and <= 2010

Current Validation Level V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Parent Project

Sub-projects DER016: EMERTA - EMERging Technologies opportunities, issues and impact on ATM
DNA083: CNS-SAT/EMERTA WP2
NAT090: ADS-B
NLR054: EMERTA - EMERging Technologies opportunities, issues and impact on ATM

Sponsors Aerospatiale
DERA
EC DG TREN: European Commission DG Transport Energy
NATS: National Air Traffic Services Ltd
NLR: Nationaal Lucht& Ruimtevaartlaboratorium
Sofreavia

Partners DERA Malvern
EADS Airbus SA
European Communities
Luchtverkeersleiding Nederland / ATC the Netherlands
National Air Traffic Services Ltd
Sofreavia

New This Year

Included in Safety HI

Included in SAFS

Results in VDR

Keywords hits

Link to ESARRs Implicitly related to ESARR 4

Category Safety Management

Topic Assessment of new system/procedure
Objectives

ISAWARE is aimed at defining human-machine interface which merges data from the following safety systems:
- ACAS;
- GPWS;
- weather and windshear radar;
- radar and infrared radar;
- FMS;
- uplinked messages from the ATN and from the SMGCS.

The project will focus on the improvement of the flight safety on all phases of the flight, from gate to gate. Air transport application will be mainly considered within ISAWARE. Helicopter application will be dealt with during first phases of the project (up to the system definition).

Approach

Expected results

Applicability Timeframe => 2006 and <= 2010

Current Validation Level V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Target Validation Level V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Parent Project

Sub-projects

Sponsors

Aerospatiale
EC DG XII
Eurocopter
GEC MARCONI: GEC MARCONI Avionics
Iberia
NAT AVIONICS: National Avionics
NLR: Nationaal Lucht& Ruimtevaartlaboratorium
RTSN: Redes Telematicas e Sistemas Navegacion
THALES AS P: Thales Airborne Systems (ex Dass. Elec.)
THALES AVN F: Thales Avionics France (ex Sextant)
VDO: VDO Luftfahrtgerate Werk GmbH

Partners

EADS Airbus SA
EUROCOPTER
European Communities
GEC-Marconi Avionics
Iberia
Luchtverkeersleiding Nederland / ATC the Netherlands
National Avionics
Skysoft
Teschnische Hochschule
THALES Airborne Systems (ex-Thomson-CSF Detexis)
THALES Avionics - Vélizy (ex-Thales-CSF Sextant)
VDO

New This Year

Included in Safety HI

 Included in SAFS

Results in VDR

Keywords hits

flight safety

Link to ESARRs

Implicitly related to ESARR 4

Category

Safety Management  Topic

Assessment of new system/procedure
The main objective of the study is the development of a methodology that will enable safety targets to be set and optimised for each of the participants in the air transport system (i.e. airports, air traffic management, airworthiness of 'products' and operations), to achieve the optimum level of safety for the system as a whole. To support this process, means will be developed for assessing the safety benefits of any changes (including changes in legislation/rulemaking) in relation to the cost of implementing those changes.

The project adopts a logical approach to the development of a methodology for assessment of cost-benefit aspects of new rulemaking aimed at safety improvements. Five main lines of research are followed:
- review of methods for setting Target Levels of Safety;
- analysis of current safety levels;
- analysis of cost effects of unsafety and cost implementation of safety improvements measures;
- analysis of safety benefits in terms of reductions in unsafety;
- integration into an air transport safety optimisation methodology.

Main project outputs include:
- an overview of strength and weaknesses of current methods for CBA in air transport safety;
- cost taxonomies, which include generic cost levels for direct and indirect effects of unsafety and the cost of implementation of safety measures;
- a methodology for predicting benefits from safety enhancing measures;
- an assessment of the current distribution of safety levels and safety targets and proposal for a more cost-effective distribution.
The objective of GALA study is to perform an optimised and justified overall definition of Galileo architecture paving the way for the implementation of Galileo components. It includes:
- exhaustive analysis of potential applications needs;
- consolidation of system requirements;
- major system technical trade-offs optimising the allocation of functions and performances among Galileo components;
- overall navigation signal design, including innovation signal structures and cryptology;
- preliminary definition of main Galileo components;
- derivation of cost elements, revenue opportunities and cost benefit analysis corresponding to the system definition.

Gala study is defined as the core activity providing the overall view and orientation in relation to the definition of Galileo and the link with all other activities carried-out in the same frame either by EU or ESA.

It follows a step approach ensuring the progressive derivation of all required elements and their consolidation / refinement through an iterative process. Three phases have been identified:
- Phase 1: providing preliminary system requirements together with an initial architecture definition and specifications;
- Phase 2: providing refined system requirements, consolidated architecture and specifications as well as an initial cost/benefit analysis;
- Phase 3: providing a consolidated definition file with the required justification.

The tasks to be performed have been organised into nine first-level work-packages addressing the major topics of Galileo Overall Architecture Definition under the responsibility of nine different principal contractors:
- definition sizing of Galileo related applications;
- system level analyses and trades-offs;
- overall architecture definition;
- technological projection of user terminal;
- definition of Galileo main components;
- RAM and safety analyses;
- specifications of support tools;
- preparation of pilot projects related to Galileo early demonstrations;
- programmatic issues and cost/benefit analyses.

Four additional work-packages address the overall co-ordination and management of works, the liaison with other Galileo related activities and the implementation of the team of independent experts supporting EU in the follow-up of Gala Study.

**Expected results**

- **Applicability Timeframe**: => 2006 and <= 2010
- **Current Validation Level**: V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy
- **Target Validation Level**: V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**Parent Project**

- EC DG TREN: European Commission DG Transport Energy

**Sub-projects**

- AENO26: GALA/ GAST (Galileo Architecture Support Team)

**Sponsors**

- Alcatel-Espace
- Alenia Aerospazio
- Astrium Ltd (Matra Marconi Space)
- Centro Ricerce Fiat
- DaimlerChrysler Aerospace Dornier (Astrium GmbH)
- European Communities
- Galileo Architecture Support Team
- Grupo Mechanica del Volo
- Industrieanlagen Betriebsgesellschaft mbH
- THALES ATM France (ex Airsys ATM France)
- THALES Avionics - UK (ex-Racal Avn)

**Partners**

- Alcatel-Espace
- Alenia Aerospazio
- Astrium Ltd (Matra Marconi Space)
- Centro Ricerce Fiat
- DaimlerChrysler Aerospace Dornier (Astrium GmbH)
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- Grupo Mechanica del Volo
- Industrieanlagen Betriebsgesellschaft mbH
- THALES ATM France (ex Airsys ATM France)
- THALES Avionics - UK (ex-Racal Avn)
Objectives

The main objective of the project is to pave the road for future deployment of ATM services in relation to DAP. The benefits of related services are several and will be quantified further in the context of En-route and Approach phases of flight. The data-link technologies allow today redundancy of the Air/ground related functions. To define how they will interact and co-operate for the purpose of safety is amongst the objectives of DADI-2. Another aim is to establish a coherent open architecture were the various links will co-operate in a way transparent for the ATM application of Air traffic Controller. The ATM users of data-link techniques will be served with airborne data (results of combination of air-ground receptions) at a necessary level of reliability and integrity. Impact of DAP on ATC controller tools will be established. Associated improvements will be quantified. A last objective is the preparation of the next step, i.e. deployment of ATM functions related to DAP applications. It will be achieved through technology implementation plan and business case.

Approach

A set of three DAP tools will be addressed by the consortium:
- provision of aircraft parameters to the controller for core European en-route airspace, evaluated in the French pre-operational environment;
- development of an enhanced arrival manager improving capability of automation support, evaluated in ATC simulated environment;
- benefits of dual data-links (including the impact on safety) providing aircraft parameters in off-shore, uncontrolled airspace, evaluated in an operational environment using Norwegian offshore helicopters.

The evaluation of these tools will take place within the Open Communication Architecture Concept. Each tool will take advantage of all communication means made available by the aircraft, transparently to the end-user, so as to offer a higher quality of service, efficiency and flexibility. Various communication means will be addressed (ATN, Mode-S specific services, ACARS, VDL-4/STDMA) in terms of performance and safety, against the requirements identified in the operational concept associated with each tool. An overall business justification will be prepared that will be based on the benefits to many users. The expected benefits will be drawn from other studies as well as from the outputs of DADI-2 evaluations.

Expected results

- Assessment of a safe architecture for DAP service;
- evaluation of the open architecture concept (accommodation and integration of complementary data-link techniques);
- demonstration of dual data-link technique benefits;
- ATC controller tools enhanced with DAP evaluation;
- business case about the DAP services.

Applicability Timeframe

=> 2000 and <= 2005

Current Validation Level

V3b: Generic Specification - Requirements Validated

Target Validation Level

V4: System Development - Completion of Development and Integration

Parent Project

DNA210: DADI-2: Datalinking of Aircraft Derived Information 2
NLR066: DADI-2: Datalinking of Aircraft Derived Information 2

Sponsors

BA: British Airways
DERA
EC DG INFSO: European Commission - DG INFSO
KONGSBERG: Kongsberg Gruppen ASA
NLR: Nationaal Lucht & Ruimtevaartlaboratorium
Sofreavia
THALES ATM F: Thales ATM France

Partners

British Airways
DERA Malvern
European Communities
Kongsberg
Nationaal Lucht en Ruimtevaartlaboratorium
Sofreavia
THALES ATM France (ex Airsys ATM France)
AFAS should be seen as the first step in achieving the airborne components of the functionality set out in the ECAC ATM 2000+ document. The main objectives of this project include:

- define and propose an achievable ATM operational scenario for the European airspace, that will be inter-operable with ground segments and will yield a potential benefit in terms of capacity and safety increase, while maintaining or even enhancing the level of costs benefits;
- draw benefit of previous and current projects in the ATM area;
- select the most promising CNS/ATM technologies that will be integrated in an avionics package;
- define, develop, integrate and verify this avionics package supporting ATM functionalities;
- check inter-operability issues on test benches fully representative of European operations in 2005, from both functional and operational (e.g. mixed aircraft) perspective;
- evaluate pre-operational concepts in view of establishing a standard that can offer benefits (capacity, safety, cost) and propose an alternative to US standards dominant position;
- assess the impact of these new functions on pilot in terms of Human Factors including situation awareness;
- demonstrate the viability of concepts based on real-life 2005 scenarios.

In order to achieve its objectives, the AFAS project is divided into the following work areas:

- selection of ATM operational concepts that can demonstrate short-term benefits, mainly traffic planning concepts with their impact on efficiency and capacity. This selection will be performed in close connection with ground ATM experts, from a list of candidate CNS functionalities;
- definition of operational scenarios fully representative of the European airspace in 2005 by taking examples of real routes, mixed traffic and actual ground equipage. VLOC and regional aircraft representatives are part of the project to ensure that these aircraft will not be excluded from future CNS/ATM airspace;
- inputs coming from on going projects like TORCH and NUP will complement the CNS functionality analysis;
- specification, development and integration of avionics package meeting upcoming CNS 2005 functionalities based on existing CNS components. The work comprises the establishment of functional architecture, performances including safety assessment, interfaces with onboard systems, including the aspect of Human interface and definition of test cases and pre-operational scenarios;
- validation of these packages will be addressed by performing a spectrum of testing activities that range from equipment testing up to full integration testing between a cockpit and an ATC centre. This activity covers both technical and operational interoperability tests, as well as a Human Factor Analysis;
- Investigation of airworthiness and standardisation issues that will prepare future standards;
- Monitoring and interaction with standardisation bodies in the CNS/ATM field.

In terms of exploitable results and milestones, AFAS will generate the following results:

- a validated CNS avionics package meeting the requirements of a high-density airspace ATM system, ready for certification process, to be exploited by avionics suppliers as a first release in their new CNS product line;
- operational concept as supported by this avionics package;
- studies on cost effectiveness of these operational concepts, that aim at demonstrating the potential benefits in order to encourage airlines and ATM Service Providers decision-makers in applying these new concepts;
- an assessment of the impact of such requirements on current airborne systems. This will help airframe manufacturer to integrate these systems in the cockpit, as well airworthiness authorities in charge of certifying CNS systems and aircraft;
- a definition of the role of the crew and of the share of responsibilities between pilot and controller, as well as human factors aspects that are impacted by this new way of communicating. The outcome will consist in full requirements for these new operational procedures that will be mostly useful for airlines, pilots, airframe manufacturer, avionics suppliers and airworthiness authorities.
THALES ATM F: Thales ATM France
THALES AVN F: Thales Avionics France (ex Sextant)

Adelard
AENA
Aerospatiale Matra ATR
Airbus Industrie
Alenia Difesa
AVTECH SWEDEN AB
DaimlerChrysler Aerospace Airbus GmbH
EADS Airbus SA
EUROCONTROL EEC
European Communities
GKN Westland Helicopters Ltd
Luchtverkeersleiding Nederland / ATC the Netherlands
Skysoft
Smiths Industries
Sofreavia
THALES ATM France (ex Airsys ATM France)
THALES Avionics - Vélizy (ex-Thales-CSF Sextant)

New This Year

Keywords hits
safety assess, airworthiness, validation AND safety

Link to ESARRs
Implicitly related to ESARR 4

Category
Safety Management

Topic
Assessment of new system/procedure
Objectives:
This project aims at transforming European research results into practical operational ATM procedures with the potential to radically improve the European ATM scenario in the near term (from 2005 onwards). By selecting and validating key Airborne elements of CNS, and defining their economic benefits and certification requirements, the research will enable more autonomous aircraft operation in the European ATM system.

Approach:
The improvements must be capable of being fitted into existing aircraft; therefore, this project will focus on the ATM solution required for aircraft retrofit. It shall use the ATM and ground requirements, ground infrastructure and operational scenarios, as defined and reviewed by users (such as airlines and ATS providers) in WP1 - Operational Concept, as a basis. The retrofit avionics solution will be designed and developed to meet this baseline (under WP2 - Avionics Package) and demonstrated within representative future ATM environments (under WP3 - Validation). The capabilities to be validated will be confirmed at the start of the programme, however the following will be specifically addressed:

- validation of GNSS (with ground- and space-based augmentation) procedures for approach using 4D flight path control;
- evaluation of airborne 4D flight path generation for integration with ground-based flight path planning;
- validation of ADS-B (using VDL Mode 4) with airborne display of traffic (CDTI) and separation assurance algorithms;
- integration of airborne taxiway map and data-linked clearances;
- evaluation of flight deck HMI improvements to support 4D flight path generation and monitoring in a more autonomous environment;
- integration of the full ATN stack/VDL mode 2 in the airborne environment to support AOC and ATC communications using ODIC defined standards.

WP4 - Operational Support will be used to identify the steps required to transition from the trials demonstration of the avionics package to in-service pre-operational validation, by providing cost benefit analysis, operational procedures, new and modified standards, and implementation, exploitation and certification plans.

Expected results:
The MA-AFAS milestones will be:
- formulation of an achievable common operational concept which builds upon EC and Eurocontrol Research in the functional areas of air-ground and air-air data-links, SBAS and GBAS approaches, 4D flight path generation and guidance, CDTI and ASAS;
- validation by Avionics Package Definition and trials;
- verification of communication loop using MA-AFAS defined Operational Procedures;
- verification that ground infrastructure can support mixed capability aircraft;
- establishment of a safe strategy implementation, based on economic benefit, Standards and World-wide Agreement;
- development of User Buy-in.

Start Date: 01/03/2000
Finish Date: 28/02/2003
Applicability Timeframe: => 2006 and <= 2010
Current Validation Level: V4: System Development - Completion of Development and Integration
Target Validation Level: V4: System Development - Completion of Development and Integration

Parent Project

Sub-projects
- DER041: MA-AFAS - More Autonomous Aircraft in the Future ATM System
- DNA053: ASAS (Airborne Separation Assurance Systems) studies
- EUR185: MA AFAS - AFAS
- LFV012: MA-AFAS - More Autonomous Aircraft in the Future ATM System
- NLR077: MA-AFAS - More Autonomous Aircraft in the Future ATM System

Sponsors
- AIRTEL: Airtel ATN Ltd.
- ALENIA DIF: Alenia Difesa
- AMS: Alenia Marconi System
- DERA
- DLR: Deutsches Zentrum für Luft-und Raumfahrt
- EC DG RES: European Commission - DG Research
- Euro Telem.: Euro Telematik GmbH
- EUROCONTROL: European Org. for the Safety of Air Nav.
- Frequentis: Frequentis Nachrichtentechnik GmbH
- INDRA DTD: INDRA DTD SA
- LFV: Luftfartsverket (Swedish CAA)
- MES: Marconi Electronic Systems
- NATS: National Air Traffic Services Ltd
- NLR: Nationaal Lucht& Ruimtevaartlaboratorium
- QinetiQ: QinetiQ (ex-DERA)
- SAAB CELSIUS: Saab Celsius TransponderTech AB
- Skyssoft
- Sofreavia
- STASYS: Stasys Limited
- THALES ATM F: Thales ATM France

Partners
- Airtel ATN Ltd.
- Alenia Difesa
| AMS (ex-Alenia Marconi System) |  |
| DLR Institute of Flight Guidance |  |
| EUROCONTROL EEC |  |
| European Communities |  |
| Eurotelematik |  |
| Frequentis Nachrichtentechnik GmbH |  |
| INDRA DTD |  |
| LFV - Luftfartsverket (Swedish CAA) |  |
| Luchtverkeersleiding Nederland / ATC the Netherlands |  |
| Marconi Electronic Systems Ltd. |  |
| National Air Traffic Services Ltd |  |
| QinetiQ Malvern (ex-DERA) |  |
| Saab Celsius TransponderTech AB |  |
| Skyssoft |  |
| Sofreavia |  |
| Stasys |  |
| THALES ATM France (ex Airsys ATM France) |  |

| New This Year | ☐ | Included in Safety HI | ☐ | Included in SAFS | ☑ | Results in VDR | ☐ |

| Keywords hits |  |
| Link to ESARRs | Implicitly related to ESARR 4. |

| Category | Safety Management | Topic | Assessment of new system/procedure |  |
Objectives

S-Wake aims to develop and apply tools for assessing appropriate (safe) wake vortex separation distances. In more details, the objectives of the project are:
- to define suitable weather categories for wake vortex safety for aircraft on the approach glide path;
- to improve the physical understanding of wake vortex evolution and decay in the atmosphere;
- to assess what a low-vortex design means in practice for a following aircraft;
- to establish realistic flight simulation environments for investigating wake vortex encounter safety aspects and pilot's response;
- to establish a validated probabilistic safety assessment environment;
- to analyse the safety aspects for current practice;
- to define possible new concepts which allow a safe mitigation of current separation rules under certain conditions.

Approach

The project consists of five main Work Packages (WP):
- in WP1, the Wake vortex transport and decay, and the influence of weather conditions, will be investigated by a team of wake vortex modellers, with input from meteorological experts and air traffic regulation authorities. A large pre-existing data-base with wake vortex transport and local meteorological data will be used for model validation;
- in WP2, Wake vortex encounter models for quantifying the disturbing aerodynamic forces and moments will be developed and validated against flight tests. The dynamic response of the aircraft when passing through a wake vortex system is influenced by the flight mechanical characteristics of the encountering aircraft and the pilot control inputs;
- in WP3 (managed by DA), Flight Simulations will be made for vortex encounters of different aircraft sizes, wake topology (strengths) and wake interception conditions, including worst-case scenario's. Pilot's perceptions of aircraft handling quality and the level of safety during the encounter, will be important outcomes of this study;
- in WP4 (managed by NLR), simplified deterministic models for wake vortex evolution and decay, and flight mechanics models for wake encounter and pilot response will be integrated in a probabilistic method for assessment of flight safety. The study will concentrate on the safety levels under current ATM separation rules, considering different classes of weather and a matrix of different aircraft weight classes;
- in WP5, an extensive amount of Flight Recording Data of aircraft at approach and landing will be gathered and analysed with an automatic processing tool to be validated with flight test data in S-Wake. Statistical analysis of the results will be made and results will be compared with that of the probabilistic approach and the flight simulations. It is indeed essential, for a final validation of the developed tools, to compare the results with actual wake vortex incident data.

Expected results

The expected exploitable project outputs are as follows:
- advanced numerical tools and simple numerical methods for the simulation of wake vortex behaviour in the atmosphere near ground, under various weather conditions, will lead to improved understanding of the wake vortex physics in the atmosphere. Meteorological predictable wake vortex weather classes will be defined;
- validated simple models for computing aerodynamic forces and moments during wake vortex encounter that can be used in flight simulations and for probabilistic safety studies. Flight test data for various controlled wake interception conditions will be obtained for validating the wake vortex encounter models;
- flight simulator environments for assessing the levels of flight safety by analysing the aircraft response and pilot reactions during simulated wake vortex encounters;
- a probabilistic safety assessment method will be developed and employed for assessing the levels of wake vortex safety under the current separation rules and for evaluating possible new concepts which allow a safe mitigation of current separation rules;
- a large quantitative database yielding frequency and severity of wake vortex encounters for incoming aircraft at London Heathrow Airport during a period of one year. The data collection is based on Flight Data Recordings and enables a detailed statistical analysis of the data.
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<th>Results in VDR</th>
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<td>Category</td>
<td>Safety Management</td>
<td>Topic</td>
<td>Assessment of new system/procedure</td>
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DaimlerChrysler Aerospace Airbus GmbH
DFS
DLR Institute of Flight Guidance
European Communities
Flight Data Company Ltd.
Instituto Superior Tecnico
Luchtverkeersleiding Nederland / ATC the Netherlands
MET Office
Meteo France
National Air Traffic Services Ltd
Office National d'Etudes et de Recherches Aérospatiales
Sofreavia
University of Berlin / Technische Universität Berlin
Objectives
The objectives of THEATRE are the following:
- create the appropriate co-ordination and collaboration environment to gain efficiency and transparency between projects engaged in ATM validation activities,
- gain consensus on large scale validation elements to be performed in 5FP,
- form a high level advisory group with stakeholders interested in ATM validation,
- provide the EC, the Maxi-group (ECAC transport Ministers) and the HLG (ECAC Civil Aviation) with a clear and regular view on ATM validation activities,
- help in the prioritisation of RTD investment for maximum benefit in Air Transport,
- create a pool of European validation experts, that will provide the expertise and the knowledge needed to orient the 5FP validation objectives,
- provide support to the Master Plan tasks and validation trials,
- develop a dedicated Web site that support the working groups and dissemination activities.

Approach
The experts will be organised in working groups, each one addressing a specific validation issue. THEATRE will consist in 3 Work Packages:
- WP0 will manage the other WPs and provide support to a core team (representative of the major ATM stakeholders), create and maintain intranet for the Thematic Network members,
- WP1 will manage and support the organisation and activities of the WGs.
- WP2 will support dissemination activities related to the project.

Expected results
- creation of a collaborative environment to gain transparency between ATM validation projects, to meet and exchange views between stakeholders,
- provision of support to the ATM Master Validation Plan and the large-scale integration and validation projects in the 5FP,
- creation of a high level advisory group to provide co-ordination and consultation between the policy makers and Air Transport stakeholders, helping in RTD investment for the maximum benefit for Air Transport.

Applicability Timeframe
N/A

Current Validation Level
N/A

Target Validation Level
N/A

Sub-projects
AEN040: THEATRE - Thematic Network on Air Transport for ATM Validation Activities
NLR084: THEATRE - Thematic Network on Air Transport for ATM Validation Activities

Sponsors
AENA: Aeropuertos Españoles y Navegación Aérea
CENA: Centre Etudes de la Navigation Aérienne
DERA
DFS: Deutsche Flugsicherung GmbH
EC DG TREN: European Commission DG Transport Energy
INDRA DTD: INDRA DTD SA
Isdefe
NLR: Nationaal Lucht & Ruimtevaartlaboratorium
QinetiQ: QinetiQ (ex-DERA)
THALES ATM F: Thales ATM France

Partners
AENA
CENA
DFS
European Communities
Hungarian Scientific Association for Transport
Indra
ISDEFE
Nationaal Lucht en Ruimtevaartlaboratorium
QinetiQ Malvern (ex-DERA)
THALES ATM France (ex Airsys ATM France)
Transport Research Centre
**Objectives**
The main objective of THENA is to create and develop a co-ordination and collaboration environment for Airport activities, in order to gain transparency and effectiveness in the development of the projects related to this issue. THENA will provide administrative and technical support for the assessment and consolidation of the results of the various projects in the airport domain, and to facilitate their dissemination to the Member states and other interested parties. The objectives of this TN are the following:
- provide a focal point for collaboration between the different programmes where the stakeholders can meet and exchange views on Airport activities,
- ensure that the exchange of information on Airport activities is conducted efficiently and effectively,
- explore issues not yet covered by the R&D projects and propose recommendations.

**Approach**
THENA intends to divide the work into 6 different relevant areas of the airport domain (capacity and efficiency, Safety, Policy and Regulation, Simulation and modelling, Information Systems Technologies, and Environmental Impact). Each working group will work independently, but overall co-ordination will be done by the WP1 leader. 3 workshop maximum will be organised in each working group.

THENA will be structured in 3 Work Packages:
- WP1 will be dedicated to the management of the network,
- WP2 will gather all the working groups formed during the project lifetime,
- WP3 will be dedicated to promote and disseminate the work performed through a web site development.

**Expected results**
Expected results will be:
- reports summarising state-of-the-art and state-of-practice related to airport activities,
- recommendations to avoid overlapping and make progress in areas not covered by RTD
- dissemination web site.

**Keywords hits**
regulation AND safety

**Link to ESARRs**
None in particular.

**Category**
Safety Management
Objectives

The main objective of INTENT is to answer INTENT’s research question “how does the level of aircraft intent information, shared among ATM users and actors, relate to the air traffic system capacity, the avionics system design and ATM system design “. This question will be answered by means of translating simulation results into a technology roadmap for airborne and ground based equipment, aimed at increasing airspace capacity.

Approach

To find the answer to the INTENT research question as stated in the objectives, and to link aircraft intent information, the location of the traffic separation assurance process and capacity, the following three dimensional matrix will be considered:
- four levels of intent information (aircraft position, aircraft state information, aircraft flight plan information 10 minutes ahead, aircraft flight plan information 20 minutes ahead),
- three locations of the traffic separation assurance process (airborne, ground based, collaborative air/ground),
- three traffic samples (today, 2010, 2030).
Compressed-time simulations, using the matrix above, will include air traffic controller characteristics and pilot characteristics derived from real-time human-in-the-loop part task simulations. The compressed-time simulations will collect data on workload, safety, efficiency and capacity metrics, new to be developed during the INTENT project. The simulations are expected to demonstrate where (air/ground) and when (traffic scenario) the different levels of aircraft intent information can be best used to increase capacity. Following the compressed-time simulations, the results of the compressed-time simulations will be verified during real-time human-in-the-loop full simulations.

Expected results

The main project output will consist of quantified results from the compressed-time simulations, translated into INTENT’s main deliverable, a technology roadmap for airborne and ground based equipment to increase airspace capacity. A second major result of the project would be a research method using compressed-time simulations with modelled human characteristics.
CEC115: MFF - Mediterranean Free Flight

Start Date: 01/07/2000  Finish Date: 31/12/2004

Objectives
The geographic location of the Mediterranean Area between the European Core Area and the States of North Africa and Near East is a critical factor regarding future air navigation service provision in Mediterranean Coastal States. The Core Area already shows high-density level of air traffic and the latter has low/very low density and poor technological infrastructures. However, this boundary situation along with Mediterranean peculiarity of low air traffic complexity scenario is an attractive draw to address studies and validation trials concerning the latest CNS technologies and most recent operational concepts identified in the ECAC 'ATM 2000+ Strategy' to accomplish EATMS.

The MFF main objectives are:
1) To provide technical and operational evaluation of integration, interoperability and safe use of CNS/ATM technologies and applications suitable for future Mediterranean ATM scenario (e.g. operational requirements and procedures based on the use of new CNS/ATM technologies enabling the introduction of free flight operations in Mediterranean area);
2) To verify appropriate new operative procedures for ATM staff and crew in free routing and free flight scenarios (e.g. the delegation of separation responsibility from ATC to aircraft and vice versa, through simulations and flight trials using specially equipped aircraft and controller working positions);
3) To take advantage of the inherent results to address standardisation and further maturation of relevant CNS/ATM technologies and applications both in ground systems and avionics;
4) To define guidelines to implement free flight operations in suitable parts of the airspace.

Approach
The Mediterranean Free Flight programme will avoid duplications by using as input the available results of efforts from other European programmes/projects relevant for free flight operational concept (e.g.: FREER, FARAWAY, MA-FAFAS, ADS-MEDUP, NUP, CARE-ASAS Action (Airborne Separation Assurance System) etc.)

While the Mediterranean Free Flight programme would be devoted to explore the aspects of airborne separation assurance concept and applications in En route airspace and in Low Density Area, the CARE ASAS Action would be devoted to Core Area and Terminal Area.

The Programme will last 5 about years and is split into two main phases. The Programme contains 8 main Working Areas (WA):

- WA 1 - Management
- WA 2 - MFF Operational requirements and procedures
- WA 3 - Technological framework and Operational scenario
- WA 4 - Simulation Trials
- WA 5 - Flight Trials
- WA 6 - Validation
- WA 7 - Operational Benefits and Safety Case
- WA 8 - End Results

The Mediterranean Free Flight Programme will start with the survey of users' expectations and present air traffic constrains to define operational requirements and procedures for the future implementation of free flight in the Mediterranean area. The mentioned requirements and procedures will then matched with current CNS technologies to obtain the specifications for an integrated Ground-Airborne test bed system able to assess the feasibility of free flight in the Mediterranean area. Using the defined specification, a real test bed will be implemented, real time simulation will be carried out and flight trials will be executed. En-route airspace with low-density level of air traffic is the intrinsic operational location for MFF flight trials. The programme will also cover Validation, Operational Benefits and Safety Case aspects and activities.

Expected results
The results of studies and validation trials will be contained in the final report and be presented at the national and international level together with the possible recommendations for implementing free flight in Mediterranean area and in other areas with characteristic similar to those present in the Mediterranean scenario.

In a later stage, with the support of the European Commission it will be exploited the possibility to achieve co-operative agreements with boundary Mediterranean countries (Tunisia, Libya, Egypt).

Mediterranean Free Flight is targeted to allow more flexible and direct routings over the Southern and Eastern Mediterranean area. The mentioned requirements and procedures based on the use of new CNS/ATM technologies and applications suitable for future Mediterranean ATM scenario. Effective operation of ANS will be achieved through the delegation of separation responsibility from ATC to aircraft and vice versa, through simulations and flight trials.

This target would generate the following expected positive spin-offs:
- To eliminate the bottlenecks in the air-routes with Europe, by adopting common operational procedures allowed by CNS/ATM system;
- To include the use of CNS/ATM network for the safe and time efficient operations in Mediterranean area;
- To support trade growth and human capital mobility in Mediterranean area by making flight safer and more efficient;
- To support local economies by applying the results of the programme as useful guidance regarding the deployment of new ANS infrastructure/facilities, wherever beneficial or necessary.

Applicability Timeframe
= 2006 and <= 2010

Current Validation Level
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level
V4: System Development - Completion of Development and Integration

Parent Project

Sub-projects
- AEN033: MFF - Mediterranean Free Flight
- DNA001: MASS Simulator and Validation tools
- DNA035: DAARWIN - Test Bed
- DNA040: GOETHE/SHAMAN
- DNA053: ASAS (Airborne Separation Assurance Systems) studies
- DNA186: Safety studies guide
- DNA221: Assistance tool for en-route Terminal Sectors (ASTER)
- DNA227: REFLEX - Flexible routes in France
DNA236: MFF - Mediterranean Free Flight
DNA237: MFF - Mediterranean Free Flight
DNA245: Controller Workstation evaluation
ENAO24: MFF - Mediterranean Free Flight
EUR212: MFF - Mediterranean Free Flight
LFV016: MFF - Mediterranean Free Flight
NLR085: MFF - Mediterranean Free Flight

**Sponsors**
AENA: Aeropuertos Españoles y Navegación Aérea
DNA: Direction de la Navigation Aérienne
EC DG TREN: European Commission DG Transport Energy
ENAV: ENAV SpA
EUROCONTROL: European Org. for the Safety of Air Nav.
HCAA: Hellenic Civil Aviation Authority
LFV: Luftfartsverket (Swedish CAA)
MIA: Malta International Airport
NATS: National Air Traffic Services Ltd
NLR: Nationaal Lucht & Ruimtevaartlaboratorium

** Partners **
AENA
DNA
Ente Nazionale Assistenza al Volo
EUROCONTROL EEC
EUROCONTROL HQ
European Communities
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LFV: Luftfartsverket (Swedish CAA)
Malta International Airport
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National Air Traffic Services Ltd

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**Keywords hits**
safety case, flight safety, validation AND safety

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**
Safety Management

**Topic**
Assessment of new system/procedure
**Objectives**
Feasibility verification of capacity increase and flexibility of access to air space, for the Mediterranean homogeneous area, by large scale deployment of VDL Mode 4 infrastructure for ADS-B and D/L communication applications.

**Approach**
Establishment of a network of infrastructures based on ADS-B and VDL Mode 4:
- **Italy**: 5 Ground stations (VDL Mode 4 and ADS-B Router/network node) and 4 en-route shadow ATC centres
- **Spain**: 2 Ground stations and 1 en-route shadow ATC centre
- **Greece**: 1 Ground station
- **Malta**: 1 Ground station and 1 en-route shadow ATC centre
- **France**: ADS-B Router/network node
- **Germany**: ADS-B Router/network node

Development of applications/services:
A) Communication:
- CPDLC - data link services from controller to pilot and vice versa for services like clearance delivery, transfer of communications, etc.
- AIDC - exchange of co-ordination information among ATSU for the different phases of co-ordination, namely trajectory Notification, trajectory Co-ordination and Transfer of Control.
- FIS-B - transmission over data link of FIS related information.
B) Navigation
- GNSS - airborne utilisation of satellite signals to determine the aircraft's 4-D position.
C) Surveillance
- ADS-B - broadcast of relevant flight data, such as 4-D position, attitude, IAS, magnetic heading and other a/c parameters. ADS-B will support improved separation assurance (integrated with surveillance radar data, if available), automatic downlink of airborne parameters, notification of aircraft short term intent.
- TIS-B - transmission of radar traffic situation, which aims to support the CDTI airborne application and possible future ASAS algorithms.

Large scale pre-operational experimentation in shadow mode ATC Centres using a small number of equipped a/c.

The ADS-MEDUP airborne platform will consist of:
- Airborne basic component, capable to manage VDL Mode 4 protocols and act as a mobile user in the ADS-MEDUP network.
- Cockpit Display and Navigation Unit (CDNU), running the software applications that co-operate in the CNS/ATM scenario.

The aircraft planned to be equipped are 7, of which five from Italy (Alitalia), one from Spain, one from Malta (Air Malta)

**Expected results**
Evaluation of experimentation results in the light of possible further exploitation towards operational use. Survey of institutional and safety issues.
Support to other experimentations (Mediterranean Free Flight MFF and others).

**Applicability Timeframe**
=> 2000 and <= 2005

**Target Validation Level**
V4: System Development - Completion of Development and Integration

**Parent Project**
CEC117: ADS-MEDUP - ADS Mediterranean Upgrade Programme

**Start Date** 01/03/2000  **Finish Date** 31/05/2004

**Current Validation Level**
V4: System Development - Completion of Development and Integration

**Target Validation Level**
V4: System Development - Completion of Development and Integration

**Sub-projects**
AEN032: ADS-MEDUP - ADS Mediterranean Upgrade Programme
ENA026: ADS-MEDUP - ADS Mediterranean Upgrade Programme
EUR207: ADS-MEDUP - ADS Mediterranean Upgrade Programme
LFV017: ADS-MEDUP - ADS Mediterranean Upgrade Programme

**Sponsors**
AENA: Aeropuertos Españoles y Navegación Aérea
DFS: Deutsche Flugsicherung GmbH
EC DG TREN: European Commission DG Transport Energy
ENAV: ENAV SpA
EUROCONTROL: European Org. for the Safety of Air Nav.
HCAA: Hellenic Civil Aviation Authority
LFV: Luftfartsverket (Swedish CAA)
MIA: Malta International Airport

**Partners**
AENA
DFS
Ente Nazionale Assistenza al Volo
EUROCONTROL EEC
European Communities
Hellenic Civil Aviation Authority
LFV - Luftfartsverket (Swedish CAA)
Malta International Airport
Objectives

New operational procedures for the improvement of air flow efficiency have come to maturity thanks to advances in technology and refinement of new concepts. To obtain the expected capacity benefits, new ways to implement advanced procedures must be identified, exploited and tested.

Following the criteria contained in the Procedures for Air Navigation Service-Aircraft Operations (PANS-OPS), and making use of new technologies as well as of new concepts, the APPROVE project comprises the implementation of Precision Area Navigation (P-RNAV) instrument approach procedures to obtain capacity benefits.

Approach

To assess the validity of the procedures, APPROVE will use three different aerodromes, each one selected and used as test site for the new airport approach operations. The aerodromes - located in the Netherlands, Italy and Spain - have different traffic complexities and densities, thus ensuring that the procedures are applicable in different environments.

APPROVE will elaborate specific approach procedures - based on a set of guidelines identified and described previously in the project - for each one of the selected sites. The safety and benefits of these procedures will be assessed using fast and real-time simulations; following this action, the procedures will be flight tested to ensure their airworthiness and efficiency.

Expected results

APPROVE contributes to create a harmonised set of European airport approach procedures leading to reduced training costs for the airline, thus increasing their profits. The increase in airline efficiency will most likely result in a higher activity for aircraft manufacturers, air navigation system designers, airport services, equipment suppliers, ATM providers and Controllers.

The project directs the promotion of competitive and sustainable growth, enhancing human potential in terms of socio-economic research to acquire a better understanding of the impact of new technologies on work, the economy, education and culture. APPROVE promotes the optimal use of human resources and facilities as well as knowledge dissemination throughout Europe.

Start Date 01/07/2001    Finish Date 30/06/2003

APPROVE - Advanced airport aProach PROceodures including Validation and Elaboration

CEC118: APPROVE - Advanced airport aProach PROceodures including Validation and Elaboration

Sponsors:
- CEC118: APPROVE - Advanced airport aProach PROceodures including Validation and Elaboration
- ENAV: ENAV SpA
- INECO: Ingeniería y Economica del Transport
- Isdefe
- NLR: Nationaal Lucht& Ruimtevaartlaboratorium
- SICTA: Sist Innovativi Controllo Traffico Aereo

Partners:
- AENA: Aeropuertos Españoles y Navegación Aérea
- EC DG TREN: European Commission DG Transport Energy
- Ineco: Ingenieria y Economica del Transport
- ISDEFE
- SICTA: Sist Innovativi Controllo Traffico Aereo
- AENA: Aeropuertos Españoles y Navegación Aérea
- European Communities
- INECO
- ISDEFE
- Nationaal Lucht en Ruimtevaartlaboratorium
- Sist Innovativi per il Controllo del Traffico Aereo
**Objectives**

With the continuous growth of air traffic and the increasing level of urbanisation around most airports in Western Europe, the impact of aircraft noise and emissions on the quality of life for the surrounding communities has become a serious issue to be dealt with. A solution to noise reduction around an airport is the definition of new approach and departures procedures. The SOURDINE II project is proposing to develop enabling technologies, tools and methods to ensure the safe, efficient and economic operation of new noise abatement procedures.

**Approach**

SOURDINE II is a Research, Technology development and Demonstration (RTD) project aimed at providing solutions to the following issues:
- Airport approach and departure procedures that are aimed at reducing the environmental (noise and emissions) impact around airports require a co-ordinated solution by all involved parties. A European and international standardisation and harmonisation of such procedures is required in order for them to become operationally acceptable and only then can such new procedures be easily introduced on a larger scale and at a level of safety acceptable to the community.
- Provide an accepted implementation plan by all involved stakeholders to be able to migrate from the current situation to advanced environmentally friendly approach and departure procedures. This avoids the need to develop specific local solutions to a European problem.
- Produce air traffic controller and pilot tools to guarantee a high level of safety for the new advanced procedures.

**Expected results**

Principle innovative elements are the development of a thoroughly validated and harmonised implementation plan for new advanced noise abatement solutions. The validation will be performed according to a thorough validation methodology, using fast-time and real-time simulations to evaluate environmental, capacity, safety and financial effects of the new procedures.

The project will also include the development and validation of advanced controller and pilot tools, which are needed to achieve more environmentally friendly airport operations, without impeding the growth in air traffic and maintaining or increasing the present level of safety.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**

V3a: Generic Specification - Requirements Defined

**Parent Project**

AENO39: SOURDINE II - Study of Optimisation procedURes for Decreasing the Impact of NoisE around airports II
EUR224: SOURDINE II - Study of Optimisation procedURes for Decreasing the Impact of NoisE around airports II
EUR294: MONICA - Mitigation of the Noise Impact of Civil Aviation-
EUR296: RIANNA - Research into Improving Aircraft Noise Nuisance Assessment
NLR087: SOURDINE II - Study of Optimisation procedURes for Decreasing the Impact of NoisE around airports II
SIC011: SOURDINE II - Study of Optimisation procedURes for Decreasing the Impact of NoisE around airports II

**Sponsors**

AENA: Aeropuertos Españoles y Navegación Aérea
EADS: EADS - Airbus Division
EC DG TREN: European Commission DG Transport Energy
EUROCONTROL: European Org. for the Safety of Air Nav.
INECO: Ingenieria y Economica del Transport
Isdefe
NLR: Nationaal Lucht& Ruimtevaartlaboratorium
SICTA: Sist Innovativi Controllo Traffico Aereo

**Partners**

AENA
EADS Airbus SA
EUROCONTROL EEC
European Communities
INECO
ISDEFE
Nationale Lucht en Ruimtevaartlaboratorium
Sistemi Innovativi per il Controllo del Traffico Aereo

**New This Year**

- [ ] Included in Safety HI
- [ ] Included in SAFS
- [ ] Results in VDR

**Keywords hits**

validation AND safety

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management

**Topic**

Assessment of new system/procedure
The European Community's Single Sky policy aims at the creation of the single European Sky. The final report of the High Level Group set up to advise the European Commission on the reform of the ATM sector underlines that the ATM organisation suffers from significant handicaps standing in the way of a more efficient performance. So, it is necessary that the overall performance of the European ATM system is enhanced. Benchmarking is a tool to identify and release the potential for improvement. That is why a major study on benchmarking, covering the European Community area, and some third countries (Switzerland, Norway, the USA, Canada, South Africa and New Zealand) has been launched.

