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Message from the Staff Committee (SC)

EUROCONTROL and the Experimental Centre

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Is everybody telling the truth?

Are the airline hub and spoke strategies, shuttles, alliances, for the passengers' benefit?

Are the airports allocating airport slots commensurate with actual departure/arrival rates?

Are the ATM organisations going to provide the capacity they promise?

Are all the European programmes and the technological developments going to provide the expected capacity?

After a temporary relief (compared to 1999!) in 2000, models show that delays might build up again in the coming years.

Are the different actors again going to point a finger at each other while the passengers are going to wait more and more in crowded airports and crowded skies?

Hopefully the passengers will organise themselves in powerful enough lobbies backed by political support. The European Commission on passengers' rights may, in the future, appear as important as the HLG (High Level Group of the European Commission) report in making air transport evolve. Thanks to their pressure one can hope that all actors will get together to understand the contributing factors to sustainable growth of the air transport industry and even, more ambitiously, to multimodal transportation.

At the EEC we intend to recognise air passengers as a "new" and important stakeholder in the context of a possible wider Agency approach to be implemented in the future in agreement with the Provisional Council and to work harder for a safer, more efficient, cleaner and quieter air transport.

To meet the new challenges that are subsequently facing us, EUROCONTROL and the European Commission are developing a global strategy that will redirect the actions of all the aviation community.

As one of the key actors in ATM R&D, the EEC strongly supports this strategy.

In this context, four main orientations for improvement have been identified:

- re-position Safety as the first priority;
- give a significant push to the implementation of the really promising new ATM concepts;
- develop the tools and the methods for the best use of available capacity, in order to support a sustainable growth of the aviation industry;
- stimulate innovation for preparing the future.
In 2000, the current Staff Committee's mandate was extended by 9 months in order to make necessary changes to its structure. For various reasons, most of these changes did not take place, and elections were finally held in December under the old rules. It had been a difficult period, for the Bretigny SC, which nevertheless continued to represent the staff despite the difficulties presented by a lack of guidance from the Central Committee.

The SC has been a leading participant in the Working Group for the setting up of a Child Development Centre for Bretigny staff (Experimental Centre and IFPU2), similar to the one already existing for Brussel's staff. The aim is to make it operational during summer 2001. The SC also took an active part in the newly-created Suggestion Box Working Group.

The SC continued its usual activities such as participation in various management meetings, sometimes as observers in the Core Management Meeting (CMM) and as active participants in others like the Extended Management Meeting (EMM) or the Personnel Management Meeting (PMM). The SC sent representatives to the Recruitment Procedure, Promotions Procedure, Contact Group, Canteen and ASAP (Alcohol and Substance Abuse Policy). The SC received an increasing number of staff complaints, requests and suggestions which were followed up. A presentation of all of these activities was made at the SC Open Forum on 9 September 2000.

We hope that the continuation and deepening of serious dialogue between management and the Staff Committee will permit staff representatives to have a real impact on decisions, with a view to mutual benefit.
EUROCONTROL is the European Agency for the Safety of Air Navigation. Founded in 1960 to oversee air traffic control of the then Member States, EUROCONTROL has today a mission to manage and coordinate the development of a uniform European ATM system within the framework of the ATM2000+ strategy.

In June 1997, the ministers of transport of the EUROCONTROL Member States signed the revised Convention which expands EUROCONTROL’s responsibilities and creates a new organisational and management structure.

At the end of 2000 EUROCONTROL comprised 30 Member States:

Germany, Austria, Belgium, Bulgaria, Cyprus, Croatia, Denmark, Spain, Finland, France, Greece, Hungary, Ireland, Italy, The Former Yugoslav Republic of Macedonia, Luxembourg, Malta, Moldova, Monaco, Norway, the Netherlands, Portugal, the Slovak Republic, the Czech Republic, Romania, the United Kingdom, Slovenia, Sweden, Switzerland and Turkey.