### Approach

The work to be carried out can be split into four main activities related to the benchmarking of the ATM sector. With regard to the geographical scope, the study should cover the Community Member States and for a global comparison, it should be extended to other major states with well-developed ATM systems. With regard to the operational scope, it will be necessary, when appropriate, to extend it to the relevant operations of airports and airlines according to the "gate-to-gate" concept. 

The four main activities are the following:
- identification of the relevant objectives and areas of benchmarking
- selection of the relevant dimensions, identification of the indicators and data needed
- data and information collection, analysis and assessment
- identification of benchmarks and best practices and requirements for continued assessment.

### Expected results

The study should finally provide for an initial set of benchmarks and related best practices in the areas and domains of investigation. The foundations for a continued process of assessment of the ATM sector, at the operational and regulatory levels, should be established, based on the requirements for systematic process of benchmarking. This is intended to stimulate the ATM market orientation and efficiency of ATM organisations.

<table>
<thead>
<tr>
<th>Project</th>
<th>CEC122: Benchmarking for best practises in ATM (European Community)</th>
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<tbody>
<tr>
<td>Start Date</td>
<td>01/01/2002</td>
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<tr>
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So this study should enhance the findings of the related benchmarking study concerning EU countries, and investigate the context of candidate countries with a view to the efficient and safe use of their ATM systems and regulatory arrangements during the next twenty years.

With regard to the scope of this study, it should cover all the EU candidate states: Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Slovenia, Romania, Bulgaria, Turkey, Cyprus, Malta.

With regard to economic and temporal scope, the study should consider all economic developments of the regions involving these states that can be expected to affect the conditions of airspace management in these countries the next twenty years. With regard to the institutional scope, the study should take a systemic view.

The work can be split into four main activities related to the benchmarking of the ATM sector:
- brief consolidated view of the status quo of ATM services in the EU candidate states
- assessment of key practices and identification of key indicators of performance
- analysis of the special situation in the candidate states and development of scenarios
- consultation with EU candidate states and conclusions.

Key insights into the state and evolution of ATM in the candidate states are expected. Recommendations of approaches to be taken by the states, either national, regionally or at the European level should be made. Assessments of the impact of such approaches for the EU enlargement process for aviation and of the impact that can be expected on public or private investments in ATM in these countries/regions during the next twenty years should be made.

The value of benchmarking and best practice assessment should be provided, indicating key pointer for future work.

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EC DG TREN: European Commission DG Transport Energy
European Communities
Helios Technologies
Integra Consult A/S
Solar Alliance

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<tr>
<th>Project</th>
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GIFT final objective is to demonstrate that GNSS navigation (augmented by IRS and other onboard sensors) can answer to the following operational needs: Cat2/Cat3 precision approach and landing, and autoland in Cat1 conditions. GIFT proposes to study the capabilities of hybridisation between the information obtained from GNSS elements with information from IRS and other sensors already available onboard the aircraft. Such an augmentation technique allows to compensate GNSS limitations, and will provide integrity and continuity improvements. Performance of proposed algorithms will be appreciated with regard to these operational needs. Algorithms will be evaluated both on an AIRBUS simulator and in flight conditions. Result of this study are necessary to prepare future European certification of satellite based navigation systems.

The GIFT project is split into 6 work-packages.

WP1 is directed to the management and the co-ordination of the project.
WP2 is dedicated to system studies: performance criteria for certification will be reviewed, in order to allocate requirements applicable to navigation (positioning) parameters for Cat1 autoland, and for Cat2/Cat3 precision approach and landings. Starting from existing architectures on AIRBUS aircraft, one will analyse how they would have to be modified, within the frame of a positioning and guidance system no more based on one single sensor (typically ILS), but combining different sensors (hybridisation concept). This architecture study will be safely oriented, and will conclude by allocating requirements (accuracy, integrity, safety) to the navigation subsystem components. A detailed safety analysis will then refine these objectives on the different system components.

WP3 is dedicated to algorithms study: hybridisation algorithms combining benefits of the different navigation sources available on aircraft (especially IRS and GNSS) will be studied. This WP includes the definition and software realisation of realistic behaviour models of the different sensors. A sensitivity analysis will prolong the algorithms study with the objective to evaluate the applicability of the proposed concept to regional and smaller aircraft.

WP4 is dedicated to the development of a functional aircraft simulator, to perform simulated approaches and autoland, for evaluation of algorithms efficiency in various approach conditions.

In WP5, a flight experimentation will be performed, with a double objective: to demonstrate that algorithms can be implemented in an airborne computer and can run in real-time conditions; to evaluate the concept in real flight and dynamic conditions.

WP6 corresponds to the exploitation and dissemination plan.

The main expected results of the GIFT project are:
- Presentation of proposed hybridation technique and algorithms.
- mid-term review: presentation of architecture studies, and experimentation package design.
- presentation and acceptance of the aircraft simulator.
- presentation and acceptance of the experimentation package, before integration on aircraft.
- review of algorithms performance evaluation on simulator, flight test results and GIFT conclusions.
CEC128: ISAWAIRE II - Increasing Safety Through Collision Avoidance Warnings Integration II

Start Date: 01/07/2002  Finish Date: 30/06/2005

Objectives
The density of the air traffic increases steadily with local congestion becoming more and more of a problem. These increasing traffic demands call for new innovative system solutions on-board aircraft to improve the current safety and reliability standards. ISAWAIRE II is a major contribution to solve the issue of improving both safety and efficiency of flight operations. It consists of a new and unique way to present to the pilots terrain, surrounding traffic, weather and airport information consistent with their natural perception. This comprehensive presentation, not only provides a totally new quality of the crew situation awareness but additionally enables the pilots to become active and co-operative partners in ATM. Therefore, ISAWAIRE II fulfills the Growth programme objectives 4.4.3 (accident prevention).

Based on the findings in the ISAWAIRE project, the main objectives in ISAWAIRE II are:
- The introduction of interactive cockpit provisions, specific to surveillance system, that will enable pilots to customise their display presentation and provide the surveillance system with more inputs coming from pilots,
- The adaptation of the ISAWAIRE reactive into a proactive system providing the crew with view of the threats in "protected" areas in which the crew could intend to fly;
- An Intelligent Crew Support System (ICS) to assist the crews in high workload conditions (approach and landing), in adverse weather and in critical situations, that is to say when flight operations are found most difficult and prone to human error;
- An exocentric Navigation Display presentation that shall greatly enhance the crew vertical awareness in approach and departure phases of flight;
- A Taxi Display, which is integrated with the Navigation Display to support the standard flight procedures;
- Presentation of different types of safety altitudes on the displays upon pilot request.

Approach
The following technical innovations will be developed and evaluated by airline pilots on flight simulators during ISAWAIRE II:
- Interactivity concept, applied to the use of surveillance system, that will enable pilots to customise their display presentation, introducing more flexibility through pop-up menus to be selected by a novel Crew Control Device, and to build non-dedicated control panels reducing the number of control panels required, and so doing reducing the overall cost of the aircraft.
- Proactive system enabling the pilot to prepare his route planning thanks to the interactivity with both the cockpit display system and the FMS.
- An Intelligent Crew Support (ICS) system to assist the crews in high workload and critical situations, when flight operations are found most difficult and prone to human errors.
- A novel, exocentric, Navigation Display presentation that shall greatly enhance the crew's vertical awareness during approach and departure, in order to enhance safety during these phases of flight prone to CFIT accident.
- Situation Awareness during the ground phases (Taxiing, Take-Off and Landing) will be further evaluated by using a Taxi Display, which is integrated with the Navigation Display.

Furthermore, following the studies done in ISAWAIRE on workstations, ISAWAIRE II will address the integration and certification aspects of such a system by developing and experimenting a mock-up based on embedded hardware. ISAWAIRE II mock-up will be tested on a fixed base flight simulator with test pilots to have a first evaluation of the work and to test the various HMI and other system options available. Finally, the mock-up will be installed on a moving base flight simulator to be evaluated by airline crews.

Expected results
ISAWAIRE II project is aimed at improving the safety level as referenced for 2010, by bringing down the current CFIT related Approach-and-Landing Accident rate for civil transport aircraft with about 5% per year. Furthermore as terrain, weather and other traffic are presented in a natural way, Take-off and Landing intervals may become the same for IMC conditions as with those today under VMC conditions. It will bring the European industry not just aside, but ahead of US competitors.

The initial 18-month period was divided in four phases:
- WP 1: 'ISAS Specification' to determine operational and functional requirements and characteristics of all surveillance components used to validate the ISAS (Intelligent Situation Awareness System) concepts.
- WP 2: 'ISAS Test Bed' to define the mock-up environment. Several version of the 'WP 2.2 test bed ICD', the last version including the final definition is planned with the end of WP 4.2 Integration Analysis. WP 2.4 Integration Analysis will end at the beginning of the next period.
- WP 3 ISAS Development' started once the project environment was well defined and characterised in January 2003. Most of the development is finished, the remaining part will be done at the beginning of the next period. The WP 3.5 Evaluation & scenario procedure development started in September 2003.
- WP 4 Integration and test' started with the WP 4.1 Integration & test-off-line' that was completed at the end of 2003 (its final report to be released soon), and the WP 4.2 integration on basic flight simulator'. The ISAWAIRE II project is now in the integration and validation phase. Next targets are:
  - to finalize test bed, ISAS hardware and software development (WP 2 and WP 3)
  - to finalize the 'WP 4 integration and test' on a basic flight simulator, including pre-evaluation phase,
  - to start the 'WP 5 integration and evaluation on the full flight simulator’ that will be used for the ISAS evaluation by the pilots.

Applicability Timeframe: => 2006 and <= 2010

Current Validation Level: V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level: V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Parent Project
AIRBUS: Airbus Industries
BAE: British Aerospace
Dav: Diehl Avionics
EC DG RES: European Commission - DG Research

Sponsors
AIRBUS: Airbus Industries
BAE: British Aerospace
Dav: Diehl Avionics
EC DG RES: European Commission - DG Research
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<tr>
<td>Eurocopter</td>
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<td>NLR: Nationaal Lucht &amp; Ruimtevaartlaboratorium</td>
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<td>THALES AVN F: Thales Avionics France (ex Sextant)</td>
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<td>Safety Management</td>
<td>Assessment of new system/procedure</td>
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Objectives

Overall objective is to improve air transport operational capacity and safety by developing on-board integration of a system for remote detection, warning and avoidance of wake-vortices and other atmospheric hazards (dry wind-shear, clear air turbulence, volcanic ashes). The system will principally provide on-board remote detection of wake-vortices during approach phases. In this way, the required level of safety can be guaranteed during approaches with reduced separation distances or behind a very large transport aircraft without the need to apply extended separation, while autonomously flown by the pilot.

Approach

Work is organised to easily gain progress in system definition, integration capability and airborne performances:
- WP 1000 "System Definition" is dedicated to define the airborne I-WAKE system and its integration in aircraft, including system safety and benefits assessment.
- WP 2000 "Flight Simulation Tests" contributes to validate WP 1000 studies on wake-vortex avoidance manoeuvres definition and to test appropriate Man Machine Interface concept.
- WP 3000 "Flight Tests" objective is to fly a prototype of airborne LIDAR, to perform in-flight measurements behind a leading aircraft and to analyze wake-vortex detection capabilities. Longer range detection capabilities for detection of dry wind shear and clear air turbulence will also be tested. Additionally, to prove the feasibility and the efficiency of an airborne system, WP 3000 in-flight recordings -will be compared with previous ground results.
- WP 4000 "Techniques and Technologies" is oriented to the European development of the techniques and technologies required for a compact, reliable, efficient and affordable future industrial airborne system. The LIDAR optics used for flight test in WP 3000 is based on high technology components from a USA company. I-WAKE aims at developing in Europe capability to provide similar and hopefully more compact components. Development of processing algorithms for automatic wake-vortex pattern recognition in real time, to be integrated in the future equipment is also a challenging point to be demonstrated in this work package.
- WP 5000 "Management and Final Synthesis". Synthesis is the convergence key point of all other works, allowing an update of conclusions. The definition of the future airborne equipment, its perspectives, the necessary complementary activities will be identified.

Expected results

- Availability of major system definition inputs, of installation constraints for equipment to be flight tested and first results laboratory LIDAR mock-up
- Availability of most input elements for final on-board system definition and benefit update
- Project conclusions concerning techniques and technologies progress made during I-WAKE, and final on-board system definition and benefit.

Applicability Timeframe

=> 2006 and <= 2010

Current Validation Level

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level

V4: System Development - Completion of Development and Integration

Parent Project

CEC129: I-WAKE: Instrumentation Systems for On-board Wake Vortex and Other Hazards Detection Warning and Avoidance

Start Date

01/04/2002

Finish Date

31/03/2005

Sub-projects

EUR228: ATC Wake

Sponsors

Airbus D: Airbus Deutschland
DLR: Deutsches Zentrum für Luft-und Raumfahrt
EC DG RES: European Commission - DG Research
FhG: Fraunhofer-Gesellschaft zur Förderung de
LISA: Lisa Laser Products oHG Furhberg & Teich
NLR: Nationaal Lucht & Ruimtevaartlaboratorium
THALES AVN F: Thales Avionics France (ex Sextant)

Partners

Airbus Deutschland GmbH
DLR German Aerospace Centre - Deutsches Zentrum für Luft- und Raumfahrt e.V.
European Communities
Fraunhofer-Gesellschaft zur Förderung der Angewandten Forschung e.V
Lisa Laser Products oHG Fuhrberg & Teichmann
Nationaal Lucht en Ruimtevaartlaboratorium
THALES Avionics - Toulouse (ex-Sextant Avionique)
Université Catholique de Louvain
University of Hamburg

New This Year

Included in Safety HI

Included in SAFS

Results in VDR

Keywords hits

hazard

Link to ESARRs

Implicitly related to ESARR 4

Category

Safety Management

Topic

Assessment of new system/procedure
The C-Wake project addresses physical aspects of aircraft generated wakes through characterisation. It aims to provide application guidelines for the European aircraft industry by treating wake control; synthesises findings from various critical technology projects and other related sources with the eventual goal to arrive at a validated method of predicting wake characteristics of Large Transport Aircraft with sufficient accuracy.

C-Wake results are intended to contribute to flight safety, to enhance competitiveness of the European aircraft industry and provide input to approaches for capacity increase.

The C-Wake project will advance Wake Vortex characterisation and control in future applications of large passenger transport aircraft. This is accomplished within two main work packages, one experimental and one numerical, in which various high-standard tools are employed that address wake vortex topics in a complementary scheme. A third work package summarises results, provides a wake vortex database structure and issues guidance to industry.

WP1 focuses on experimental investigations, first to measure and then to characterise the flow field generated by aircraft models in experimental facilities (wind tunnel, catapult, towing tank) or by real aircraft overflying a facility that measures a wake. The main objective will be the characterisation of aircraft vortex wakes and the effects which a particular aircraft configuration, or a single component, has on wake behaviour.

Experiments are expensive. Hence, employing less expensive, numerical approaches becomes mandatory. The goal in WP2 is wake modelling which emerged as a challenging topic aiming at realistically describing vortex wakes. The tools employed are high-end computers, with experimental results serving to validate codes.

Greatest added value could be achieved by combining both numerical and experimental approaches to complement each other. Interrelated activities between both work packages become mandatory to meet the objectives set out in the program.

A prime target in the C-Wake project are unsteady effects in a wake which are believed a key to understanding wake decay.

The focus to which the whole C-Wake research effort will converge, are methodologies which industry could use as a guidance for designing large transport aircraft which shed benign vortex wakes. A unique database will be established which will allow for the first time to draw on resources obtained in the C-Wake Project and elsewhere. Assembling these findings into workable methods will be the goal of WP3.

Wind tunnel tests of realistic large aircraft model in near field will provide the effect of wake-modifying devices. A parametric database will be available from near field testing.

In Catapult tests an Airbus type model and a very large aircraft model will be tested with the PIV operational with up to ten CCD cameras. That will be a new dimension in the PIV application. A database will be available from the testing available and will deliver inputs to WP2.

Towing tank experiments will provide realistic wake decay and by this deliver a new dimension to access the far field.

Flight tests of Airbus A340 overflights will be measured by ground based LIDAR systems. The analysed data will deliver datasets for the database.

The Numerical Assessment of far field simulations will deliver inputs to databank

From the Synthesis of the established database the needed inputs will be used to produce validated recommendations for the acceptance by the industry.
Centro Italiano Ricerche Aerospaziali
CERFACS
CFD Norway AS
Debis
DERA Malvern
DLR German Aerospace Centre - Deutsches Zentrum für Luft- und Raumfahrt e.V.
European Communities
German Dutch Wind Tunnel (DLR/NLR)
Hamburgische Schiffbau-Versuchsanstalt GmbH
Institut National Polytechnique de Toulouse IMF
Instituto Nacional de Técnica Aerospacial
Instituto Superior Tecnico
Nationaal Lucht en Ruimtevaartlaboratorium
National Technical University of Athens
Office National d'Etudes et de Recherches Aérospatiales
Société d'Ing., de Rech. et d'Et. En Hydrodynamique Navale SA
Technische Universität München
University of Cambridge
University of Delft
University of Patras
Ustav Jaderneho Vyzkumu NRI

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<th>Category</th>
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<th>Assessment of new system/procedure</th>
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<td>Safety Management</td>
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Objectives

The SHINE project aims at improving air transport efficiency and quality by offering new navigation and attitude sensors at low cost, enabling aircraft to fly and land in a more dense European airspace with the same or better level of safety. Allowing helicopter and regional aircraft to have Head Up Guidance or CAT I landing capability at a low cost also makes a major contribution to the reduction of operating costs, allowing a reduction in number of diversions to other airports in case of bad weather conditions.

The main goal is to make progress at European level in the following domains:

* Requirement identification for future AHRS/GNSS system,
* Low-cost inertial technology by evaluation of one technology singled out as best candidate,
* Self-redundant inertial sensor equipment,
* GNSS signal-processing technique for attitude determination applied to aircraft environments,
* Improved AHRS/GNSS hybridisation techniques,
* GNSS1 EGNOS receiver performance, including promotion of EGNOS system through Fly Tests,
* GNSS receivers transition to different augmentations and constellations (GBAS, GALILEO/GNSS2),
* GNSS techniques for enhanced robustness to environmental interference.


Approach

The approach selected in SHINE is to build on progress already made in two areas (GNSS integrity and low-cost inertial sensor technology) and add in advanced processing techniques in order to design equipment that will deliver navigation and kinematics parameters that are smaller and cheaper than current configurations, while maintaining at least equivalent performance. In one low-cost low-weight configuration, the equipment will provide all positioning attitude and kinematics parameters required by control, guidance and navigation avionics systems.

The work plan is structured around the key research area (low-cost IMU, GNSS based attitude) and includes development of the prototype equipment (base-line design, prototyping, flight test, etc.). The project aims to define, manufacture and test in flight an airborne prototype equipment based on this new concept, to assess what performance can be achieved. The project also aims to define the future product, with preliminary safety, certification analysis and analysis of user requirements. The work programme is divided into eight work packages. Each key component of the SHINE concept is associated with a dedicated work package.

Expected results

The following expected results have been identified for the complete SHINE project:

* Definition of the whole system taking the variety of potential users into account, from light helicopters to heavy airline carriers.
* Definition and testing of self-redundant inertial sensor architecture and of sensor fusion algorithms.
* Definition and validation of basic inertial sensor technologies.
* Prototype Development, Laboratory and Flight Tests.

Applicability Timeframe

=> 2006 and <= 2010

Current Validation Level

V3b: Generic Specification - Requirements Validated

Target Validation Level

V3b: Generic Specification - Requirements Validated

Parent Project

Sub-projects

Sponsors

AERODATA: AERODATA Flugmesstechnik GmbH
DUT: Technical University of Delft
EC DG RES: European Commission - DG Research
EUROCOPTER F: Eurocopter France
Industry
NLR: Nationaal Lucht& Ruimtevaartlaboratorium
THALES AVN F: Thales Avionics France (ex Sextant)

Partners

Aerodata
Cranfield University
EUROCOPTER
European Communities
Nationaal Lucht en Ruimtevaartlaboratorium
THALES Avionics - Vélizy (ex-Thales-CSF Sextant)
University of Delft
The ASAS Thematic Network is organised within the work programme for Competitive and Sustainable Growth of the European Community, Key action 4, New Perspectives in Aeronautics, Target Platform 4, 'More autonomous aircraft in the future air traffic management system'.

The main goal of the ASAS Thematic Network (ASAS-TN) is to accelerate the implementation of ASAS applications in the European Airspace taking global applicability in order to increase airspace capacity and safety. The main project objective is to ease the transfer and comparison of information and results on ASAS research in order to improve the research strategy, in particular thanks to the production of recommendations.

To reinforce the cooperation on ASAS, it is proposed:
1. To organise three workshops on topics related to ASAS applications;
2. To organise a seminar to present RTD results on ASAS applications open to all stakeholders;
3. To organise moderated forums of discussions related to ASAS topics on the Internet;
4. To maintain an ASAS repository where all the documents related to ASAS could be identified and downloaded; and
5. To develop guidelines and recommendations for standardisation, certification and implementation of ASAS applications.

The ASAS-TN project is divided into four workpackages:
- WP0: ASAS-TN Management;
- WP1: ASAS-TN Workshops and Seminar;
- WP2: ASAS-TN Internet and Document Repository; and
- WP3: ASAS Implementation Strategy and Reports.

Exploitation of the results of ASAS-TN can start immediately, but the proposed solutions are designed for medium and long-term perspectives.

It is expected that these results will be of use to guide future EC actions from 6th Framework RTD projects to shorter-term TEN-T pre-operational experimentations. The expectation is also that the shared knowledge and the agreed upon recommendations will allow European industry to optimally plan and focus their new products development strategy.

### Applicability Timeframe
N/A

### Current Validation Level
N/A

### Target Validation Level
N/A

### Sponsors
EC DG RES: European Commission - DG Research

### Partners
Bae Systems
Ente Nazionale Assistenza al Volo
EUROCONTROL EEC
European Communities
LFV - Luftfartsverket (Swedish CAA)
Nationaal Lucht en Ruimtevaartlaboratorium
THALES ATM France (ex Airsys ATM France)
THALES Avionics - Toulouse (ex-Sextant Avionique)

### New This Year

### Keywords hits

### Link to ESARRs
Implicitly related to ESARR 4

### Category
Safety Management

### Topic
Certification of ATM Systems
This project is aimed at studying the operational, institutional and economic issues of adopting the fully-fledged GNSS (consisting of GPS, Galileo and their augmentations) as the sole navigation service provided to civil aviation in Europe. The context of this project is the launching of the Galileo project and the parallel on-going activities regarding the deployment of EGNOS and of GBAS augmentation systems, the preparation of the 2nd generation of GPS and the on-going discussions on ILS, MLS and GBAS for precision approach.

This study calls for investigations to be conducted in two key areas: the cost-benefit assessment of the GNSS Sole Service strategy, and the safety issues that could be raised by that notion of sole service. As regards the cost-benefit assessment a comparison between a baseline scenario (combining GNSS-1 with conventional nav aids) and the full fledged GNSS-2 sole service scenario was conducted. A conservative view of the benefits has been taken by evaluating only directly quantifiable benefits corresponding to the progressive withdrawal on other navigation aids. Other benefits related to safety, flight data consistency, and other Air Navigation Service improvement issues certainly exist. Some of them have been discussed without attempting to quantify them.

### Expected results
- Cost Benefit Assessment
- Operational, Institutional and Safety Issues

**Applicability Timeframe**
=> 2011 and <= 2015

**Current Validation Level**
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**Target Validation Level**
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

### Keywords hits
- Included in SAFS [✓]
- Results in VDR [ ]

### New This Year
- Included in Safety HI [ ]
- Included in SAFS [✓]

### Link to ESARRs
- Implicitly related to ESARR 4

### Category
- Safety Management

### Topic
- Assessment of new system/procedure
**Objectives**

The main objective is to develop and build a wake vortex safety and capacity platform. This platform will be used to evaluate interoperability with existing ATC systems, to assess possible safety and capacity improvements, to evaluate operational usability and acceptability, and to make a technological implementation plan. This platform is an essential step that will lead to installation of an integrated ATC decision support system at airports, enabling air traffic controllers to apply new optimised weather based aircraft spacing. The ATC system will integrate weather and wake sensors, weather forecasting and now casting systems, wake vortex prediction system, aircraft spacing predictor and air traffic controller interface. Used with new harmonised safety regulation, this system will provide tactical and strategic benefits, while maintaining safety.

**Approach**

The main work will be to develop and build an integrated ATC wake vortex safety and capacity platform. The work is based on six work packages:

- **WP1 System Requirements**: the main work is to define the requirements for the system. This includes operational concepts and procedures, user requirements, and system requirements;
- **WP2 Integrated System Design and Evaluation**: the main work is to develop and build the platform, integrating all subsystems. This includes a wake vortex prediction and monitoring system, weather forecasting and monitoring systems, aircraft spacing predictor, and human machine interface for air traffic controllers. A task is to evaluate technical feasibility of building the system;
- **WP3 Safety and Capacity Analysis**: the main work is to quantify and evaluate possible safety and capacity improvements (tactical and strategic benefits) when using the system. Safe and appropriate separation distances will be determined for single runways and closely spaced parallel runways;
- **WP4: Evaluation of Operational Feasibility**: the main work is to evaluate operational feasibility of the system, including analysing the interoperability with existing ATC systems and usability and acceptability by air traffic controllers;
- **WP5: Technological Implementation Plan**: the main work is to provide the TIP, in accordance with the guidelines from the EC. This will be done in co-ordination with the User Group members, representatives of the aerospace and ATM community;
- **WP6: Management and Final Synthesis**: the main work is to maintain an efficient communication with the EC, other related projects, and to disseminate findings through workshops, conferences, and an Internet Site. A further task is the final synthesis, resulting in a confidential and a publishable final report with conclusions and recommendations.

**Expected results**

Main milestone is availability of the ATC wake vortex safety and capacity platform to interested organisations (ATS providers, airport authorities, ATM industry, and research and development centres). This platform will integrate: wake vortex prediction and monitoring system; aircraft spacing predictor; weather forecasting, now casting and monitoring systems; total airspace and airport simulator; and air traffic controller interface (HMI).

**Applicability Timeframe**

=> 2011 and <= 2015

**Target Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Parent Project**

CEC135: ATC Wake: Integrated Air Traffic Control wake vortex safety and capacity system

**Sub-projects**

EUR228: ATC Wake

**Sponsors**

DLR: Deutsches Zentrum für Luft-und Raumfahrt

EC DG INFSO: European Commission - DG INFSO

EUROCONTROL: European Org. for the Safety of Air Nav.

NLR: Nationaal Lucht & Ruimtevaartlaboratorium

THALES AD: THALES Air Defense

THALES AVN F: Thales Avionics (ex Sextant)

**Partners**

DLR Institute of Atmospheric Physics - Institut für Physik der Atmosphäre

EUROCONTROL Agency

European Communities

Nationaal Lucht en Ruimtevaartlaboratorium

THALES Air Defense

THALES Avionics - Vélizy (ex-THALES-CSF Sextant)

Université Catholique de Louvain
HYBRIDGE: Distributed Control and Stochastic Analysis of Hybrid Systems Supporting Safety Critical Real-Time Systems Design

Safety critical operations are increasingly in need of high performance robust and fault tolerant distributed real-time control systems that are composable and meet stringent requirements under all possible complex uncertain conditions. Since humans carry responsibility for safety, the safety management needs to be embedded in the design process of these distributed control systems. In this respect, one of the most demanding design challenges are posed by air traffic management, which is an application domain in which experience has shown that the system engineering type of approaches fall short. The HYBRIDGE project builds the necessary bridge between control theory and stochastic analysis of hybrid systems on one hand and the design of real-time distributed control systems for safety critical operations on the other hand, and demonstrates this for advanced design of air traffic management.

Approach

In order to lay the foundations for a systems theory for safety critical complex uncertain systems, the challenging developments are organised in clusters of innovative areas:

I. Characterise in mathematical terms the relations between various mathematical models that are in use by the various hybrid systems researchers. Key examples are Automation models, Petri net models, Piecewise Deterministic Markov Processes and Stochastic Differential equations on an hybrid state space and Hierarchical control models;

II. Develop architectures and algorithms for distributed conflict control and error evolution control for safety critical systems which are embedded within safety management;

III. Development of stochastic analysis based accident risk assessment methodology which supports the design of distributed control of complex systems for safety critical operations.

The interplay between these areas is shown through the demonstration of these results on working examples and risk assessment courses to learn others how these results are used in practice. For the realisation of this it will be systematically referred to the design of advanced air traffic management, since:

1) It is well known as one of the most complex distributed safety critical systems;
2) It allows to show how the different HYBRIDGE developments complement each other, and;
3) It supports the urgent need of innovative approaches in advanced ATM developments.

Expected results

The HYBRIDGE project has several concrete milestones:

- Methods for modelling, analysing and verifying complex uncertain hybrid systems and use these methods to identify models to perform conflict prediction in air traffic;
- Methods for controlling uncertain hybrid systems, both centralised and decentralised, and use these methods towards the development of distributed control architectures and algorithms for conflict resolution in air traffic management;
- Error detection methods in uncertain distributed hybrid systems in particular for the detection of human situational awareness errors and system reconfiguration needs;
- A stochastic analysis framework for accident risk modelling and assessment methodology for distributed hybrid control systems and its demonstration towards advanced air traffic management.

Start Date 01/01/2002 Finish Date 31/12/2004

Applicability Timeframe N/A Current Validation Level N/A Target Validation Level N/A

Sub-projects

NLR092: HYBRIDGE - Distributed Control and Stochastic Analysis of Hybrid Systems..

Sponsors

AEA: AEA Technology
Aquila: Universita degli Studi di l’Aquila
BAESys: BAE Systems
CENA: Centre Etudes de la Navigation Aerienne
EC DG INFSO: European Commission - DG INFSO
EUROCONTROL: European Org. for the Safety of Air Nav.
INRIA
NLR: Nationaal Lucht& Ruimtevaartlaboratorium
Twente: Universiteit Twente

Partners

AEA Technology
BAE Systems Avionics Ltd
CENA
EUROCONTROL Agency
European Communities
Institut National de Recherche en Informatique et en Automatique
Nationaal Lucht en Ruimtevaartlaboratorium
National Technical University of Athens
Universita degli Studi di Brescia - University of Brescia
Universita degli Studi di l’Aquila - University of l’Aquila
Universiteit Twente
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<td>Category</td>
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<td>Topic</td>
<td>Methodology development</td>
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<td><strong>Objectives</strong></td>
<td>OPTIMAL is an air-ground co-operative project which is aiming to define and validate innovative procedures for the approach and landing phases of aircraft and rotorcraft in a pre-operational environment. The goal is to minimise external aircraft/rotorcraft noise nuisance and increase the ATM capacity while maintaining and even improving safety.</td>
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<td><strong>Approach</strong></td>
<td>Noise reduction, ATM capacity increase and safety improvement achievement will be enabled by new precision approach landing aids (MLS, SBAS, GBAS), more accurate navigation means (RNP 0.1) and enhanced airborne system, such as FLS, for Non-Precision Approaches. The work to be conducted during the 4-year project is ranging from the elaboration of the operational concept up to simulations and pre-operational flight trials implying effective modifications of avionics onboard aircraft and rotorcraft and ground systems. On the ground side system special attention will be placed on the new tools which will be necessary for Air Traffic Controller to efficiently and safely manage the OPTIMAL procedures.</td>
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| **Expected results** | 1. Validation of innovative approach and landing procedures  
2. Validation of modifications of airborne and ground systems |
| **Start Date** | 01/01/2004 | **Finish Date** | 30/12/2007 |
| **Current Validation Level** | V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy |
| **Target Validation Level** | V3a: Generic Specification - Requirements Defined |
| **Applicability Timeframe** | => 2011 and <= 2015 |
| **Parent Project** | CEC137: OPTIMAL - Optimised Procedures and Techniques for Improvement of Approach and Landing |
| **Sub-projects** |  |
| **Sponsors** | AENA  
Agusta - a Finmeccanica company  
Airbus France  
Airbus SAS  
Davidson Ltd  
DFS  
DLR German Aerospace Centre - Deutsches Zentrum für Luft- und Raumfahrt e.V.  
Ente Nazionale Assistenza al Volo  
EUROCONTROL HQ  
EUROCOPTER  
European Communities  
Grupo Mechanica del Volo  
INECO  
ISDEFE  
Litton Systems, Inc.  
Luchtverkeersleiding Nederland / ATC the Netherlands  
Nationale Lucht en Ruimtevaartlaboratorium  
Office National d’Etudes et de Recherches Aérospatiales Tlse  
Sistemi Innovativi per il Controllo del Traffico Aereo  
Smiths Aerospace (Electronic Systems)  
Sociedad Estatal para las Ensenanzas Aeronauticas SA  
THALES ATM France (ex Airsys ATM France)  
THALES Avionics (ex-Sextant Avionique)  
University of Liverpool |
| **Keywords hits** |  |
| **New This Year** | ☑ | **Included in Safety HI** | ☐ | **Included in SAFS** | ☐ | **Results in VDR** | ☐ |
| **Categories** | Safety Management |
| **Topic** | Assessment of new system/procedure |
| **Link to ESARRs** | Implicitly related to ESARR 4 |
IFATS proposes a revolutionary concept for a future air transportation system by adding as much onboard autonomy to the aircraft as necessary to fulfil the overall requirements of improved efficiency and safety of air transportation.

IFATS basics are:
- The aircraft will fly autonomously a pre-programmed flight plan using sophisticated on board computing and sensor systems. A ground operator will be responsible for the overall situation, whereabouts of the aircraft and tracking of their intentions,
- Functionalities of the system will be flexibly distributed between the ground and the aircraft, relying on intensive data communication capabilities between the aircraft and other aircraft, and between the aircraft and a network of ground stations.

The central goals of this project are:
- to define a technically viable concept of an air transportation system where aircraft would be operating autonomously controlled by a ground operator;
- to identify the difficulties to overcome to build such an Air Transport System, in both the technical and cultural aspects;
- to analyse a procedure to migrate from the present situation to the future system;
- to define autonomous operation procedures, task sharing between the operators, the autonomous on board computing system and an on board engineer (if needed);
- to determine the minimum requirements and functionality of the on-board system, to ensure safe operation in the case of communication loss with the ground control system;
- to perform safety analysis of the IFATS concepts and provide guidelines to certification issues.

Driven by the assumption of an aircraft with a sophisticated level of autonomy, the necessary functionalities of the ground and onboard components of a future air transportation system can be isolated and analysed on their conceptual maturity. This includes normal operations as well as critical flight situations or emergency cases. Comparing the IFATS approach with the planned evolutionary improvements of the existing air transportation system will determine the main differences, advantages and weaknesses of IFATS vs. The existing system. The comparison results could be used in one of the two directions: the IFATS approach could be adopted as the long-term air transportation concept, or IFATS ideas could be used to improve the current air traffic systems in the mid term perspective while using IFATS validated concepts.

Air transportation system concept definition and preliminary evaluation (comparison)

=> 2021 and <= 2025

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Airobotics GmbH
Alenia Aeronautica S.p.A.
CENA
Centro Italiano Ricerche Aerospaziali
DLR German Aerospace Centre - Deutsches Zentrum für Luft- und Raumfahrt e.V.
EADS Systems & Defense Electronics S.A.
European Communities
Israel Aircraft Industries
Office National d'Etudes et de Recherches Aérospatiales
Technion - Israel Institute of Technology
Thales Communications S.A.
University of Patras

VC Included in SAFS
✓ Results in VDR

Implicitly related to ESARR 4

Assessment of new system/procedure
**Objectives**

Airports have been identified as the future bottlenecks of air transport. The A-SMGCS project EMMA aims to become the most significant R&D contribution to solve this problem by maturing and validating the A-SMGCS concept as an integrated air-ground system, seamlessly embedded in the overall ATM system. EMMA will in a first phase consolidate the surveillance and conflict alert functions, and in the second phase focus on advanced onboard guidance support to pilots and planning support to controllers.

To achieve the superior goal of an harmonised European implementation of A-SMGCS, A-SMGCS will be implemented at three European airports in the first project phase. The systems implemented are to be verified and validated against the predefined operational and technical requirements. On-site long term trials are to ensure the assessment of benefit estimations. The issues of this test phase feed back to the concept of operations and are intended to fix standards for future implementation in terms of common operational procedures, common technical and operational system performance, common safety requirements and common standards of interoperability with other ATM systems.

**Approach**

EMMA cornerstones for project phase 1 are:
- the operational concept analysis for all A-SMGCS level,
- the derivation of the necessary performance requirements,
- A-SMGCS System integration at three airports and in two aircraft (test aircraft + one airliner),
- two iterative on-site test periods,
- verification of performance requirements,
- validation of operations,
- guidelines and recommendations to common technical and operational system performance, safety requirements, certification aspects, and procedures for the transition phase.

**Expected results**

- A validated A-SMGCS concept
- Guidelines and recommendations for the transition phase

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V3a: Generic Specification - Requirements Defined

**Target Validation Level**

V3b: Generic Specification - Requirements Validated

**Parent Project**

CEC142: EMMA - European airport Movement Management by A-SMGCS

**Sub-projects**

**Sponsors**

AENA
Air Navigation Services of the Czech Republic
Airbus France
AMS (ex-Alenia Marconi System)
Athens University of Economics and Business
Aviation Hazard Analysis
BAE Systems Avionics Ltd
Ceska sprava letist (Czech Airports Authority)
DFS
Diehl Avionics
DLR German Aerospace Centre - Deutsches Zentrum für Luft- und Raumfahrt e.V.
DNA
Ente Nazionale Assistenza al Volo
ERA
EUROCONTROL EEC
European Communities
Eurotelematik
Messier Dowty Ltd.
Nationaal Lucht en Ruimtevaartlaboratorium
Park Air Systems
Sistemi Innovativi per il Controllo del Traffico Aereo
Star Alliance Service GmbH
THALES ATM France (ex Airsys ATM France)
THALES Avionics - Vélizy (ex-Thales-CSF Sextant)
University of Darmstadt / Technische Universität Darmstadt

**Keywords hits**
certification AND safety, validation AND safety
### Project: CEC143: CAATS - Co-operative Approach to Air Traffic Services

**Start Date:** 01/03/2004  
**Finish Date:** 28/02/2006

**Objectives:**
The objective of the proposed Cooperative Approach to Air Traffic Services (CAATS) coordination action is to manage, consolidate and disseminate the knowledge produced in the European Commission's FP6 ATM-related projects. The focus will be in three areas: the knowledge produced in the areas of safety, human factors and validation. The aim is to provide a coordinated approach by all FP6 projects to achieve the Commission's paradigm shift.

**Approach:**
The aim will be achieved in three workpackages, whose activities will be project management and coordination, including dissemination of the results of CAATS, knowledge management and knowledge consolidation. The consortium consists of 16 organizations from all parts of Europe, ranging from universities through service providers to engineering consultancies. CAATS will also have two levels of expert groups to provide relevant expertise on specific issues and provide opinions at dedicated dissemination forums. The project will last 24 months.

**Expected results:**
The most significant expected output of CAATS is the achievement of a coordinated, cooperative approach to ATM research within FP6. In addition best practice manuals will be produced in the areas of safety, human factors and validation for use not only by European Commission projects but other interested stakeholders.
**Objectives**

Eurocontrol's Communication strategy indicates the need of alternative communications systems as the saturation point of the current system is reached around 2015 even with full VDL Mode 2 and 8.33 kHz deployment. B-VHF proposes bottom up research on multi-carrier technology for aeronautical communications in the VHF band now, in order to have systems available when needed by the European Air Transport community.

The project aims at identifying MC-CDMA as the still missing European approach for the future ATM VHF communication system that supports Single European Sky and the Free-flight concept and leads far beyond 2015 into Vision 2020.

**Approach**

B-VHF is neither another VDL mode nor a new flavour of CDMA, but a highly innovative, high capacity communication system based on MC-CDMA, a modern communications technology also discussed for fourth generation (4G) mobile communications systems. MC-CDMA exploits the mobile aeronautical channel better than any known broadband VHF alternative. It increases the voice and data capacity and addresses security and safety issues with a service level unknown to the aeronautics users today. Moreover, MC-CDMA preserves the excellent cost performance of the VHF band as it may be applied as an overlay system and co-exist with the existing VHF infrastructure, thus providing smooth transition and rollout scenarios.

**Expected results**

The expected result of this project is the assessment of B-VHF based on MC-CDMA to support aeronautical communications.
The main objective is to accelerate the implementation process of the ADS-B applications package, by means of the preparation and carrying out of large scale trans-European pre-implementation trials using a high number of commercial aircraft fully equipped, and ATM modified systems with new functions.

SEAP project intends to:
1. Equip a high number of aircraft with ADS-B avionics, which will be completely certified following conventional procedures and involving the Industry and national-international standardisation organisations.
2. Open a technical infrastructure of ADS-B/TIS-B ground stations. This infrastructure will be compatible with ADS networks already created in Europe (NUP, MFF/MEDUP) in order to assure interoperability in Europe as a whole.
3. Update a representative number of Control Centres in order to allow the exploitation of the new ADS aircraft functions and to prove the package's applications in a "gate to gate" environment.
4. Prove, on a large scale basis, ADS-B/C services which are likely to provide the biggest benefits in terms of costs, safety and capacity, and validate the system in terms of performance and benefits.

The geographic area covered in SEAP project includes the Iberian Peninsula, the Azores (Southwest), Madeira, Canary Islands with a potential extension to Scandinavia and other areas for the trial making process. This region completes the already existing coverage of NUP and MFF/MEDUP projects and allows the establishment of a complete European ADS infrastructure.

In the initial part of the project:
- The operational scenarios will be defined in detail, basing on the work done in other projects funded by the EC.
- Clear validation objectives as well as a Validation Plan will be defined. SEAP will identify the appropriate procedure to show that the SEAP concept can operate in an effective way, in a real environment and fulfilling the already defined specifications in terms of requested functionality, operability and performance. This work will be based on the conclusions of other related projects, but it will be completed with specific activities of SEAP, and it will be essential so to define the next SEAP phase planning.
- Benefits and associated costs to the implementation of ADS-B applications package I will be both identified and assessed.
- Avionics and ground systems initial specifications will be developed. The definition of these specifications will be carried out in accordance with the future introduction of more advanced applications (packages II and III).
- An initial security analysis will be developed.

In the following SEAP phases, the deployment of both infrastructure and pre-operational implementation of ADS applications will be carried out.

The result achieved at the end of SEAP-1 will be the scenarios definition in which ADS applications, the necessary ground and aboard systems specifications and an initial cost-benefit study for participant airlines in the second phase of the project will be implemented.

In the following SEAP phases, the deployment of both infrastructure and pre-operational implementation of ADS applications will be carried out.
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<th><strong>Start Date</strong></th>
<th>01/01/1996</th>
<th><strong>Finish Date</strong></th>
<th>31/12/2000</th>
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| **Objectives** | - Adapt the currently existing approach and departure procedures to the technical possibilities of FMS by appropriate measures on the part of DFS;  
- Optimise Arrival and Departure Procedures using airborne flight management systems, for example Frankfurt Airport. | **Expected results** | NESS Implementation at major German aerodromes. |
| **Approach** | In order to achieve optimum utilisation of modern airborne systems, NESS has been elaborated in collaboration between Deutsche Lufthansa and the DFS under participation of Condor and Honeywell:  
- Studies;  
- Concept development;  
- Simulations;  
- Validation (trial phases);  
- Implementation;  
- Phase 1: Optimisation of Conventional Arrival and Departure Procedures using airborne FMS and GPS;  
- Phase 2: Optimised TMA procedures based on RNAV (after 2000). | **Applicability Timeframe** | => 2006 and <= 2010 |
| **Expected results** | Expected benefits are:  
- Reduced work load for air traffic control and capacity gain (tactical waypoints instead of standard RADAR vectoring)  
- Fuel saving by shorter routes and optimised decent profiles- Environment relief- Improved flight safety (cockpit workload reduction; improved situational awareness). | **Current Validation Level** | V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy |
| **Target Validation Level** | V5: Local Implementation - Sign-off for Operational Use | **Target Validation Level** | V5: Local Implementation - Sign-off for Operational Use |
| **Parent Project** | **Sub-projects** | **Sponsors** | DFS: Deutsche Flugsicherung GmbH |
| **Sponsors** | DFS | **Partners** | DFS |
| | Eurowings | Honeywell International |
| | Jeppesen | Lufthansa |
| | Smiths Industries | **New This Year** | |
| | | **Included in Safety HI** | |
| | | **Included in SAFS** | |
| | | **Results in VDR** | |
| | | **Keywords hits** | Flight safety |
| | | **Link to ESARRs** | Implicitly related to ESARR 4 |
| | | **Category** | Safety Management |
| | | **Topic** | Assessment of new system/procedure |
Objectives
- One candidate means for increasing the capacity of Frankfurt Airport;
- for certain meteorological conditions the WVWS will allow for the suspension of wake vortex separation between aircraft in staggered approach to the two parallel runways.

Approach
- Model the propagation of wake vortices produced in the atmospheric boundary layer by aircraft approaching the runways 25L and 25R;
- forecast the crosswind and thereby the wake vortex transport, which is influenced mainly by the crosswind.
For this purpose the local 3-d wind field is measured with 10 ultrasonic anemometers mounted on masts between the extended centrelines of the two parallel runways.

The development of the WVWS is based on the results of a long-term programme started in the 80's. The developed algorithm constitutes the core of the WVWS.

The predicted propagation of wake vortices towards the adjacent runway together with the expected life time of the vortices is used to determine whether or not the vortices infringe the safety area of the adjacent runway. On the basis of the hazard prediction which lasts for up to 20 minutes an appropriate operational procedure will be recommended to the approach controller using a dynamic graphical display presentation on his radar screen. After evaluation the two operational procedures "staggered approach" and "modified staggered approach" have been identified for initial operational use of the WVWS.

In 1999-2004 the system will be supplemented by a glidepath component. Wind and temperature profiling up to 2000 m height shall provide necessary input to an additional prognosis algorithm. This algorithm will produce forecasts for wake vortices' transport and decay along the glidepath. Finally the wake forecast near the ground and the on the glidepath will be merged.

Expected results
a) results 1995-1996:
- results of the risk analysis and a cost/benefit study;
- begin of WVWS implementation in 1995. During a first evaluation period (Nov.95 - March 96) the measuring equipment, the prognosis algorithm and the wake vortex software model were validated.

b) results of activities 1999 and 2004:
- Prognosis algorithm allowing the prediction of the motion of wake vortices in horizontal and vertical direction;
- tested system available for the operational trials.
Objectives
The High Approach Landing System (HALS) is part of the capacity enhancement program of Frankfurt Airport. The objective of this project is to show the feasibility of capacity enhancement by a novel approach procedure on the example of one runway of Frankfurt airport. The main feature of this system is the establishment of a displaced threshold and related ILS glidepath for light and medium aircraft. This ensures an approach on a higher glide path than that of preceding heavy aircraft to the parallel runway. The effect is the reduction of wake vortex hazards which gives the opportunity to enhance capacity by reducing the separation between aircraft.

Approach
As a first step it is intended to establish the new procedure at the southern runway 25L and perform a test operation to one displaced threshold and ILS 26L. To do so a dedicated ILS/DME has to be installed and a completely new approach lighting system to both sides of the runway has to be installed. To ensure safety of the new procedures a safety assessment is conducted.

Expected results
The expected results will be gained at the end of the test operation. It will be
- operational feasibility and improvement of the new ATC procedures and taxi performance
- operational feedback from aircraft crews
- safety of the system
- potential capacity gain by introducing the system for the full runway system

Start Date 19/05/1998  Finish Date 31/12/1999

DFS046: HALS - Phase I

Sponsors DFS: Deutsche Flugsicherung GmbH

Partners Frankfurt Airport

New This Year

Included in Safety HI

Included in SAFS

Results in VDR

Keywords hits safety assess, hazard

Link to ESARRs Implicitly related to ESARR 4

Category Safety Management  Topic Assessment of new system/procedure
**Objectives**

1) Develop and validate operational procedures using satellite based navigation signals and associated augmentation for multi-modal applications;
2) consider the best configuration to support multi-modal applications;
3) availability of results to international organisations such as ICAO and IMO, to help generate the required international standards for system and procedural operations.

**Approach**

WP6: East-West Link

1) assist German Air Traffic Management in the integration of SBAS services into the operational use and to facilitate the expansion of EGNOS to East-European countries;
2) host an SBAS master station at an operational site in Germany which shall be interconnected with distributed monitor stations in Europe;
3) demonstrate the geographical growth capability of the SBAS architecture by performing demonstration and validation (DemVal) activities in Russia;
4) conduct assessment activities similar to the above on a location in this country using the infrastructure created for the German part of the program.

Phase I (Infrastructure):

- installation of SBAS master station at an operational site;
- installation of monitor stations in Germany and Russia;
- connection of all relevant monitor stations to the SBAS master station;
- connection of the SBAS master station to other master stations as necessary.

Phase II (Trials):

- integration of SBAS in the operational environment (ATC Interface);
- gathering operational data for SAPPHIRE evaluation through ground test and flight trials;
- study of certification issues related to EGNOS.

**Expected results**

- Guidelines on the management configuration required to satisfy multi-modal applications;
- role of ATC and VTS;
- preliminary risk assessment, mitigation and backup procedures;
- proposals for implementation specifications;
- facilitation of the expansion of EGNOS outside of EU;
- model for the investigation of other future satellite navigation systems.

**New This Year**

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<th>Included in Safety HI</th>
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<th>Results in VDR</th>
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**Keywords**

- risk assess

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management

**Topic**

Assessment of new system/procedure
**Project**

**DFS064: Kooperatives ATM (LUFO III)**

**Start Date** 01/08/2003  **Finish Date** 31/12/2007

**Objectives**

KATM aims at using the airport resources more efficiently by coordinating the planning processes of airline, airport and ATC. For implementing the planned traffic flow the control means of all partners will be considered. In addition to that KATM will investigate safety aspects in the context of safety nets distributed between aircraft and ground. Finally some aspects of procedures necessary for GBAS approaches are subject of KATM.

**Approach**

Within KATM concepts, prototypes will be developed and finally be evaluated in various simulations.

**Expected results**

The improved planning is expected to harmonise air traffic flow and thus reduce delays and operator workload.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**Target Validation Level**

V3b: Generic Specification - Requirements Validated

**Parent Project**

**Sub-projects**

**Sponsors**

BMWA: Germ. ministry of economy and employment

DFS: Deutsche Flugsicherung GmbH

Airbus Deutschland GmbH

DELAIR Air Traffic Systems GmbH

DLS Institute of Flight Guidance

Frankfurt Airport

Lufthansa

Tecnhische Hochschule

THALES Airborne Systems (ex-Thomson-CSF Detexis)

TU (Technical University)

University of Berlin / Technische Universität Berlin

University of Braunschweig / Technische Universitätaet Braunschweig

**New This Year**

✓

**Keywords hits**

TLS, target level of safety, risk AND safety

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management  **Topic** Assessment of new system/procedure

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**Project**

**DLR002: RSVM Implementation Programme**

**Start Date** 01/01/1983  **Finish Date** 31/12/1999

**Objectives**

Implementation of reduced vertical separation above FL290.

**Approach**

Comparing estimated collision risk with Target Level of Safety (TLS).

**Expected results**

Measures in order to get the high safety standard in a 1000ft environment.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V3b: Generic Specification - Requirements Validated

**Target Validation Level**

V4: System Development - Completion of Development and Integration

**Parent Project**

**Sub-projects**

**Sponsors**

EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**

Airport Hannover

DLR Institute of Flight Guidance

**New This Year**

✓

**Keywords hits**

TLS, target level of safety, risk AND safety

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management  **Topic** Assessment of new system/procedure
**Project**  
DLR029: MOSES: More Operational flight-Safety by Enhanced Situation awareness

**Start Date**  
01/07/2001  
**Finish Date**  
31/12/2003

**Objectives**
Within the scope of MOSES are following scientific goals:
- A measurable definition of situation awareness starting from three different levels (perception, comprehension, projection)
- Development of safety-critical scenarios from accidents/incidents with loss of situation awareness
- Proposition of a blend of measurements indicating situation awareness (pilot's eye-point-of-regard measurements, pilot behaviour, physiological and input data, flight and display parameters, and pilot self-assessment of situation awareness)
- Application of the measurements in safety-critical scenarios
- Identification of key elements for visual display design and procedures which supports situation awareness

**Approach**
Pilots will fly different realistic scenarios. Their situation awareness will be assessed by different methods: physiological data (eye tracking, EEG for example), psychological assessments (e.g. cognitive styles) and performance.

**Expected results**
Results of these experiments will be published in a study. The study will directly influence the development of DLR pilot assistance systems

**Applicability Timeframe**
=> 2006 and <= 2010

**Current Validation Level**
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**
V3a: Generic Specification - Requirements Defined

**Parent Project**

**Sub-projects**

**Sponsors**
DLR: Deutsches Zentrum für Luft-und Raumfahrt

**Partners**
DLR Institute of Aerospace Medicine - Institut für Luft- und Raumfahrtmedizin  
DLR Institute of Flight Guidance

**New This Year**

**Keywords hits**
accident, incident

**Link to ESARRs**
Implicitly related to ESARR 2, ESARR 4 and ESARR 5.

**Category**
Safety Management  
**Topic**
Assessment of new system/procedure
Adverse weather conditions affect flight safety as well as efficiency of airport operations. The problem becomes evident in critical flight phases such as approach, landing, take-off, and taxiing so that the nominal airport capacity has to be reduced during low visibility conditions due to safety concerns. Hence, a lot of research work is done to overcome these problems by improving pilot’s visual perception.

Since 1995 DLR’s Institute of Flight Guidance has been working in the field of Enhanced and Synthetic Vision (ESV). The basic concept of an ESV-system is the combination of data acquired by weather penetrating sensors with digital terrain data and status information by application of data fusion techniques. The resulting description of the situation is given to the pilot via head-up or head-down displays. Within the DLR project ADVISE (Advanced Visual System for Situation Awareness Enhancement), 1999-2002, basic concepts and components of ESV-systems have been developed. Furthermore, an experimental test bed (simulation as well as flight testing equipment) to evaluate ESV-concepts and components has been built up.

The design and development of a complete ESV-system is within the scope of this project. This ESV-system should support the pilot during approach and landing under reduced visibility conditions. The ADVISE-PRO system will enable low visibility operations independently from the infrastructure on ground. The key features of the ADVISE-PRO systems will be:

- Integrity monitoring of navigation data and terrain data
- Sensor based navigation to determine the aircraft’s position relative to the runway by automatically analysing sensor data (MMW, IR, radar altimeter) without using neither (D)GPS nor precise knowledge about the airport geometry
- Obstacle detection

Within the scope of ADVISE-PRO are the following scientific topics:

- Information fusion
- Sensor data analysis
- Human machine interface (HMI) of ESV-Systems.

Flight trials will be conducted to gather real data from weather penetrating sensors (MMW-Radar, IR-Sensor). These data will be used to develop data analysis and information fusion algorithms. Later on additional flight trials will be performed to test and evaluate the performance of the developed algorithms. In addition, human machine interfaces for Enhanced Vision systems will be developed and evaluated using DLR’s cockpit simulator.

The expected result of this project is a functional prototype of a board-autonomous landing system that allows the pilot to land under adverse weather conditions up to CAT III conditions without using any infrastructure on ground (e.g. landing without ILS).
### Objectives
Human Factors research for application in ATM and Flight Guidance, in order to provide consulting and methods for Human / Machine Interface design and evaluation. Support the development of automated pilot and controller assistance tools, conduct validation exercises in Real Time Simulations, Field Tests and In-Flight Demonstrations.

### Approach
Application of Human Factors design principles, including modelling of human decision making.

Screening of Advanced Human/Machine Interaction Techniques (Augmented Reality, Virtual Reality) for utilisation in ATM and Flight Guidance.

Development and application of methods for the assessment of performance, operator workload, acceptance and situation awareness.

### Expected results
Improved human/machine co-operation and improved collaborative decision making in highly automated systems

### Start Date
01/01/2003

### Finish Date
31/12/2009

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**Project**

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<th>Project</th>
<th>DLR032: Human Centered Automation</th>
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**Start Date**

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**Objectives**

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**Expected results**

Improved human/machine co-operation and improved collaborative decision making in highly automated systems

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**Applicability Timeframe**

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**Current Validation Level**

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<td>V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy</td>
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**Target Validation Level**

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<tr>
<td>V2: Feasibility - Initial Proof of Concept ready for Implementation Decision</td>
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</table>

**Expected results**

Improved human/machine co-operation and improved collaborative decision making in highly automated systems

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**Sponsors**

DLR: Deutsches Zentrum für Luft-und Raumfahrt

**Partners**

DLR Institute of Aerospace Medicine - Institut für Luft- und Raumfahrtmedizin

DLR Institute of Flight Guidance

**Parent Project**

**Sub-projects**

**Sponsors**

DLR: Deutsches Zentrum für Luft-und Raumfahrt

**Partners**

DLR Institute of Aerospace Medicine - Institut für Luft- und Raumfahrtmedizin

DLR Institute of Flight Guidance

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**New This Year**

- Included in SAFS

**Keywords hits**

- Included in Safety HI

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management

**Topic**

Assessment of new system/procedure
Objectives
Evaluate the impact of ACAS on the present and future ground ATC system so as to allow a seamless integration of ACAS. International standardisation of ACAS by ICAO as well as the definition of technical standards (RTCA MOPS) for TCAS is considered.

Approach
At national level, assess the impact of ACAS on the ground ATC system:
(1) monitoring of ACAS implementation within Europe and analysis of TCAS II events in France
(2) TCAS II simulations using recorded radar data and information collected through experimental Mode S ground stations
(3) impact on ATC: operational procedures, compatibility with Short Term Conflict Alert, ACAS controller training
(4) compatibility between ACAS and future ATM concepts (RNAV, RVSM, ASAS, etc.)
(5) participation in international standardisation of ACAS and future enhancements.

At European level, two projects are conducted to support the ACAS II implementation:
(1) The SIR project, sponsored by EUROCONTROL, following EMOTION7.
(2) RITA 2 (Replay Interface for TCAS Alerts), sponsored by Eurocontrol is aimed at addressing TCAS events analysis and training to TCAS II
(3) ASAR
(4) IAPA

In addition, ACAS studies will be requested by Eurocontrol to support the ACAS programme, in particular the implications on ACAS performance to cooperative ASAS implementations: the IAPA project.

Expected results
The expected results are:
(1) evaluation reports on TCAS II events reported in France by pilots and controllers
(2) working papers presented at SCRSP (ICAO panel in charge of ACAS) and RTCA (standardisation of TCAS).
(3) involvement in TCAS training within the French ATC centres and ENAC (French Civil Aviation academy).

Applicability Timeframe
=> 2000 and <= 2005

Current Validation Level
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Target Validation Level
V3a: Generic Specification - Requirements Defined

Parent Project
EUR203: ACASA - Airborne Collision Avoidance System Analysis
EUR204: EMOTION7 - European Monitoring of TCAS II version 7.0

Sub-projects

Sponsors
DNA: Direction de la Navigation Aerienne
EUROCONTROL: European Org. for the Safety of Air Nav.

Partners
CENA
DFS
EUROCONTROL EEC
EUROCONTROL HQ
NATS, One Kemble Street
QinetiQ Malvern (ex-DERA)

New This Year
Included in SAFS
Results in VDR

Keywords hits
risk AND safety, flight safety

Link to ESARRs
Implicitly related to ESARR 4

Category
Safety Management

Topic
Assessment of new system/procedure
Objectives

Generic studies on methods to be used to improve the safety of the whole ATC system.
- certification of ground systems,
- human reliability,
- software reliability,
- dependability of HMI.

Approach

Through our practical experience in dependability and safety studies and our knowledge in ATC, try to define new generic approaches and methodologies suitable for our domain. In this context, participating in works performed at European level in Safety methodology.

Expected results

Guidance materials.

Applicability Timeframe

=> 2006 and <= 2010

Current Validation Level

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Parent Project

CEC075: ARIBA - ATM system safety criticality Raises Issues in Balancing Actors responsibility

Sub-projects

DNA043: Global Dependability Analysis

Sponsors

DNA: Direction de la Navigation Aerienne
EUROCONTROL: European Org. for the Safety of Air Nav.

Partners

CENA
LAAS
SRTI SYSTEM

New This Year

☑

Keywords hits

safety method, certification AND safety

Link to ESARRs

In relation to all SRC regulatory material.

Category

Safety Management
Objectives
The aim of ATC is to handle traffic in a safe and efficient way. Since the systems operate 24 hours per day, reliability and availability are of great importance to minimise the risk of collision and maximise the capacity of ACC's. The main objectives of this project are the assessment of safety, reliability and availability of technical systems used by ATCO's in order that they could justifiably rely on their systems.

Systems concerned by these studies are, for instance:
- ODS-France (operational display system including LAN)
- Voice and Communication Switching system,
- Data-Link application,
- Controller Assistance tools (ERATO),
- ARTAS,
- eFDP (European flight plan data processing).

Approach
The dependability study can be done for systems already in use or for systems in design or development phase.
The main methods used are:
- Functional Analysis,
- Functional Hazard Analysis,
- Preliminary Hazard Analysis,
- Qualitative and quantitative dependability (reliability, availability, safety, maintainability) assessments,
- Risk Assessment.

The aims of these assessments are:
- to set dependability requirements to the most critical functions of the technical systems, during the design phase, in order to choose the best architecture,
- to assess, during the development phase, the dependability that can be expected, taking into account the architecture, and to verify that the requirements can be met,
- to follow up the system during its operational life.

Expected results
For the year 2000, it is planned to carry on the dependability assessments for ODS-France in order to follow the first operational starting up.
It is also planned to collaborate, from a dependability point of view, with STNA on projects like ERATO (controller assistance tools), ATC server on workstations, ARTAS, eFDP (European flight plan data processing) in order to design the best architecture of these systems and prepare their integration in ACC's.
In order to assess the severity of failures in data-link application or in the domain of controller assistance tools, it is planned to experiment these situations on test bed.

Applicability Timeframe
=> 2006 and <= 2010

Current Validation Level
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Parent Project
EURO48: Surveillance Data Processing and Distribution

Sub-projects

Sponsors
DNA: Direction de la Navigation Aérienne
EC: European Communities
EUROCONTROL: European Org. for the Safety of Air Nav.

Partners
CENA
SCTA
SRTI SYSTEM

New This Year

Keywords hits
functional hazard, risk assess, hazard analys, risk AND safety

Link to ESARRs
Implicitly related to ESARR 4

Category
Safety Management

Topic
Assessment of new system/procedure
DNA066: Human Factors in ATM

Start Date 01/01/1988  Finish Date 01/01/2005

Objectives
Understanding organisational issues as related to safety and performance, both at individual and network levels.

Approach

Expected results
Beyond the role of the front actors in the performance of the ATM, the CENA also studies the role of the organization of work, the procedures, the human framing and resource management in the total performance of ATM.
Part 1 Safety: To better apprehend the culture safety in the air navigation services. To identify the elements contributing to it, the possible deviations, the levers of change. To analyse the role of the procedures in the safety and the attitude of the operators.
Part 2 Performance: this step is significant as the European institutional evolutions (Eurocontrol, PRC, PRU) stress more and more the performance as an essential criterion for the ANSOs.

Applicability Timeframe => 2000 and <= 2005
Current Validation Level N/A
Target Validation Level N/A

Project
DNA066: Human Factors in ATM

Start Date 01/01/1988  Finish Date 01/01/2005

Objectives
Understanding organisational issues as related to safety and performance, both at individual and network levels.

Approach

Expected results
Beyond the role of the front actors in the performance of the ATM, the CENA also studies the role of the organization of work, the procedures, the human framing and resource management in the total performance of ATM.
Part 1 Safety: To better apprehend the culture safety in the air navigation services. To identify the elements contributing to it, the possible deviations, the levers of change. To analyse the role of the procedures in the safety and the attitude of the operators.
Part 2 Performance: this step is significant as the European institutional evolutions (Eurocontrol, PRC, PRU) stress more and more the performance as an essential criterion for the ANSOs.

Applicability Timeframe => 2000 and <= 2005
Current Validation Level N/A
Target Validation Level N/A

Parent Project

Sub-projects

Sponsors DNA: Direction de la Navigation Aerienne

Partners CENA Laboratoire CETCOPRA

New This Year

Keywords hits
safety AND culture

Link to ESARRs
Implictly related to ESARR 2 and ESARR 3

Category Safety Management Topic Safety Culture

Project
DNA086: ECAC RVSM: Implementation of the Reduced Vertical Separation Minima within ECAC airspace

Start Date 01/05/1996  Finish Date 30/09/2000

Objectives
- Assess safety of RVSM implementation on European route network
- Estimate the benefits
- Develop implementation scenarios
- Develop and refine ATC and ASM operational procedures
- Ensure that automated ATM systems and ACAS software is modified to accommodate RVSM

Approach
- Fast and real time simulations
- Safety and collision risk modelling

Expected results
- RVSM safety assessment.
- Capacity benefits.
- Implementation scenarios
- « Go ahead » to :
  - the verification trial - 2000 ft separation (start date : 11/1999).
  - the operational trial - 1000 ft separation (start date : 11/2000).

Applicability Timeframe => 2000 and <= 2005
Current Validation Level V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy
Target Validation Level V5: Local Implementation - Sign-off for Operational Use

Parent Project

Sub-projects

Sponsors DNA: Direction de la Navigation Aerienne

Partners CENA EUROCONTROL EEC

New This Year

Keywords hits
safety assess, risk AND safety, collision risk model

Link to ESARRs
Implicity related to ESARR 4

Category Safety Management Topic Assessment of new system/procedure

Project DNA086: ECAC RVSM: Implementation of the Reduced Vertical Separation Minima within ECAC airspace

Start Date 01/05/1996  Finish Date 30/09/2000

Objectives
- Assess safety of RVSM implementation on European route network
- Estimate the benefits
- Develop implementation scenarios
- Develop and refine ATC and ASM operational procedures
- Ensure that automated ATM systems and ACAS software is modified to accommodate RVSM

Approach
- Fast and real time simulations
- Safety and collision risk modelling

Expected results
- RVSM safety assessment.
- Capacity benefits.
- Implementation scenarios
- « Go ahead » to :
  - the verification trial - 2000 ft separation (start date : 11/1999).
  - the operational trial - 1000 ft separation (start date : 11/2000).

Applicability Timeframe => 2000 and <= 2005
Current Validation Level V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy
Target Validation Level V5: Local Implementation - Sign-off for Operational Use

Parent Project

Sub-projects

Sponsors DNA: Direction de la Navigation Aerienne

Partners CENA EUROCONTROL EEC

New This Year

Keywords hits
safety assess, risk AND safety, collision risk model

Link to ESARRs
Implicity related to ESARR 4

Category Safety Management Topic Assessment of new system/procedure
**Project** DNA091: Wake Vortex  

**Start Date** 01/01/1992  
**Finish Date** 31/12/2002

**Objectives**
One way to increase one airport capacity is to reduce the separations between aircrafts at take off and landing. However, it is necessary to take into account wake vortices which are created by the preceding aircraft.

**Approach**
The STNA, in collaboration with the CERFACS, has created a model, called VORTEX, which enables a real time evaluation of the vortex related hazard. With this model and the wind information, it is possible to determine a duration where the runway cannot be used because there is a danger due to some vortices. Since 1997, an experiment has been launched on the Toulouse Blagnac airport with the installation of seven pylons equipped with propeller anemometers. This experiment allows to validate the VORTEX model and to create a wind database for airport weather nowcasting.

**Expected results**
In 2002, the SYAGE model was validated. At least, the intent is to create a WVAS (Wake Vortex Advisory System) which could be connected to the SMGCS or to any future DMAN (Departure Management) and AMAN (Arrival Management) architecture which would allow to increase the airport capacity with an equivalent or better level of safety.

End of 1999, a preliminary real time display of the event should be available. The wind variations and the detection of the vortex will be continuously displayed on a PC based on the airport. All the pieces of information are recorded and can be replayed afterwards.

In 2000, the intent is to launch three studies. The two first ones are dedicated to the improvement of a future ATC tool. The intent of the first one is to improve the wind nowcasting in the next 20 minutes. Those 20 minutes are the minimum time necessary for the ATC in order to optimise the aircraft arrivals and to increase the runway capacity. The second study intends to optimise the hazard duration computation and will require a new anemometer. The hazard duration corresponds to the time where the vortex stays on the runway and creates a hazard for the following aircraft.

The new anemometer will provide new information such as temperature, which allow to improve the knowledge of the vortex life.

The third study is linked to the future RVSM requirement above Europe. The intent is to collect information about the incidents encountered above the North Atlantic and to perform a study to check if, in an RVSM environment, wake vortex may decrease the safety.

The intent is, now, to finalise a future ATC tool in order to improve the safety by applying the correct separation minima in accordance with the current and the near term wind conditions, and to improve the capacity by allowing reduced separation, when possible. Such tool will be developed and coordinated with people working on the DMAN service.

**Keywords hits**
danger, hazard, incident

**Link to ESARRs**
Implicitly related to ESARR 4

**Category** Safety Management  
**Topic** Assessment of new system/procedure
This project covers activities related to the implementation of the pre-operational European mode S Station developed under Eurocontrol contract (programme POEMS) and to the preparation of the deployment of the operational stations within the core area:

- Preparation and technical follow up of POEMS contract: DNA (STNA) by work package delegation within the POEMS programme, has in charge the technical follow up (including FAT and SAT evaluation) of the POEMS station (manufactured by Thales ATM) which is to be installed and evaluated at Orly site. Quality and safety aspects for POEMS development are ensured by a STNA expert.
- Acquisition of POEMS station: a contract was signed with Eurocontrol for the procurement by STNA of the POEMS hardware. At FAT milestone, the ownership of POEMS hardware is transferred from Eurocontrol to STNA.
- Participation to standardisation groups or to EATCHIP/EATMP working structure: ICAO/SICASP, WG1 and its technical group TSG; Eurocae (WG 49, WG 52 & 53); EATCHIP/EATMP (POEMS, MSTA, Architecture TF,..)
- Preparation of the deployment of the national operational Mode S stations in the framework of an European coordinated approach:
  * evaluation of Mode S POEMS stations and validation of common specification for operational stations
  * study and adaptation of assessment means/tools
  * definition of the configuration of national operational station (call for tender for acquisition of 10 stations)

Approach
Set up of a European strategy for the initial implementation of Mode S enhanced surveillance (IIIMSES programme) within the European core area. Participating states: BENELUX, FRANCE, GERMANY, U.K.
For the POEMS project (as part of IIIMSES programme) a specific organisation has been set up: PMB (Programme Management Board), PMC (Programme Management Cell), technical working groups and national project leaders (team of up to 4 persons UK, France and Germany)
French national project leader in charge of the technical follow up and validation of the POEMS station developed by Thales company and set up in Orly airport.

Expected results
Technical amendment of the initial specifications: clarification and update of external interfaces specifications, use of ASTERIX format, output link management, DAP extraction application (data flash). Amendment to the contract has been negotiated and signed in 1999 between manufacturers and Eurocontrol/national administration introducing a phasing in the delivery.

Delivery of POEMS stations with enhanced surveillance capabilities (phase1) realised in October 2000 (instead of November 1999 initially expected) and POEMS with full functionalities (data link, dynamic enhanced surveillance) in October 2001.

Common specification of operational mode S station will be finalised with the validation POEMS phase (end 2003).
## Objectives

Modelling of error management processes and taxonomy of incidents
CISM (Critical Incident Stress Management)
Definition of incident analysis method and grid.

## Approach

Reinforce the positive human role on safety: as stated in most high risk situations analysis, one of the most promising line of actions to manage safety is to implement an efficient experience feedback process. We need new concepts to assess error managements in ATM and to extract a taxonomy of incidents, and we need to build up confidence among the different actors so that everyone feels concerned with safety issues.

## Expected results

- **Start Date**: 01/01/1998
- **Finish Date**: 31/12/2005
- **Keywords**: risk AND safety, incident
- **Included in SAFS**: ✔
- **Applicability Timeframe**: => 2000 and <= 2005
- **Current Validation Level**: N/A
- **Target Validation Level**: N/A
- **DNA**: DNA: Direction de la Navigation Aerienne
- **Sponsors**: DNA: Direction de la Navigation Aerienne
- **Partners**: Aeroports de Paris, CENA, CRNA, EUROCONTROL HQ, STCA
- **New This Year**: 
- **Included in Safety HI**: 
- **Included in SAFS**: ✔
- **Link to ESARRs**: Implicitly related to ESARR 2
- **Category**: Safety Management
- **Topic**: Methodology development
- **Parent Project**: Sub-projects
- **Sponsors**: DNA: Direction de la Navigation Aerienne
- **Partners**: Aeroports de Paris, CENA, CRNA, EUROCONTROL HQ, STCA
- **Results in VDR**: 

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### DNA152: Safety and Human factors

**Start Date**: 01/01/1998  **Finish Date**: 31/12/2005

**Objectives**
- Modelling of error management processes and taxonomy of incidents
- CISM (Critical Incident Stress Management)
- Definition of incident analysis method and grid.

**Approach**
- Reinforce the positive human role on safety: as stated in most high risk situations analysis, one of the most promising line of actions to manage safety is to implement an efficient experience feedback process. We need new concepts to assess error managements in ATM and to extract a taxonomy of incidents, and we need to build up confidence among the different actors so that everyone feels concerned with safety issues.

**Expected results**
- **Start Date**: 01/01/1998  **Finish Date**: 31/12/2005
- **Keywords**: risk AND safety, incident
- **Included in SAFS**: ✔
- **Applicability Timeframe**: => 2000 and <= 2005
- **Current Validation Level**: N/A
- **Target Validation Level**: N/A
- **DNA**: DNA: Direction de la Navigation Aerienne
- **Sponsors**: DNA: Direction de la Navigation Aerienne
- **Partners**: Aeroports de Paris, CENA, CRNA, EUROCONTROL HQ, STCA
- **New This Year**: 
- **Included in Safety HI**: 
- **Included in SAFS**: ✔
- **Link to ESARRs**: Implicitly related to ESARR 2
- **Category**: Safety Management  **Topic**: Methodology development

**Parent Project**

**Sub-projects**

**Sponsors**: DNA: Direction de la Navigation Aerienne

**Partners**: Aeroports de Paris, CENA, CRNA, EUROCONTROL HQ, STCA

**Results in VDR**: 

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**Objectives**

This project aims at integrating the data-link services identified in the Eurocontrol program "Link2000+" into the French operational system and keeping up with the standards that define these services so as to ensure interoperability among all actors (ground and air).

This project covers various activities from planning of necessary activities required to end up in operational mode to actually performing architectural choices proving, technical implementation, functional validation of services, development of test and training tools, safety basement of functional architecture etc...

In 2001, this project supported the technical evaluation of ATN and VDL2 with real aircraft (B767 AA) in the scope of PETAL II trials.

In 2002, the project dealt with DADI-2 trials, the air server evolution and the contribution to the AFAS project.

In 2003, extensive validation of the end-to-end architecture is being performed in relationship with the AFAS project.

**Approach**

The development of a pre-operational ground platform for data-link in CAUTRA has 3 major components:

- a data-link server which will have a certain level of commonalities with other European implementation
- modification of ODS-France HMI to enable data-link communication on the controller display and device,
- modification of FDP system to support flight plan functionalities such as correlation with flight plan.

However the project is not limited to implementation of these three components. The aim is to generate all activities (testing, training, hazard analysis) that will ensure the correct and safe operation of these three systems.

**Expected results**

The datalink ground platform was delivered in 99 and enabled global ground-ground integration with airborne simulation tools and to participation in other programs such as PETAL/2 for pre-operational evaluation trials.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V3b: Generic Specification - Requirements Validated

**Target Validation Level**

V5: Local Implementation - Sign-off for Operational Use

**Parent Project**

CEC060: EOLIA - European pre-Operational data Link Applications
CEC105: AFAS: Aircraft in the Future ATM System

**Sub-projects**

**Sponsors**

DNA: Direction de la Navigation Aerienne
EC DG TREN: European Commission DG Transport Energy

**Partners**

DFS
EUROCONTROL Agency
National Air Traffic Services Ltd
STNA

**New This Year**

- [ ] Included in Safety HI
- [ ] Included in SAFS
- [ ] Results in VDR

**Keywords hits**

hazard analyis, hazard, validation AND safety

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management

**Topic**

Assessment of new system/procedure
### Project DNA168: SDF CNS/ATM Safety Analysis linked to the implementation of CNS/ATM technologies

**Start Date** 01/01/1995  
**Finish Date** 31/12/2001  

**Objectives**  
Safety analyses linked with the introduction of a CNS concept.

**Approach**  
Conduct safety analyses. A close coordination with certification authorities (SFACT, JAA, EASA, SRC) and manufacturers will enable to ease the introduction of these concepts by gaining certification credit and be sure industrial developments could be used. Participation to Eurocae will be sought through the final studies of WG-45 and the on-going activity of WG53.

**Expected results**  
A methodological guide for conducting safety analyses linked with the development of CNS/ATM technologies. This guide that deals mainly with ground applications aspects, nonetheless take into account the constraints led by aircraft certification and future air-ground services certification.

**Applicability Timeframe** => 2006 and <= 2010  
**Current Validation Level** V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy  
**Target Validation Level** V4: System Development - Completion of Development and Integration  

**Parent Project**  
**Sub-projects**  
**Sponsors** DNA: Direction de la Navigation Aerienne  
**Partners** SFACT  
STNA

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### Project DNA185: MEFISTO - Modeling, Evaluating and Formalising Interactive System using Tasks and interaction Object

**Start Date** 01/01/1997  
**Finish Date** 31/12/2000  

**Objectives**  
Le projet MEFISTO est un projet européen (DGIII) dont le but est de déterminer une méthode de spécifications formelles d'interface d'application critique sur le plan de la sécurité et de développer un ensemble d'outils permettant de vérifier a priori les performances de l'IHM spécifiée.

La division CCC participe à ce projet en proposant un terrain d'application pour la future méthode MEFISTO, le projet DRUIDES (CENA/EAAC/94-02).

**Approach**  
**Expected results**  
**Applicability Timeframe** => 2011 and <= 2015  
**Current Validation Level** V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy  
**Target Validation Level** V2: Feasibility - Initial Proof of Concept ready for Implementation Decision  

**Parent Project**  
**Sub-projects**  
**Sponsors** DNA: Direction de la Navigation Aerienne  
**Partners** CENA

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**New This Year** | Included in Safety HI | Included in SAIFS | Results in VDR
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**Keywords hits**  
SRC, JAA, EASA, safety analysis, certification AND safety

**Link to ESARRs**  
Declared as in close co-ordination with certification authorities (SFACT, JAA, EASA, and SRC).  
In relation to ESARR 4.  

**Category** Safety Management  
**Topic** Methodology development
### DNA186: Safety studies guide

**Start Date** 01/01/1999  
**Finish Date** 31/12/2006

**Objectives**
To modify or to put into service ATC systems safely, all partners involved must take into account Safety in the very earliest stages of the studies. In order to reach this goal, this activity provide a support in describing or performing the safety studies required to develop, implement or modify safely ATC systems.

**Approach**

**Expected results**
A report describing the Safety Management System and its conformance to ESARR 3. Guidance materials. Dependability studies and Safety cases performed on the most critical systems.

**Applicability Timeframe** => 2000 and <= 2005

**Current Validation Level** N/A

**Target Validation Level** N/A

**Parent Project** CEC115: MFF - Mediterranean Free Flight

**Sub-projects**

**Sponsors**
DNA: Direction de la Navigation Aeriennne  
EC DG TREN: European Commission DG Transport Energy

**Partners**
CENA  
SCTA  
SRTI SYSTEM

**New This Year**
- Included in Safety HI [ ]  
- Included in SAFS [✓]  
- Results in VDR [ ]

**Keywords hits**
ESARR, safety case, safety manag

**Link to ESARRs**
Declared as related to ESARR 3, implicitly related to ESARR 4.

**Category**
Safety Management  
**Topic** Methodology development

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### DNA189: GNSS studies

**Start Date** 01/01/1999  
**Finish Date** 31/12/2005

**Objectives**
As of 2003, this project includes DNA124, DNA125, DNA165, DNA190 and DNA213.  
Support use of Gnss in France (ex. non-precision approach) or investigate possible advanced use (ex. cat2 or 3 landing). Support international work for standardisation in the field (Icao, Eurocae and Rtca)

**Approach**

**Expected results**
Definition and validation of requirements  
Evaluation of prototypes  
Compatibility analysis  
Safety cases

**Applicability Timeframe** => 2006 and <= 2010

**Current Validation Level** V3a: Generic Specification - Requirements Defined

**Target Validation Level** V3b: Generic Specification - Requirements Validated

**Parent Project**

**Sub-projects**

**Sponsors**
DNA: Direction de la Navigation Aeriennne

**Partners**
STNA

**New This Year**
- Included in Safety HI [ ]  
- Included in SAFS [✓]  
- Results in VDR [ ]

**Keywords hits**
safety case, validation AND safety

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**
Safety Management  
**Topic** Assessment of new system/procedure
The MSAW function allows to prevent accidents of a CFIT type (Controlled Flight Into Terrain). It consists in supervising the tracks worked out by the radar processing system in order to compare them to a relief database to alert the controller in case of occurrence of a flight too close to the ground and not in VFR.

The MSAW system studied is predictive: for each aircraft handled, we predict the trajectory and check the risks of collision with the relief in tens seconds or so. The quality of the prediction depends on:
- the extrapolation time,
- the quality (accuracy, renewal frequency) to let the aircraft location and speed be known,
- the techniques of prediction to carry into effect.

- MSAW: The configurations of Nice, Biarritz, Tarbes, Ajaccio, Bastia, Roissy and of the French West Indies will be performed in collaboration with STNA.
- STCA: operational implementation of STCA in Roissy and Orly before the end of the first half 2002.

Beyond 2002:
- MSAW: From 2002 onwards, the sites of list 2 then of list 3 will be taken into account for the deployment of MSAW (3 sites per year).
- STCA: Adaptation to the CRNA context (in particular RVSM). Adaptation to big approach control centres fed by DACOTA. Assistance to the resolution of conflicts: This study proposes an evolution of the initial objectives of STCA. From the analysis of real cases of miss of separation is derived the following report: the controller, even if he detects the conflict, proposes sometimes a resolution which is not optimal because he doesn't perceive well the vertical evolutions. This may lead to the worsening of the conflict. STCA, as a tool of ultimate help, doesn't but detect conflicts. Therefore, it will not contribute to improve the cases. The objective of the study is to assign to the safety net a function of resolution in order to propose a strategy of avoidance, as TCAS orders resolutions to the pilot.
### Project
**ENA011: MEFISTO - Modeling, Evaluating and Formalising Interactive System using Tasks and interaction Object - LTR 24963**

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### Objectives
Objective of this contract is to capture usability and safety requirements for ATC applications and to show that it is possible to check their satisfaction at both formal specification and implementation level. This project has three main objectives:
- A method which allows designers to develop ATC user interfaces specification and related software implementations which satisfy usability and safety requirements
- The development of a set of automatic tools supporting the method and allowing designers to address size, industrially relevant, case studies
- The development of ATC user interface prototypes which will be validated against usability and safety requirements by specification and empirical testing.

### Approach
We will develop and use various tools to support the different phases of the design cycle: to express the task model, to translate it into an architectural model, to evaluate the usability of prototypes.

### Expected results
- To develop a method, and related tools, which allows designers to apply formal methods in order to perform usability and safety evaluation over the formal specification of the system
- To define and implement an approach which takes formal specifications validated against usability and safety requirements and produces a related software prototype in a multi-modal environment
- To develop a method for usability evaluation of ATC user interfaces and to apply it to the prototypes developed to improve their overall quality.

### Applicability Timeframe
=> 2006 and <= 2010

### Current Validation Level
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

### Target Validation Level
V3a: Generic Specification - Requirements Defined

### Keywords hits
- Included in SAFS

### Link to ESARRs
Implicitly related to ESARR 4 and ESARR 6

### Category
- Safety Management
- Methodology development
**Objectives**
The main aim of the GFTI project is to contribute to the validation of ground-based augmentation systems for CAT I approaches, in compliance with ICAO SARPS. The GBAS CAT I performances will be verified performing appropriate flight trials at Linate airport Italy.