To support the tasks confided to EUROCONTROL by its Member States, the organisation has a headquarters (located at Haren, Belgium) and five external services: The Central Flow Management Unit (CFMU), the Institute of Air Navigation Services (IANS), the Maastricht Upper Area Control Centre (MUAC), the Central Route Charges Office (CRCO) and the EUROCONTROL Experimental Centre (EEC). Also part of the Agency but administrated independently are the Performance Review Unit, which supports the Performance Review Commission, and the Safety Regulation Unit, which supports the Safety Regulation Commission. Finally there is a small unit in Prague, the CEATS Strategy Planning and Development Unit (CSPDU).

HQ

EUROCONTROL Headquarters are based in Haren, Belgium, in the vicinity of the Brussels National Airport. Here, operational and engineering services are provided on various technical programmes for Member States, as well as financial, legal, linguistic and administrative services for all EUROCONTROL establishments.

Special organisational arrangements have been made for the management of the European Air Traffic Management Programme (EATMP) on behalf of the 38 Member States of the European Civil Aviation Conference (ECAC).

CFMU

The CFMU is co-located with EUROCONTROL headquarters at the Haren site. It is tasked with providing air traffic flow management services, such as slot allocation and re-routing directives, to the 38 ECAC Member States. The CFMU is supported by two Initial Flight Plan Processing System Units (IFPU-1/2), one co-located with the CFMU at Haren, the other located at the EEC site, Brétigny-sur-Orge, France.

IANS

IANS, located in Luxembourg, provides operational, technical and managerial training to ATM staff in the ECAC Member States, and in the Agency.
MUAC
MUAC provides air traffic services in the upper airspace of: Belgium, Luxembourg, the Netherlands and northern Germany. Co-located at this EUROCONTROL site is a control unit of the German ATS (DFS), allowing close civil/military coordination in this airspace. MUAC has handled over 1184 000 flights in 2000.

CRCO
States provide ATC facilities and services to ensure the safe, efficient and expeditious flow of air traffic through their airspace. The Central Route Charges Office bills and collects charges from users of en-route air traffic services on behalf of 29 States participating in the EUROCONTROL Route Charges System and for 7 other states under bilateral agreements. The CRCO has expanded its services to cover billing and collection of terminal charges (four agreements at the end of 2000).

The EEC
The Mission and Strategy of the EEC have been developed and refined in recent years.
Details of the projects, activities and results are provided in the rest of this annual report.

In 2000 the EEC hosted several important meetings:

- **Inauguration of the renovated EEC Building**, September (see page 52);
- 300 visitors from "La Semaine de la Science d’ADP - Aéroport de Paris" (October) with real-time simulation, fast-time simulation and the Multi Cockpit Simulator;
- **EUROCONTROL Development, Validation and Standardisation of ATM Systems Workshop** organised by ERIS (EATMP) Reference Industry-based ATM Simulation and trials platform Programme (November);
- CARE, ASAS Technical Interchange Meeting (Cooperative Actions of R&D in Eurocontrol, Airborne Separation Assurance System), (November);
- **EATCHIP III ATM Operational Concept Demonstration Days “Controller Working Environment for Tomorrow** (December).

This year the Experimental Centre was responsible for the organisation of the 3rd **USA/Europe Air Traffic Management R&D Seminar**, which was held in Naples, Italy, in June 2000. This conference is organised by turns under the leadership of the FAA or the EEC and takes place every 18 months. It has become a meeting place for the presentation and discussion of state-of-the-art ATM R&D, to which this time around 150 researchers of both sides of the Atlantic had been invited. For detailed information on this event, on the previous Seminars in Orlando, Florida, USA, 1998 and Saclay, France, 1997 and on the next Seminar, planned for December 2001 in Santa Fe, New Mexico, USA, see [http://atm2001.eurocontrol.fr](http://atm2001.eurocontrol.fr). At this occasion the EEC presented IPSky.