In the frame of the GFTI project, GBAS/SBAS interoperability and new GBAS approach procedures (e.g. curved and/or stepped) will be tested. Safety and economic issues related to possible GBAS implementations in Italian airports will be dealt with as well.

The data collected during the GFTI project and the criteria for data processing shall allow the Linate trials databank and results to be utilized in view of the assessment of GBAS to provide safe CAT I approach and landing services in Europe.

**Approach**
To install GBAS CAT I SARPS-compliant systems, both on the ground and on board an ENAV experimental aircraft.
To develop and fly GBAS experimental procedures in CAT I.
To collect and analyse technical and operational data.
To develop a Safety Case
To carry out a Business Case.

**Expected results**
Contribution to validation of the SARP’s ICAO for GBAS CAT I and assessment of both safety and business case.
Ground Segment accepted and installed at Linate Airport.
Foreseen in the second half of 2003 : acceptance and on board integration of GBAS avionics
Flight trials execution
post-flight analyses
safety assessment according to EUROCONTROL methodology and guidelines
development of a business case.
**Project** | **EUR059: Operational Development of Integrated Air/Ground Data Communications and Surveillance Services**
--- | ---
**Start Date** | 01/01/1996 | **Finish Date** | 30/06/2004

**Objectives**

(Part of Air/Ground Co-operative ATS)

AGC WP2, WP3, WP4, WP5, WP6, WP7

R&D activities consist in the validation of the operational concept and requirements of the air/ground data communications services and contribution to the specifications for prototyping, HMI, simulations and trials. In addition, this task comprises the development and conduct of the Preliminary EUROCONTROL Tests of Air/ground data Link number 2 (PETAL II) and subsequent trials when determined.

Objectives of R&D Activities

Validate and refine the requirements for air/ground data communications services and the requirements specification methodology.

**Approach**

Development of operational concepts and requirements through the ODIAC sub-group, contribution to the world wide Standards via ICAO and Industry standards groups and as soon as practicable validation exercises starting from benefits analysis, prototyping, simulations and actual operational trials of the ODIAC services for real time validation.

The project is carried out with separate activities for the steps in the ATM 2000+ roadmap.

- Step 2 (2005-2007): Implementation of a basic set of downlink of airborne parameters (CPDLC, ADAP, DFIS), applied in Link2000+, Mode-S, and ACARS programmes (Validation in DOVE)
- Step 3 (2008-2011): Enhancements to controller-pilot datalink communication (ASAS, CPDLC+, ADAP+, DFIS+) to be applied in ADS programme (validation in DOVE, FREER, PETAL)
- Step 4 (2012-2020): Higher levels of transfer of separation responsibility to pilots (currently in concept stage)

The project merged into the CASCADE programme in mid-2004 and was therefore closed.

**Expected results**

The resulting material is used to review the requirements documents in order to progress to an implementable system.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**

V4: System Development - Completion of Development and Integration

**Parent Project**

EUR059: Operational Development of Integrated Air/Ground Data Communications and Surveillance Services

**Sub-projects**

**Sponsors**

EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**

EUROCONTROL EEC

EUROCONTROL HQ

**Results in VDR**

[]

**New This Year**

[]

**Included in Safety HI**

[]

**Included in SAFS**

[]

**Keywords hits**

validation AND safety

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management

**Topic**

Assessment of new system/procedure
**Objectives**
As of 2002, merged into EUR186.
- To identify new technologies and concepts potentially applicable to ATM and which would enable radically different solutions to be used.
- To sponsor the investigation of feasibility and applicability conditions of the identified new technologies and concepts.
- To ensure the proper transfer of promising solutions into the planning of relevant domains.

**Approach**
The results of the studies will be made available to the relevant domains, for them to further investigate those topics for which a positive applicability has been shown.
The type of activities within the project typically include:
- Develop scenarios describing anticipated long term ATM concepts or systems, and in particular the framework and manner to make use of the identified emerging concepts and technologies.
- Define together with other research partners the analytical work or demonstrators necessary to conduct experiments aimed at evaluating the suitability and feasibility of new concepts, new technologies and techniques.
- Sponsor experiments with the agreed approach in order to assess the impact of these new concepts on the total ATM system performance.

1. University Trieste: Design of innovative route charge schemes considering ATC and airline new perspectives
2. DEEP BLUE: Art, design and technology: an interdisciplinary approach for innovation in ATM
3. RMC: Managing uncertainty between controllers & pilots: the presentation of uncertainty information
4. AEA TECHNOLOGY: Whole airspace ATM system safety case
5. ROKE MANOR: Airport runway debris detection
6. UNIVERSITY of Linköping / AVTECH: Absolute flow control
7. QinetiQ/ Cardiff University: Cognitive streaming, and the impact of loss of "party-line" information on ATM situational awareness
8. IABG: Integration of unmanned aerial vehicles into future air traffic management
9. DLR: Total airport management

**Expected results**
The task is an initiator for further research or development. It is aimed at identifying the new opportunities that may help to improve ATM performance in all aspects, or speed up its development, possibly as a break through of the current line of thought.
All ATM domains and R&D areas may be affected.

On 15 March 2001 a call for preliminary study proposal on innovative subjects was published through the internet on the CARE website and emails were sent out to the large group of CARE interested parties to alert them to the existence of this call.
The web page was consulted more than 200 times and it resulted in 36 proposals received before the deadline date of 30 April 2001.
A two-day meeting was held with a selection board consisting of 5 people on 7-8 May 2001 in which the proposals were ordered according to innovativeness of the idea, trust in the proposed team, potential benefit to the overall ATM system efficiency and time period before practical implementation.
It was decided that 9 proposals could receive funding for work to be performed in 2001.
All preliminary study proposals will contain identification of follow-on work to be performed in the 2002-2003 time period from which a selection will be made early January 2002.
All final reports were delivered and accepted on time and on 24 January 2002 a CARE Innovative Action presentation session was organised at Eurocontrol Headquarters in which the project leaders could present their preliminary study and the proposal for further work to interested persons from inside and outside Eurocontrol.

In the project selection board meeting four proposals (n. 1, 2, 3 and 7 of the above list) were retained for a full project study.
Project stopped in 2001 and replaced by four separate projects (one for each study).

http://www.eurocontrol.int/care/innov/innovative.htm

**Applicability Timeframe**
=> 2021 and <= 2025

**Current Validation Level**
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**Parent Project**
EUR071: CARE innovative ATM Research

**Sub-projects**
EUR175: CARE in Innovative ATM Research

**Sponsors**
EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**
AEA Technology
AVTECH SWEDEN AB
Deep Blue
DERA Farnborough
DLR Institute of Flight Guidance
EUROCONTROL HQ
Industrieanlagen Betriebsgesellschaft mbH
Risk Management Consultants ltd.
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Automatic Dependent Surveillance (ADS) is a surveillance technique which enables aircraft to transmit aircraft derived data for reception on the ground and by other aircraft. This data set includes the provision of position, velocity and other aircraft state vector information, and ultimately of trajectory intent data.

The prime objective of the ADS programme is to perform all necessary actions for the development, validation and implementation planning of ADS, as an enabler of a number of EATMP Operational Improvements based on a safe and cost-effective ADS infrastructure in Europe. This is underpinned by the development of harmonised and validated ADS technical concept, requirements and infrastructure specifications (including safety analysis), the development of an ECAC-wide business case for implementation of ADS, and a consensus based implementation planning.

Economic reward in terms of safety, capacity and efficiency benefits are generated as a result of the Operational Improvements and applications enabled by ADS.

The air-to-ground component of the ADS system thereby contributes to the traditional Air Traffic Control concept through the provision of a data rich ground surveillance environment whilst being complementary to and interoperable with other surveillance systems, such as SSR and Mode S SSR systems. In this respect, ADS will also deliver benefits by providing surveillance services in areas with no or only limited radar coverage. Airborne applications based on ADS-B, on the other hand, are going to contribute, in a progressive way, to a new ATM concept through the provision of airborne traffic situational awareness, airborne spacing and airborne separation functions, and could ultimately lead to autonomous aircraft operations in designated airspace.

Co-ordination and harmonisation of these activities by the ADS programme aim at the most expedient development of ADS systems by fostering ECAC wide implementation in a structured manner and ensuring interoperability with other technologies within a global context. This will help to provide systems to airlines operators and service providers at the lowest overall cost.

The Eurocontrol ADS Programme work carried out in 2003 and 2004 was to further progress on the "Development" and to initialise the "Validation" activities. The main results of this work relate to the:

- Definition of the Package I Master Plan to establish consensus of all stakeholders on the working arrangements for the development, validation and implementation of Package I applications (completed).
- Package I Requirements Focus Group (RFG) for the globally co-ordinated determination of requirements for Package I applications, including the initial work of the European OSED Harmonisation Group in 2003.
- Development of ADS Technical Concept, ADS Requirements and TIS-B Requirements documents. These documents form an important input into the ICAO ADS-B "Concept of Use" document (approved by the ICAO ANC/11), and the Package I requirements determination work (RFG) (completed);
- Architecture Definition (initial versions completed, updates on-going);
- Initiation of the "CRISTAL" validation activity (Co-opeRative Validation of Surveillance Techniques and AppliCations of Package I), performed in partnership with individual ANSPs and other stakeholders, in various ECAC sites.

- Requirements determination: 2004 deliveries relate to the "Initial OSED" and SPR material for some Package I applications. In addition, the Programme completed a study on ATC separation minima based on the use of ADS-B data.

- Infrastructure Development:
  - ADS-B/TIS-B ground stations were procured as follows: VDL Mode 4 and UAT ground stations in 2003, a 1090 ES ground station in 2004;
  - The "ARTAS V7" system (incl. Support of ADS) was delivered in 2004;
  - The development of a prototype TIS-B server was delivered in 2004;

- Validation Preparation:
  - For the Package I Validation Strategy and Plan, baseline documents were produced;
  - The first two phases of ADS-B/TIS-B Validation Test-bed (AVT) platform development were completed in 2003, Within 2004, AVT Phase III progressed towards operational completion in support of Package I airborne applications and multilateration validation;
  - SDPD evaluation tools development: SMART 5 for delivery end 2004, MAS for delivery in the 2nd half of 2004, and TRES project preparation in 2004.;
  - CAPT tool development was initiated in 2004;
  - Ground network validation tools development was advanced.
  - Initial Validation and Pre-operational trials activities (CRISTAL): projects with ten States were established.

- Initial Data Link Selection: Consensus on ADS-B data link was reached, and led to a EUROCONTROL paper for ICAO ANC/11, harmonised with a corresponding FAA paper.

- Safety: Completion of the Programme's stage 2A safety work. In 2004, work was initiated on the development of the various components of a Package I Safety Case.

- Business Case: An "Initial CBA" for further consultation with the stakeholders was delivered in 2004.

With the establishment of the Eurocontrol CASCADE Programme (September 2004), the ADS Programme activities are subsumed under CASCADE. From a budgetary perspective, this becomes fully effective from 2005 on.
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<td>EUR116: ADS Studies and Trials</td>
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<td>EUR172: SASS-C - Surveillance Analysis Support System for ATC Centre</td>
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<td>EUR207: ADS-MEDUP - ADS Mediterranean Upgrade Programme</td>
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<td>EUR248: Route Spacing and Aircraft Separation for P-RNAV Operations</td>
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<td><strong>Topic</strong></td>
<td>Assessment of new system/procedure</td>
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Objectives

As of 2003, it includes EUR185.

The concept and term of ASAS - Airborne Separation Assistance System was first introduced in 1993 by ICAO SICASP (today SCRSP) when considering other uses of Airborne Collision Avoidance Systems - ACAS. At EEC, the ASAS concept work started in April 1998 by a presentation at the IFATCA annual meeting in Toulouse, France. The work was made within FREER project, renamed Freer Flight, and was then designated as EACAC study. In 2001, Freer Flight was merged within AGI (Air Ground Integration) project structure, encompassing ASAS and datalink projects performed at EEC.

Since 2002, the project was (re)named CoSpace and is in SSP (Sector Safety and Productivity) business area. From the beginning, the project was driven by two key constraints: (1) From a human perspective, take into account current roles and working methods of both controllers and flight crew and (2) from a system perspective, keep things as simple as possible. The concept relies on an analogy with existing practices (visual separation clearance), and assumes minimal change in terms of role and responsibilities (e.g. no transfer of separation responsibility, decision making to the controller) and technologies (e.g. no automation required, no real change in ground systems).

The emphasis is on the concepts and implications in terms of roles, working methods and procedures of the ATM actors, rather than on the technical enablers

The objective of CoSpace is to determine the operational feasibility and potential benefits of the use of spacing instructions (airborne spacing). CoSpace covers concept definition up to validation aspects through human-in-the-loop and model-based simulations.

Approach

Because of its exploratory nature (at least at the beginning), the project follows an iterative process, in which every step (real-time simulation) helps defining the next one. The stepwise strategy followed can be described along three dimensions:

- Operational: start in cruise (in extended TMA) and progressively get closer to the runway (in TMA).
- Validation: start assessing usability (e.g. concept, procedures, interface) and progressively address impact on user activity (controller, pilot) and eventually on the ATC system (e.g. quality of control/flying, safety, efficiency).
- Technology: start with a basic working environment (e.g. paper strips, voice communications, no advanced tools, manual mode in the cockpit) and progressively introduce assistance and technology when need clearly identified (e.g. uplink of target selection, downlink of spacing parameters, controller spacing monitoring aids, automatic spacing mode in the cockpit).

- EVP (European Validation Platform) - The aim is to validate Air/Ground Integration concepts for Air Traffic Management through simulation and live trials based on ADS-B, ASAS and Sequencing Tools. The focus of the activity is towards validation trials using live data (both at the EEC and at National Service Providers sites). Since 2003, CoSpace is handling the flight deck experiments on ASAS (WP3) in co-operation with other work packages in particular regarding the use of arrival manager (WP4).

- NUP 2 (North European automatic dependent surveillance broadcast network Update Programme) - the goal is to identify and evaluate, through simulations, operational applications based on ADS-B that could be potentially used in Northern Europe.

Expected results

Validated Service Description,
Operational Requirements and associated Benefits at a level to allow pre-operational trials.

Part of the ATC Domain and CASCADE Programme activities

Applicability Timeframe

=> 2011 and <= 2015

Current Validation Level

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Target Validation Level

V3b: Generic Specification - Requirements Validated

Parent Project

CEC113: INTENT- the Transition towards Global Air and Ground Collaboration in Traffic Separation Assurance

EURO58: PETAL II - Air Ground Applications

Sub-projects

Sponsors

EC 5th Frame: European Commission - 5th Framework
EC DG RES: European Commission - DG Research
EC DG TREN: European Commission DG Transport Energy
EC DG VII
EUROCONTROL: European Org. for the Safety of Air Nav.

Partners

Airline Companies
CAAs
COFRAMI
CS Systèmes d’information
DFS
EUROCONTROL EEC
Eurotelematik
INRIA
LFV - Luftsverket (Swedish CAA)
PACTE NOVATION
STERIA
THALES information system (ex-SYSECA)
Transiciel
University of Berlin / Technische Universität Berlin

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**Keywords hits**
risk AND safety, validation AND safety

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**
Safety Management

**Topic**
Assessment of new system/procedure
In the last decade, the ATC community has launched projects to modernise their Controller Working Positions (CWP) while computing industry was discovering WIMP (Windows, Icons, Menus, Pointing). For the modern ATC CWP progressively a culture based on SSM (Sony Screen and Mouse) was developed with high commitment of ATC resources. However it appears that all of them have been designed on knowledge and technologies that are quite dated. Since the computer-human interaction community has gained considerable knowledge and has identified a weakness for WIMP.

New mass-market technologies are emerging and should provide a better use of human ability based on large tactile flat screens, flexible interaction styles, elaborated graphics and others state of the art multimedia tools.

The SkyTools project shall evaluate and demonstrate the state of the art benefits for the Controller Working Position of the future. The ongoing tool integration in the same SSM display should be stopped, separated to the original traffic display and an innovative working surface with integrated tools.

The paradoxes of human factor’s safety aspect for almost totally safe systems (civil air traffic has actually 10-6 accidents per year) should influence SkyTools concept development and especially the evaluation.

The SkyTools project shall participate on the strength of the progressive young generation as human resource.

Operational approach is centered around the Digistrips approach developed by CENA. Digistrips represents a “pseudo paper strips” which use new technology to mimic traditional interactions, whereas less sophisticated designs had failed to reach the necessary level of comfort. It will provide users with electronic environment and advantages associated (the system is informed) while respecting their traditional skills. Some Digistrips features are:
- Manipulations are effected through a combination of gestures and direct manipulation
- Data input is done by combining gesture recognition and menus
- Texture, dedicated fonts, and graphic techniques provide for unprecedented information readability
- Animated feedback enables data manipulation task that where previously impracticable

The project will address:
- New use of Hardware Technology (WP2)
- New use of Multimedia Interactive Technology (WP3)
- New Controller Working Position Environment for En-Route Centre (WP4)
- New Multidimensional Human Factor Evaluation and Experimentation (WP6)

The objectives are threefolds:
- Build a prototype to demonstrate and experiment the technical and operational feasibility
- Make extensive experimentations to validate some operational issues through the LOOK project
- Based on this result, develop a marketing and a lobbying activities, to push this technology and concept both to the industry and users, supported by the freeware philosophy (www.openatc.org)
**Project** EUR110: SATNAV / GNSS

**Start Date** 01/01/1997  
**Finish Date** 31/12/2002

**Objectives**
The basis of the Strategy is that the ECAC States already have available a high-density, high-performance navigation infrastructure which they own and control. They would be unlikely to replace it with something else if that could not provide equivalent or better performance. Hence, GNSS would have to deliver Sole Means performance, meeting strict RNP criteria. If GNSS could be shown to meet these criteria, the States and the airlines could then consider removing ground equipment and avionics. The Strategy foresaw that this may happen, but probably only when a civil, internationally-controlled GNSS were available, in other words GNSS-2. This is because both core systems - GPS and GLONASS - are under single-State control and so removing infrastructure would remove ECAC's ability to plan ahead as long as GPS and GLONASS remained the core systems. Nevertheless, there may be some scope for rationalising the distribution of existing navigation aids. GPS and GLONASS do, however, exist and the Strategy recognised the need to provide early benefits to those airlines investing in the relevant receivers. However, this would require augmentations to be in place, such as EGNOS, RAIM, AAIM and LAAS before the capabilities of GPS and GLONASS could be fully exploited. The core systems and the augmentations thereto are collectively known as GNSS-1. In Europe, ESA and the EU are involved in GNSS because of its ability to serve the needs of many users - other modes of transport, scientists, geodesists etc. The Strategy recognised that although aviation would have an important role to play (and may even drive early requirements) it was unlikely to be the main user of GNSS, either by units shipped or the value thereof. Hence, GNSS in Europe had to be seen as a development involving many and varied industrial sectors. Consequently, EUROCONTROL, ESA, the EU and the States would have to work together.

**Approach**
- EC programmes MAGNET A/B, GNSS Support
- ESA programme ARTES-9 (Advanced Research in Telecommunication Systems - Element 9)
- Various national programmes in EUROCONTROL Member States.

**Expected results**
- Acceptable institutional arrangements achieved - EUROCONTROL GNSS Unit and European Multi-modal GNSS Agency established
- Regulatory mechanism for GNSS agreed - probably based on the Safety Case philosophy
- Cost recovery and sharing mechanisms for GNSS established and implemented
- All GNSS components fully tested and validated
- GNSS/ATC interface implemented
- GNSS incorporated in European Air Navigation Plan
- Transition plan from ground-based to space-based navigation aids agreed by ECAC States
- SAPPHERE implemented and producing regular evidence of GNSS performance on-board commercial airliners
- GNSS Education and Awareness Programme kept up-to-date, relevant and in demand
- GNSS globally interoperable, mainly through acceptance of ICAO SARPs
- System baseline and user requirements for GNSS-2 agreed.

**Applicability Timeframe** => 2016 and <= 2020

**Current Validation Level** V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level** V5: Local Implementation - Sign-off for Operational Use

**Parent Project**

**Sub-projects** NLR044: GPV: GNSS Performance Validation

**Sponsors** EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**
- ALLIUM SA
- EUROCONTROL EEC
- EUROCONTROL HQ
- INDRA DTD
- REELEKTRONIKA BV
- Sofreavia
- STERIA
- University of Braunschweig / Technische Universitaet Braunschweig

**New This Year**

**Keywords hits** safety case

**Link to ESARRs** Implicitly related to ESARRs 2, 3 and 4

**Category** Safety Regulation

**Topic** Regulatory mechanism
**Objectives**
The objectives of the R&D activities of the Operational Safety Monitoring project are to define methods to detect some safety occurrences by use of ATC surveillance data: radars, trackers, satellites, Mode S stations, flight plans, and other potential sources. They also include the application of these methods to different types of airspace, and the determination of causes and local safety indicators. Finally, the R&D activities also relate to the Operational experimentation itself, the way to introduce Safety Monitoring in Operations and the impact on roles and responsibilities, procedures and operations.

**Approach**
The approach taken in the Operational Safety Monitoring project is to help finding the conditions for the operational acceptability, by conducting several local pilot experiments in co-operation with the Member States’ ATCCs Operations, and by collecting the experience, mainly regarding the operational impact, gained through these experiments. In support to this experimentation approach, the project uses a prototyping approach to demonstrate feasibility, and to help clarifying the operational requirements. The final 2 years of the project consists in working closely with the pilot sites in MUAC/Bratislava/Rome & Gatwick to get operational acceptance and use.

**Expected results**
Apart from the ASMT tool developed within the project, which implements the safety monitoring function and supports the experimentations, the expected results of the Operational Safety Monitoring project are a summary of some conditions facilitating the operational acceptability of safety monitoring, and a set of new common local safety analyses and indicators. Set of European operational requirements and guidelines on automatic Safety monitoring to facilitate implementation plan.

**Applicability Timeframe**
=> 2000 and <= 2005

**Current Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**Target Validation Level**
V5: Local Implementation - Sign-off for Operational Use

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<tr>
<th>Project</th>
<th>EUR133: ASMT - ATM Safety Monitoring Tool</th>
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<td>Start Date</td>
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**Category**
- Safety Management
- Topic: Methodology development

**New This Year**
- Included in Safety HI
- Included in SAFS

**Keywords hits**
safety analysis, safety occurrence
The Safety Reporting project intends to develop methods for supporting harmonised human incident reporting and exchange of safety information throughout Europe, in order to determine causal factors and European safety Indicators. This work will take into account the existing reporting systems in Europe and facilitate the identification of the causes of the safety events. It may comprise, when appropriate, the definition, provision and support in the use of prototypes and tools helping in safety incident reporting, causes determination and safety indicators.

The objective of the Safety Reporting project is to facilitate the exchange of operational safety information in Europe, to foster cooperation of the EATCHIP Member States in this field, and to enable a wider distribution of safety improvement methods and procedures.

In a longer term, this work should help the development of a global view of the European ATM system safety status, for the identification of trends and the development of common safety indicators. Such a global view would give support to the European regulatory authorities as well as to the body of the ATM service providers.

The first step of the project is the European harmonisation of definitions in ATM incidents, based on ICAO/ADREP2000, in 1999. The second step is the implementation of systems for reporting safety related occurrences from 2000 onwards.

The expected results of the R&D activities of the Safety Reporting for Indicators project are both support of a harmonisation of the ATM safety reporting in Europe and the actual exchange of safety information throughout Europe. In a longer term, this work should help the development of a global view of the European ATM system safety status, for the identification of trends and the development of common safety indicators. Such a global view would give support to the European regulatory authorities as well as to the body of the ATM service providers.

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Objectives

The overall objective is to use the EOLIA system together with the ProATN infrastructure for an operational and technical validation of pre-operational data link services and communication infrastructure compliant with the ICAO standards before they are implemented in member states and to demonstrate the potential benefit. The objectives for the involvement of Eurocontrol is to ensure that the EOLIA infrastructure is representative for an operational environment in which the selected data link services can be implemented and that it covers all requirements of an operation use in a safety critical environment. The overall objective is supported by the following key objectives:

- integration of EOLIA services within Member States' ATC systems
- evaluation of Data Link Services between EOLIA equipped A/C and on-line operational centres (e.g. Maastricht, Reims)
- Implementation of additional air/ground data link services, and conduct of the associated cost/benefit and safety analysis
- Integration of EOLIA services in UAC Maastricht to provide feedback on the operational and on-line use of the selected services
- Inclusion of the EEC in Brétigny to provide the simulation capabilities in a data link environment
- Addition of ground/ground communication services to support the forwarding of aircraft application information between centres

Increase the number of data link equipped aircraft; and to increase the number of implemented data link services per aircraft.

Approach

- integration of EOLIA services within Member States' ATC systems
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Increase the number of data link equipped aircraft; and to increase the number of implemented data link services per aircraft.

Expected results

Integration of EOLIA services within Member States' ATC systems: Eurocontrol, in its contract with Pro-ATN has access to the binary code supporting the services used by the EOLIA services.

Development of additional air/ground data link services: The EOLIA Consortium will develop and demonstrate the Down Stream Clearance (DSC) and ATIS service in a realistic operational scenario.

AGDG:
An AGDG capable to support multiple aircraft.

FLAAS:
Prototyping of airborne ATN data-link services including a representative pilot HMI, prove its readiness for integration into the NLR Cessna Citation through local end-to-end tests in the NLR laboratory environment. It will be integrated with the EEC PETAL lie ground system in Brétigny.

EOLIA2PIT/FLAAS FLIPCY:
Upgrade of NLR's FLAAS to be either operated in the N-Bay or the Cessna Citation II. In addition, this FLIPCY capable airborne platform would serve as airborne reference system for further studies on the FLIPCY ground implementation and use.

Use of the STNA ground system with its evolving FLIPCY implementation. FLAAS FLIPCY is envisaged to be used with the NLR NARSIM system and become a prototype implementation of the future FLIPCY implementation at Dutch ATC (LVNL).

EOLIA2PIT/FLAAS Flight trials:
The task aims at using this infrastructure to conduct fight trials demonstrating data-link services functionality exceeding that of the original EOLIA project, and at the same time contributing to the recognition and validation of the PETAL Ile specification and implementation efforts.

NATS_SAS:
The NATS-SAS ground end-system is updated to be compliant with the ICAO SARPs (Doc9705), and provide the data link service functionality requested by the Eurocontrol/FAA PIT project. Integrate the new EOLIA Service Layer into the NATS-SAS, develop the NATS-SAS HMI to be ICAO Doc 9705 compliant and support the additional CPDLC messages required. Develop the NATS ProATN emulation (ProATN) to be ICAO Doc, 9705 compliant.

Start Date 01/01/1999
Finish Date 31/12/2000

Applicability Timeframe => 2006 and <= 2010

Current Validation Level V3b: Generic Specification - Requirements Validated

Target Validation Level V4: System Development - Completion of Development and Integration

Sponsors EUROCONTROL: European Org. for the Safety of Air Nav.

Partners EADS Airbus SA
EUROCONTROL EEC
EUROCONTROL HQ
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Luchtverkeersleiding Nederland / ATC the Netherlands
NATS
Sofreavia
THALES ATM France (ex Airsys ATM France)
**Objectives**

The objectives of this project are:
- Definition of the EATMS Verification and Validation (V&V) Strategy;
- Specification of the V&V Methodology;
- Production of the V&V Master Plan;
- Implementation of V&V Master Plan together with common tools and validation platform;
- Overseeing the implementation of the V&V Master Plan;
- Integrating and reporting the results of the validation activities to the relevant organisational bodies.

**Approach**

General:
The related R&D work is envisaged to be executed under the sponsorship of EUROCONTROL Headquarters by R&D partners, mainly the key EUROPEAN Aeronautical Research Institutes, including the EUROCONTROL Experimental Centre Brétigny, by consultancy services of ATC providers and by additional partners from industry and academia. The advisor role of the EUROCONTROL Agency to the Commission of the European Union (CEU) in the execution of their ATM R&D initiatives will continue. Certain tasks might be executed by funding of complementary work packages to the Consortia selected by the CEU on the basis of their call for proposals.
The cooperation with corresponding R&D activities in the US (FAA, NASA, leading aircraft manufacturer) and in Canada shall be strengthened within the available frame of the agreements of cooperation with both countries.

EATMS Verification and Validation:
This task group relates to the Specialist Task FCO.ET2. ST 03, ST04 and ST09.
Validation is the process through which a desired level of confidence in the ability of a deliverable to operate in a real-life environment may be demonstrated against a pre-defined level of functionality, operability and performance.
Verification is the process of checking that the production version of a system or product complies with the detailed production specification, i.e. it covers the quality management, factory and site acceptance testing.
The EATMS requires a scheme of verification and validation (V&V), which will ensure that the necessary results are available in-time and in a form which is acceptable to safety regulators/certification bodies for their approval.

So the scheme of EATMS verification and validation and its demonstration on a platform is an applied research item in itself with high priority, as it is a supporting element for the further development of the EATMS concept and system elements.

**Expected results**

Preliminary internal EUROCONTROL work emphasised the requirement for the development of a validation strategy and a trials platform. On that basis of key statements on EATMS Validation mission, objectives and strategy the Future Concept Team has set-up a drafting group for a validation strategy. Other contributions are expected to be available with the results of the corresponding 4th Framework Programme Studies.
The EUROCONTROL Experimental Centre has shown its interest to cooperate by contributions in kind to selected consortia.
The final results will be:
- EATMS Validation Strategy;
- V&V Methodology;
- V&V Master Plan;
- Implementation of the V&V Master Plan;
- Common infrastructure (tools and validation platform);
- Overall EATMS V&V Status Summary Reports (periodically).

**Applicability Timeframe**

=> 2000 and <= 2005

**Current Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**

N/A

**Parent Project**

NLR060: VALERY - Study for the Development of a Prototype Validation Data Repository

**Sponsors**

EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**

EUROCONTROL EEC

EUROCONTROL HQ

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**Keywords hits**

certification AND safety, validation AND safety

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management  

**Topic**

Methodology development
In support of policymakers in air transport safety in general and the regulatory authorities in particular, the ASTER project develops a method and tools to define target levels of safety for the total air transport system and to support the identification of optimal safety improvement measures (through regulation) to achieve the target level of safety. Cost benefit analysis and risk assessment techniques are applied. Activities are carried out to: review methods for setting Target Levels of Safety, to analyse current safety levels, to analyse cost effects of unsafety and costs of implementation of safety improvement measures, to analyse safety benefits in terms of reductions of unsafety, and to integrate these elements into an air transport safety optimisation methodology.

It holds for any system that to have good performance with regard to a particular property, this property must be part of the design requirements rather than a mere spin-off of the development process of the system. For this reason, aircraft speed and fuel-efficiency are design requirements instead of the coincidental outcome of the design. The same ‘design approach’ should be followed with regard to the safety of air transport in order to achieve a significant improvement in relative safety. Usually there are several ways to achieve a particular safety improvement. Also, particular safety improvements in some elements of the air transport system (ATS) may be more easily (at lower costs) achieved than in other elements of the ATS. Therefore, in view of the fact that the available resources for the improvement of safety are limited, it is imperative to establish the most effective way of spending the resources available for safety improvements. The proposed project is aimed at providing methods for this need.

1.1 Working document Description of current safety targets
1.2 Working document Review of strengths and weaknesses
1.3 Working document Review of current role of stakeholders
2.1 Working document ATS system definition
2.2 Working document List of causal factors
2.3 Report Model of safety levels
2.4 Working document Data requirements, list of data sources
2.6 Report Quantification of safety levels
3.1 Working document Description of methodological issues and elaboration of approach
3.2 Working document Assessment of direct cost elements
3.3 Working document Assessment of indirect cost elements
3.4 Working document Cost allocation to different actors/stakeholders
3.5 Working document Timing aspects per cost element
4.1 Working document Taxonomy of implementation cost
4.2 Working document Life cycle cost period per taxonomy element
4.3 Working document Accountable party per taxonomy element
4.4 Working document Evaluation of side effects of a regulation action per regulatory category
4.5 10 Report Cost table for generic cost level per taxonomy element
5.1 Working document Definition of safety benefits
5.2 Working document Description of timing of impact
5.3 Report Description of safety benefits prediction methodology
5.4 10 Report Validation report
6.1 14 Report Review of feasibility and need for a CBA driven approach to safety regulation
6.2 Report Assessment of current distribution of safety levels and safety targets and proposals for a more effective distribution
7.1 6 Progress report Overview of activities in month 1-6
7.2 10 Progress report Overview of activities in month 1-10
7.3 14 Consolidated final report Overview of main activities, conclusions and recommendations.

EUR180: ASTER

01/01/2000
30/06/2001

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision
CEC096: ASTER: Aviation Safety Targets for Effective Regulation
EC DG TREN: European Commission DG Transport Energy
EUROCONTROL: European Org. for the Safety of Air Nav.
EUROCONTROL EEC
European Communities
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<td>Safety Regulation</td>
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Objectives

The EATMP Operational Concept Document in its target concept for ATM in Europe from 2010 onwards recognises the need for enhanced computer support for Controllers. Automated decision-support tools (DST) can assist in the primary task of the Controller: the detection and resolution of conflicts between aircraft. DST will have greater significance when the existing route network is replaced with free routes, as conflicts will be more difficult to detect and resolve.

Through the Automated Support to Air Traffic Services Programme, EUROCONTROL is developing DSTs aimed at reducing controller workload to generate new capacity.

CORA (COnflict Resolution Assistant) is a phased project:

CORA level 1 builds directly on top of the MTCD underlying functionality i.e. the detection and display of potential conflicts. CORA 1 provides specific functionality and HMI features i.e.:
- conflict probe;
- trajectory edition;
- prepared clearance;
- filter by problem, flight plan parameters, context aircraft;
- trajectory implementation support;
- conflict identification and notification.

CORA 1 can best be described as an environment which brings together automated DSTs such as MTCD, Trajectory Prediction, Monitoring Aids, and Safety Nets in an advanced graphical HMI.

CORA level 2 sits on top of CORA 1 functionality and provides automated decision support to the controller in the form of system advisories for conflict resolution. CORA 2 will generate conflict resolution advisories, i.e. manoeuvres that one or more aircraft would have to execute in order to resolve the conflict, and display this information to the controller, who in turn can accept or reject the proposed resolutions. The advisories are available either automatically or on request and the resolutions will be ranked. CORA 2 provides specific functionality and HMI features i.e. resolution:
- generation
- update management
- implementation support
- provision for display

Approach

The CORA project builds on our experience in developing MTCD, which has now been demonstrated in simulations and field trials and has been accepted as a basis for development of future systems.

We foresee a phased implementation approach:
CORA 1 starting from 2005
CORA 2 starting after 2007 when flight data management infrastructure is in place in Europe
CORA 3 a longer term development, implementation starting after 2015

We advocate ‘user-centred’ design and the need to keep the operator ‘in the loop’. This means that the controller must remain the responsible part of the system, acting as a decision maker in full control of the situation. The question we must address throughout the project lifecycle is how to best match the capabilities of such automated systems to the abilities and limitations of the human operator.

To this end we have involved (and planned the involvement of) operational Controllers from the outset of the project in the following studies and activities:
- European controller and controller management survey of attitudes towards automation and change to identify concerns and issues to be addressed in the development of CORA.
- European controller study on resolution strategies - to inform algorithm build.
- Establishment of European Controller Group (ICON) to ensure up-to-date operational expertise and feedback.
- Development and application of a user-centred requirements engineering process to involve controllers in design and to ensure complete requirements capture.
- Safety studies and analysis throughout the project lifecycle (FHA, PSSA)
- Rapid prototyping activities using the EUROCONTROL eDEP platform.
- Real-time simulations to validate concepts and working methods
- Field Trials - to validate concepts and working methods

Expected results

The objectives of the CORA project are to develop, validate and, if required, standardise operational requirements and functional specifications for conflict resolution tools, which enhance the controller’s decision making process. These objectives are met by working closely with EUROCONTROL member states, industry and research establishments. The project will develop the operational concept and the supporting roles, responsibilities and procedures for the use of these tools.

For detailed deliveries see "Deliverables" section

Applicability Timeframe

=> 2006 and <= 2010

Current Validation Level

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level

V4: System Development - Completion of Development and Integration

Parent Project

EUR160: ASA (Automated Support to ATS) - Advanced Functions

Sub-projects

Sponsors

EUROCONTROL: European Org. for the Safety of Air Nav.

Partners

ALLIUM SA
CENA
DFS
EUROCONTROL Agency
EUROCONTROL EEC
Luchtverkeersleiding Nederland / ATC the Netherlands
Nationale Lucht en Ruimtevaartlaboratorium
National Air Traffic Services Ltd
STERIA
THALES information system (ex-SYSECA)

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**Keywords hits**

- accident

**Link to ESARRs**

- Implicitly related to ESARR 4

**Category**

- Safety Management

**Topic**

- Assessment of new system/procedure
The MSP project aims at defining and managing metasector complexity.

The objective of MSP is to ensure that the complexity of the future air traffic situations in any sector within the metasector is reduced just enough to allow resolutions of aircraft conflicts to be found at an acceptable level of controller workload.

MSP will co-ordinate and organise the merging of already available advanced air traffic management tools: Conflict Resolution Assistant (CORA), Arrival Manager (AMAN), Departure Manager (DMAN), En-route Manager (EMAN), with additional tools required for planning across sectors and FIRs and thus leading to a global ATM concept.

The MSP project shall take into account the air traffic demand expected within the busiest parts of the European airspace by the year 2015. The tools produced shall be adaptable and scalable to the requirements of all users and areas of ECAC airspace. The tools shall be interoperable as required.

The tools shall support ATC operations that are environmentally sustainable and that will satisfy national security requirements.

When planning the design and implementation of enhanced automation of planning tasks the following extract from the ATM 2000+ Strategy document is of importance:

Operational improvements shall incorporate three methods of raising productivity by changing controller tasks:

- The use of automated tools to assist the controller in planning across sectors and tactical decision making.
- The redistribution of control tasks within sector teams or between controllers within a control centre.
- The transfer of some separation tasks to the cockpit

The MSP project concepts A, B and C respectively investigate the three methods listed.

- Prototype tools and HMI.
- Controller-in-the-loop trials and simulations.

Three complementary concepts are presented:

A. (Multi-sector or metasector) Traffic and Complexity Management, fills the gap between flow management and sector planning.

B. Sector control with MSP, responds to the growing pressure for individual sectors to be part of a team delivering a multi-sector plan;

C. (Multi-Sector) Four-D Control provides an example of a future concept involving a mix of current control and control based on trajectory negotiation via datalink. Overall, the conclusion is that the ever more busy and complex traffic situation in European airspace needs consistent, continuous and responsive traffic management, starting from the planning of airspace right through to the executive controller delivering separation. The presented multi-sector concepts are about delivering that type of management, and should unlock capacity that would otherwise remain unused, undeclared or wasted. The principal recommendations from the initial study for MSP are as follows:

There should be further development of the Traffic and Complexity Management concept in the context of one or more particular implementation. Projects such as AMAN, CORA and MTCD should note the discussion of sector control with multi-sector planning and adopt the principles described there as a framework: in particular relating to constraint management and workload optimisation. More radical concepts such as Four-D Control should be investigated further as a separate project, again adopting a specific implementation as an example.

Successful MSP implementation will generate benefits similar to those expected of other decision support tools. These may be generally described as those associated with an effective reduction in controller workload per aircraft, with consequences for increase in airspace capacity and more time available for assuring safety. In addition, since multi-sector planning by definition implies planning at longer look-ahead periods, quality of service to airlines will be improved by the provision of smoother and more stable clearances. Further MSP proposals specifically target better use of existing airspace capacity.

The projected start date is 01/01/2000 and the finish date is 06/12/2003. The applicability timeframe is >= 2006 and <= 2010.

Expected results

Successful MSP implementation will generate benefits similar to those expected of other decision support tools. These may be generally described as those associated with an effective reduction in controller workload per aircraft, with consequences for increase in airspace capacity and more time available for assuring safety. In addition, since multi-sector planning by definition implies planning at longer look-ahead periods, quality of service to airlines will be improved by the provision of smoother and more stable clearances. Further MSP proposals specifically target better use of existing airspace capacity.

Applicability Timeframe

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Target Validation Level

V3b: Generic Specification - Requirements Validated

Parent Project

EUR160: ASA (Automated Support to ATS) - Advanced Functions

Sponsors

EUROCONTROL: European Org. for the Safety of Air Nav.

Partners

EUROCONTROL EEC
### QinetiQ Malvern (ex-DERA)

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**Keywords hits**

**Link to ESARRs**

- Implicitly related to ESARR 4

**Category**

- Safety Management

**Topic**

- Assessment of new system/procedure
**Project** EUR185: MA AFAS - AFAS  

**Start Date** 01/01/2000  
**Finish Date** 31/12/2002

**Objectives**  
As of 2003, activities are declared under EUR096.

The project technical objectives are:  
- Demonstrating a more autonomous aircraft concept  
- Proving Air-Ground loop, in terms of communication and procedures  
- Proving that Ground infrastructure can support mixed capability aircraft  
- Updating and modifying standards to pave the way for global seamless ATM  
- Generating and validating Operational Procedures, showing that the avionics package gives benefit in the ATM environment and is compatible with cockpit HMI requirements  
- Preparing for pre-operational validation of the avionics package, including exploitation activities  
- Demonstrating the combined European strategy to future ATM is:  
  - achievable  
  - gives benefits in terms of efficiency, capacity and safety,  
  - upgradeable to meet future demands  
  - can form the basis of a global ATM environment.

**Approach**  
The proposed work has been broken down into 5 areas:  
0. Management  
1. Operational Concept  
2. Avionics Package  
3. Validation  
4. Operational Support  

This programme shall commence with developing an operational concept to link the air-ground requirements and procedures, focusing particularly on the European perspective. Airborne ATM functions will then be selected for implementation, and reviewed by users, together with the scenario under which they will be demonstrated. From this, the avionics package will be designed, developed and tested using specifically developed test platforms. Then, the avionics package will be verified and validated against flight simulators and trials aircraft using appropriate ground and communication infrastructure. During this time, the operational procedures developed for its effective use within the ATM will be verified and validated. Finally, the cost benefit of the avionics package will be assessed. The effect of its implementation on standards will be identified and new and modified standards will be proposed for adoption. An exploitation plan will be produced that will define the steps required to take the avionics package into the market place, and an implementation plan written which will describe the phases required to obtain pre-operational validation of the avionics package, in preparation for in-service operation.

**Expected results**  
The specific objectives of the participation of the EEC to the AFAS and MA-AFAS projects:  
- Transfer to industry its existing ASAS knowledge  
- Refine the ASAS concepts through the industry involvement  
- Leverage the EU funding to validate ASAS and bring it to pre-operational status  
- Provide a commonly agreed upon and open validation platform stimulating ATM industries into the development of EATMP compliant ASAS components.

**Applicability Timeframe**  
=> 2006 and <= 2010

**Current Validation Level**  
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**  
V3a: Generic Specification - Requirements Defined

**Parent Project**  
CEC105: AFAS: Aircraft in the Future ATM System  
CEC106: MA-AFAS - More Autonomous Aircraft in the Future ATM System  
EUR160: ASA (Automated Support to ATS) - Advanced Functions

**Sub-projects**

**Sponsors**  
EC DG RES: European Commission - DG Research  
EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**  
DERA Malvern  
DFS  
EUROCONTROL Agency  
EUROCONTROL EEC  
Marconi Electronic Systems Ltd.  
Sofreavia

**New This Year**

**Keywords hits**
validation AND safety

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**  
Safety Management  
**Topic**
Assessment of new system/procedure
**Project**

**EUR192: FRAP - Eight States Free Route Project**

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**Objectives**

The general objective of the project is to provide a feasibility assessment, implementation strategy, plan and business plan for the introduction of Free Route Airspace across eight ECAC member States.

The Feasibility Report was accepted by the Steering Committee in November 2001. No date for implementation has been established.

**Approach**

The project is organised into four phases:
- P0: Project Planning Phase
- P1: Development Phase
- P2: Implementation Phase
- P3: Post-Implementation Phase

Specifically, the project shall:
- Define the Free Route Airspace Concept (FRAC);
- Define the ATM procedures and system support package required;
- Develop and update the business case for Free Route Airspace;
- Perform a feasibility assessment;
- Develop a safety case;
- Perform demonstrations of Free Route Airspace operation;
- Develop an implementation strategy and plan and then implement Free Route Airspace in the Eight-States;
- Provide post-implementation system monitoring and development.

**ORGANISATIONAL STRUCTURE**

The Eight-States Free Route Steering Group has been established and shall give direction to two Working Groups, the Airspace Management Working Group (AMWG) and the System Support Working Group (SSWG). In order to inform other States of the progress of the project the Steering Group will also make regular reports to the EATCHIP Airspace and Navigation Team (ANT) and Operational Requirements and Data Processing Team (ODT) to co-ordinate this project with ANT and ODT activities.

**Expected results**

- Benefits in cost reduction to airspace users saving flight distance (time/fuel and frame lifetime),
- Increased flexibility and efficiency for airspace users resulting from the operation at more optimal horizontal and vertical profiles, with corresponding additional fuel savings,
- Significant decrease in the number of conflicts (approx. 30% less conflicts) has the potential to increase airspace capacity provided the right ATC Systems support tools are implemented,
- Airborne equipment requirements foreseen in other programmes are expected to be sufficient to support the Concept.

**Applicability Timeframe**

=> 2000 and <= 2005

**Current Validation Level**

V5: Local Implementation - Sign-off for Operational Use

**Target Validation Level**

V5: Local Implementation - Sign-off for Operational Use

**Parent Project**

**Sub-projects**

**Sponsors**

BE-AIR-FORCE: Belgian Air Force
Belgocontrol
Bundeswehr: Bundeswehr ATS Office
CAA-FIN: Finnish Civil Aviation Administration
CAA-SLV: NAVIAIR - CAA Denmark
DFS: Deutsche Flugsicherung GmbH
DK-AIR-FORCE: Danish Air Force
EC DG INFSO: European Commission - DG INFSO
EUROCONTROL: European Org. for the Safety of Air Nav.
FN-AIR-FORCE: Finnish Air Force
HKV: Swedish Armed Force - Flygi Luftfart
KON-LUCH: Koninklijke Luchtmacht
LFV: Luftfartsverket (Swedish CAA)
LVNL: Luchtverkeersleiding Nederland
NLR: Nationaal Lucht & Ruimtevaartlaboratorium
RNAF: Royal Norwegian Air Force

**Partners**

Belgian Air Force
Belgocontrol
Bundeswehr ATS Office
Civil Aviation Administration Finland
Danish Air Force
DFS
Direction de l'Aviation Civile
EUROCONTROL EEC
EUROCONTROL HQ
EUROCONTROL MUAC
Finnish Air Force
Luchtverkeersleiding Nederland / ATC the Netherlands
Luffartsverket (Swedish CAA)
Nationaal Lucht en Ruimtevaartlaboratorium
NAVIAIR (Danish Civil Aviation Administration)
Risk Management Consultants ltd.
Royal Norwegian Air Force
Swedish Armed Force - Flygi Luftfart

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| Keywords hits       | EASA, safety case     |

| Link to ESARRs       | Implicitly related to ESARR 4 |

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<th>Topic</th>
<th>Assessment of new system/procedure</th>
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Objectives
This project replaces previous EUR064 and EUR082. This programme addresses the identified and agreed ANS Providers' needs for timely availability of suitable people and will provide the framework and a series of ECAC wide accepted tools for human factors, manpower planning, selection and training. It will also focus on the proactive management of human performance issues as identified in the EATMP Programme portfolio. This will finally enable the achievement of effective human performance in Air Traffic Management and form a mandatory basis for the regulation of any safety related task in ATM and will contribute to aviation safety, capacity, flight efficiency and cost-effectiveness through consistent quality of service delivery by ATM staff and the best use of evolving technology within the current and future European ATM.

Approach
This programme is managed as a collection of sub-programmes, projects and application support each delivering specific deliverables and measurable benefits relevant to the Human Resources European Convergence and Implementation Programme (ECIP) objectives:
- ECIP HUM 01: Timely Availability of Controllers
- ECIP HUM 02: Implement Harmonised Selection, Recruitment and Training of ATM Staff.
- ECIP HUM 03: Implement the Full Integration of Human Factors into the Lifecycle of ATM Systems.

Expected results
Expected benefits of the programme include:
- safety enhancement, through more uniform quality of the service provided by ATM staff, harmonised training and widespread application of individual and teamwork-based safety-assurance measures throughout the ECAC area;
- productivity and flexibility gains, through better use and adaptability of ATM staff;
- capacity increase through enhanced availability of staff, improved design of ATM working positions, optimised task sharing between operational staff and advanced technology;
- cost savings through economies of scale and more effective tools and methodologies;
- increased motivation, mobility and adaptability of staff to cope with an ever-changing environment.

The results/products will be mainly provided as ECAC wide accepted deliverables in the form of documents (e.g. manuals, handbooks, reports), software/multimedia tools (e.g. application and simulation software, test and assessment methods, computer-based training, intra and internet applications) and consultation tools (e.g. interviews, questionnaires). Most of the existing deliverables can be accessed and downloaded via the following web-site: http://www.eurocontrol.int/humanfactors/.

Stage 1 of the programme has been extended to produce validated deliverables over a period of four years (2000-2003). These deliverables, together with appropriate marketing, training and implementation guidance material will be ready for implementation in the time period 2003-2007.
Stage 2 of the programme has been shifted (starting 2004) to the human factors domain and stakeholder customisation and implementation support will be provided on individual stakeholder request.

Applicability Timeframe => 2000 and <= 2005
Current Validation Level V4: System Development - Completion of Development and Integration
Target Validation Level V4: System Development - Completion of Development and Integration
Parent Project
Sub-projects DER017: HIFA (Human Factors Integration in Future ATM Systems) - Phase 1 & 2
Sponsors EUROCONTROL: European Org. for the Safety of Air Nav.
Partners EUROCONTROL EEC
EUROCONTROL HQ
EUROCONTROL Institute for Air Navigation Services
FAA Headquarters

New This Year
Keywords hits regulation AND safety
Link to ESARRs Implicitly related to ESARR 5
Category Safety Management
Topic Human Resources
This project provides studies results essential for ACAS implementation. These studies include the following areas:
- provision of confirmation of the safety benefit expected to be provided by TCAS II Version 7 and will confirm the need to maintain Phase 2 implementation for smaller aircraft;
- provision of a methodology for future ACAS/ATM interaction studies;
- provision of objective information to the RVSM Programme on TCAS operational performance in RVSM;
- confirmation of the acceptability of extended altitude reporting;
- confirmation of the acceptability of TCAS II Version 7 RF interference;
- controller training;
- provision of measurements of ACAS Resolution Advisories (RAs) and ACAS signals in space using Mode S as a detection system;
- investigation of the efficiency of horizontal RA acceptability.

**Approach**

**Expected results**

**Applicability Timeframe** => 2000 and <= 2005

**Current Validation Level** V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level** V5: Local Implementation - Sign-off for Operational Use

**Parent Project**

**Sub-projects**
- DER002: ACASA - Airborne Collision Avoidance System Analysis
- DNA011: ACAS (Airborne Collision Avoidance Systems) impact on ATC

**Sponsors**
- EC: European Communities
- EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**
- CENA
- DERA Malvern
- DFS
- EUROCONTROL EEC
- EUROCONTROL HQ
- National Air Traffic Services Ltd

**New This Year**

**Keywords hits**
safety AND benefit

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**
- Safety Management
- Topic: Assessment of new system/procedure
**Project**

**EUR204: EMOTION7 - European Monitoring of TCAS II version 7.0**

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</table>

**Objectives**

This project provides an appropriate framework and means to minimise the significant risk of safety, operational and technical issues associated with the introduction of modifications to TCAS II Version 7 software. The project will identify the safety, operational and technical issues which may arise during the introduction of TCAS II Version 7 and, where necessary, develop rectification change proposals for the CAS logic. It will also ensure that the required level of TCAS II expertise is maintained.

**Approach**

**Expected results**

- **Applicability Timeframe**: => 2000 and <= 2005
- **Current Validation Level**: V5: Local Implementation - Sign-off for Operational Use
- **Target Validation Level**: V5: Local Implementation - Sign-off for Operational Use
- **Parent Project**
  - DNA011: ACAS (Airborne Collision Avoidance Systems) impact on ATC
- **Sponsors**
  - EUROCONTROL: European Org. for the Safety of Air Nav.
- **Partners**
  - CENA
  - EUROCONTROL HQ
  - Sofreavia

**New This Year**

- Included in Safety HI
- Included in SAFS
- Results in VDR

**Keywords hits**

risk AND safety

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management

**Topic**

Assessment of new system/procedure
The Strategy for ATM2000+ identifies the requirement for automated support to ATM to increase capacity at a rate that matches the rapidly increasing demand for air travel. Many tools have been or are being researched into providing automated support for the controller. In particular, the PHARE Programme has indicated a clear way forward although the results were not quantified as measurable benefits.

Development continues in the EATMP in the Automated Support to ATC (ASA) programme. Nevertheless, a number of research issues remain to be undertaken. The tools vary in their levels of sophistication and automation; some tools could rapidly be put into operational use providing an immediate increase in capacity. Whereas other tools would require development, upgrades and changes of procedures in other areas but could be capable of providing capacity gains that meet the traffic demands forecast for nearer to 2015.

Identify Metrics. Automated support tools need to be evaluated and their potential benefits in real or forecast environments quantified. The quantification should be in agreed terms using agreed methodologies against the criteria of: Safety, Capacity, Economy, Environmental Impact

Unfortunately, there are no fully agreed validation metrics or methodologies for these criteria. One of the first tasks of the INTEGRA Project is to identify metrics and methodologies and gain agreement with the stakeholders for their use. The intention is to end with the capability to make valid comparison between simulations at different establishments.

Approach

Identify Support Tools. Work has taken place in other projects (such as PHARE, EATCHIP3, EMERALD, CINCAT and Torch) identifying automated support tools that could be available for rapid introduction into operation. These projects need to be drawn together to suggest potential tool-sets suitable for the requirements of differing airspaces. The cockpit, controller and airspace procedures will need to be defined and refined.

Quantification Trials and Simulations. The identified tool sets and procedures will need to be trialled in progressively more detail within simulated ATM systems to quantify their benefits as specified in the Metrics and Methodology sub-Project 0[Reference 3.]. The trials will vary operational aspects and airspace aspects such as:

- fixed or free routing,
- en-route and terminal airspace,
- managed and unmanaged airspaces

Flexible use of airspace.

For each of these areas tools and tool-sets will be trialled. Costs and benefits will be made available to all stakeholders: ATC, ATS and Airspace Users providing better arguments for introduction of the tools through development and implementation programmes.

Identification of Transitional Path. The Project will then suggest the most efficient transitional upgrade paths in terms of the quantified metrics from the baseline early tool-set(s) to the more complex but more capable tool-sets envisaged in the Strategy for ATM2000+ for 2015 and as detailed in the ODP Strategy. These transitional steps will each be shown to be supported by a defensible business case, supporting development effort in EATMP programmes such as ASA or AGC.

Expected results

Metrics using agreed methodologies against the criteria of: Safety, Capacity, Economy, Environmental Impact.

Current Validation Level

V3a: Generic Specification - Requirements Defined

Target Validation Level

V4: System Development - Completion of Development and Integration

Parent Project

EUR186: CARE (Co-operative Actions of R&D in EUROCONTROL)

Sub-projects

Sponsors

EUROCONTROL: European Org. for the Safety of Air Nav.

Partners

EUROCONTROL EEC
EUROCONTROL HQ
National Air Traffic Services Ltd
QinetiQ Malvern (ex-DERA)
Objective
As of 2003, activities are included in EUR116.

ADS Mediterranean Upgrade Programme addresses the pre-operational testing of integrated ATM functions, enabled by the deployment of an ADS-B infrastructure over a large homogeneous area such as the Mediterranean one, with specific traffic pattern and trends. EEC-MEDUP organises the EUROCONTROL participation to ADS-MEDUP; the specific objectives of the project are:

1. Facilitate ASAS experiments providing on-board situation of real ADS-B equipped aircraft and TIS-B and contributing to the current E-Cockpit and MCS CDTI upgrade, to present the output tracks of prototyped ARTAS tracker component named TRK2.
2. Use ADS-MEDUP infrastructure as a pre-operational prototype to verify:
   - Ground Architecture (PROVE, TIS-B-server, ARTAS2)
   - Situation awareness MCS CDTI
   - Safety issues and CB

Approach
The section highlights the principal technical issues related to the EUROCONTROL participation to ADS-MEDUP. In particular, the following areas are identified:

1. Use MEDUP network as a pre-operational prototype to verify and validate:
   - Concept & Requirements
   - Ground and Airborne Architecture
   - Safety & CBA
2. Ensure the inter-operability with:
   - SDPDS ARTAS based
   - Radar and ADS-B (transition area)
   - TIS-B
3. On-Board Separation Assurance Delegation experiments providing shadow on-board situation of real ADS-B equipped aircraft (MCS with its CDTI)

Expected results
Main justification of EEC-MEDUP is the integration of ADS information into EEC network to allow validation of MEDUP network by means of new integrated ATM functions included in AVT.

The EEC participation to ADS-MEDUP proposal is based on the EUROCONTROL validation infrastructures experience such as AVT, MCS, and PROVE and project such as ASTP.

The above mentioned infrastructures contribute to the implementation of various recommendations made in the document, EATMS Validation Strategy, and endorse its definitions of Validation and Verification.

- Validation: The process through which desired level of confidence in the ability of a deliverable to operate in a real-life environment may be demonstrated against a pre-defined level of functionality, operability and performance.
- Verification: The process of evaluating the products of a given system development activity to determine correctness and consistency with respect to the products and standards provided as input to that activity.

Applicability Timeframe
=> 2006 and <= 2010

Current Validation Level
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level
V4: System Development - Completion of Development and Integration

Parent Project
CEC117: ADS-MEDUP - ADS Mediterranean Upgrade Programme
EUR081: ADS Programme

Sub-projects

Sponsors
EC DG TREN: European Commission DG Transport Energy
EUROCONTROL: European Org. for the Safety of Air Nav.

Partners
AENA
DFS
Ente Nazionale Assistenza al Volo
EUROCONTROL EEC
Hellenic Civil Aviation Authority
LFV - Luftfartsverket (Swedish CAA)
Malta International Airport

New This Year

Included in Safety HI

Included in SAFS

Results in VDR

Link to ESARRs
Implicitly related to ESARR 4

Category
Safety Management

Topic
Assessment of new system/procedure
**Project**  
**EUR212: MFF - Mediterranean Free Flight**

**Start Date** 01/07/2000  
**Finish Date** 31/12/2005

**Objectives**  
To provide technical and operational evaluation of integration, interoperability and safe use of CNS/ATM technologies and applications suitable for the future Mediterranean ATM scenario (e.g. operational requirements and procedures based on the use of new CNS/ATM technologies enabling the introduction of free flight operations);

To verify appropriate new operational procedures for ATM staff and aircrew in free routing and free flight scenarios (e.g. the delegation of separation responsibility from ATC to aircraft and vice versa, through simulations and flight trials, using specially equipped aircraft and controller working positions);

To take advantage of the inherent results to address standardisation and further maturation of relevant CNS/ATM technologies and applications both in ground systems and avionics;

To define guidelines to implement free flight operations in suitable parts of the airspace

**Approach**  
On the basis of the user expectations and present traffic constraints, the MFF programme will define operational requirements and procedures for the future implementation of free flight in the Mediterranean area. Requirements and procedures will be matched with current CNS technologies to obtain the specifications for an integrated Ground Airborne test bed system able to assess the feasibility of free flight in the Mediterranean area.

Based on this specification, a test bed will be implemented. Real-time simulation will be carried out and flight trials will be executed. It is to be noted that en-route airspace with low-density level of air traffic characterises the MFF flight trials.

The programme will also cover Validation, Operational Benefits and Safety Case aspects and activities.

**Expected results**

- Production of the Operational Requirements Document (ORD) and the Operational Procedures Document (OPD) that can be seen to build in coherence to other EC and international programmes.
- Production of the Safety Requirements Document (SRD) and the Validation and Certification Processes Document (VPD) that can be seen to build in coherence to other EC and international programmes.
- Identification that the MFF ATM SSD meets the requirement of ORD, OPD, SRD, and take into account the technological framework defined for the MFF operational experimentation.
- Identification that the initial (Step 2) and extensive (Step 3) of flight tests is completed verifying the basic operational concept of MFF through real flights.
- Identification that Human Factors analysis for Controller's and Pilot's HMI/workload will be performed in the flight trials.
- The Flight Trials activity could continue in the next months for the refinement of flight data and experiments
- Identification that the final report on all flight trials results is completed verifying operational concept, procedures and safety.
- Identification that the final report on validation and certification is available.
- Identification that the final report on safety is available.
- Identification that the Operational Benefit analysis is available including the feasible strategy to promote the Free Flight operations.

**Applicability Timeframe**  
=> 2011 and <= 2015

**Current Validation Level**  
V3a: Generic Specification - Requirements Defined

**Target Validation Level**  
V3b: Generic Specification - Requirements Validated

**Parent Project**  
CEC115: MFF - Mediterranean Free Flight

**Sub-projects**

**Sponsors**  
EC DG RES: European Commission - DG Research
EC DG TREN: European Commission DG Transport Energy
EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**  
AENA
DNA
Ente Nazionale Assistenza al Volo
EUROCONTROL EEC
EUROCONTROL HQ
Hellenic Civil Aviation Authority
LFV - Luftfartsverket (Swedish CAA)
Malta International Airport
National Air Traffic Services Ltd

**New This Year**

**Keywords hits**
safety case, certification AND safety, validation AND safety

**Link to ESARRs**  
Implicitly related to ESARR 4

**Category**  
Safety Management  
**Topic**  
Assessment of new system/procedure
Objectives

The project "LOOK" within EEC/INO aims at exploring and providing answers to the recurrent issues raised along a concept design, evaluation and validation. It is based on a human-centred approach to enhance human involvement in ATM, and a better understanding of controllers working strategies and environment in terms of safety and performance. It will rely essentially on the operational facilities used at the EUROCONTROL Experimental Centre, although it would require an external expertise in social and human factors domains.

Understanding and evaluation of controller working methods and controller environment in term of safety, performance, automation limits are key issues for the design of human-centered ATM concept. Therefore, there is a strong need to develop a new social and multidimensional human factors approach, although such an approach could be refined and consolidated through successive iterations.

The LOOK project has three main objectives

1) Provide documented answers to questions
   - Can human factors provide something useful ?
   - If yes, which human factors sub-domains are interesting (socio, psycho,) ?

2) Build and validate a multi-dimensional human factors approach to evaluate the impact of Human/automation systems in safety/capacity
   - Based on human factors aeronautics/avionic/cockpit expertise
   - Concrete results (not only theory)
   - Applied to a first simple example (comparison of three CWP environment : paper strip, digistrip, stripless)

3) Integrate the approach into operational concept and technology research
   - If it succeed, apply to other ATM projects

Approach

The LOOK project proposes additional methods and tools to compare three different CWP environments: Paper strip (which will provide reference model), Digistrip and stripless environment. The simulation platform will be set up for one measured sector handled by two controllers (radar executive and planner) with mutual control and monitoring.

Expected results

Reports on study

Applicability Timeframe

=> 2006 and <= 2010

Current Validation Level

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Parent Project

Sub-projects

Sponsors

EUROCONTROL: European Org. for the Safety of Air Nav.

Partners

CENA
CETCOPRA
Ente Nazionale Assistenza al Volo
EUROCONTROL EEC
Laboratoire d'Anthropologie Appliquee

New This Year

Included in Safety HI

Included in SAFS

Results in VDR

Keywords hits

validation AND safety

Link to ESARRs

Implicitly related to ESARR 4

Category

Safety Management

Topic

Assessment of new system/procedure
Sourdine II is a three-year, EU/DG-TREN 5FW shared-cost RTD project led by the NLR. Its objectives are:
- development and validation of new advanced, innovative, environmentally friendly approach and departure procedures - called Noise Abatement Procedures (NAP) - that have a positive impact on capacity, the environment and financial aspects whilst at least maintaining current safety levels;
- development of an implementation plan to provide guidance for the migration from the current operational environment to the new procedures, and of a report enabling the decision-maker to visualise and assess, for each new procedure, the relationship between capacity, safety, environment and financial aspects;
- development of enabling technology to achieve the successful introduction of the selected departure and approach procedures, such as ATC controller tools, automated aircraft-ATC interaction tools and cockpit monitoring tools (e.g. safety nets).

Work on Sourdine II will be performed by the consortium, in co-operation with the Sourdine II Expert Panel consisting of representatives from the airlines, air traffic service providers, airports, CAAs and the ATM and aircraft industries. It is important to note that Boeing and the FAA have agreed to participate in this Expert Panel.

Sourdine II will produce:
- validated, internationally agreed, Noise Abatement Procedures;
- a guide for implementation aimed at decision makers;
- tools to assist controllers in the execution of these procedures.

Applicability Timeframe: => 2000 and <= 2005

Target Validation Level: V4: System Development - Completion of Development and Integration

Parent Project: CEC121: SOURDINE II - Study of Optimisation procedURes for Decreasing the Impact of NoisE around airports II

Sub-Projects

Sponsors

- EC 5th Frame: European Commission - 5th Framework
- EUROCONTROL: European Org. for the Safety of Air Nav.
- AENA
- Airbus Industrie
- EUROCONTROL EEC
- Fokker
- INECO
- ISDEFE
- Nationaal Lucht en Ruimtevaartlaboratorium
- Sistemi Innovativi per il Controllo del Traffico Aereo

New This Year

Keywords hits: validation AND safety

Link to ESARRs: Implicitly related to ESARR 4

Category: Safety Management

Expected results

Start Date: 01/01/2002

Finish Date: 30/09/2002
The work performed in ATC-Wake contributes directly to several objectives of the EC Information Society Technologies (IST) (5th FP). The project is forecast to be conducted within 3 years and started on July 2002. Two industrial branches (Thales Air Defence and Thales Avionics) are part of the ATC-WAKE project, together with three research organisations (NLR, DLR and EEC) and one academic institute (Université Catholique de Louvain). These six partners belong to four different European countries.

Objectives:

The main objective of the ATC-wake project is to develop and build an innovative platform integrated into the Air Traffic Control (ATC) systems with the aim of optimising safety and capacity. This platform will have a test bed environment role:

- To assess the interoperability of this integrated system with existing ATC systems currently used at various European airports;
- To assess the safety and capacity improvements that can be obtained by applying this integrated system in airport environments;
- To evaluate its operational usability and acceptability by pilots and controllers.

Approach:

ATC-Wake:

The impact of weather on wake vortex safety is a crucial aspect, and the uncertainty in predicting the behaviour of wake vortices in different weather conditions implies that continuous monitoring of both wake vortices and weather will be necessary. This will enable continuous verification and possibly update - of safe predictions of required aircraft spacing (separation minima). The ATC wake vortex safety and capacity platform will therefore integrate:

- Weather and wake sensors;
- Weather forecasting and nowcasting systems;
- Wake vortex prediction systems;
- Aircraft spacing (i.e. separation distance) predictor;
- Air Traffic Controller Human Machine Interface (HMI).

Expected results:

The main expected exploitable project outputs is the integrated ATC Wake Vortex safety and capacity platform, which contains as further exploitable elements:

- Wake Vortex Prediction and Monitoring Systems;
- Wake Vortex Safety and Separation Predictor;
- Weather forecasting, now-casting and monitoring systems;
- Wake Vortex Predictors and monitors;
- Fast-Time ATC Simulator (upgraded with 'wake vortex modules');
- Controller Human Machine Interface (HMI).

In addition to these exploitable project outputs, the consortium will propose new modified wake vortex safety regulation. This will strongly enhance the introduction of new systems and procedures to alleviate the wake vortex problem.

- ATC-Wake Operational requirements (EEC note n° 12 - July 2003)
- ATC-Wake Operational Concept and procedures (EEC note n° 13 - July 2003)
- ATC-Wake Users requirements (EEC note n° 14 - July 2003)
- ATC-Wake Final report on system requirements (EEC note n° 16 - August 2003)

- Identification of simulations aims
- Definition of airport simulation
- Analysis of total airspace and airport simulations
- Evaluation of operational concept and procedures
- Evaluation of interoperability with ATC systems
- Evaluation of usability and acceptability
- Final report on operational feasibility

Applicability Timeframe:

=> 2011 and <= 2015

Current Validation Level:

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level:

V3a: Generic Specification - Requirements Defined

Parent Project:

CEC129: I-WAKE: Instrumentation Systems for On-board Wake Vortex and Other Hazards Detection Warning and Avoidance
CEC135: ATC Wake: Integrated Air Traffic Control wake vortex safety and capacity system

Sub-Projects:

EC DG INFSO: European Commission - DG INFSO
EUROCONTROL: European Org. for the Safety of Air Nav.

Sponsors:

CERFACS
DFS
DLR Institute of Atmospheric Physics - Institut für Physik der Atmosphäre
EUROCONTROL EEC
The current safety paradigm focuses on a normative approach to safety, in order to fight any deviation. At the same time, the front-line operators more and more have to adapt their practice to the demand increase, therefore applying an adaptive approach.

Knowing that no system can be fully controlled - total safety or zero-accident are unreachable - and that "real life" works on an implicit "good enough" principle, shouldn't we accept to modify our views on safety and to consider another safety paradigm, based on adaptive safety and good-enough principles, in order to go beyond the normative limits?

Objectives

With the emergence of more integrated ATM functions shared between air and ground, the need for an approbation-certification mechanism taking an appropriate account of the role of the human in the system will arise, and may even become a blocking point for implementing ATM concept changes. There is a need to confront the somehow traditional approach of risk management - more and more accepted in ATM safety management - with a more innovative approach of "adaptive" safety.

The project aims at exploring innovative approaches related to the human - as an individual and as part of the organisation - in the centre of understanding safety. It intends to better understand the human adaptation in the organisational, emotional and cognitive domains in ATM.

Approach

The Implicit study is proposing to investigate this problematic through the organisational and legal issues perspective, looking at the role, the use and the perception of the rules in ATM. The Emotional Management of Risk perception by the front-line operators appear as the key understanding of the balance between three contradictory constraints : safety, capacity and operator resources through the other normative-implicit axes. The Explorer study is proposing to investigate this problematic into the emotional domain.

The basic principle of natural safety is that unanticipated events require operator adaptation. Where traditional approaches emphasise the anticipation using specification and normative approach, natural safety emphasises the need for adaptation in the design of controller tools for example, through emphasising the safety margins. The Natural Safety study is proposing to investigate this problematic into the cognitive domain.

Expected results

Develop the adaptive approach for the safety improvement

Deliverables 2003 :
- CEE PROJET IMPLICIT Mai 2003
- WP 1 Définition des hypothèses RISSEX (draft)
- WP Synthèse des résultats de l'étude de terrain (project RISSEX)
Safety Models applied to Air Traffic Control: understanding the Work of the Air Traffic Controller (Interim Report)
Objectives
It is vital that future operational concepts are safe. This means that safety assessment must be carried out for all future system elements. Since explicit safety assessment is relatively new to ATM compared to other industries, SAFMOD is aimed to support the development of a set of safety tools and techniques to ensure that comprehensive safety assessment can be carried out for all future systems including their interactions, in accordance with ESARR 4, the regulation on safety assurance. This work programme supports both Concept development work at the EEC and also the Safety Assessment Methodology (SAM) developed at Eurocontrol HQ for more mature concept assessment and for Member States own assessment needs.

SAFMOD is short for Safety modelling techniques. Up to now SAFMOD has focussed on development of human error techniques, providing techniques for human error identification (TRACER & HAZOP), task analysis & human error dependency. SAFMOD has also developed an approach for assuring the Safety of Live Trials (Live Trial Hazop). Work in 2005 will focus on 3 areas: Human error probabilities, operational readiness testing (assuring the safety of the period of transition to operations), and Common Cause Analysis.

Approach
The basic approach of Safmod is to adapt safety techniques from others industries where possible e.g. for human errors probabilities, a nuclear data base will be used as a starting point, adding ATM context via simulation studies. Where borrowing from other industries is not possible, then work is carried out with members states to develop new approaches (e.g. operational readiness testing).

Expected results
Guidance documents on the following:
- Task analysis
- Human error analysis
- Human dependency analysis
- Human error quantification
- Live trial HAZOP
- Common cause analysis
- Fault and event tree analysis
- Operational readiness testing

All of the above will also be integrated into the EUROCONTROL Safety Assessment Methodology (SAM)
In other industries, safety is assessed in programmatic form at key stages in the design life cycle. Such safety assessments moreover feed information back into the design process. In ATM, this does not tend to happen. Safety cases are derived late in the design process, and there is little linkage between safety and design: design does not gain the insights that certain safety tools can give.

Objectives:

The goal of the approach is to develop a framework for building safety into the design process. This framework would not replace the currently developing safety assessment methodology, but rather would mirror it, making sure that safety insights are utilised to improve designs.

Approach:

The work commenced with a comprehensive review of safety techniques used in nine other industries. This helped to identify techniques that can be used in ATM safety assurance, including new techniques that need to be developed. This has led to two strands of safety support. The first has been application and testing of methods to support the EATM Safety Assurance Methodology (SAM). The second has been to adapt certain methods for application on new concept projects for ATM being developed at the Eurocontrol Experimental Centre (EEC). To date several methods have been successfully adapted: human error analysis and hazard analysis approaches (TRACER; HAZOP; live trial HAZOP), task analysis approaches, and human dependence analysis. Application of fault and event trees and bow-tie methods have also occurred.

For applications inside the EEC the SAND approach is being used (also in ARDEP). This includes applications of HAZOP, Human Factors Case and TRACER analysis, SAFLEARN (also in ARDEP), cross-boundary HAZOP, SAFSIM (also in ARDEP) and live trial HAZOP. This suite of safety tools is being applied to a number of projects to derive safety requirements and preliminary safety case information for those projects. In this way, safety is being built into projects at a very early stage.

In parallel, study of how other industries get safety into design is occurring. There is a particular focus on the potential for improvement of safety during the Requirements Engineering stage. This work is occurring in connection with MIT in the USA.

Finally, this work program will review the impacts of changes in working methods on Safety Culture. The aim of this work would be to help designers define working methods. That will maintain a positive Safety Culture.

Expected results:

Safety becomes something for which confidence is gained through the whole design process, rather than something which is tested late on, in fact when it is realistically too late to alter design concepts. In practical terms, various projects will have preliminary safety case information (using a hazard tracking system) to record the derived safety requirements for the projects. Such information can be passed to the stakeholders who may develop the concepts into real systems.

Start Date: 01/01/2002
Finish Date: 31/12/2006

Keywords hits: safety assess, safety case
Link to ESARRs: In relation to all ESARRs, but more specifically with ESARR 4.
Category: Safety Management

New This Year: 
Included in SAFS: ✔
Results in VDR: 

EUR232: SAFBUILD - Building Safety into Design

Sub-projects: 
Sponsors: EUROCONTROL EEC
Partners: 

Applicability Timeframe: N/A
Current Validation Level: N/A
Target Validation Level: N/A

Included in Safety Hi: ✔
Included in SAFS: ✔
### Objectives
Evaluate safety benefits from improving each part of the ATM system. A case study will be done using Mandatory Occurrence Reports of accidents and incidents, focusing on Meteorological data. Consideration will be given on how this can be generalised to other safety areas.

### Approach
Collection of MOR accident and incident reports. Read the reports to identify the main mechanisms through which Met. can lead to accidents and incidents. Confirm that Heidi classification contains all necessary classifications. Determine when improved Met. forecasts could have improved the situation. Note when improved Met. can lead to improved safety. Collate the results to determine overall benefits.

Based on this preliminary experience, plan the way to conduct a thorough study. Estimate efforts involved. Brainstorm other safety issues that would be suitable to extending this approach.

### Expected results
- Preliminary model of Meteorological Forecast errors on safety.
- Preliminary evaluation of safety benefits from improved Meteorological Forecasts.
- Plans for thorough investigation of safety benefits from Meteorological Forecasts.
- Suggestions for other areas for safety data investigations.

### Applicability Timeframe
=> 2006 and <= 2010

### Current Validation Level
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

### Target Validation Level
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

### Sponsors
EUROCONTROL: European Org. for the Safety of Air Nav.

### Partners
EUROCONTROL EEC
**Objectives**

Real-time simulations are a significant test of a new system, organisation of airspace or procedures, or interface. They consume significant resources, and are generally seen as a major validation exercise. During such simulations, there is the opportunity to learn about safety in terms of new errors, faults that may occur to do with the system or way of using it, and of course near misses that may occur. Such information, however, is either not processed at all, or is not processed in a formalised way that allows proper learning. This therefore prevents safety insights occurring about the system, insights that could be fed forward to the final stages before implementation of the system, insights which could protect or even improve safety.

**Approach**

R&D approach suggested: Several centres are about to transition to new systems, and others are considering implementation of new tools. Some lessons can probably be learned from Rome, and from the implementation of STCA and RVSM, for example, as well as the New En Route Centre in the UK. Key aspects will be the training system and the capturing of important system knowledge during transition, as the system nears full maturity (e.g. errors and system problems occurring, including system failures and bad data, that all controllers will need to be aware of). The approach is therefore to track such transitioning systems and determine the risks and how to avoid them. The outputs will be a methodology for such study, and guidance for future systems.

The "paradigm" of the research will be one of learning and application: learning from Rome and other recent transitions (e.g. NERC), studying transition on-line with systems that are undergoing transition (e.g. in Sweden), and determining needs and guidance for systems that will transition in the future (e.g. Maastricht; Lisbon; etc.).

**Expected results**

Likely impact on safety if R&D successful (H;M;L): M/H -- it depends - many accidents occur after a change, and so transition management can add more resilience to the system, and may also lead to insights on previously unforeseen problems that could lead to accidents. The aim should be to track aspects such as trust, and also to identify failure and error-related problems that can then be protected. The occurrence or absence of such anticipated problems and how they are resolved during actual operation, can then be tracked.

Possible side-benefits: Smoother transition to new systems, better acceptance by controllers, better information on the actual readiness to move to the new system or tool.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V3b: Generic Specification - Requirements Validated

**Target Validation Level**

V3b: Generic Specification - Requirements Validated

**Parent Project**

**Sub-projects**

**Sponsors**

EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**

EUROCONTROL EEC

**New This Year**

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<th>Included in Safety HI</th>
<th>Included in SAFS</th>
<th>Results in VDR</th>
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**Keywords hits**

accident, validation AND safety

**Link to ESARRs**

In relation to ESARR 4.

**Category**

Safety Management

**Topic**

Methodology development
"Organisational Transparency, the case of ATM safety: A socio-anthropological approach of safety", 2002-2005. This sociological study, which supports a PhD, is looking at the origins and constituents of the increasing demand for transparency in our modern society, and particularly in the High Risks Organisations domain. The goal is to extend and develop theoretical aspects able to link sensemaking in organisations (Weick) and decision processes concerning the identification of risks, and the mitigation mechanisms. A socio anthropological approach explores how ATM Safety is affected and answers to that demand (e.g., performance indicators, regulatory requirements, reporting flows, organisational learning). The first year study (see Report 378) explored the notion of transparency in different domains (philosophical, political science, juridical domain) and structured it along the 3 following dimensions:

- the transparency of an Organisation analysing its own functioning, an element of reflexivity
- the transparency of the Organisation vis-à-vis the outside (Public, regulators) - an element of Public confidence -, and
- the transparency expected from individuals and its necessary limits.

In 2002, the study focused on the relationship between ATM providers and regulators through the angle of "demand for transparency" in Operations (see Papers [SAF-02-04]). This includes a field study where the difficulties for ANSPs to implement ESARR2 on reporting (ambiguities, mapping with local reporting systems, confidentiality, resources) are analysed.

The goal is to extend and develop theoretical aspects able to link sensemaking in organisations (Weick) and decision processes concerning the identification of risks, and the mitigation mechanisms.

**Deliverables:**
- Final report 01/03/2005
- Semestrial intermediate report

**Approach**
Develop a socio-anthropological approach which comprises cognitive and sociological aspects in order to better understand the risk identification processes at an inter-organisational level (i.e., comprising the ATC services, EUROCONTROL SRC/PRC, and safety groups).

**Expected results**
Will participate in a better understanding of implicit and explicit risk management. An history of the elaboration and maturation of reporting safety performance in European ATM for the period 2000-2004.

**Publications:**
- SAF02-04-Automatic Monitoring 15/07/2003 / Other Documentation SAF02-04 Automatic Monitoring in ATC -

**Applicability Timeframe**
>= 2006 and <= 2010

**Current Validation Level**
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**Keywords hits**
ESARR, SRC, risk AND safety, incident

**Link to ESARRs**
Explicitly related to ESARR 2, implicitly related to ESARR 1, ESARR 3, ESARR 4, ESARR 5, ESARR 6.

**Category**
Safety Regulation  Topic  Safety Culture
### Objectives

A proposal for a CARE-ASAS Action was presented during the R&D Review Group Meeting 5 (23-24 April 1999). The proposal received support from the Group. A strong need for a co-ordinated European action was identified. Members of the Group expressed the intention from their organisation to support this action with effort and budget.

4 activities have been defined:

- Activity 0: Communications
- Activity 1: Problem dimensions / evaluation of past studies: The Activity 1 final report was delivered in November 2000.
- Activity 2: Validation framework for ASAS including scenarios
- Activity 3: Safety assessment of ASAS applications
- Activity 4: Support to the definition and the validation of selected ASAS applications

### Approach

The project is running satisfactorily with an action manager under contract by the agency and a management board assisting him in monitoring progress. Close co-operation exists with the work of the Eurocontrol Experimental Centre on ASAS.

CARE/ASAS will finish in 2004 with package I responsibility transferred to the CASCADE programme and more advanced packages responsibility handled by ATS and CMS domain in tight co-operation with EEC.

### Expected results

- Activity 1 has produced a comprehensive state of the art study.
- Activity 2 has produced a validation framework for ASAS including scenarios.
- Activity 3 has produced a series of reports concerning airborne separation minima.
- Activity 4 has produced reports concerning operational benefits and applicability of Package I airborne surveillance applications’ in the context of the “FALBALA” project.

For updated information, pls visit the project web-site: http://www.eurocontrol.int/care/asas

For full set of CARE/ASAS deliverables see

http://www.eurocontrol.int/care/asas/documentation/reference_document_list.htm

### Applicability Timeframe

=> 2016 and <= 2020

### Current Validation Level

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

### Target Validation Level

V3a: Generic Specification - Requirements Defined

### Parent Project

EUR186: CARE (Co-operative Actions of R&D in EUROCONTROL)

### Sub-projects

### Sponsors

EUROCONTROL: European Org. for the Safety of Air Nav.

### Partners

AENA
CENA
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Ente Nazionale Assistenza al Volo
EUROCONTROL EEC
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ISDEFE
LFV - Luftfartsverket (Swedish CAA)
Nationaal Lucht en Ruimtevaartlaboratorium
NATS
QinetiQ Malvern (ex-DERA)
Sofreavia
University of Glasgow

## Project Details

<table>
<thead>
<tr>
<th>Project</th>
<th>EUR246: ASAS - Airborne Separation Assurance Systems (CARE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Date</td>
<td>23/04/1999</td>
</tr>
<tr>
<td>Finish Date</td>
<td>31/12/2005</td>
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</tbody>
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## Keywords

- OHA

## Link to ESARRs

Implicitly related to ESARR 4

## Category

- Safety Management

## New This Year

- Included in Safety HI
- Included in SAFS
- Results in VDR

## Applicability Timeframe

=> 2016 and <= 2020

## Current Validation Level

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

## Target Validation Level

V3a: Generic Specification - Requirements Defined

## Parent Project

EUR186: CARE (Co-operative Actions of R&D in EUROCONTROL)

## Sub-projects

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QinetiQ Malvern (ex-DERA)
Sofreavia
University of Glasgow

## New This Year

- Included in Safety HI
- Included in SAFS
- Results in VDR
EUROCONTROL has a requirement for a number of tasks to be conducted concerning the development of a 3-d risk model. The final model should provide a method of assessing the en-route collision risk, due to all causes and across all dimensions, within European airspace. The collision risk must be able to be specified as either an average per flight hour, or per flight section (i.e. en-route phase) metric. In addition, measurement of the peak risks - in terms of time, geographical location, or point in flight - would be desirable. The method should be able to estimate the current risk, based on observed traffic data. It must also be able to predict the future risk, in the light of system changes such as increased traffic density, changes in separation, or changes in surveillance/navigation capability etc.