The EEC also participated in several other international Exhibitions/Conferences:

- **ATC Maastricht 2000** (February) with E-cockpit for Freer Flight, STO RIA/ARTAS, EATCHIP 3 and Audio/LAN;
- **ATCA Atlantic City** (October) with Digistrip, EATCHIP3 and STO RIA;
- **IST 2000** (Information Society Technology), Nice (November), organised by the European Commission, with DIGISTRIP (demonstration), IPSky (presentation);
- **IATA European Technical Conference in Brussels** with Freer Flight (Spring 2000);
- **Ipv6 Forum Summit Birmingham** (May), presentation IPSky.
Central European Air Traffic Services (CEATS)

The CEATS programme, an Agency/EA T M P initiative, aims to establish a regional ATC centre in central Europe on behalf of seven EUROCO NTROL Member States. The EUROCO NTROL Agency has been entrusted with the establishment and operation of the air traffic services and support units.

The Experimental Centre is leading the CEATS project to implement the CEATS Research, Development and Simulation Centre (CRDS) in Budapest. The CRDS will validate main technical and operational choices during the implementation period of the CEATS UAC. Subsequently it will provide a focal point for ATM R&D in central Europe and will partner with the EUROCO NTROL Experimental Centre.

The project started informally in Spring 1999 and was formally initiated in October 1999. The project team is drawn from many Agency services in a matrix organisation and the project reports to the Head of the CEATS programme, the Head of the CEATS Strategy Planning and Development Unit (CSPDU), Prague.

The major part of the project was accomplished during 2000. Procurement embraced building, equipment, services, and recruitment of staff, and simulation support to CEATS took the form of one fast time simulation and the preparation phase of one real time simulation. The first phase of the real time simulation will execute at the EEC in April/May 2001. The CRDS building is provided by the Hungarian ATS provider, LRI, and will be rented by EUROCO NTROL. The building was delivered at the end of 2000. The simulation platform, which is 100% compatible with the platform at the EEC, will be delivered to the CRDS in January 2001. Staff will take up their duties at the CRDS in a phased manner during the first six months of 2001.

The CRDS will become fully operational on 01/ 7/ 2001

The Experimental Centre Consultation Group (ECCG)

The Experimental Centre Consultation Group (ECCG), one of the EUROCO NTROL Organisation consultancy groups, was established to advise the Director General on the role, strategy, and performance of the Experimental Centre. The members of the ECCG are drawn from the EUROCO NTROL Member States, ATM service and systems providers, airspace users, airports, R&D establishments, the European Commission and the EUROCO NTROL Agency, and thus represents the full spectrum of EEC Stakeholders.

In 2000 the ECCG met on 09 May at the EEC. In addition to the standard ECCG agenda (EEC Business Plan and EEC performance), the meeting was dedicated to the following special topic: What capacity increases can R&D really deliver.

Christian Pusch, EEC Core Management, gave a presentation on the newly launched Agency Strategic Performance Framework (SPF). The required future performance of the European ATM system is mapped onto the contributions which can be expected from the different operational improvements. It was emphasised that at this stage, figures were for illustration only.
Alain Printemps, CENA, gave a short presentation on the DNA capacity plan and the recent Eurocap (capacity) study. Volker Heil, DFS, focused on the Free Routes Airspace Project. A lively debate followed the chairman's introduction, where he urged the ATM community to challenge conventional wisdom. The debate was concluded as follows:

1. R&D must validate all benefits (not just capacity) which are claimed for operational improvements;
2. The validation of the Free Routes concept should continue but results must be clearly and honestly presented. There may be benefits;
3. The CFMU must be further enhanced;
4. The lack of controllers is a business planning issue, but solving the problem is key to achieving capacity increases;
5. Research into human factors must be strengthened;
6. Investment in innovative research must be increased;
7. Safety is the number one priority, capacity will follow. Research into safety issues must be augmented;
8. Industry must be involved early on in the R&D lifecycle;
9. ATCOs must be fully involved in the R&D process. We must better understand the problems which ATCOs have with current systems.

European Commission

During the Year 2000 the European Commission remained one of the most important partners for R&D in the EEC, mainly through its Fifth Framework Programme (FP5) on Research and Technological Development. Projects in various domains (ex. Safety, Performance, CDM, Simulations etc) were conducted in cooperation between the European Commission and the corresponding Business Areas at the EEC.