This work will also be shared within other technical fora including ICAO SASP and EUROCONTROL/FAA R&D Committee.

Review of existing models and other relevant information. Definition of the scope of remaining development necessary to produce comprehensive 3-d model, and outline of the strategy for doing so.

Derivation of 3-d model and production of documents detailing fully the derivation, including complete list of references.

Production of document detailing fully the data requirements for estimation of parameters of the model, including detailed description of method by which each parameter can be estimated, format and size of data requirements, and limitations on applicability of model, if any.

Development of fully documented software (i.e. source code and application manual) necessary to calculate 3-d collision risk estimate.

Presentation of the model and software
Objectives
The determination of Route Spacing Standards for RNAV operations both in terminal airspace and for en-route operations.

The identification of safe aircraft separation for operations in Terminal Airspace where one or both aircraft are operating on RNAV procedures.

Approach
Review of the RNAV operations and identification of the issues that have to be addressed.

Development of a detailed plan to address the issues raised. This plan should identify any additional data and resources required including Radar data/analysis, supporting documents, Hazard Identification, Collision risk modelling etc.

The execution of the analysis covering the en route spacing criteria.

The execution of the analysis covering aircraft separation.

Expected results
Final report detailing the proposed route spacing and traffic separation criteria for P-RNAV operations, in both radar and non-radar environments, during the departure, en-route, arrival and approach phases of flight.

An Executive Summary highlighting:
- the ability to the methodology to evaluate system safety and setting out the prioritisation of design features according to their safety significance to enable decisions to be made on the criticality of components of the analysis;
- the shortcomings to the analysis to enable residual risks to be managed; and
- system performance monitoring requirements to provide a measure of the quality of the Safety Case and the effectiveness of both the Quality and Safety management Systems.

Applicability Timeframe
=> 2000 and <= 2005

Current Validation Level
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Parent Project
EUR081: ADS Programme

Sub-projects

Sponsors
EUROCONTROL: European Org. for the Safety of Air Nav.

Partners
Det Norske Veritas
EUROCONTROL HQ

New This Year

Keywords hits
safety case, risk AND safety, hazard, collision risk model, safety management

Link to ESARRs
Implicitly related to ESARR 4

Category
Safety Management

Topic
Assessment of new system/procedure
Objectives

The L2KBC simulation was conceived in order to assist with the cost/benefit analysis associated with the datalink concept within the LINK 2000+ project. The primary aim of the simulation was to therefore provide objective data pertaining to the following:

1. The effect of CPDLC operations on controller workload. (The availability of CPDLC was supplemented by the ADS function of CAP (Controller Access Parameters) which provides the controller with downlinked heading, speed and vertical rate information.)
2. The effect of CPDLC operations on the Level of Service provided to airspace users.
3. The effect of CPDLC operations on the participating controllers perception of safety.

In addition, the simulation was required to provide further subjective information regarding the use of datalink and the requirements of the underlying HMI as part of the continuing EATCHIP development process.

A number of operational working practices were defined before the experiment, namely:
1. Open dialogues will be closed before transfer of flights.
2. The reflex action for the Controller should be immediate "revert-to-voice" to clarify any non-nominal situations or to ensure aircraft compliance in time-critical situations.
3. The participating "measured" controllers should define a team working methodology i.e. task allocation between the radar and planning controller to ensure that the available technology is used to maximum benefit.

Following the last EOLIA/EATCHIP 3 experiment, the importance of the datalink transmission delay was highlighted as was the necessity for a high proportion of successful dialogues. It was anticipated that the simulation would provide a realistic platform for the assessment of the objectives providing that an acceptable delay and success rate were maintained.

Approach

The L2KBC simulation area comprised adapted sectors from Reims, Paris and Maastricht ACCs. A single measured sector (comprising planning and tactical positions) corresponding to the Reims sector YR (FL245 to UNL) was employed.

For the measured sector YR, the ATC working procedures corresponded to those applicable for the given route structure being simulated and were in accordance with the appropriate Letters of Agreement. The control actions of the feed sectors were kept to a minimum, although updating of the data block and response to co-ordination requests was required.

The services implemented were: ATC Communication Management (ACM), ATC Clearance (ACL) and Controller Access Parameter (CAP).

The traffic samples were created at the EEC based on recordings of flight plan information available from the CFMU for the 24 hour period of 7 August 1998.

For each traffic sample volume, four different datalink percentages were assessed, corresponding to 0% (baseline), 50%, 75% and 100%. Military and VFR traffic were not included in the assessment.

Expected Results

Workload assessment

Clearly, the presence of datalink will have an impact on the number of r/t communications carried out with aircraft. A secondary effect is the availability of downlinked aircraft parameter (CAP) data which is also expected to reduce the number of communications as a result of the removal of the need to query aircraft current parameters.

Analysis of the communication workload showed a reduction of 45%, 61% and 84% for the 50%, 75% and 100% datalink scenarios respectively.

Level of Service

For a simulation the size of L2KBC with only a single measured sector, any objective measure of level of service e.g. adherence to user preferred trajectory can at best be expected to provide only a broad indicator of performance.

Whilst there is consistent variation arising from the traffic volume increase (Low, Medium and High), no consistent behaviour related to the variation in datalink percentage can be observed.

An analysis of the percentage of time spent at the aircraft Requested Flight Level (RFL) was also performed and, again, no consistent results were obtained.

Safety

The simulation highlighted the most serious safety issues as being:
1. Potential loss of situational awareness for controllers
2. The importance of not allowing the planning controller to perform inputs on behalf of the radar controller, or at least to define clear task allocations within the sector team.
3. The importance of only using the CPDLC message system for non-time-critical instructions.

Applicability Timeframe

=> 2006 and <= 2010

Current Validation Level

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Target Validation Level

V3a: Generic Specification - Requirements Defined

Parent Project

Sponsors

EUROCONTROL: European Org. for the Safety of Air Nav.

Partners

EUROCONTROL EEC

EUROCONTROL HQ

Reims Area Control Centre

Romanian Air Traffic Services Administration

Results in VDR

[ ] Included in Safety HI
[ ] Included in SAFS
[ ] Included in SAFS

New This Year

[ ] Included in SAFS
[ ] Results in VDR

Keywords hits

safety issue

Link to ESARRs

Implicitly related to ESARR 4
| **Category** | Safety Management | **Topic** | Assessment of new system/procedure |
**Project**

**EUR257: OATA - Overall ATM/CNS Target Architecture**

**Start Date** 01/09/2002  **Finish Date** 01/06/2006

**Objectives**

As of 2004, it includes EUR304.

This project aims to provide an Overall ATM/CNS Target Architecture for the EUROCONTROL Organisation's programmes and projects. Its purpose is to ensure cohesion of EUROCONTROL Organisation work, and to support the future Interoperability and Standardisation activities by providing an EATM Technical Framework for the implementation of the ATM 2000+ Strategy.

A pilot project (Phase1) was carried out during 2000 primarily for the benefit of the Agency and its internal programmes. It reflected the system characteristics envisaged to be required by the year 2011.

- Further developments will be performed in subsequent phases (Phase 2, Phase 3, etc) in partnership with the stakeholder community as a whole.

The overall goals to be achieved at the end of all phases of the Project are as follows:

1. To define and maintain an Overall ATM/CNS Target Architecture that is accepted as a target throughout the EUROCONTROL Organisation, and as widely as possible throughout the ATM stakeholders, users and industry.
2. To contribute, by means of the Overall ATM/CNS Target Architecture, to the future European-wide processes for the industry-standardisation of ATM system components, and to feedback the results of that process into the maintained baseline.
3. To achieve alignment between the EUROCONTROL Overall ATM/CNS Target Architecture, and those of the USA and other ICAO Member States outside EUROCONTROL, in particular with respect to common interfaces to stakeholders (including aircraft).

The OATA project is co-funded by the EC through TEN-T. It will in particular provide reference architecture in support to Single European Sky regulations.

**Approach**

Phase 2 of the project has been approved by the Agency and will be carried out from mid 2002 to beginning of 2006 with the active participation of all civil and military Stakeholders:

- EATM Domains and Programmes
- ANS Providers
- ATM System and Aircraft Manufacturing Industry
- Airlines and other airspace and ATM Users
- Other European ATM stakeholders
- Military Authorities
- The European Commission
- Standardisation bodies (EUROCAE, RTCA, JAA, etc.)
- FAA

Goals and Deliverables of Phase 2

The goals to be met by the end of Phase 2 of the project are as follows. These goals should be contributory towards the overall goals above.

   - Derived from existing documents (OCD, COOPATS, etc.)
   - Detailed to derive Use Cases for driving the Architecture
   - Covering nominal and non-nominal conditions
2. An agreed proposal for an Overall ATM/CNS Target Architecture for 2011, specifying
   - A framework of logical system components
   - The services each provides and consumes.
   - Identification and high-level definition of interfaces, especially those needed for cross-boundary (domain/stakeholder) interoperability.

**Expected results**

The documentation will be both textual and in the form of a UML model.

3. The Information Model :
   - Common Vocabulary and Data Dictionary across Domains to enhance Interoperability
   - The basis for standardisation
   - Documented in the UML model
   - A survey of relevant R&D Architectures
   - A study on Institutional Constraints
   - A report on Avionics for 2007-2011
4. Basic principles for synchronisation of like components.
5. Requirements for Distributed Systems
   - Analysis of Geographical Distribution
   - Middleware Requirements
6. A Generic Evolution Plan for ECAC.
   - Driven by the Roadmap OIs/Enablers
   - Generic steps to evolve to the target architecture
   - When and where services are required
7. An implementation assessment of the Road Map from the architecture perspective.
   - Mapping of OIs and System Enablers to Components and Services
   - Refined System Enablers consolidated through the architecture
8. Sample Stakeholder organisation Transition Plans.
   - How legacy systems can be adapted to meet each step change
   - Which legacy systems need to be replaced/adapted to stay on the path towards a common target architecture
   - Different types of Stakeholders will be selected

The OATA Project deliverables are an input to the EATM Domains and Programmes, for SPF, for the ECIP and LCIP processes, for Regulations and for EUROCAE Standardisation Working Groups.

**Applicability Timeframe**

=> 2011 and <= 2015
| **Current Validation Level**               | V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy |
| **Target Validation Level**               | V2: Feasibility - Initial Proof of Concept ready for Implementation Decision |
| **Parent Project**                        |                                                                                  |
| **Sub-projects**                          |                                                                                  |
| EUR264: OATA - Overall ATM/CNS Target Architecture (former: Definition of concept of Aeronautical Information Manager) |
| EUR304: OATA - Overall ATM/CNS Target Architecture |
| SIC015: OATA - Overall ATM/CNS Target Architecture |
| **Sponsors**                              | EUROCONTROL: European Org. for the Safety of Air Nav. |
| **Partners**                              |                                                                                  |
| EUR264: OATA - Overall ATM/CNS Target Architecture |
| EUR304: OATA - Overall ATM/CNS Target Architecture |
| SIC015: OATA - Overall ATM/CNS Target Architecture |
| **Results in VDR**                        |                                                                                  |
| **New This Year**                         |                                                                                  |
| **Keywords hits**                         | JAA                                                                                  |
| **Link to ESARRs**                        | Implicitly related to ESARR 2 and ESARR 4 |
| **Category**                              | Safety Management                                                                                  |
| **Topic**                                 | Methodology development |
| **Current Validation Level**              |                                                                                  |
| **Target Validation Level**               |                                                                                  |
| **Parent Project**                        |                                                                                  |
| **Sub-projects**                          |                                                                                  |
| EUR264: OATA - Overall ATM/CNS Target Architecture (former: Definition of concept of Aeronautical Information Manager) |
| EUR304: OATA - Overall ATM/CNS Target Architecture |
| SIC015: OATA - Overall ATM/CNS Target Architecture |
| **Results in VDR**                        |                                                                                  |
| **New This Year**                         |                                                                                  |
| **Keywords hits**                         | JAA                                                                                  |
| **Link to ESARRs**                        | Implicitly related to ESARR 2 and ESARR 4 |
| **Category**                              | Safety Management                                                                                  |
| **Topic**                                 | Methodology development |
| **Current Validation Level**              |                                                                                  |
| **Target Validation Level**               |                                                                                  |
| **Parent Project**                        |                                                                                  |
| **Sub-projects**                          |                                                                                  |
| EUR264: OATA - Overall ATM/CNS Target Architecture (former: Definition of concept of Aeronautical Information Manager) |
| EUR304: OATA - Overall ATM/CNS Target Architecture |
| SIC015: OATA - Overall ATM/CNS Target Architecture |
| **Results in VDR**                        |                                                                                  |
| **New This Year**                         |                                                                                  |
| **Keywords hits**                         | JAA                                                                                  |
| **Link to ESARRs**                        | Implicitly related to ESARR 2 and ESARR 4 |
| **Category**                              | Safety Management                                                                                  |
| **Topic**                                 | Methodology development |
| **Current Validation Level**              |                                                                                  |
| **Target Validation Level**               |                                                                                  |
| **Parent Project**                        |                                                                                  |
| **Sub-projects**                          |                                                                                  |
| EUR264: OATA - Overall ATM/CNS Target Architecture (former: Definition of concept of Aeronautical Information Manager) |
| EUR304: OATA - Overall ATM/CNS Target Architecture |
| SIC015: OATA - Overall ATM/CNS Target Architecture |
| **Results in VDR**                        |                                                                                  |
| **New This Year**                         |                                                                                  |
| **Keywords hits**                         | JAA                                                                                  |
| **Link to ESARRs**                        | Implicitly related to ESARR 2 and ESARR 4 |
| **Category**                              | Safety Management                                                                                  |
| **Topic**                                 | Methodology development |
### Objectives

The main objective is to: provide guidelines (on the ACAS and ASAS interaction issue) for the development of future co-operative ASAS applications in Europe.

The other objectives are to:
- address, before any European co-operative ASAS implementation, an open issue (ACAS & ASAS interaction) never thoroughly investigated;
- maintain the acquired level of expertise on ACAS II to promote, if necessary, the European views on ACAS and ASAS interaction; and
- provide Eurocontrol with a strong opportunity to proceed with its world-wide leading role on both ACAS and ASAS.

The IAPA Project will ascertain:
- not only whether there are any significant operational implications for ACAS II performance due to possible ECAC co-operative ASAS implementation; but also
- whether the benefits expected from co-operative ASAS could be compromised due to the operation of ACAS II.

### Approach

The IAPA Project is composed of twelve work packages as follows:
- WP-0: Project management;
- WP-1: Co-operative ASAS application selection and definition;
- WP-2: Performance indicator definition;
- WP-3: Simplified modelling of the application behaviour;
- WP-4: Case study;
- WP-5: Co-operative ASAS encounter model development;
- WP-6: Study based on co-operative ASAS encounter model;
- WP-7: Study based on modified radar data;
- WP-8: Study based on data extracted from fast-time simulations;
- WP-9: Study based on data extracted from real-time simulations;
- WP-10: Safety case based on OSA methodology; and

The IAPA Project is composed of three main steps:
- phase I (scope) will perform an initial scoping of the ACAS and ASAS interaction issue. It is mainly composed of WP-1 to WP-4. After phase I, a decision to proceed or not with the IAPA Project will be taken. At this stage, some re-orientations could be proposed;
- phase II (analysis) will consist in conducting the required simulations for analysing the ACAS and ASAS interaction. It is mainly composed of WP-5 and of the first tasks of WP-6 to WP-10; and
- phase III (synthesis) will conclude in synthesising the work performed during phase I and II and delivering guidelines for the development of future co-operative ASAS applications. It is mainly composed of the report development tasks of WP-6 to WP-10 and of WP-11.

### Expected results

The IAPA project Phase 1 commenced in November 2002 and will complete in November 2003.
**Objectives**

Improved traffic management on the movement area, improving safety and the efficiency of surface operations, in particular during reduced visibility conditions, through the phased development and implementation of the Advanced Surface Movement, Guidance and Control System (A-SMGCS) functionality, i.e. improved surface movement surveillance, conflict detection and alert and the development of runway safety nets based on A-SMGCS.

**Approach**

Advanced Surface Movement Guidance and Control System, A-SMGCS, will in its initial stages, provide a display to controllers with the uninterrupted identification of all suitably equipped aircraft and vehicles on the manoeuvring area. The introduction of a secure and high integrity labelling system will greatly increase the situational awareness of controllers, which will not only increase safety but also improve efficiency and airport throughput.

In conditions of restricted or reduced visibility the benefits of the system will become more apparent, allowing the controller to be completely sure of the position of aircraft and vehicles. In addition the system will enhance safety, alerting the controller by detecting potential conflicts on the runway.

Harmonised procedures are being developed to ensure that as A-SMGCS becomes widespread, pilots, vehicle drivers and controllers will be working to the same rules and standards throughout the European region.

**Expected results**

- Improved Surveillance
- Improved Safety
- Increased Airport Throughput
- Increased Efficiency
- Secure Labelling for uninterrupted identification of aircraft and vehicles
- Enhanced procedures to make best use of improved surveillance capabilities
- Runway incursion alert system

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**

V4: System Development - Completion of Development and Integration

**Parent Project**

EUR268: A-SMGCS (Advanced Surface Movement Guidance and Control System) development - APR Project 1

**Sponsors**

EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**

EUROCONTROL EEC

EUROCONTROL HQ

**New This Year**

- [ ] Included in Safety HI
- [ ] Included in SAFS
- [ ] Results in VDR

**Keywords hits**

incident, licen

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management
The OR for RNAV Approaches with Vertical Guidance are:
- To increase safety through the provision of RNAV approaches as a replacement of conventional non-precison approaches
- To increase capacity and operational efficiency during poor visibility conditions at airports which are not suitably equipped for precision approach and landing
- To use the RNAV capability to provide approach paths that avoid noise sensitive areas or where vertical obstructions on the extended centreline, or in the missed approach, would prevent a non-RNAV instrument approach.

RNAV approaches will be gradually implemented as a local need is identified and business cases approved. As such the Navigation Domain role will be one of ensuring that the necessary material is available to enable States/airports to implement RNAV approaches in a commonly agreed manner and to common standards. In this context the objectives of this WP are:
- To facilitate the early implementation of RNAV Approaches with Vertical Guidance in ECAC states using aircraft equipped with RNAV/Baro-VNAV and Augmented GNSS (APVI and APV II). Appropriate emphasis will be placed on APV I in view of the decision of ANC/11
- To develop guidance material, to validate standards and procedures, and to undertake the generic safety assessment (safety argument) to enable States to more readily implement RNAV approaches
- To support states where implementation is proposed
- To ensure, through co-ordination with stakeholders, that implementation can be undertaken in a common manner
- To develop the safety cases needed to enable implementation of RNAV Approaches
- Support WP 12 in undertaking safety assessments post implementation.

The assumed navigation infrastructure will be primarily GNSS based, with EGNOS availability enabling a geometric vertical path to be flown. Whilst such approaches at the level of APV 1 have been identified by ANC/11 as an appropriate target for global applicability, it is recognised that stakeholders have differing operational requirements. Not all will wish to achieve APV 1 as similar performance capabilities (e.g. DA/H) are achievable with appropriate airborne architecture. In addition many operators will be capable of realising many of the expected safety gains using existing RNAV/FMS equipment, there is therefore potential for early and cost effective implementation using Basic GNSS and DME based approaches with Barometric VNAV.

Additionally, whilst APV I is the common level proposed by ANC/11, EGNOS is expected to be able to provide an enhanced capability identified as APV II and this needs to be addressed in the Navigation domain.

As a result it is considered essential that the Navigation Domain addresses the whole range of RNAV approach capabilities to ensure that stakeholders are able to safely implement the level of capability identified for their individual business needs. There is a high degree of commonality in the requirements for these procedures in respect of the procedure design material, RNAV/FMS specification, collision risk analysis etc. As a result, the wide range of stakeholder needs can be effectively addressed concurrently so long as this commonality is taken into account at the start of the preparation of the material. The Navigation Domain will develop support material enabling a common methodology for the implementation of the RNAV procedures and will work with JAA/EASA in the specification of equipment and operational procedures.

Activities will be performed through close co-operation between the States, ANSPs, Airspace Users and equipment providers, and EUROCONTROL AFN, ASM, AEM, AIM domains. Navigation Domain will provide the overall co-ordination. It is expected that EGNOS related activities would be co-ordinated with the Galileo Joint Undertaking; the Navigation Domain being responsible for the management of the workplan for the introduction of the EGNOS in aviation Services on behalf of the GJU.
### Objectives

Action 6 of the Navigation Domain

This WP will determine the navigation precision required for operation on runway and taxiway, which is higher than that achievable by navigation systems today or expected to be achieved using planned GNSS augmentation. The navigation requirements for A-SMGCS are still undefined. Studies will investigate those requirements. Other studies will provide data for Cost Benefit Analysis and safety assessment.

### Approach

**Expected results**

The project was closed in 2003.

**Applicability Timeframe**

$\Rightarrow 2011$ and $\leq 2015$

**Current Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**

V3a: Generic Specification - Requirements Defined

### Parent Project

**Sub-projects**

### Sponsors

EUROCONTROL: European Org. for the Safety of Air Nav.

### Partners

EUROCONTROL EEC

EUROCONTROL HQ

### New This Year

- Included in SAFS

### Keywords hits

- safety assess

### Link to ESARRs

Implicitly related to ESARR 4

### Category

Safety Management

**Topic**

Assessment of new system/procedure
WakeNet2-Europe is a continuation of the European Thematic Network WakeNet on wake turbulence that started in April 1998 and finished in June 2002.

The aim of WakeNet2-Europe is to promote the exchange of technical information as described in the Mission Statement:

Mission Statement:
WakeNet2-Europe will promote multidisciplinary contacts between specialists active in the field of wake turbulence to disseminate relevant information. WakeNet2-Europe will enable the development of a shared view how to address the existing and foreseeable safety and capacity related problems caused by wake turbulence.

EEC participation:
With regards to WakeNet2-Europe activities, the EEC role will provide appropriate support aiming at:
- Observing and communicating progress of research and novelties
- Ensuring effective circulation of information flows in both ways between both Thematic Network entities (WakeNet USA and WakeNet 2-Europe).

The EEC will also lead WG1 where its role will mainly be to co-ordinate investigations of establishing possible procedures and organisations for collecting and analysing WV incidents and induced risks. WG1 will also be responsible for publishing and communicating obtained results.

To facilitate the exchange of information Working Groups and Links are formed:
- Working Groups are organised around specific themes. Besides the exchange of information, the working groups will review ongoing research and will make recommendations for the future. It is attempted to have a mix of specialists from the research side and users from the operational side in each working group.
- Links establish contacts with particular European activities (e.g. EU-programs), US activities or specific interest groups (e.g. pilots).

Expected results:
The added value of WakeNet2 is to facilitate the information exchange between these various programs with operational needs as driver. EUROCONTROL, IFALPA, DFS and NATS are the users of these research activities represented in WakeNet2.

Deliverables:
- Intermediate activities reports (First year) 31/03/2004 31/03/2004
- Intermediate activities reports (Second Year) 31/03/2005
- Final activities reports 31/03/2006
### Project

**EUR289: Safe Sound**

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**Objectives**

Within INO (Innovative Research at EEC):

- Context:
  - The SAFESOUND consortium is convinced that a large number of cockpit tasks could benefit from enhanced audio functionality. A potential realisation of enhanced audio functionality for some of these tasks would not fulfil all of SAFESOUND's fundamental requirements: safety gain, end user acceptability and certificability.
  - With a huge questionnaire the consortium enquired therefore end user acceptability from pilots with different background (captain, pilot, test-pilot, examiner). Based on these results a working-group selected target application to be developed and evaluated by the SAFESOUND project.

- Objectives:
  - SAFESOUND is based on the hypothesis, that enhanced audio functionalities are able to improve commercial aircraft handling during ground and flight operation significantly. The project partners will define and develop a mock-up and evaluate it in a full-flight-simulator. The expertise and experience of the participants will guarantee the portability of the simulation result.

**Approach**

SAFESOUND follows a human-centred approach, by collecting operational requirements related to existing scenarios and future ATM scenarios, by performing extensive human factors studies, and by validating the proposed concepts in a full-flight simulator. Three partners in the consortium will provide crew members (test pilots and operational crews), who will guarantee the operational significance of activities all along the project.

**Expected results**

SAFESOUND is a European project (8 partners from 5 countries) with an impotent contribution of the EC and its added value contributes so to EU policies:

- federate contributors at this European level,
- transport and employment policies will be positively impacted,
- tackling certification issues will allow industries to be in phase with upcoming rules.

The SAFESOUND project aims at improving safety and operational integration of CNS functions in the civil cockpit, multiplying the benefits of the CNS/ATM solutions that have been defined at the European level to answer the need for increasing the airspace capacity.

Results will be disseminated to European industries involved in other aerospace market segments (e.g. Dassault FALCON for business-jets), so that economic growth generated by SAFESOUND is maximised and support European industries global competition.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**Sponsors**

EC DG RES: European Commission - DG Research

**Partners**

EUROCONTROL EEC

**European Communities**

### Keywords hits

- certification AND safety

### New This Year

- Included in SAFS

### Results in VDR

- Included in SAFS

### Link to ESARRs

- Implicitly related to ESARR 4

### Category

- Safety Management

### New This Year

- Included in SAFS

### Results in VDR

- Included in SAFS
**Objectives**

Although human errors are often invoked as primary cause of accident, the majority (60%) of accidents in aviation have their roots in design. Whenever a member state decides to implement a concept or system that EUROCONTROL has helped to develop, some of the initial research, testing and thinking will carry over into the real world. Therefore, EEC projects can have an impact on safety. Consequently, EEC projects have the responsibility to evaluate their potential safety impact, and should improve safety where possible, and at least should record safety issues and insights for future potential implementation.

SAND aims at:

- Defining objectives for the safety assessment of EEC projects according to EATM life-cycles definitions and activities covered by related projects or standardisation groups,
- Identifying EEC projects being candidates to safety assessment,
- Providing 'hands-on' guidelines and assistance to apply safety assessment on EEC projects,
- Providing safety plan and initial safety assessment for some 'representative' EEC projects,
- Maintaining hazard logs database and evaluating hazard log tools,
- Providing Safety Summary for studied projects.

**Approach**

EUROCONTROL EHQ has initiated the development of a safety Methodology named SAM (Safety Assessment Methodology). This methodology provides guidance for the assessment of ATM system safety for EUROCONTROL projects. Since ERC projects do not always progress up to EATMP development phase, SAM requires some adaptations to be adjusted to the different ERC projects’ needs. For this reason, EEC has started the development of SAND (Safety Assurance for New Designs) that intends to adapt SAM to the different EEC projects’ needs. SAND activities will be co-ordinated for methodology aspects with EUROCONTROL HQ and will implement one building block of EEC Strategic Safety Plan. SAND does not aim to develop yet another method but intends to help and assist projects to apply safety assessment to their needs. SAND will be complemented by basic safety training.

**Expected results**

2003:

- 'PLAN': definition of objectives for safety assessment on 3 EEC projects
- safety plans for 3 EEC projects
- preliminary safety assessment for 3 EEC projects

2003-2005:

- 'DO': develop guidelines on how to perform safety assessment for various types of EEC projects
- 'STUDY': integrate safety operational feedback, continuously monitor new methods' development and EEC projects needs
- 'ACT': assist and review safety assessment on all EEC projects and measure progress of ‘safety culture’ in EEC

Deliverables:

- Safety plan for AMAN 31/07/2003 achieved 01/09/2003
- Safety plan for CAMES (phase 1) 01/10/2003 achieved 01/10/2003
- Time-based: safety scoping 31/12/2003 achieved 02/01/2004
- Preliminary FHA for AMAN 31/12/2003 achieved 06/01/2004
- Human Error Analysis of AMAN procedures 27/02/2004 achieved 21/01/2004
- Safety objectives for AMAN Rome RTS 26/03/2004
- SAND training for project managers 01/10/2004
- SAND training for project designers 30/12/2004
- Templates and guidelines 30/12/2005

**Keywords hits**

- FHA
- safety assess
- safety method
- hazard
- accident
- safety AND culture

**Link to ESARRs**

- Implicitly related to ESARR 2 and ESARR 4

**Category**

- Safety Management
- Methodology development
Objectives
To learn from Incident data. To gather lessons from the occurrence learning process in ATM operations and to inform the design practices and risk assessment practices at the EEC.

The safety of new ATM systems today is assured by safety assessments that are often carried out late in the design process. There is a perceived need to build safety into the design process from a very early stage. For this to be done, safety information needs to be provided to designers.

Together with the other SAF projects, SAFLearn aims at creating a learning process and to provide information that effectively helps design safety into systems at a very early stage. The lessons learned that SAFLearn will provide to ERC projects will be derived from safety occurrences. A process needs to be created to collect and collate operational experience from different sources, and then deliver it to projects. It is essential that this information be provided to designers in a format that will effectively support them in their design decisions and ensure safety is built into the system from the very beginning.

Athis-Mons: 22nd September
22/03 - SAFLearn meeting at SCTA re Data Collection (10h-17h)
(nothing to do here just mission order)

Approach
In the first phase of the project the need of EEC projects for the information SAFLearn purports to provide was assessed. A validation exercise of the concept was carried out, as well as an initial evaluation of formats of presentation of the lessons learned relevant to one project.

The second phase will continue refining the definition of the process of collection, analysis and delivery of information. An iterative process should be used with 5 EEC projects, whereby the process of collection, analysis and delivery of lessons learned from safety-occurrences and relevant to the project, will be refined with each iteration. In parallel a formal structure will be defined, so that at the end of the year the way in which safety-related information is collected, analysed and delivered will be clearly specified. This will result in a resource being developed to support projects in designing safety an early as possible.

The choice of the EEC 5 projects will be agreed with the contractor. With regard to organising the provision of Safety occurrence data, this will be the responsibility of the Project Manager.

Due to the nature of the work it is expected that the contractor be present at the Centre. EEC can provide the necessary word processing equipment and office space.

Expected results
The SAFLearn project aims at designing a process that will result in a database of ‘lessons learned‘ to inform the projects carried out at EEC.

The two high level objectives are:
- Support EEC projects in making design decisions with safety implications by providing them with information from the operational environment
- Provide safety-related operational information to projects in a way that meets their needs

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Applicability Timeframe
N/A
Current Validation Level
N/A
Target Validation Level
N/A
Parent Project
N/A
Sub-projects
N/A
Sponsors
EUROCONTROL: European Org. for the Safety of Air Nav.
Partners
EUROCONTROL EEC
New This Year
Included in Safety HI
Included in SAFS
Results in VDR
Keywords hits
risk assess, safety assess, risk AND safety, incident, safety occurrence
Link to ESARRs
Implicitly related to ESARR 2
Category
Safety Management
Topic
Methodology development
HMI development is needed throughout the ATM research and development lifecycle (from concept prototyping, through pre-industrial experimentation and simulation, to implementation and eventual system management and evolution). Its significance is increasing steadily in terms of potential cost and risk in system development. This leads to consolidation and re-use of both software and specifications. If safety, quality and a variety of increasingly demanding regulatory requirements are to be met, this re-use must be properly managed and supported with a traceable design rationale and development history. In response, the mission of the ECHOES project is to provide an effectively documented process for establishing the HMI requirements associated with evolving ATM functions, and develop, test and maintain good quality HMI solutions to support all phases of the development lifecycle.

Objectives:
Specific objectives in Phase 1: Create an integrated, thoroughly documented set of HMI options for the ERC to coincide with the transition to ACE. Establish effective procedures and process interfaces to integrate a wide range of ATM functions at the interaction/presentation level of the interface.

Targets:
- DOVE3a study December 2004
- Gate to Gate Delivery, January 2004
- ACE Transition for EVP AMAN Studies early 2005
- DOVE3b study Q3, 2005

Approach:
Application and extension of the development processes and UML based framework established by the CoRe Project (HRS/HSP-006). The framework allows the maintenance of separate Functional (Specification) and Component (Implementation) models linked in a coherent manner by a GLUE model. The GLUE model manages traceability and also provides document management and generation. An initial CoRe baseline is being extended to provide HMI requirements and solutions for all the principal ATM functionalities currently available to ERC supported projects. These will be delivered fully documented, tested and running under ACE for the end of 2004.

Expected results:
Better understanding of the requirements for HMI to support future ATM functions.

Short-term
Better quality, faster, and more cost effective production of HMI for studies at the ERC

Long term
A process for validating sound and safe HMI principles as the basis for operational improvements

Deliverables:
- ECHOES Technical Deliveries V3.0 (EAT2003A) 21/02/2003 - Delivered
- General Functional Model HMI Specs (UML/XML) Phase 1 21/10/2003 - Delivered
- ECHOES Technical Deliveries V4.0 (EAT2003A) 02/12/2003 - Delivered
- HMI Acceptance Testing Phase 1 Completed 30/10/2004
- ECHOES Technical Deliveries V5.0 (EAT2003A) 04/11/2004
- HMI Acceptance Testing Phase 2 Completed 30/12/2004
- HMI Acceptance Testing Phase 3 Completed 15/03/2005
- ECHOES Delivery Project DOVE V1.0 22/03/2005
- ECHOES Technical Deliveries V6.0 (EAT2003A + ACE2004A) 31/03/2005
- ECHOES Delivery G2G V1.0 31/03/2005
- General Functional Model HMI Specs (UML/XML) Phase 2 (Final) 06/04/2005
**Objectives**

As of 2004, activities are included under EUR257.

The EUROCONTROL Agency is developing a High-level Architecture in order to define an initial reference point. The aim is to build this reference in order to create a clear target for the evolution of systems and a reference for developing system transition plans. This development is being carried out in the OATA (Overall ATM/CNS Target Architecture) project http://www.EUROCONTROL.int/eatmp/library/documents/oata/index.html

OATA Project and its activities are managed at HQ and amongst these activities ERC in 2003 is operating the following tasks (see the EPDA, WBS and PMP):

- WP1.2, WP1.3 and WP1.4 - Participation and support to project management team for Overall Architecture
- WP1.10, WP2.5 - UML Support
- WP2.4 - Report identifying the OATA relevant R&D Architectures
- WP2.5 - OATA modelling Methodology
- WP3.1, WP3.2 - Contribution to OCC, Con-OPS and Operational Scenarios (and relative Use cases) development
- WP4.2.5, WP4.2.6 - Contribution to Surveillance cluster (Air and Ground) UML model production
- WP4.2.12 - Aircraft Derived Data Manager UML model production
- WP4.7 - Architecture Technical Review
- WP7.1 - Methodology for Legacy's systems
- WP8.1 - Contribution to Validation Methodology and Plan
- WP9.1 Contribution to Safety Methodology, Policy and Plan
- Participation to EUROCAE WG59 (interoperability) and WG61(Architecture) and assistance to drafting of work plan and standardization proposals

**Approach**

The Target Architecture represents the high level design of an integrated ATM system of systems across all ECAC States. Its role is to determine the services and interfaces for the future systems, the potential for cross-domain components, and also to identify dependencies, overlaps and duplications between work items, thus improving the management of the technical system evolution. The initial straw-man for this Target architecture is component-based with uniformly and unambiguously defined Services and Functions as well as interfaces and semantics of information exchanges specified with Interface Definition Language (IDL). This model uses concepts and notations from UML (Universal Modelling Language). Current Phase 2 of OATA project shall encompass the following activities:

- To develop and document methods for performing the work of the project.
- To develop and document operational scenarios for the period 2010 to 2015, covering normal and non-nominal operating conditions, and concentrating on the changes in operations from those of today.
- To develop the proposal for Overall ATM/CNS Target Architecture reflecting the operational needs of the systems for 2010, having a clear evolution path to meet the needs of 2015. The development shall start from the Straw-man delivered during Phase 1, and shall proceed through a review and amendment process involving experts from the EATMP Domain Units and Programmes and from outside stakeholder bodies (the European Union, civil and military ANS providers, airlines, airports, system manufacturers, aircraft manufacturers, etc.). The development process shall identify and take into account, to the extent appropriate, functional and non-functional (including safety) requirements for system services derived from the developed Scenarios and other documents. The target architecture shall be a logical architecture and shall not predicate a particular physical implementation.

**Expected results**

Expected Results :
A target overall ATM/CNS architecture on which all Stakeholders agree.

Publication :
- OATA-EPDA2.2 final.doc 27/05/2003 EATMP Project Delegation Agreement EPDA 2003
- oata schedule-1-0 gantt.pdf 20/06/2003 MS Project File OATA Schedule in PDF version
- OATA Work Breakdown Structure 20/06/2003 Other Documentation
- Overall Architecture for EATMP 20/06/2003 Other Documentation OATA overview for Management
- OATA Project Management Plan I 27/05/2003 Project Management Plan OATA PMP in pdf version

**Applicability Timeframe**

N/A

**Current Validation Level**

N/A

**Target Validation Level**

N/A

**Parent Project**

EUR257: OATA - Overall ATM/CNS Target Architecture

**Sub-projects**

- EUROCONTROL: European Org. for the Safety of Air Nav.
- EUROCONTROL EEC
- EUROCONTROL HQ

**New This Year**

- Included in Safety HI
- Included in SAFS
- Results in VDR

**Keywords hits**

- safety method, validation AND safety

**Link to ESARRs**

Implicitly related to ESARR 2 and ESARR 4

**Category**

- Safety Management
- Methodology development
As of 2004 project merged into FAM_CAMES Project (EUR337).

CAMES is the operational application of FAM concept and tools. The project will trial real time Traffic Synchronisation measures on the selected candidate axis with the objective of operating on real traffic flows to a pre-operational level. The proposed study axis connects the Air Traffic Service units of Rome, Milan, Geneva, Aix-en-Provence with Barcelona and Palma.

Air transport in Europe has to be dealt with from a global, system-wide perspective. Thus, the European Commission Single Sky Initiative puts forward, inter alia, the notion of functional blocks of airspace, which would be independent from geopolitical consideration (mainly national borders) and would enable to exercise Air Traffic Control (ATC) services on consistent and optimised pieces of airspace. Currently, when an overload of traffic in an airspace sector is predicted, the Central Flow Management Unit (CFMU), has the authority to regulate the delivery of traffic to that sector through the allocation of Calculated Take Off Time (CTOT). According to “The independent Study on ATFM” led by Philippe Jaquard, whether flights are regulated or not, the actual traffic demand can be markedly different to that which was forecast. Over-delivery challenges the safety of the system whilst under-delivery implies a waste of spare capacity.

The project will demonstrate, for a given field of play, the feasibility of implementing Traffic Synchronisation techniques that will foster inter-centre co-operation in Europe. This project is trying to develop operational procedures and tools, which will enable the air traffic control centres, the airports and the aircraft operators, to work together in a dynamic manner, in order to maximise the efficiency of the System from the gate of departure until the gate of arrival of the aircraft. These procedures are mainly making use of existing technologies, and therefore need not require any major technological shift. On the other hand, because of their very nature (that is, one organisation providing co-operative, added value services to other organisations), they will need an institutional and economic framework to be defined.

The first phase of the project is a feasibility study involving the EEC, CFMU, ENAV, AENA, DGAC/SCTA, Skyguide and Boeing ATM. This study will identify candidate flows for the use of Traffic Synchronisation measures and, in addition, will provide indicators on the impact on the system of such measures in terms of safety, complexity and cost benefit. Thereafter, a second phase of the project is planned, focussing on the same axis, which will aim at doing tests on real flows of traffic, to a pre-operational maturity To achieve this work the following activities are planned:

- Project co-ordination
- User requirements definition and system specifications
- ATFM measures definition and selection
- On-site trials
- Analysis and evaluation studies

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- Project co-ordination
- User requirements definition and system specifications
- ATFM measures definition and selection
- On-site trials
- Analysis and evaluation studies
The Operational Requirements for RNP RNAV are to improve the aircraft operational efficiency and support an increase in airspace capacity by enabling reductions in route spacing. This WP will investigate and quantify the potential improvements that can be achieved within the medium term by the availability of a total RNAV environment made possible by the use of RNP RNAV equipment in the aircraft.

The benefits of this work package will be the ability to support RNAV applications in medium to high-density traffic conditions with the integrated support of advanced ATC support tools, thereby providing fuel efficient and environmentally friendly operations, which otherwise could only be achieved under low-density traffic conditions.

The objectives are:
- To demonstrate that, within the medium term (current target date set out in the Eurocontrol Navigation Strategy is 2010) a cost effective transition can be made to a total RNAV environment (en-route and in TMA) in accordance with the Navigation Strategy;
- To demonstrate the safety, capacity, economic and environmental benefits to be derived from a total RNAV environment;
- To identify the opportunities to exploit ATC support tools, where available, to further enhance the benefits derived from RNP-RNAV;
- To develop and validate standards, procedures and software tools necessary to achieve the above application.

Activities will be performed through close co-operation between the Nay, ASM, AEM and ATS-DP domains. NAV will provide the overall co-ordination. Progress reporting will be through the ANT and, where appropriate, AOT, AIST and ADT.

A Proposal for the Programme will be developed and offered for approval. If successful the next phase will comprise developing a Charter for the Programme, outlining the overall Programme lifecycle work plan and phase deliverables and developing in detail the Planning and Feasibility phase work packages. Subsequent to approval of the Charter the next phase will be the execution of the Planning and Feasibility work packages. This will deliver feasibility reports, a set of options, a business case and a safety case together with detailed plans for the next phase in the Implementation cycle of the Programme.
**Project**

EUR327: Long-Term Application of 4D RNAV (WP04 of the Navigation Domain)

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**Objectives**

The Operational Requirements for 4D RNAV are to increase capacity levels and operational efficiency for all phases of flight from take-off to touchdown. Their feasibility has been demonstrated by research programmes such as PHARE. Significant benefits, in terms of system capacity and operational efficiency, were shown to be possible given an aircraft's capability to fly 4D trajectories accurately, and to negotiate user preferred trajectories, via data link, with advanced ATC tools. FMS equipment capable of 4D-control in the en-route and terminal area are becoming available and ATC tools such as arrival and departure managers and conflict probe are also being developed. Programmes such as Link 2000 are putting in place the necessary data communications infrastructure. All these improvements are necessary for an integrated ATM as defined in ATM 2000+ Strategy for operations by 2015.

This WP will address the issues from an airborne perspective by initiating studies and trials to evaluate and quantify the benefits of 40 RNAV.

The objectives are:
- To evaluate the potential benefits of 4D RNAV in an integrated ATM environment;
- To develop concepts for the potential phasing of the requirements;
- To define Operational Requirements for each of these phases in a 4D RNAV application;
- To identify the main dependencies;
- To provide input to the design of the overall ATM system architecture to accommodate advanced 40 FMS capabilities.