Marketing and Communication

In the year 2000, the inauguration of the renovated EEC building offered an incomparable opportunity for marketing and communication activities. Most of our stakeholders participated in the two days R&D symposium covering a wide scope of presentations and demonstrations of projects under the theme of "Partnership in ATM Research and Development". On the third day, a large number of high level personalities of the ATM world assisted to the round tables. Ministers, ambassadors and local authorities joined them for the official ceremony of the inauguration. More details on this important event are given at the end of the present report under the heading of "Development of organisation and infrastructure".

The EEC has taken advantage of this opportunity to develop and publish a complete set of brochures, both as a general presentation of the centre and its business and as a more detailed description of projects. All the projects which were either the subject of a presentation or which were demonstrated during the symposium edited such a brochure. Some twenty were largely distributed and are since then permanently available in the entrance hall.

The inauguration event was also the first opportunity to install and exploit the new show-room which is now available, following the completion of the renovation works. It was also decided to take advantage of the new facilities to propose and organise workshops and seminars on topics of interest to R&D in the ATM domain. During the last quarter of 2000, three of these workshops were already held.
During 2000, the EEC analysed the replies to the second stakeholder/customer survey which had been conducted at the end of 1999. 97% of our customers replied that they are satisfied with the service provided by the EEC, 33% of them being very satisfied.

An internal marketing workshop was organised with the aim to better understand who are the EEC’s customers, better adapt our offer of services and products to their expectations and improve our communication.

The ATM Forum, a Web based forum aiming at stimulating the ATM R&D debate, was developed in 2000. A pilot implementation, focusing on the ASAS community will be launched in the beginning of 2001 with a planned complete implementation in June.

The industrialisation process was actively pursued. One of the referred workshops, organised in partnership with EATMP, was dedicated to this subject.

The product catalogue introducing EUROCONTROL, the EEC, the industrialisation process and the related offer, has been widely distributed during the year 2000.

Several new proposals and requests for industrial use of EEC products have been received, corresponding licence agreements have been negotiated and signed in 2000.
The total approved budget for the EEC in 2000 was 55.3 MEUR of which more than 98% was spent. The graph “Budgetary Expenditure for 2000 – EEC Budget” shows the repartition between the different nature of expenditure (salaries/pensions, assets and operating). Taking into account the credits that have been delegated by our various sponsors [EATMP, CFMU, European Commission, CEATS, PRU, Maastricht and IANS], the total expenditure amounts to 68.5 MEUR as shown in the second graph; 65% is committed to core business projects.

The trend chart with the evolution over five years is a clear indication that the performance of EEC expenditure, including the external funding, has improved substantially. This is a direct result of the evolution of our new organisation and the measures taken to improve the financial processes (organisation of regular budget checkpoints and feedback as well as the development of user-friendly tools).
Work Programme

The EEC work programme covers Core Business projects and activities, Enablers and Support activities (general services, infrastructure, human resources, finance, technical services and management). The 2000 figures confirm the general trend over 1996 to 2000 of a significant transfer of resources from facilities and support to the projects (exception in 1999 due to the payments for the EEC building renovation). It is a direct consequence of the EEC policy to draw as much as possible the EEC resources towards the projects which provide a direct benefit to the ATM community.

The EEC projects and activities are grouped in the new organisational entities. The pie chart shows the relative percentages of the use of resources in Core Business Areas, Core Business Enablers.

In 2000, the EEC Core Business included more than 75 projects and activities requiring close monitoring at both financial and project management levels by means inter-alia of regular budget checkpoints and project reviews.

The main outcomes of the 2000 work programme are further presented in the following sections of the present report.

People

At the end of 2000, the number of budgetary posts amounted to 273, of which 263 were occupied. Other personnel, including seconded staff, contractors, interim staff and students amounted to a total of 224. The Human Resources Development Centre of Expertise also manages the 74 budgetary posts of the Initial Flight Plan Processing Unit (IFPU-2) located at the Brétigny site.
The specific actions undertaken by the Human Resources Development Centre of Expertise throughout 2000 were:

- reorganisation: the new structure is now composed of 4 entities dealing respectively with: integration of newcomers, staff management, training and management of internal EEC training;
- implementation of a streamlined procedure in the selection of new recruits;
- participation in the different tests (for example O PQ - occupational professional questionnaire) and in the interviews for new recruits, organisation and coordination of tests at local level and interpretation of the O PQs;
- participation in the recruitment of CEATS officials;
- organisation of "welcome breakfasts" in order to improve the induction of the newcomers;
- participation in the Working Group "arrival-departure" in order to optimise the welcome and putting materials at the disposal of the new comers;
- participation in the Working Group in charge of the improvement of the use of IT tools at the EEC;
- improvement in the welcome of "stagiaires" and students and proposals made to Headquarters in order to have parts of this service outsourced to a specialised Association;
- implementation of an internal procedure with regard to the renewal of "5 year contracts";
- in cooperation with Headquarters, implementation of decentralised procedures in certain domains: pensions, part-time work, etc...;
- implementation of an internal procedure with regard to the probation periods for the newly recruits;
- in cooperation with Headquarters, participation in the HiRIS project (staff data base);
- management of the different budgets of the Centre of Expertise;
- in cooperation with Headquarters, drafting of rules concerning the secondment of Agency staff;
- in cooperation with Headquarters, drafting of letters and studies concerning specificities of the French fiscal system (CSG, CRDS, ...);
- participation in Headquarters projects: Job Management, Enhancement Programme, etc...;
- preparation of the PMM (Personnel Management Meeting) meetings.

Training

Training continues to be an important activity at the EEC, an enabler of individual high performance and self-fulfilment, and a driver of future business success. It is actively pursued by staff and supported by management.
The major Management programmes run in 2000 included:

- Five waves of the Project Management Skills Development Programme were sponsored by DHR. We also organised our own Brétigny wave for Project Supervisors, Project Leaders and Managers;
- “Project Overview” for Project participants;
- People Management for Project Leaders;
- Using Microsoft Project98 for Planning, Managing and controlling projects in EATMP;
- S.M.A.R.T: an EEC candidate attended this programme focused at the A5, A4, and A3 Management level.

A high level of training in the Air Traffic Management domain continued to be provided in 2000; IANS provided a significant number of courses which are a core element of our business.

Human Resources training concentrated in four areas:

- Individual Coaching for Heads of Centres of Expertise and Project Managers;
- Individual competency training (e.g. Effective Presentation Skills, Team Management, Effective Meeting Management, Negotiating effectively, Effective Report Writing Personal Stress Control and Developing your Personal influence and impact) aimed at improving our ability to provide high quality professional services to our customers;
- An introduction to Marketing;
- Training of Key Users on HiRIS.

Language training continued to be a significant activity in 2000 with a high participation of staff. Five languages were covered (English, French, German, Italian and Spanish). Half of the Centre’s staff participated in the language training programme;

A number of staff was trained in Web page creation and maintenance in order to continually improve both external and internal communications and transparency;

A significant number of conferences and workshops on ATM, Information Technologies, Quality and Human Factors were also attended.

Overall there was an increase in training effort and a slight decrease in the training expenditure in 2000. Total effort amounted to 3166 man-days, an increase of 10.6% over 1999. This works out at approximately 11 days effort per EEC staff member for 2000 compared to 10.6 days of effort in 1999.

The final training budget allocation for 2000 was 335.700 EURO, a decrease of 9.5% over 1999. The training budget was totally committed and spent.
Support to European enhanced Flow Management (ATFM Studies)

ATFM simulations have been performed at the EEC either on request of the CFMU/FMD (Flow Management Division) or in support of the EAG (European ATFM Group), showing still an increase up to 50 experiments.

The ATFM team has been particularly involved in providing decision information for the elaboration of the Standard Routeing Schemes in particular for the Iberian Axes. The approach, based essentially on simulations using the pre-tactical COSAAC simulator, has become an essential step in these scenarios elaboration, highlighting the possible network effect of any given routing scenario. The approach has also supported the definition of sector opening schemes, hence contributing to the best use of capacity.