**Approach**

Activities will be performed through close co-operation between the NAV, ASM, AEM, ATS and CSM domains. The Navigation Domain will provide the overall co-ordination. Progress reporting will be through the Navigation Application Sub-Group and ANT.

**Expected results**

This WP is presently suspended. Due regard will be paid to methods by which WP 3 output (especially prototyping facilities) can be used in future years to enable this work to proceed. The deliverable timescales are those needed to enable 4D RNAV to be implemented in the timescales set out in the Navigation Strategy. At present delays of at least one year must be expected.

**Applicability Timeframe**

=> 2011 and <= 2015

**Current Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**

V3a: Generic Specification - Requirements Defined

**Sponsors**

EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**

EUROCONTROL HQ

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<th>Keywords hits</th>
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Implicitly related to ESARR 4

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<tr>
<th>Category</th>
<th>Topic</th>
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<tr>
<td>Safety Management</td>
<td>Assessment of new system/procedure</td>
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Implicitly related to ESARR 4
Objectives
The objectives are:
- Propose a detailed planning for the most efficient and advantageous means of transitioning to the future ECAC Precision and Landing System;
- Identify operational requirements for a future landing system and review:
  - The ability of the candidate precision approach systems to meet these requirements
  - The safety targets for PA Operations in the ECAC environment
- The Quality of Service requirements for PA Operations in the ECAC environment
- Identify Technical and Operational Characteristics of the available options in terms of: advantages and limitations, feasibility, availability, time-scales, order of costs.
- Conduct a safety assessment of GNSS for Precision Approach and develop appropriate safety cases for GNSS Cat I and subsequently for Cat II/III.

Approach
The long-term aim of the Navigation Strategy is to transition to a GNSS based landing system. ANC/11 concluded that there is no technical reason why GNSS cannot be used for all phases of flight. However, the technical capability of GNSS to be applied in all precision approach and landing visibility categories still need to be confirmed. This will start with the validation of Cat I performance. In addition there is a significant task to be carried out to prepare a safety case for the application of GNSS as the only available guidance system for precision approach and landing. Prior to any transition to a GNSS based landing system, safety and security issues have to be adequately addressed and mitigated, in addition to the primarily technical and operational evaluations. Moreover, a sound and transparent business case has to be developed.

ILS will be maintained for as long as practicable.

The current uncertainties surrounding the proposed use of GNSS for all categories of approach and landing can only be resolved by appropriate analysis and trials, some of which will be conducted under WP 09. The work under this WP will concentrate on the application of the landing system whilst WPO9 concentrates on the signal in space performance.

This WP will address, inter alia, the continuing pressure on radio frequencies allocated to air navigation, and the need to provide stakeholders with data to support future plans.

This work package will include the identification of:
- the constraints upon ILS and hence the timeframe within which the transition to a new PA (GLS/MLS) aid will be necessary;
- the advantages and limitations of each of the options as a future PA aid;
- the ECAC wide implications of these considerations on the future PA environment including safety case the timescales/costs for its achievement.

Expected results
It is recognised that a considerable amount of work has been undertaken in the European Region by the ICAO AWOG. This Work Package will take account of the AWOG activities and will be co-ordinated and performed in close cooperation with EUROCAE, JAI/EASA, ICAO, OEMs, etc. Navigation Domain will ensure that there is coherency in the availability of Standards/Guidance Material.

Applicability Timeframe
=> 2011 and <= 2015

Current Validation Level
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level
V3a: Generic Specification - Requirements Defined

Sponsors
EUROCONTROL: European Org. for the Safety of Air Nav.

Partners
EUROCONTROL HQ
Objectives

Extract safety insights showing the main ATM contributions to risk areas, and hence the priority areas for investment in safety improvements.

Provide a baseline risk picture, capable of evaluating the significance of improvements that are estimated in individual safety assessments.

Scope of the work

The present work covers the entire ATM service, i.e. everything ATM supplies to the pilot. This includes:

- Strategic conflict management
  - Airspace Organization & management
  - Demand & Capacity balancing (Flow management)
  - Traffic synchronization (Traffic management)
- Tactical conflict management
  - Tactical separation provision (preventive)
  - Collision avoidance (recovery)
- Information Services (AIS, MET, etc.)

The work covers gate-to-gate: starts at the moment the user first interacts with ATM and ends with the switch-off of the engines.

The present work covers ATM as it is in 2004. The approach will be suitable for the developing the risk pictures for 2007 (Master Plan - Foundation stage) and 2012 (Master Plan - Transition stage supporting SES implementation).

Beneficiaries:

- EEC SVC, SSP, APT, NCD (Top-down approach)
- HQ SD/ESC (key safety inputs to OATA Project - a Functional Hazard Assessment for OATA is an option to be activated in the present IRP contract and is intended to develop quantitative safety objectives for each component of OATA)
- European ATM Master Plan & SESAME
- SD/ESC: SPF
- EUROCAE Standardisation
- EC Regulation on interoperability
- DG PRU/SRU

Approach

In 2006, on the basis of the different risk pictures, a strategic planning of safety benefits of the various changes being introduced in the gate-to-gate ATM process will be developed, so that these safety benefits are realised. This will take the form of a «roadmap». It will act as a «balance sheet» for safety, to see how we can reach the target, and then how we actually proceed according to the target. The Safety Roadmap project will therefore develop the approach and show how it can work, after which time it will become a safety management tool. It will in particular:

- Determining how increasing safety will be progressively achieved, and as a means to monitor safety performance; and
- Investigating the future safety role and responsibilities of the controller.

Modelling aspects

The IRP will enable to derive a model for the safety architecture of the ATM system (in particular understanding interactions of elements).

Concept of Operation

The IRP will identify safety functions and processes and their corresponding interactions and information flows, concerned actors, their roles and responsibilities.

Safety Requirements aspects

The IRP will enable to identify safety requirements for the design of new systems or sub-systems.

Safety performance aspects

The IRP will enable to attribute safety contributions to the different elements of the overall ATM (in fact the growing interdependent nature of aviation means that both ATM and risk models will cover aviation as a whole) system. The roadmap will propose a way forward towards achieving safety performance and will support monitoring of safety performance.

The roadmap will enable to generate feedback for improvement of system performance.

Expected results

Deliverables:

- A common Methodology on a gate to gate risk assessment for ATM.
- Quantified risk picture.
- Pre-Concept Functional Hazard Assessment (FHA)
- Human Factors Case (2005)
- Integrated Risk Picture (IRP) for ATM 2012. (December 2005)
- Integrated Risk Picture (IRP) for ATM 2020 (June 2006)
- Roadmap (strategic planning for safety achievements) (December 2006)

Applicability Timeframe

=> 2006 and <= 2010

Current Validation Level

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Target Validation Level

V3b: Generic Specification - Requirements Validated

Parent Project

EUR343: Integrated Risk Picture

Sub-projects

Sponsors
The objectives are:
- To determine the capability of GNSS (GPS/Galileo) and the augmentation systems (SBAS/GBAS) in meeting the technical requirements for the planned navigation applications;
- To assess the degree to which the EGNOS performance can meet the navigation application requirements;
- To develop and maintain tools to support the assessment of EGNOS performance against defined requirements and in co-ordination with work being carried out by ECAC States;
- To develop a methodology to evaluate GBAS technical performance against Cat I/II/III performance requirements;
- To develop and maintain tools to support the assessment of GBAS performance against Cat I/II/III requirements;
- Identification of siting requirements and development of prototype tools to aid site approval and support operational approval and safety assessment;
- To support the development and validation of GBAS Cat I and Cat II/III Standards;
- To assess the degree to which the Galileo/GPS performance can meet the navigation application requirements;
- To adapt tools developed for the EGNOS/GBAS activities to support future assessments of GPS and Galileo;
- To provide data to support the development of safety cases for RNAV and Precision Approach operations using GNSS;
- To determine the ultimate performance limits of all GNSS systems, including both SBAS and GBAS. This includes:
  - Investigations into multi-path characteristics for both GNSS and VDB signals improve performance for PA CAT II/III and A-SMGCS operations;
  - VDB coverage investigations support GBAS use for future RNAV operations;
  - Validation of Ionosphere delay prediction for dynamic events supports more reliable operation of both EGNOS and GBAS;
  - Application of GNSS signal delay characteristics as an input to the Numerical Weather Prediction model.

This WP addresses the work required to allow the navigation applications to maximise the use of GNSS for all phases of flight and to support the application of GNSS to ASMGCS supporting Airport Operations Domain.

Whilst the ANC/11 concluded that there is no obstacle to GNSS being used in all phases of flight, the degree of application is still dependent upon a confirmation of GNSS performance. This WP will provide the studies and trials needed to confirm GNSS capability and provide the data needed to support the system definitions and safety cases prepared in respect of GNSS use in the Navigation Applications of WPs 2-6. This work will form part of a European wide work programme of GNSS avoiding unnecessary duplication and ensuring that all required data needed to support proposed navigation applications are made available in a timely and cost effective manner.

Work will be carried out in co-operation with ANSPs, other stakeholders and the Navigation Applications Sub-Group. The results of this work will be input to WP5, WP6 and WP8 to support the overall assessment of navigation infrastructure requirements for navigation applications. Significant elements of this WP are expected to fall within the context of a joint programme with the Galileo Joint Undertaking on EGNOS. Appropriate working and reporting arrangements will need to be established.

### Expected results

**Applicability Timeframe**
- => 2011 and <= 2015

**Current Validation Level**
- V3a: Generic Specification - Requirements Defined

**Target Validation Level**
- V3b: Generic Specification - Requirements Validated

### Partners

- EUR351: Enabling GNSS for all Phases of Flight (WP09 of Navigation domain)

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**Keywords hits**
- safety case

**Link to ESARRs**
- Implicitly related to ESARR 4

**Category**
- Safety Management

**Topic**
- Assessment of new system/procedure
Safety Case

Objectives

Development and implementation of a new Operational Concept at Maastricht UAC. The MANTAS Operational Concept aims to derive maximum safety and capacity benefits, whilst protecting controller workload. This is achieved by a combination of new technologies and methodologies, with an overall focus on:
- Detecting and reducing complexity,
- Reducing the functional volume workload, and
- Moving the decision-making process as far in advance of the event time as is consistent with accuracy.

Approach

MANTAS Phase I: Concept of proof.
Emphasis in this phase is on change of control methodology, in the context of a Mixed Route Airspace with dynamic sectorisation managing the distribution of workload in sectors built upon gateways and fences. Main activities are Real-time Simulations, Airspace Design, Safety Case Study and early implementation of validated concept elements.

MANTAS Phase II: Development and Implementation of MANTAS concept elements with new tools and systems. Emphasis in this phase is on advanced concepts (such as Meta-Sector Planning and Highway sectors), moving ATM from tactical to adaptive management, supported by new tools (such as MTCD and Complexity Management). Main activity is the incorporation of validated MANTAS concept elements in the new MADAP architecture, resulting from the MASUAC New FDPS program.

MANTAS Phase III: Development and Implementation of MANTAS co-operative concept elements. Emphasis in this phase is on capitalising concept benefits on wider scale by effective deployment of Collaborative Decision Making and Networked Capacity Management processes, and by implementation of Interoperable System Support. Main activity is the incorporation of validated co-operative MANTAS concept elements supported by Interoperability Tools provided by the MASUAC eFDPS program.

Expected results

The overall expected results are:
- Safe Capacity grow path by alleviating capacity limiting factors and enabling effective capacity gains from new tools and concepts.
- Optimised use of available capacity by effective and efficient use of resources.
- Validate and implement tools and concepts in conformance with EATM program and ATM2000+ strategy.
- Securing Maastricht UAC position as high capacity centre in compliance with Single European Sky regulations.
- Demonstrating Maastricht UAC commitment as operational validation centre for new tools and concepts.

Restricted Public documents are accessible to MASUAC and OneSkyTeam MANTAS members. Access to OneSkyTeam or direct copies of documentation can also be requested by e-mail to masuac.mantas-team@eurocontrol.int

Start Date 01/02/2004
Finish Date 31/12/2010

New This Year ✓

Included in Safety HI

Included in SAFS

Results in VDR

Keywords hits

Safety Case

Link to ESARRs

Implicitly related to ESARR 4

Category Safety Management

Topic Assessment of new system/procedure
Under the provisions of NUP (NEANS Update Programme) it has been recognised that in order to validate the ADS-B related concepts defined in its programme that live trials involving Ground-based applications are required. PROVE provides a suitable infrastructure upon which such trials can be performed and DUP is a first step in supporting air/ground integrated "live" trials in ADS-B related applications. The output of DUP will be fed into EUROCONTROL, LFV and European Commission Programmes.

PROVE/DUP supports:
- LFV's strategy for the introduction of datalink and surveillance technologies in its ATM Systems
- ERIS's strategy of support to the pre-operational validation of EATMP concepts, Air/Ground Integration and the Gate-to-Gate concept
- The strategies laid out in the EEC Business Plan
- The strategies defined in the EATMS Validation Strategy Document, version 1.1

Objectives are defined for PROVE/DUP are:
- the upgrade of the S2K HMI to include the ADS-B related functions for partial delegation of separation assurance (Station Keeping and Crossing)
- The integration of ADS-B position reports from the NEANS network into the RDPS
- Upgrade of the RDPS to consolidate ADS-B position reports with traditional radar data sources
- A demonstration of these capabilities in Q4 2001
- Design implementation of TIS-B services and infrastructure
- Extension of the live trials infra-structure to Arlanda.

Approach

The live trials infrastructure is currently installed in Malmo and Copenhagen and shall be extended to Arlanda. It consists of a complete RDPS and FDPS running in shadow mode to the live system with four Controller Working Positions in each site. PROVE is fed with live radar, ADS-B position reports from the NEANS network and Flight Plans from the AFTN. Controllers are fed R/T from the applicable sectors so that they have all pertinent information available to them.

The operational platform in Malmo (ATCAS) is fed with Flight Plans derived from the CFMU via the AFTN and Radar data. These same data feeds are duplicated and fed to the PROVE platform. In addition ADS-B position reports are delivered to PROVE via the NEANS network and ARTAS S0.

Expected results

- The upgrade of the S2K HMI to include the ADS-B related functions for partial delegation of separation assurance (Station Keeping and Crossing)
- The integration of ADS-B position reports from the NEANS network into the RDPS
- Upgrade of the RDPS to consolidate ADS-B position reports with traditional radar data sources
- A demonstration of these capabilities in Q4 2001
- Design implementation of TIS-B services and infrastructure
- Extension of the live trials infra-structure to Arlanda.

At the end of January 2002 two Mitsubishi MU-2 aircraft departed Stockholm-Skavsta airport with destination Malmö-Sturup. These aircraft were equipped with cockpit displays for traffic information (CDTI). Further these aircraft were supposed to demonstrate In Trail Separation (ITS) using ADS-B technology distributed over the North European ADS-B Network (NEAN). This means that the aircraft positions were solely based upon ADS-B position report distributed over the network. The ATCO pointed out the first aircraft in sequence for the number two in sequence. Number two acknowledged the instructions and confirmed that he was locked on target. Hence the instructions were given to manoeuvre and maintain a certain time to the preceding aircraft. Then the responsibility to maintain separation from now on was delegated to the number two aircraft. The pilot in the number two aircraft used the information presented on his CDTI to maintain separation in terms of seconds to the preceding aircraft.

The ATCOs and pilots demonstrated that delegation of separation to cockpit is possible when the proper equipment, phraseology and procedures are available. The demonstration was done in the PRe Operational Validation platform (PROVE) and was a joint project between Swedish Civil Aviation Administration (SCAA) and Eurocontrol EEC.

A limited hazard analysis was made and a safety report was issued.
The general objective for the Human Factors in ATM (HUFA) is to care for the development of the operational ATM organisation and the management of daily ATM operations and which includes follow up system activities. Explicitly this activity will address how to cope with ATM system changes more efficient and in the future. The nature of safety culture and its relation to the ATM organisation.

Specific objectives are:
- Investigate interaction in operational environment between ATCO, ATCO team and the operational leadership in terms of effect of different leadership style and effect of implementation of new technology to the organisation.
- Reveal the nature of ATM safety culture and its relation to the ATM system change process. A tool to monitor and measure safety culture will be designed.
- ATCO overload and role of operational leadership.
- The ATM organisation and more specific ATCO ability to adapt e.g. transfer skills from old to new prerequisites.

The HUFA project comprises the major ATC production units and headquarters. The following competences are dealing with the project. Organisational psychology, safety culture and quality assurance. The project is supervised by change@work at Lund University and ANS Headquarters.

Expected results:
- a) Analysis on how ATM System Change e.g. new technique affect operational leadership.
- b) Tool to monitor and assess ATM safety culture.

Expected results
a) Analysis on how ATM System Change e.g. new technique affect operational leadership.

ATCO overload and role of operational leadership.

The ATM organisation and more specific ATCO ability to adapt e.g. transfer skills from old to new prerequisites.

Approach

The HUFA project comprises the major ATC production units and headquarters. The following competences are dealing with the project. Organisational psychology, safety culture and quality assurance. The project is supervised by change@work at Lund University and ANS Headquarters.

Expected results

- a) Analysis on how ATM System Change e.g. new technique affect operational leadership.
- b) Tool to monitor and assess ATM safety culture.

Applicability Timeframe

>= 2000 and <= 2005

Current Validation Level

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level

V5: Local Implementation - Sign-off for Operational Use

Parent Project

Sub-projects

Sponsors

LFV: Luftfartsverket (Swedish CAA)

Partners

change@work, University of Lund

LFV - Luftfartsverket (Swedish CAA)

Luftfartsverket (Swedish CAA)

New This Year

Included in Safety HI

Included in SAFS

Results in VDR

Keywords hits

Safety AND culture

Link to ESARRs

Implicitly related to ESARR 3, ESARR 4 and ESARR 5.

Category

Safety Management

Topic

Safety Culture
**Objectives**
At Amsterdam airport Schiphol the infrastructure is such there is a taxiway going around the southern end of runway 18/36C. So whenever a large aircraft crosses the imaginary extension of the runway centreline, the ICAO Obstacle Clearance area or the ILS basic services area is infringed. For certain inbound and outbound modes this situation may lead to a potential hazard.

Therefore the objective of this project is to improve runway crossings procedures in order to increase safety level and maintain the hourly runway capacity.

**Approach**
This project involves many stakeholders:
- KLM demands a high runway capacity;
- Schiphol Group is responsible for possible changes to airport infrastructure / systems;
- The NL CAA is responsible for safety oversight and possible impacts to the environment;
- Acceptance of operational solution by ATCo and pilots;
- Engineers and technicians develop the ATM system design that is easy to maintain.

A set of 5 operational scenarios have been analysed on their impacts to safety, capacity and environment. The results were discussed with experts from all involved stakeholders. Once the most suitable solution has been selected, procedures were amended and additional training given to operations personnel.

**Expected results**
- Change of ATC-procedures;
- Implementation of extra stopbars and holding points;
- Training package
- Evaluation and validation of new developed procedures

**Applicability Timeframe**
=> 2000 and <= 2005

**Current Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**Target Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**New This Year**
- Included in SAFS

**Keywords hits**
- hazard

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**
Safety Management

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**Project LVN028: Improving Runway Crossing operations**

<table>
<thead>
<tr>
<th>Start Date</th>
<th>Finish Date</th>
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<tbody>
<tr>
<td>01/05/2003</td>
<td>31/12/2003</td>
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</table>

**Objectives**
Change the procedures for approaching converging runways outside Universal Daylight Period (UDP) in such a way that the same runway capacity is achieved as the same operations within UDP.

**Approach**
- development of scenarios using Concept of Operations (CONOPs)
- analyse the CONOPs on their impacts to safety, efficiency, environment and legal affairs
- based on analysis results, select best CONOP for implementation

**Expected results**
The amended procedure has been implemented and fully operational. The NL CAA approved the operations and qualified it as fulfilling the target level of safety requirements.

**Current Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**Target Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**New This Year**
- Included in SAFS

**Keywords hits**
- target level of safety

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**
Safety Management

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**Project LVN029: Approaches on converging runways outside UDP**

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**Objectives**
Change the procedures for approaching converging runways outside Universal Daylight Period (UDP) in such a way that the same runway capacity is achieved as the same operations within UDP.

**Approach**
- development of scenarios using Concept of Operations (CONOPs)
- analyse the CONOPs on their impacts to safety, efficiency, environment and legal affairs
- based on analysis results, select best CONOP for implementation

**Expected results**
The amended procedure has been implemented and fully operational. The NL CAA approved the operations and qualified it as fulfilling the target level of safety requirements.

**Current Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**Target Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**New This Year**
- Included in SAFS

**Keywords hits**
- target level of safety

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**
Safety Management
This work supports the Radar Separation Standards Working Group (RSSWG) in providing recommendations on safe separation minima for application in radar controlled airspace.

**Approach**

ASSESSMENT OF THE PERFORMANCE OF THE NERC MULTI RADAR TRACKER

NERC will use a new multi radar tracker (MRT) system to process data displayed to controllers. It is important that this data is sufficiently accurate to allow the required separation standards to be applied. A technique for the assessment of the NERC data has already been developed and some initial analyses have been undertaken. A final analysis of the system will be undertaken during 1999 when final data becomes available.

**Expected results**

Provision of radar accuracy assessments.

<table>
<thead>
<tr>
<th>Project</th>
<th>NAT004: Radar Separation Minima</th>
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<tbody>
<tr>
<td>Start Date</td>
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<td>Objectives</td>
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<td>Parent Project</td>
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<td>Sub-projects</td>
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<td>Sponsors</td>
<td>NATS: National Air Traffic Services Ltd</td>
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<td>Partners</td>
<td>NATS, One Kemble Street</td>
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<td>Safety Management</td>
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<tr>
<td>Topic</td>
<td>Assessment of new system/procedure</td>
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</tbody>
</table>
### Project: NAT071: Wake Vortex Research

**Start Date**: 01/05/1995  
**Finish Date**: 31/03/2003

**Objectives**
Spacing minima to guard against the possibility of wake vortex accidents are a constraint on the capacity of major airports. Reported wake vortex encounters are monitored and assessments of the impact of proposed changes in procedures are performed to ensure that the minimum wake vortex spacing consistent with safe operations are maintained.

**Approach**

**WAKE VORTEX ENCOUNTER DATABASE:**
NATS maintains a unique database of pilot reported wake vortex encounters. It is used in analysing the safety of current and proposed future procedures and each year the collected reports are analysed and an R&D report is produced.

**PARTICIPATION IN THE EC WAKENET PROJECT:**
NATS is part of the WakeNet consortium which provides a forum for the discussion of research into wake vortex issues. NATS' role is as a co-ordinator for the provision of information on data collection on vortices. This work is funded by the EC.

**FDR DATA ANALYSIS FOR WAKE VORTEX IDENTIFICATION - CLOSED**
This project will build on work currently being performed in conjunction with British Airways to develop methods of identifying vortex encounters from Flight Data Recorder records. An algorithm for the identification of wake vortex encounters developed during 1998/99 will be further refined and then used to analyse one months' FDR data from BA aircraft. This data will be correlated with the achieved separations and meteorological data (both from the ground and from the aircraft FDR records) to allow analysis of the conditions under which vortex encounters occur. This work may help to identify areas where current separations can be modified.

**S-Wake**
This EC 5th Framework project aims to develop tools for assessing appropriate (safe) wake vortex separation distances.

**Expected results**
- ii) Participation in the EC WAKENET consortium which provides a forum for discussion of research into WV issues.
- iii) Analysis of Flight Data Recorder information from aircraft involved in WV encounters and participation in the EC S-Wake Project.

**Applicability Timeframe**
=> 2006 and <= 2010

**Current Validation Level**
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**Parent Project**
CEC107: S-Wake - Assessment of Wake Vortex Safety

**Sub-projects**
EC DG RES: European Commission - DG Research
NATS: National Air Traffic Services Ltd

**Sponsors**
NATS, One Kemble Street

**New This Year**
- [ ] Included in Safety HI
- [ ] Included in SAFS
- [ ] Results in VDR

**Keywords hits**
- accident

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**
Safety Management  
**Topic**
Assessment of new system/procedure
**Objectives**

i) Development and maintenance of a preliminary database of SMF encounters and trend analysis of data.

ii) Risk contour modelling for 20 airports to assist the DETR in the setting of PSZ zones.

iii) Ad-hoc tasks at short notice.

**Approach**

**RESEARCH INTO METHODS FOR REDUCING SAFETY RELATED INCIDENTS:** - CLOSED

The object of the work programme is to seek to develop a function which will relate the frequency with which safety related incidents occur to measurable or assessable airspace characteristics. The task will include a factor analysis of data available from a number of databases (UKFDB, LATCC IDB etc) and also a subjective assessment of sector complexity using expert controller judgement.

**DEVELOPMENT OF THE BARRIER ANALYSIS APPROACH:** - CLOSED

This task will include: further investigation of the barrier categorisation; investigation into the effects of interdependence of barrier failure rates; and, refinement of the approach used to derive collision risk estimates from the most serious incidents.

**DEVELOPMENT OF SMF DATA TREND ANALYSIS:**

This task will include the ongoing maintenance of the database during 1999/2000 and the development of some simple statistics for trend analysis. The objective will be to produce quarterly summaries of the data designed to highlight any adverse safety trends. This analysis will form the basis of a complementary safety Performance Indicator.

**EOLIA:** - CLOSED

The EOLIA project is developing pre-operational data-link applications for use in European ATC. As part of this project, safety analyses were undertaken during 1997/98 &1998/99. This work item will involve follow up work to the initial safety analysis as simulations of new systems are developed at ATMDC. This work is 50% funded by the EC.

**SUPPORT TO DETR ON THE DEVELOPMENT OF PUBLIC SAFETY ZONE POLICY:**

This task will involve using new models to provide forecasts of third party risk contours for the year 2015 for the twenty airports at which PSZs are defined and recommending a number of standard sizes to be adopted for new PSZs.

**Expected results**

Completion of PSZ study for DETR;
Report on relationship between safety related incidents and sector characteristics;
Report on proposals for SMF trend analysis.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**Parent Project**

CEC035: RHEA - Role of the Human in the Evolution of ATM Systems

CEC060: EOLIA - European pre-Operational data Link Applications

**Sub-projects**

EC DG INFSO: European Commission - DG INFSO

EC: European Communities

NATS: National Air Traffic Services Ltd

**Sponsors**

EC DG INFSO: European Commission - DG INFSO

EC: European Communities

NATS: National Air Traffic Services Ltd

**Partners**

NATS, One Kemble Street

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**New This Year**

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<tr>
<th>Included in SAFS</th>
<th>Included in Safety HI</th>
<th>Results in VDR</th>
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**Keywords hits**

safety analy, risk AND safety, incident

**Link to ESARRs**

Implicitly related to ESARR 4 and ESARR 1

**Category**

Safety Management

**Topic**

Assessment of new system/procedure
### Project: NAT085: North Atlantic Risk Monitoring

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<tr>
<td>01/04/1996</td>
<td>31/03/2003</td>
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#### Objectives
- Rapporteurship of the NAT SPG mathematicians' working group.
- Maintenance and development of the NORTH ATLANTIC CMA database.
- Production of monthly monitoring and annual risk assessments.

#### Approach
**RAPPORTEURSHIP OF THE NAT SPG MATHEMATICIANS' WORKING GROUP**
This task provides resource to fulfil the role of the rapporteur at the annual meeting of the MWG which undertakes safety and performance analyses in support of the current operation of the North Atlantic airspace. It also includes the provision of expert advice to the UK members of NATSPG and its sub-groups.

**MAINTENANCE AND DEVELOPMENT OF THE NORTH ATLANTIC CMA DATABASE**
As part of the ongoing commitment to monitoring the safety of the application of reduced vertical separations in the North Atlantic region, a database of aircraft height keeping performance is maintained for the Central Monitoring Agency. This involves the day-to-day maintenance of the database, ensuring that data is up-to-date and correct, and ad-hoc data extraction and analyses as required. The resource for this work is recovered from ICAO.

**PRODUCTION OF MONTHLY MONITORING AND ANNUAL RISK ASSESSMENTS**
On a monthly basis, data on the safety performance of the North Atlantic airspace is summarised and distributed to other members of the NATSPG and its sub-groups. In addition, each year, an analysis of the collision risk in NATS' North Atlantic airspace in the vertical and lateral dimensions is undertaken and presented at the annual meeting of NATSPG. This task is undertaken by NATS on behalf of NATSPG.

#### Expected results
- Collision Risk Assessments for the North Atlantic.
- Meetings of NAT SPG Mathematicians' Working Group.

**Applicability Timeframe**
=> 2026

**Current Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**Target Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**Parent Project**
NAT085: North Atlantic Risk Monitoring

**Sponsors**
NATS: National Air Traffic Services Ltd

**Partners**
NATS, One Kemble Street

**New This Year**
- Included in Safety HI
- Included in SAFS

**Keywords hits**
- risk assess, risk AND safety

**Link to ESARRs**
Implicitly related to ESARR 4

**Category**
Safety Management

**Topic**
Assessment of new system/procedure
## Project

**NAT086: UK and European RVSM**

### Objectives

Assessments of collision risk are required as part of the ECAC RVSM implementation programme and the linked UK RVSM programme. The objective is to ensure that RVSM operations in the ECAC region in general, and in the UK in particular, will meet internationally agreed safety targets. This work is undertaken in collaboration with Eurocontrol.

### Approach

**UPGRADE OF CMA DATABASE**

The CMA database holds height measurement records and 150-200 new records are being added each day from the two Height Monitoring Units (HMUs) of the North Atlantic height monitoring programme. For the ECAC RVSM programme Eurocontrol are planning to commission three additional HMUs in Europe. All of the data collected by the European HMUs will be stored on the CMA database. In order to cope with the future quantities of data the CMA database will need to be upgraded. The upgrade will include the provision of improved hardware and modification of the software to use a more up-to-date database package. This project will also benefit the NAT RVSM monitoring programme [7022]. This task will be undertaken with Eurocontrol.

### Expected results

1. Participation in RVSM Safety Work for Europe.
2. Safety Assessment for UK RVSM.
3. Upgrade of the CMA database, including the provision of improved hardware and modification of database software, to ensure that the database will have sufficient capacity to deal with the requirements of the European monitoring programme. This work will be undertaken in conjunction with Eurocontrol.

### Applicability Timeframe

=> 2000 and <= 2005

### Current Validation Level

V3b: Generic Specification - Requirements Validated

### Target Validation Level

V4: System Development - Completion of Development and Integration

### Parent Project

- EUR066: Navigation - ET2 (RVSM)
- EUR119: Studies and Trials in support of RVSM

### Sponsors

EUROCONTROL: European Org. for the Safety of Air Nav.
NATS: National Air Traffic Services Ltd

### Partners

NATS, One Kemble Street

### Keywords hits

safety assess, risk AND safety

### Link to ESARRs

Implicitly related to ESARR 4

### Category

Safety Management

**Assessment of new system/procedure**
The human links in Air Traffic Management systems are complex and often the most critical. The analysis and optimisation of the human element is the domain of the Human Factors Unit. The work is targeted at the development of ATC systems necessary to ensure the safe, efficient and expeditious flow of air traffic, and support for NATS’ projects where a deep understanding of the human element of the system is critical.

The incident analysis work is aimed at maintaining and increasing safety, by ensuring that errors and error trends are held in check, and that practicable and effective error reduction measures can be developed and implemented.

Recovery work will help prepare for failure of future support systems, supporting customer confidence and safety integrity of the ATM system.

Review and report on LATCC and NSC incidents to determine underlying causes.
Report identifying improvements in CATC training process using Cognitive Task Analysis.
Report identifying improvements in CATC training process using student instructor interviews.
Preliminary investigation and report on automation systems (e.g. SSR, FAST) failure and recovery mechanisms.
Preliminary investigation and report on FDPS2 systems failure and recovery mechanisms.

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

NATS: National Air Traffic Services Ltd
NATS

NAT119: ATMDC Human Factors Unit (HFU)

## Start Date
01/04/1997

## Finish Date
31/03/2003

## Objectives
The human links in Air Traffic Management systems are complex and often the most critical. The analysis and optimisation of the human element is the domain of the Human Factors Unit. The work is targeted at the development of ATC systems necessary to ensure the safe, efficient and expeditious flow of air traffic, and support for NATS’ projects where a deep understanding of the human element of the system is critical.

## Approach
The incident analysis work is aimed at maintaining and increasing safety, by ensuring that errors and error trends are held in check, and that practicable and effective error reduction measures can be developed and implemented.

The training support work is intended to improve its efficiency and effectiveness, and to provide better coherence between the CATC and LATCC training systems. It will do this by detailing gaps or differences in approach and/or training needs, and recommending how to close those gaps.

Recovery work will help prepare for failure of future support systems, supporting customer confidence and safety integrity of the ATM system.

Review and report on LATCC and NSC incidents to determine underlying causes.
Report identifying improvements in CATC training process using Cognitive Task Analysis.
Report identifying improvements in CATC training process using student instructor interviews.
Preliminary investigation and report on automation systems (e.g. SSR, FAST) failure and recovery mechanisms.
Preliminary investigation and report on FDPS2 systems failure and recovery mechanisms.

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

## Expected results
Review and report on LATCC and NSC incidents to determine underlying causes.
Report identifying improvements in CATC training process using Cognitive Task Analysis.
Report identifying improvements in CATC training process using student instructor interviews.
Preliminary investigation and report on automation systems (e.g. SSR, FAST) failure and recovery mechanisms.
Preliminary investigation and report on FDPS2 systems failure and recovery mechanisms.

## Applicability Timeframe
=> 2000 and <= 2005

## Current Validation Level
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

## Target Validation Level
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

## Parent Project
NATS: National Air Traffic Services Ltd

## Sub-projects
NATS

## Sponsors
NATS: National Air Traffic Services Ltd

## Partners
NATS

## New This Year

## Keywords hits
incident

## Link to ESARRs
Implicitly related to ESARR 2 and ESARR 5

## Category
Safety Management

## Topic
Safety Event Monitoring
NATS is committed to providing appropriate Safety Net systems to help further reduce the risk of collisions. STCA provides protection against mid-air collisions in the UK. This item provides the technical support necessary to enable STCA to be maintained and, where economically sensible, to be improved. It also provides for the monitoring of TCAS in the UK to ensure that the introduction of version 7 does not adversely affect safety.

The NATS Operational Strategy review recommended that R&D into medium-term capacity and safety improvements is given priority over all other R&D activities. This is in line with the requirements of NATS Operational Strategy, EATCHIP and the ICAO State Letter asking how and when States will provide for the display of MSAW alerts. The work programme contains near and medium term measures to strengthen NATS’ Safety Net base and reduce the risks associated with aircraft flying below a terrain safe altitude.

**Approach**
- Support for NATS operational STCA systems.
- Development of Enhanced STCA.
- TCAS II Operational Evaluation.
- Investigation of Minimum Safe Altitude Warning (MSAW).[Work completed 2001]
- Safety Net Independence study.

**Expected results**
Continued to development of STCA facilities to include operation at Swanwick, evaluation of performance of operational systems at LATCC, Manchester and ScATCC and, where appropriate, extension of existing coverage. Monitor the operational effectiveness and development of TCAS in UK airspace leading up to the mandate for equipage in the UK of 31st March 2001. Work undertaken in support of the TENS ACASA programme.

**Applicability Timeframe**
=> 2000 and <= 2005

**Current Validation Level**
V3b: Generic Specification - Requirements Validated

**Target Validation Level**
V5: Local Implementation - Sign-off for Operational Use

**Parent Project**

**Sponsors**
EC: European Communities
EUROCONTROL: European Org. for the Safety of Air Nav.
NATS: National Air Traffic Services Ltd

**Partners**
EUROCONTROL Agency
NATS, One Kemble Street

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### Keywords hits
- risk AND safety

### Link to ESARRs
- Implicitly related to ESARR 4

### Category
- Safety Management  **Topic**  Assessment of new system/procedure
Objectives
This work aims to develop methods to assess the safety of proposed improvements in the North Atlantic ATM service. The safety assessments are required to ensure that NATS objective of maintaining or improving safety can be met whilst improving the efficiency of operations in the NAT region.

Approach
RAPPORTEURSHIP OF THE MATHEMATICIANS’ IMPLEMENTATION GROUP (MIG)
The MIG reports to the NAT Implementation Management Group and is responsible for the development and application of methods for the assessment of risk associated with planned reductions in separation in the North Atlantic region. The present work programme supports the reduction of longitudinal separation and involves the coordination of the work of the MIG and reporting progress to the NAT IMG.

DATA COLLECTION AND ANALYSIS OF THE LONGITUDINAL RISK IN THE NAT
Following the preliminary analysis of long risk in 99/00, an estimation of long risk based on a new data collection will be carried out in 2001. The work is intended to examine the feasibility of reducing separating without other system changes. This task involves the development of a long-term programme for data collection and the execution of a full risk assessment and ongoing risk monitoring programme of the longitudinal risk in the NAT.

ANALYSIS OF FANS TRIAL IN THE NORTH ATLANTIC REGION
Since June ’99 the FANS 1 based ADS that has been in progress in the NAT. This project is analysed data collected during the trial with a view to determining the acceptability of FANS I for operational use within the region.

Expected results
i) Rapporteurship of the Mathematicians’ Implementation Group.
ii) Data Collection and Analysis for Longitudinal Risk in the NAT.
iii) Analysis of data from the FANS operational trial.

Applicability Timeframe
=> 2006 and <= 2010

Current Validation Level
V5: Local Implementation - Sign-off for Operational Use

Target Validation Level
V5: Local Implementation - Sign-off for Operational Use

Keywords hits
risk assess, safety assess

Link to ESARRs
Implicitly related to ESARR 2

Category
Safety Management

Topic
Methodology development

New This Year

Included in Safety HI
Included in SAFS
Results in VDR

Sponsors
NATS: National Air Traffic Services Ltd

Partners
NATS, One Kemble Street

Results in VDR

NAT134: SMF - Separation Monitoring Function

Start Date 01/04/1998
Finish Date 31/03/2001

Objectives
SMF alerts ATC supervisory staff to inadvertent breaches of separation criteria within 5 minutes of the event to enable immediate investigation to take place. This item provides for the ongoing technical support and development of SMF in order that rapid and accurate post-event monitoring can continue.

Approach
Support operational SMF systems.
Transfer responsibility for SMF to NSS.

Expected results
Complete the transfer of all SMF Design Authority responsibilities to NATS Software Services (NSS); continue to advise on the technical performance of all SMF systems; introduce the SMF systems at Swanwick into operational service.

Applicability Timeframe
=> 2000 and <= 2005

Current Validation Level
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Target Validation Level
V3a: Generic Specification - Requirements Defined

Keywords hits
Implicitly related to ESARR 2

Link to ESARRs

Category
Safety Management

Topic
Safety Event Monitoring
NERC and NSC operational staff anticipate the need for enhancements and changes to the NERC/NSC systems over the years following O-date, in order to cope with changing requirements and increasing traffic. The NATS Operational Strategy Review has confirmed this, and emphasised the need to define a clear plan and timetable to achieve the required capacity enhancements. The requirement is for elimination of paper strips from NERC within 2-3 years of NERC "O" date, and the introduction of computer assistance tools within 5-6 years of "O" date. The ongoing EPS and FACTS projects directly support these aims.

**Objectives**

NERC and NSC operational staff anticipate the need for enhancements and changes to the NERC/NSC systems over the years following O-date, in order to cope with changing requirements and increasing traffic. The NATS Operational Strategy Review has confirmed this, and emphasised the need to define a clear plan and timetable to achieve the required capacity enhancements. The requirement is for elimination of paper strips from NERC within 2-3 years of NERC "O" date, and the introduction of computer assistance tools within 5-6 years of "O" date. The ongoing EPS and FACTS projects directly support these aims.

**Approach**

The core research (R&D) project started in 1998 and formally concluded in November 2001. The EPS prototype system developed provides a fully electronic flight data system based on current operational concepts. In April/May 2001, the final EPS simulation (CCD4) took place using Scottish airspace with the EPS design extended to include NSC specific operations such as the Scottish TMA and Airfield Interface.

Support is now being provided for the operational implementation of EPS, including the development of a PRIME (Pre-operational Implementation of EPS) demonstrator to run in the Engineering Support Segment (ESS) at Swanwick that aims to modify the NERC operational workstation software to incorporate EPS. To date, tactical controller functionality has been successfully implemented in the PRIME demonstrator, and work is underway to implement the planner functionality.

**Expected results**

Develop prototype enhanced NERC/NSC systems with modified HCI and support tools in order to facilitate operation without paper strips, and using advanced support tools.

Develop appropriate synergy between the EPS and FACTS projects in order to define common core functions, and a likely development strategy from EPS to FACTS.

Carry out EPS1a and FACTS1b real time trials in mid 1999 and EPS2a and FACTS 2a trials in early 2000.

Carry out FACTS 3a Trial November 2001.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**

V3b: Generic Specification - Requirements Validated

**Target Validation Level**

V4: System Development - Completion of Development and Integration

**Category**

Safety Management

**Keywords hits**

safety analys, safety AND benefit

**Link to ESARRs**

Implicitly related to ESARR 4

**Expected results**

Develop prototype enhanced NERC/NSC systems with modified HCI and support tools in order to facilitate operation without paper strips, and using advanced support tools.

Develop appropriate synergy between the EPS and FACTS projects in order to define common core functions, and a likely development strategy from EPS to FACTS.

Carry out EPS1a and FACTS1b real time trials in mid 1999 and EPS2a and FACTS 2a trials in early 2000.

Carry out FACTS 3a Trial November 2001.
<table>
<thead>
<tr>
<th>Project</th>
<th><strong>NAT168: Future Concepts for ATC</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start Date</strong></td>
<td>01/04/2003</td>
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<tr>
<td><strong>Objectives</strong></td>
<td></td>
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<tr>
<td><strong>Topic 14: Collaborative Decision Making (CDM):</strong></td>
<td>Maintain a watching brief on CDM activities and disseminate information back to NATS’ business.</td>
</tr>
<tr>
<td><strong>Topic 26: Application of Medium Term Conflict Detection (MTCD) to Terminal Control:</strong></td>
<td>Research will determine the system requirements for future TC controller tool support.</td>
</tr>
<tr>
<td><strong>Topic 27: Harmonisation of TC and Surface Management Tools:</strong></td>
<td>Research will investigate requirements to support concepts for tools to simplify ground movement operations, harmonised with planned arrival and departure management tools.</td>
</tr>
<tr>
<td><strong>Topic 29: Blue Sky TC Concepts:</strong></td>
<td>The work will develop and validate a holistic future TC concept (circa 2015+) featuring such developments as extended RNAV arrival and departure routes, station keeping of arrivals, and co-operative air traffic services.</td>
</tr>
<tr>
<td><strong>Approach</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Topic 14: Collaborative Decision Making:</strong></td>
<td>To monitor developments in CDM and disseminate any information within NATS to ensure involvement and collaboration where beneficial.</td>
</tr>
<tr>
<td><strong>Topic 26: Application of MTCD to Terminal Control:</strong></td>
<td>Research to determine the system requirements for future TC controller tool support. The requirements will be analysed with reference to existing controller tools developed by NATS for en-route and external organisations for TC.</td>
</tr>
<tr>
<td><strong>Topic 27: Harmonisation of TC and Surface Management Tools:</strong></td>
<td>Research to investigate requirements to support concepts for tools to simplify ground movement operations, harmonised with planned arrival and departure management tools. In particular, taxi time predictability and safety enhancements. The research will consider planned deployments of systems such as ASMGCS, Mode S, ADS and Cockpit Display of Traffic Information (CDTI).</td>
</tr>
<tr>
<td><strong>Topic 29: Blue Sky TC Concepts:</strong></td>
<td>Development and validation of a holistic future TC concept (circa 2015+) featuring such developments as extended RNAV arrival and departure routes, station keeping of arrivals and co-operative air traffic services.</td>
</tr>
<tr>
<td><strong>Expected results</strong></td>
<td></td>
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<tr>
<td><strong>Topic 14: Collaborative Decision Making (CDM):</strong></td>
<td>Phase 1: Regular briefings to NATS business. Phase 2: Development of CDM concepts specific to UK airspace.</td>
</tr>
<tr>
<td><strong>14 Collaborative Decision Making (CDM) - Results No Deliverables produced.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Topic 26: Application of MTCD to Terminal Control:</strong></td>
<td>- Recommendations will be made for future research priorities and/or future collaboration opportunities identified. - Paper-based concept for MTCD for the TC environment.</td>
</tr>
<tr>
<td><strong>Topic 26: Application of MTCD to Terminal Control - Project Cancelled, no deliverables.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Topic 27: Harmonisation of TC and Surface Management Tools:</strong></td>
<td>Phase 1: Paper based development of techniques to support required taxi time predictability. Phase 2: Paper based outline concept of operations for tools to simplify ground movement operations, harmonised with arrival management and departure management systems, including an analysis of capacity, efficiency and safety improvements.</td>
</tr>
<tr>
<td><strong>Topic 27: Harmonisation of TC and Surface Management Tools - Project Cancelled, no deliverables.</strong></td>
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</tr>
<tr>
<td><strong>Topic 29: Blue Sky TC Concepts:</strong></td>
<td>Phase 1: Future TC Concept, to take forward for validation. Phase 2: Further development of some aspects of the Phase 1 concept.</td>
</tr>
<tr>
<td><strong>Applicability Timeframe</strong></td>
<td>=&gt; 2011 and &lt;= 2015</td>
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<td><strong>Current Validation Level</strong></td>
<td>V0: Initial R&amp;D Commences - New R&amp;D Topic</td>
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<tr>
<td><strong>Target Validation Level</strong></td>
<td>V2: Feasibility - Initial Proof of Concept ready for Implementation Decision</td>
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<td><strong>Parent Project</strong></td>
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<td><strong>Sub-projects</strong></td>
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<tr>
<td><strong>Sponsors</strong></td>
<td>NATS: National Air Traffic Services Ltd</td>
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</tbody>
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### Summary

**Project**

**NAT171: Future Systems Research - Safety**

**Start Date** 01/04/2004  **Finish Date** 31/03/2005

**Objectives**

SUMMARY: This sub-programme provides R&D addressing issues not directly related to the development of operational concepts. This work was previously carried out within the Long Term Research Programme (LTRP) a rolling 10-year programme of work. The previous LTRP theme of Safety research has been retained:

**4ABL 14 - Safety Analysis Tool:** Work was carried out by QinetiQ in FY 03-04 to investigate the feasibility of developing safety metrics particularly the incidence of altitude busts through retrospective analysis of radar data and the application of the metrics to simulation data. This work is to be concluded during the early part of FY 04-05.

**4ABL 15 - Understanding Factors that Lead to Incidents:** It is essential that NATS fully understands contributory factors to incidents to define the requirements for such systems. Activities to develop enhanced safety net systems and automation of ATC functions in support of enhanced safety will continue this year. Some work (e.g. TRACER) has already been performed by Human Factors. However, further investigation into contributory factors for incidents could help in the development of future safety nets and improvements in airspace and system design.

**4ABL 16 - Use of Colour in ATC:** Concerns have previously been raised about the use of colour in advanced ATC tools, and particularly the impact on the small proportion of controllers with a degree of blue/yellow colour blindness (currently an acceptable condition for ATCOs). An initial investigation assessed the risk for the first generation of ATC tools (e.g. iFACTS) as low. However, more general research is required to understand this issue in more detail for future generations of tools.

**Approach**

**4ABL 14 - Safety Analysis Tool:** Conclude the work carried out during FY 03-04, disseminate the results within NATS and undertake further work as required by the stakeholders.

**4ABL 15 - Understanding Factors that Lead to Incidents:** Investigate contributory factors from safety incidents and develop recommendations for safety nets, airspace and system design improvements to avoid similar incidents in the future. The work will also assess how future tools could reduce criticality or mitigate against the incident altogether.

**4ABL 16 - Use of Colour in ATC:** Provide recommendations as to how the current and, in particular, the planned use of display devices in ATC applications might be improved and the need to consider and assess the quality of vision of the operator. Develop a system for identical photometric implementation of the same information on CRT and LCD devices and characterise possible differences. Appropriate tests for assessing visual performance will be developed that reflect the use of displays in ATC applications.

**Expected results**

**DELIVERABLES:**

**4ABL 14 - Safety Analysis Tool:** Report(s) summarising the findings of the study.

**4ABL 15 - Understanding Factors that Lead to Incidents:** Identification of gaps in current Safety Nets. Make recommendations for future safety nets, airspace and system design.

**4ABL 16 - Use of Colour in ATC:** Report summarising the findings of the study.

**Applicability Timeframe**

=> 2006 and <= 2010

**Current Validation Level**  N/A  **Target Validation Level**  N/A

**Sponsors**

**Partners**

National Air Traffic Services Ltd

**New This Year**  ✔  **Included in Safety HI**  ✔  **Included in SAFS**  ✔  **Results in VDR**  ☐  **Partner Project**

**Keywords hits**

validation AND safety

**Link to ESARRs**

Implicitly related to ESARRs 2 and 4

**Category**

Safety Management  **Topic**  Assessment of new system/procedure
Objectives

This provides research and development support to the NERL Oceanic ATS business. The research addresses some of the likely issues associated with future developments in the Oceanic region. The proposed research studies the impact of these concepts on the safety and efficiency of Oceanic operations.

4ABO 02 - Maintaining Safety in Future Oceanic Operations: During FY 03-04, a project was carried out to identify areas for potential safety improvements for future Oceanic ATS operations, by Helios Technology. Potential risks were identified, a risk mitigation strategy produced and areas of further work identified. Included were areas of risk associated with new avionics and their distribution, external factors, (principally the introduction of datalink and ADS-B based services), human factors and traffic growth predictions.

4ABO 03 - Oceanic Efficiency through Reduced Separation: The principal customer requirement for Oceanic ATS is for more fuel-efficient and time-efficient routings and profiles, to be realised by reductions in separation minima and increasing levels of flexibility underpinned by satellite surveillance and communications. Reduced vertical separation is not feasible and longitudinal separation reduction has previously failed to meet target level safety (TLS).

Approach

4ABO 02 - Maintaining Safety in Future Oceanic Operations: Further research is recommended for ADS-C performance requirements to support traffic growth and reduced separation. Recommendation is also made to continue monitoring risks and in particular to review the TLS to determine whether it is consistent with predicted traffic growth. The recommendations from last year's work will be discussed in detail with the stakeholder.

4ABO 03 - Oceanic Efficiency through Reduced Separation: To assess the feasibility of reduced lateral or longitudinal separation to meet required efficiency improvements for the Oceanic operation. The assessment will take into consideration the output of the previous project - Maintaining Safety for Oceanic Operations. Previously encountered problems (unpredictability of aircraft due to inaccurate weather models) for reduced longitudinal separation will be investigated and potential solutions proposed. The alternative lateral separation will also be assessed, with consideration of aircraft equipage for ADS.

Expected results

DELIVERABLES:

4ABO 02 - Maintaining Safety in Future Oceanic Operations: Deliverables will be determined in discussion with the stakeholder.

4ABO 03 - Oceanic Efficiency through Reduced Separation: Analysis of options for reduced separation in the Oceanic region.

Applicability Timeframe

=> 2006 and <= 2010

Current Validation Level

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Category

Safety Management

Topic

Assessment of new system/procedure
<table>
<thead>
<tr>
<th><strong>Project</strong></th>
<th>NAT176: Operational Analysis and Support to Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start Date</strong></td>
<td>01/04/2004</td>
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<tr>
<td><strong>Finish Date</strong></td>
<td>31/03/2005</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td>SUMMARY: This Project supports Operational performance monitoring and improvement to Safety. It aims to provide information and support to the Operation about: Current performance; Relative Risks, Key drivers, Performance Indicators; Cost/benefit of potential improvements; Support for implementation of improvements; Including support to communication/awareness; Monitoring of effect of changes.</td>
</tr>
<tr>
<td><strong>Approach</strong></td>
<td>4SOA - Operational Analysis and Support to Safety: This project provides safety monitoring, safety analysis, and human factors support to operational safety and safety improvements.</td>
</tr>
<tr>
<td><strong>Expected results</strong></td>
<td>4SOA - Operational Analysis and Support to Safety: Deliverables tend to occur at set intervals (e.g., safety performance monitoring reports delivered quarterly), or on an as agreed basis (e.g. HF input to Level Bust initiatives). DELIVERABLES: 1. Regular monitoring and analysis of operations to determine current safety performance (e.g., STCA, SMF, Wake Vortex, NAT risk monitoring). 2. Regular reporting of the results of analysis to recommendations for improvement and action tracking. 3. Human Factors support to safety, including HF incident interviews, actions to reduce risk associated with human error, and support to ACS safety plan actions. 4. Investigating ways of improving NATS safety performance (e.g., safety culture, continuous safety improvement). 5. Ad-hoc analysis support to other NATS safety groups (e.g., DS&amp;Q, SPMG)</td>
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<tr>
<td><strong>Applicability Timeframe</strong></td>
<td>N/A</td>
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<td><strong>Parent Project</strong></td>
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<td><strong>Sub-projects</strong></td>
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<td><strong>Sponsors</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Partners</strong></td>
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<td><strong>Results in VDR</strong></td>
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<td>Implicitly related to ESARR 2</td>
</tr>
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<td><strong>Category</strong></td>
<td>Safety Management</td>
</tr>
<tr>
<td><strong>Topic</strong></td>
<td>Safety Event Monitoring</td>
</tr>
</tbody>
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**Project**

<table>
<thead>
<tr>
<th>Project</th>
<th>NAT177: Operational Analysis and Support to Training</th>
</tr>
</thead>
</table>

**Start Date** | 01/04/2004  
**Finish Date** | 31/03/2005  

**Objectives**

SUMMARY: This Project supports Operational performance monitoring and improvement. It aims to provide information and support to the Operation about: Current performance; Relative Risks, Key drivers, Performance Indicators; Cost/benefit of potential improvements; Support for implementation of improvements; Including support to communication/awareness; Monitoring of effect of changes.

It is organised around a number of Projects which address the four key improvement areas of: Safety, Service Performance, Capacity and ATC Manpower and Training.

4TOA - Operational Analysis and Support to Training: This project provides Human Factors training support to DAT&S and operational units over the current financial year (04/05).

**Approach**

4TOA - Operational Analysis and Support to Training: Deliverables tend to occur at set intervals (e.g., safety performance monitoring reports delivered quarterly), or on an as agreed basis (e.g. HF input to Level Bust initiatives).

**Expected results**

DELIVERABLES:

4TOA - Operational Analysis and Support to Training: In particular, the project includes the following tasks:

1. Training co-ordination task
2. HF support to instructor training
3. HF support to course design
4. Part Task Trainer (PTT) Implementation
5. Team Resource Management (TRM)
6. HF Support to training

Some deliverables may include:

1. Development of an HF training plan and action list that can be integrated into NATS’s wider training strategy
2. Instructor training materials and delivery support
3. New training materials (e.g. HF lessons for DAT&S introductory course, TRM materials) development and delivery support
4. Recommendations and support on new course designs
5. Implementation of a strip PTT for DAT&S
6. Delivery of TRM training at LACC and possibly other NATS units
7. Recommendations and assistance on ad hoc training requests

**Applicability Timeframe**  
=> 2000 and <= 2005

**Current Validation Level**  
N/A

**Target Validation Level**  
N/A

**Parent Project**

**Sub-projects**

**Sponsors**

**Partners**

**New This Year**  
☑ Included in Safety HI  
☐ Included in SAFS  
☐ Results in VDR

**Keywords hits**  
Safety

**Link to ESARRs**  
Implicitly related to ESARR 2

**Category**  
Safety Management  
**Topic**  
Human Resources
**Project**  | **NAT178: Operational Analysis and Support to Service Performance**
---|---
**Start Date**  | 01/04/2004
**Finish Date**  | 31/03/2005
**Objectives**  |
SUMMARY: This project supports Operational Performance monitoring & improvement and forms one of four project work streams under the Operational Analysis & Support Programme. It aims to provide information and support to the Operation and NATS Management about current performance trends and exceptions, key performance indicators and the cost-benefit of potential options for improvement. A key support area within this work is communication/awareness of problem cause & effect and the impact of performance improvements.

4POA - Operational Analysis and Support to Service Performance: This project is designed to provide on-line analytical support to Senior NATS Business and Operational Unit Managers in order to enhance awareness & effectiveness of NATS Operational Service Delivery & Performance Programme.

**Approach**  |
4POA - Operational Analysis and Support to Service Performance: This work includes analytical assessment of problems & initiatives designed to enhance the awareness & effectiveness of NATS Operational Service Delivery & Performance (key customer area - Manager ACS Traffic Management). Primarily ongoing analytical support, the work covers assessment of current and future operational performance through concept evaluation, ATM system enhancement and human factors appraisal, with the ultimate objective of supporting the safe enhancement of NATS sector throughput capability. Work under this project also includes identification of workload and performance metrics that enables enhanced monitoring of performance and annual targets to be forecast.

**Expected results**  |
DELIVERABLES:

4POA - Operational Analysis and Support to Service Performance: Key tasks include:
1. TLPD sector complexity metrics (development & validation)
2. Swanwick Workload model (evaluation & assessment)
3. Human Factors (ad hoc call-off work in support of HMI, HSE & other ATCO related process/performance issues etc.)
4. Environmental Support Function (ad hoc call-off for policy & evaluation)
5. Standard Workload Unit (validation of European-UK ACC assessment results).
6. Strategic Performance:
   - Annual delay & performance target analysis
   - Operational Partnership Agreement (OPA) forecasting work
   - Analysis support for sector configuration and resource management (Summer/Winter)
7. ATM Development Support Work to:
   - Highway concept development
   - Airspace Management Cell
   - RATAMS/ETFMS benefit-data assessment
   - CFMU regulation effectiveness (sub-rates vs. global etc.)
8. Ad hoc Analytical Support Work:
   - Unit specific post-op sector performance/problem review work
9. Operational Performance Data & Support Tool Development
   - Development support (design authority) of the Sector Performance Characterisation Tool (SPCT)
   - Pilot-user of the CFMU Interactive Reporting (CIR) system
   - Development of:
     - what-if?
     - tools for delay-configuration options
10. Future Development Options:
   - Background information on airspace utilisation and environmental performance metrics:
     - post-operational sector workload indicators based on traffic numbers, complexity, occupancy, bunching and in-sector aircraft manoeuvres
     - traffic environment measures (traffic airspace/flight density metrics) as background support information to safety-related performance analysis/review.

**Applicability Timeframe**  | => 2000 and <= 2005
**Current Validation Level**  | N/A
**Target Validation Level**  | N/A
**Parent Project**  |
**Sub-projects**  |
**Sponsors**  |
**Partners**  |
**New This Year**  | ✓
**Included in Safety HI**  | ☐
**Included in SAFS**  | ✓
**Results in VDR**  | ☐
**Keywords hits**  | Safety, Metric
**Link to ESARRs**  | Implicitly related to ESARRs 2 and 3
**Category**  | Safety Management
**Topic**  | Safety Metrics
**NAT179: Operational Analysis and Support to Capacity**

**Start Date**: 01/04/2004  
**Finish Date**: 31/03/2005

**Objectives**

This project provides expert statistical analysis and fast-time simulation modelling support to assist and inform the Operational capacity development programme, to ensure a robust plan for delivery of capacity is developed within NATS.

**SUMMARY**: This Project supports Operational performance monitoring and improvement. It aims to provide information and support to the Operation about: Current performance; Relative Risks, Key drivers, Performance Indicators; Cost/benefit of potential improvements; Support for implementation of improvements; Including support to communication/awareness; Monitoring of effect of changes.

**Approach**

4COA - Operational Analysis and Support to Capacity: Deliverables tend to occur at set intervals (e.g., safety performance monitoring reports delivered quarterly), or on an as agreed basis (e.g. HF input to Level Bust initiatives).

**Expected results**

DELIVERABLES:
1. Analysis and modelling support to airspace development during the planning of re-sectorisations.
2. Modelling of the en-route/TMA/airport airspace and interfaces to provide a holistic view of ATC capacity.
3. Support to NATS operational planners in evaluating the capacity implication of future infrastructure development.

**Applicability Timeframe**: => 2000 and <= 2005

**Current Validation Level**: N/A

**Target Validation Level**: N/A

**Parent Project**

**Sub-projects**

**Sponsors**

**Partners**

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**NLR003: DYNAMO (Dynamic-mathematical-ATM Models)**

**Start Date**: 01/01/1994  
**Finish Date**: 31/12/2001

**Objectives**

To evaluate the safety and capacity of the ATM system in the light of emerging new concepts like free flight and 4-D navigation.

**Approach**

To be able to assess the safety and capacity of the ATM concepts, adequate methodologies have to be available to carry out quantitative and qualitative analyses of these aspects. These analyses should be able to provide data useful in optimisation and validation exercises. With this aim, stochastic dynamic models are being developed, in combination with the associated mathematical analysis methods. Emphasis will be placed on the further development of existing dynamic models and numerical methods for the evaluation of accident risk and the role of pilots and air traffic controllers.

**Expected results**

Tools and models to assess the safety and capacity of new ATM concepts.

**Applicability Timeframe**: => 2026

**Current Validation Level**: V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy  
**Target Validation Level**: V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**Parent Project**

**Sub-projects**

**Sponsors**

**Partners**

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Objectives
The objective of TOSCA-II is to assess, in a model and fast-time simulation environment, the impact of the introduction of a certain number of options in the EATMS concept onto the performance of ATM.

During Phase I of Work Package 4 (Designing EATMS inherently safe), NLR has demonstrated the potential of NLR's toolset TOPAZ (Traffic Organization and Perturbation AnalyZer) in assessing ATM safety. In view of this achievement, during Phase II the objective of WP4 is to evaluate and compare two types of advanced ATM concepts.

In Phase I of Work Package 6 (Potential impact of multi-sector planning) a study was conducted into the dimensioning of the Multi Sector Planning (MSP) problem of future ATM. In Phase II of Work Package 6 NLR will further elaborate the rich set of dimensions using a Human Factors based approach. In Phase II of Work Package 7 (Relation between airports and EATMS improvements) the perceived beneficial effects of existing EATMS concepts and predicted future demand composition on airport and extended TMA capacity will be investigated. The study will identify areas where more detailed concepts are needed and areas where a concept is missing at all from the point of view of airport/extended TMA capacity. Results will be obtained by using the fast time simulation model TAAM.

Approach
During Phase II of Work Package 4 two types of ATM concepts will be elaborated and evaluated: The first type is an elaborated enhanced design of current ATM. Through collaboration with EATMS design experts, a current ground based ATM design will be enhanced by introducing the most appropriate EATMS concept options. Subsequently, the safety effect of these enhancements will be evaluated with TOPAZ. The second type of advanced ATM concept is an autonomous aircraft concept, this will be evaluated on safety with TOPAZ through collaboration with FREER experts. In order to allow a comparison with the former design, the same CNS and automation technology as used above will be incorporated within the autonomous aircraft concept. In Phase II of WP 6 a Human Factors based approach will be used to further elaborate on the rich set of MSP dimensions identified during Phase I. Subsequently follow-on simulation work will be defined in order to better evaluate the large number of potential MSP solutions for advanced ATM. In view of the findings of Phase I, the expectation is that such type of simulation studies might better be handled through a high level Petri-net and PUMA type of simulations than through RAMS type of fast time simulations.

A bundle of proposals for new technical systems and operational procedures to enhance airport and TMA capacity is part of the current EATMS concept. In order to determine in Work Package 7 the relative improvements in airport capacity that could be anticipated with the implementation of the EATMS technologies it is necessary to estimate these capacity benefits at an early stage. Phase I of this study reviewed these technical systems and operational procedures and has identified several areas for the phase II modelling study. NLR will use the simulation model TAAM in order to study the effects of different proposed EATMS improvements and predicted future demand composition on airport capacity.

Expected results
- Evaluations of:
  - ATM safety assessment for two types of advanced ATM concepts
  - Multi Sector Planning on controller workload
  - the effects of different proposed EATMS improvements and predicted future demand composition on TMA's and airports capacity

Applicability Timeframe
=> 2016 and <= 2020

Current Validation Level
V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level
V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

Parent Project
EURO94: EATMS R&D Studies and Trials

Sub-projects
NLR046: Phase II of TOSCA II (Testing Operational scenarios for concepts in ATM Phase II)

Sponsors
EUROCONTROL: European Org. for the Safety of Air Nav.
NLR: Nationaal Lucht& Ruimtevaartlaboratorium

Partners
EUROCONTROL EEC
Luchtverkeersleiding Nederland / ATC the Netherlands
National Air Traffic Services Ltd
Sofreavia

New This Year
- Included in Safety HI
- Included in SAFS
- Included in VDR

Keywords hits
safety assess

Link to ESARRs
Implicitly related to ESARR 4

Category
Safety Management

Topic
Assessment of new system/procedure
### NLR049: TOPAZ - Traffic Organization and Perturbation AnalyZer

**Start Date**: 01/01/1997  
**Finish Date**: 31/12/2020

**Objectives**: Recognizing the significance of safety assessment as one of the primary filters in Air Traffic Management (ATM) NLR has initiated the development of the TOPAZ (Traffic Organization and Perturbation AnalyZer) methodology. TOPAZ provides feedback to ATM designers on the safety of the design at the required capacity level, and identifies the safety/capacity bottlenecks, also at an early stage of concept development.

**Approach**: TOPAZ is designed to provide feedback during all design and life stages of a safety critical operation. Embedded within a safety case approach, this safety information has already been recognized by other safety critical industries to be a valuable decision-support management tool.

**Expected results**: A toolset to validate new ATM concepts on safety and efficiency according to newly developed mathematical models.

**Applicability Timeframe**: => 2026

**Current Validation Level**: N/A

**Target Validation Level**: N/A

### NLR059: EUSAR (EUROCONTROL Safety Assessment Reports)

**Start Date**: 01/01/1999  
**Finish Date**: 31/12/1999

**Objectives**: Providing mathematical/statistical input to EUROCONTROL for various programmes in which safety aspects of the application of separation minima play a role, particularly the European RVSM programme.

**Approach**: Participation to the EUROCONTROL Mathematicians Drafting Group, MDG; advisor to the EUROCONTROL member of the ICAO RGCSP; liaison with the NAT Mathematicians Implementation and Working Groups, MIG and MWG. Working papers are reviewed and prepared in relation to the work programmes of these groups.

**Expected results**: Proposals for sample sizes to be used in the European RVSM monitoring programme; text contributions to the revision of the ICAO RVSM Manual: text contributions to the math supplement to the European RVSM guidance material.

**Applicability Timeframe**: => 2000 and <= 2005

**Current Validation Level**: V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

**Target Validation Level**: V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

### Keywords and Links

**Keywords**
- Safety assessment

**Link to ESARRs**
- Implicitly related to ESARR 2 and ESARR 4

### Project Details

#### Project
- **Category**: Safety Management
- **Topic**: Methodology development

#### Keywords
- Safety assessment

#### Results in VDR
- N/A

#### New This Year
- Included in SAFS
- Included in Safety HI
- Included in SAFS
- Results in VDR
- N/A

#### Sponsors
- NLR: Nationaal Lucht & Ruimtevaartlaboratorium

#### Partners
- Nationaal Lucht en Ruimtevaartlaboratorium

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**Sub-projects**

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**Sponsors**
- EUROCONTROL: European Org. for the Safety of Air Nav.

**Partners**
- Luchtverkeersleiding Nederland / ATC the Netherlands

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**Category**
- Safety Management

**Topic**
- Assessment of new system/procedure
In passenger transport missions, rotorcraft are operated in accordance with air traffic control procedures which have been established for the needs and performance capabilities of fixed wing aircraft, i.e., which incorporate trajectories with long rectilinear legs, moderate turns and shallow slopes in climb or descent. The specific ability of rotorcraft to take-off and land vertically, and to perform terminal manoeuvres in confined space, following routes which do not interfere with other air traffic, makes much more efficient operations possible.

The potential benefit of revised flight procedures (in terms of better integration with other air traffic and reduced noise impact) and the consequent development of intercity connections, will materialise only if such procedures can be shown to preserve or improve flight safety without degrading the vehicle performance in terms of its payload carrying capability.

The main objective of the RESPECT project is to develop improved terminal procedures and airfield operations (i.e., take-off and landing manoeuvres) for a wide spectrum of field configurations, including but not limited to airports (freeing-up valuable runway slots), city centre heliports and offshore platforms. The project will demonstrate the feasibility and safety of the proposed manoeuvres, with regard to the performance capabilities of existing helicopters, addressing in particular those critical flight conditions during which an engine failure could endanger the passengers and/or population on the ground.

The strategy to reach this objective is threefold:
- establish a common performance simulation code and validate it using existing flight data.
- use the code to analytically optimise trajectories and propose improved manoeuvres.
- substantiate the practical feasibility and repeatability of new procedures by means of piloted simulations and demonstration flight tests.

The expected results of the study will be a common performance simulation code, and several optimised and/or improved take-off and landing procedures. By mid 1999, the common code is running at all of the partner sites. The validation process against flight test data and flight manual charts has been achieved and judged satisfactory enough to use the code for procedures optimisation.


Applicability Timeframe => 2006 and <= 2010

Current Validation Level V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

Target Validation Level V4: System Development - Completion of Development and Integration

Parent Project

Sub-projects

Sponsors EC DG XII
NLR: Nationaal Lucht & Ruimtevaartlaboratorium

Partners Agusta - a Finmeccanica company
Centro Italiano Ricerche Aerospaziali
DERA Malvern
DLR Institute of Flight Guidance
EUROCOPTER
Nationaal Lucht en Ruimtevaartlaboratorium
Office National d'Etudes et de Recherches Aérospatiales
Westland Helicopter

New This Year

Keywords hits danger, flight safety

Link to ESARRs Implicitly related to ESARR 4

Category Safety Management Topic Assessment of new system/procedure
**Project**  
**NLR079: VEMER support - Safety Efficiency Environment Effect Reporting support**

<table>
<thead>
<tr>
<th><strong>Start Date</strong></th>
<th>01/01/2000</th>
<th><strong>Finish Date</strong></th>
<th>31/12/2005</th>
</tr>
</thead>
</table>

**Objectives**  
NLR support in development of Safety Efficiency Environment Effect Reports (VEMERs) for the LVNL.

**Approach**  
For every potential change in the ATM system of the Dutch ATM Service Provider (LVNL) the effects on Safety Efficiency and Environment are evaluated and reported. The reporting part uses the mechanism of Safety Efficiency Environment Effect Reports (VEMERs in Dutch). The decision making process regarding implementation, adaptation or improvement of changes in the ATM system is based on the results of these reports. VEMERs are also used for external communication with the CAA and other related organisations like KLM and Schiphol Airport.

NLR supports LVNL in the development of VEMERs through applied research based on existing safety-efficiency-environment methods using combined expertises like mathematical modelling, fast and real time simulations, operational ground and airborne knowledge, Air Safety database, expert judgement techniques and brainstorming techniques.

**Expected results**  
Company confidential LVNL reports

**Applicability Timeframe**  
=> 2026

**Current Validation Level**  
N/A

**Target Validation Level**  
N/A

**Parent Project**

**Sub-projects**

**Sponsors**  
LVNL: Luchtverkeersleiding Nederland

**Partners**  
Luchtverkeersleiding Nederland / ATC the Netherlands  
Nationaal Lucht en Ruimtevaartlaboratorium

**New This Year**  

**Keywords hits**  
safety-efficiency

**Link to ESARRs**  
Implicitly related to ESARR 4

**Category**  
Safety Management

**Topic**  
Assessment of new system/procedure

**Results in VDR**  

- Included in Safety HI: ✓  
- Included in SAFS: ✓  
- Results in VDR: □
The primary objective of the research can be formulated as follows:

The quantification and evaluation of the risks of simultaneous missed approach procedures on Schiphol runways 19R and 22, up to and including ILS CAT I circumstances.

Based on the results of the risk analysis, the safety of the independent use of runway 22 as a CAT-I ILS runway will be assessed. Furthermore, when necessary, recommendations on increasing the safety with respect to approaches on runway 22 will be made.

The research will focus on the current situation of the converging runways 19R and 22 at Schiphol airport, where the OCH of runway 22 will be reduced from 350 ft (AIP, EHAM AD 2-2-10.39) to values below 200 ft. This reduction will allow for the use of runway 22 as a CAT-I ILS runway, which will support the optimisation of the arrival scheduling, in particular for forecasted CAT-I conditions. However, a reduction of the OCH moves the decision point of making a missed approach closer to the threshold of the runway. This will affect the distance between the prescribed missed approach trajectories of runways 19R and 22, which could result in an increase of the collision risk for simultaneous missed approaches on these runways. In order to achieve the primary objective, the following project tasks are identified:

- development of a mathematical model for the uncertainties about the missed approach flight phase, taking into account the specific nature of the procedures and runway configuration of Schiphol runways 19R and 22;
- review of existing safety metrics and criteria for the collision risk between aircraft;
- quantification and evaluation of the collision risk related to simultaneous missed approaches at Schiphol runways 19R and 22 for the defined scenarios;
- execution of a sensitivity analysis of important missed approach procedure aspects;
- comparison of collision risk results against the objective safety criteria;
- provision of operational feedback to the RLD, concerning the (re)design of the proposed procedures at Schiphol runway 22; and,
- consolidation of the work undertaken, including conclusions and recommendations on the safety of the proposed procedures at Schiphol runways 19R and 22.

To support the execution of the identified project tasks, the following NLR facilities are used:

- NLR's Traffic Organiser and Perturbation Analyser (TOPAZ) toolset;
- NLR's Information System for SafeTy and Risk analysis (ISTaR).

The proposed reduction of the OCH of runway 22 will allow for the use of runway 22 as a CAT-I ILS runway, which will support the optimisation of the arrival scheduling, in particular for forecasted CAT-I conditions.

**Applicability Timeframe**

=> 2000 and <= 2005

**Target Validation Level**

V1: Concept - Principles of new concept agreed and incorporated into ATM Strategy

V2: Feasibility - Initial Proof of Concept ready for Implementation Decision

**New This Year**

☑ Included in Safety HI ☐ Included in SAFS ☐ Results in VDR

**Keywords hits**

risk analysis, risk AND safety, metric AND safety

**Link to ESARRs**

Implicitly related to ESARR 4

**Category**

Safety Management

**Topic**

Assessment of new system/procedure
The conventional method of executing the final approach segment in non-precision approach procedures is often called the "dive and drive" technique. After a number of, often interrupted, descents, level flight is resumed at the Minimum Descent Altitude (MDA), if no visual reference to the runway environment is obtained. At the Missed Approach Point (MAPt), a missed approach is initiated, starting from level flight.

A number of airlines has adopted a continuous descent non-precision approach profile. If visual reference is not regained in the descent, at or shortly before arriving at the MDA, an immediate missed approach is initiated in an "ILS-alike" way, instead of a level continuation until the MAPt. During this part of the procedure the aircraft may descend below the MDA, which is presently not permitted according to the obstacle clearance criteria in PANS-OPS Volume II. Nevertheless, the question is justified whether the closely controlled continuous descent non-precision approach procedure and an "ILS-alike" missed approach procedure is not by far superior, safety wise, to the conventional stepped descent non-precision approach procedure.

A comparison is made between the required obstacle clearance for the continuous descent non-precision approach procedure and the obstacle clearance provided by the PANS-OPS non-precision approach procedure criteria. Where necessary, additional restrictions are proposed.

The following problem elements can be identified in the basic philosophy of the continuous descent non-precision approach procedure:

- Does the MOC (Minimum Obstacle Clearance) contain sufficient safety to tolerate the often small infringement caused by the height loss during the transition from approach- to missed approach path in the initial missed approach segment or is an additional margin required.

- And if so, which margin is required.

- Are all non-precision approach criteria equally applicable to the continuous descent non-precision approach procedures.

The study will be limited by the following constraints:

- The study will be restricted to aircraft, equipped with basic avionics only for IFR flight, supplemented by DME.

- The published non-precision approach procedure preferably utilises distance information to a suitably located DME.

- The pilot has at his disposal on the instrument approach chart a table with distance/altitude information.

- The methods and non-precision approach criteria of ICAO Doc 8168 PANS-OPS Volume II are used to provide a reference regarding the acceptability of the risk for the continuous descent continuous descent non-precision approach procedure.

- Specifically the OCA/H, is determined according to criteria described in PANS-OPS Volume II, Part III (excluding RNAV/BARO-VNAV criteria).

- It is not the intent to lower the published OCA/H for a continuous descent non-precision approach procedure, relative to the stepped non-precision approach procedure.

- The study will be mainly qualitative.

- The GNSS procedure in its basic form and avionics does not differ significantly -as a non-precision approach procedure- from the VOR or NDB procedure.

The continuous descent non-precision approach procedure should be permitted with some additional obstacle clearance criteria.
## APPENDIX 3: VALIDATION LEVEL DEFINITIONS

<table>
<thead>
<tr>
<th>Validation Milestone</th>
<th>R&amp;D Activity</th>
<th>Typical R&amp;D Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifecycle start</td>
<td>Initial R&amp;D Commences</td>
<td>New R&amp;D Topic</td>
</tr>
<tr>
<td>Phase leading to V1</td>
<td>Innovative Research, New Concept Development,</td>
<td>A priori analytical study, paper description, discussion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Concept formulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strategy element formulation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R&amp;D reports.</td>
</tr>
<tr>
<td>V1</td>
<td>Concept</td>
<td>Principles of new concept agreed and incorporated into ATM Strategy</td>
</tr>
<tr>
<td>Phase leading to V2</td>
<td>R&amp;D Projects Definition and Initiation.</td>
<td>Initial user requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Initial Validation plan</td>
</tr>
<tr>
<td></td>
<td>Feasibility investigations and experiments</td>
<td>Analytical models</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Early prototypes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATM fast-time simulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stand-alone simulation of function</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Experimental trials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feasibility report on initial proof of concept</td>
</tr>
<tr>
<td>V2</td>
<td>Feasibility</td>
<td>Initial Proof of Concept ready for Implementation Decision</td>
</tr>
<tr>
<td>Phase leading to V3a</td>
<td>Requirements elaboration and definition SARPS development</td>
<td>Statement of operational context and scenarios</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statement of detailed operational requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statement of other (non-operational) requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Draft SARPS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requirements review &amp; approval by stakeholders.</td>
</tr>
<tr>
<td>V3a</td>
<td>Generic Specification</td>
<td>Requirements Defined</td>
</tr>
<tr>
<td>Phase leading to V3b and/or completion of V3</td>
<td>Development Programme Requirements validation Solution validation</td>
<td>Reports on requirements validation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advanced Prototypes</td>
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<tr>
<td></td>
<td></td>
<td>Detailed and/or large-scale real-time simulations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Real data feed, shadow mode of operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-operational trials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Validated SARPS</td>
</tr>
<tr>
<td>V3b/V3</td>
<td>Generic Specification</td>
<td>Requirements Validated</td>
</tr>
<tr>
<td>Phase leading to V4 (If applicable)</td>
<td>Commercial system/product development Manufacturing Integration of system elements Verification of compliance</td>
<td>Developed products (systems, sub-systems, components)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factory Integrated system</td>
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<tr>
<td></td>
<td></td>
<td>Verification support</td>
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<tr>
<td></td>
<td></td>
<td>Validation reports on factory acceptance testing.</td>
</tr>
<tr>
<td>V4</td>
<td>System Development</td>
<td>Completion of Development and Integration</td>
</tr>
<tr>
<td>Phase leading to V5</td>
<td>Deployment of production systems etc., at the local site Validation of actual procedures / tools / systems in preparation for cutover to operational use</td>
<td>Validated systems, tools, procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Validation reports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sign-off/certification for cutover to operational use</td>
</tr>
<tr>
<td></td>
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<td>Start of ‘a posteriori’ analysis</td>
</tr>
<tr>
<td>V5</td>
<td>Local Implementation</td>
<td>Sign-off for Operational Use</td>
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Key: items shown in italics are outside the normal scope of R&D activities and deliverables.
## APPENDIX 4: SAFETY-RELATED ACTIVITIES IN VDR

<table>
<thead>
<tr>
<th>Project in VDR</th>
<th>ARDEP Reference</th>
<th>Status</th>
<th>Type of Safety Validation Performed</th>
<th>Comment</th>
</tr>
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<tbody>
<tr>
<td>A-SMGCS</td>
<td>EUR268</td>
<td>In progress</td>
<td>Objective and Subjective Measurements (Simulation)</td>
<td>Further safety validation planned</td>
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<tr>
<td>AFAS</td>
<td>NLR072 (sub-project of CEC105)</td>
<td>Complete</td>
<td>Objective Measurement (Simulation)</td>
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<tr>
<td>APPROVE</td>
<td>CEC118</td>
<td>Reporting</td>
<td>Objective Measurement (HIL) Planned</td>
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<tr>
<td>CAMES</td>
<td>EUR309</td>
<td>In progress</td>
<td>Objective and Subjective Measurements (HIL) Planned</td>
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<tr>
<td>CASCADE</td>
<td>CEC040</td>
<td>In progress</td>
<td>Safety Study</td>
<td>Study of actual air-ground communication related incidents</td>
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<tr>
<td>CoSpace</td>
<td>EUR096</td>
<td>In progress</td>
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<tr>
<td>DADI-1</td>
<td>CEC071</td>
<td>Complete</td>
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<td>DADI-2</td>
<td>CEC103</td>
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<td>DOVE</td>
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<td>In progress</td>
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<td>EACAC</td>
<td>-</td>
<td>Complete</td>
<td>Subjective Measurement (Simulation)</td>
<td>Real time experiments in support of projects</td>
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<tr>
<td>EATM-ASA CR (CORA)</td>
<td>EUR183</td>
<td>In progress</td>
<td>Formal Safety Assessment Objective and Subjective Measurements (Simulation)</td>
<td>Further safety validation planned</td>
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<tr>
<td>EMERALD</td>
<td>CEC063</td>
<td>Complete</td>
<td>Not known - limited VDR information</td>
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<td>EMERTA</td>
<td>CEC087</td>
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<td>Not known - limited VDR information</td>
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<td>EOLIA</td>
<td>EUR146</td>
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<td>FARAWAY</td>
<td>CEC059</td>
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<td>Objective and Subjective Measurements (Simulation)</td>
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<tr>
<td>Gate to Gate</td>
<td>EUR217</td>
<td>In progress</td>
<td>Objective and Subjective Measurements (Simulation)</td>
<td>Further safety validation planned</td>
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<td>Test of the use of the Integra Safety measurement metric</td>
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<td>LEONARDO</td>
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<td>EUR255</td>
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<td>Project in VDR Reference</td>
<td>ARDEP Reference</td>
<td>Status</td>
<td>Type of Safety Validation Performed</td>
<td>Comment</td>
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<td>MFF CEC115</td>
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<td>Included specific scenarios investigating safety aspects. Further safety validation planned</td>
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<td>Not known - limited VDR information</td>
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<tr>
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<td>Not known - limited VDR information</td>
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<tr>
<td>NEAP CEC068</td>
<td>Complete</td>
<td>Objective and Subjective Measurements (Simulation) Safety Study</td>
<td>Safety Study was an investigation into certification issues.</td>
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<tr>
<td>NUP I CEC093</td>
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<td>Formal Safety Assessment</td>
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<tr>
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<tr>
<td>PETAL 1 EUR030</td>
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<td>PHARE NAT121</td>
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<td>SCS-M-21/FAST - Complete</td>
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</table>

**Notes on “Type of Safety Validation Performed”:**

A simple classification has been used to try and describe, in overview, the nature of the safety investigation carried out by the projects as indicated by the content of their deliverables as captured in the VDR:

- **Objective Measurement (Simulation)** – Safety investigation using computer-model based techniques and/or simulations, shadow mode and flight trials with active controller/pilot participation etc. The investigation uses independent, normally quantitative, measurements of safety indicators such as loss of separation, runway incursions, STCA alerts, communication errors, comparison calculated position vs. actual measured position etc.

- **Subjective Measurement (Simulation)** – Safety investigation by one or more simulations, shadow mode and flight trials with active controller/pilot participation etc. using subjective, normally qualitative, measurements of safety indicators such as participants’ opinion captured by questionnaire or debrief sessions etc.
• **Formal Safety Assessment** – A safety assessment carried out using a recognized and accredited method, such as ED78-A, comprising operational hazard analysis and safety objectives/requirements identification for a clearly defined operational service.

• **Safety Study** – An ad hoc study, normally a desk based literature review or expert judgement activity, investigating a specific aspect of safety, for example certification issues or past actual safety incidents.

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