The Study of Application of ATFM Priorities has been conducted under the European Commission’s sponsorship, leading to the completion of an interim report on the initial evaluation of Priority Strategies in November 2000. Scenarios were identified as well as simulations requirements for those strategies affecting the slot allocation mechanism. This work is planned to be completed in early 2001. Some early views have been developed as a result of the analysis. Some proposed strategies are likely to provide operational benefits. It appears that improvements should be sought particularly in the arrangements and procedures for management of crisis situations, perhaps through creation of identification of specific crisis management responsibilities.

The development of CARAT, a prototype tool for constrained re-routing, has been completed to the level required both for a stand alone use in the context of route catalogue generation and for its integration in the CFMU systems.

A preliminary investigation has been conducted to investigate issues identified in the Independent Study of ATFM processes. The initial study proposals have been considered in the elaboration of the next CFMU-EEC ATFM Study Programme.
Overall Performance Analysis and Strategic Target Setting

Capacity Planning

The FAP, Future ATM Profile, methodology has been enhanced and used to:

- forecast the ATFM delay in Europe for the Summer 2000;
- set the Short-Term Capacity targets 2001 for the European Air Navigation Services;
- propose a target scenario for the Medium-Term Capacity Enhancement Plan in support to the ECIP.

A special study was also conducted for UK NATS to evaluate the London ACC planned capacity improvements for the Summer 2001.

A further study, using the FAP tools, has been launched to investigate various scenarios for a sustainable traffic growth. This study seeks to identify the current performance of the ATM system in terms of delay and to predict how this delay will evolve over time given a number of operating strategies on the part of the airlines.

Performance Studies

Several studies were conducted in support to the PRC reports:

- **Week/Weekend Delays**
  The study showed that the high delays per flight observed in weekends are not due to a reduction in capacity but to a different traffic pattern, both in space and time;

- **Civil/Military**
  The average space-time occupancy for military purposes in core Europe during weekdays is around 5%, with values up to 27% in some smaller States. During weekends the occupancy rate is less than 1%;

- **Over-deliveries**
  There are safety implications if the maximum sustainable sector workload is exceeded. ATFM is intended to protect sectors against overloads by limiting through-flows. It appears that significant over-deliveries are still present;
  Over-deliveries are probably largely due to non-adherence to ATFM slots;

- **Unused Slots**
  Unused slots also have a significant impact (+20%) on ATFM delays. These are mainly due to the misuse by airspace users of CFMU systems and lost ATFM slot improvement opportunities.

- **Cost benchmarking of Air Navigation Service Providers**
  A study, based on econometric techniques, has been conducted by the EEC to support the Performance Review Unit (PRU) in the analysis of air navigation cost effectiveness. Some important cost drivers have been identified. The number of kilometres flown, the traffic density, the average flight length, and the percentage of over-flying traffic allow, at the State level, to assess with a good accuracy the level of air navigation costs.
  The model suggests that diseconomies of traffic density exist, it predicts that, all other things being equal, a 10% increase in traffic generates a 13% increase in total costs.
  On the other hand, the model identifies slight economies of scale in respect of FIR size or route length controlled (an increase of 10% in the average controlled distance decreasing total costs by some 3%, all other things being equal).
Investigation of Air Traffic Complexity

The need to understand how air traffic complexity could potentially impact performance indicators (and especially the cost of providing the capacity) is becoming essential. A study investigating the production of Air Traffic Services as a process composed of a set of activities has been led.

The developed methodology captures the relevant components of the air traffic complexity, independently of the local equipment, procedures and size of the control areas. The results contribute to a better understanding of the discrepancies observed between the Air Traffic Service Providers as far as the controller workload is concerned.
Improvement of Information Exchange (Collaborative Decision Making-CDM)

During this year, the main part of the European Commission project “Air Collaborative Demonstrator” (A-CDM-D) has been carried out. The main objective of this project was to establish the feasibility and to assess market perspectives of increased information sharing by Airlines, Air Traffic Services providers, Airports, the Central Flow Management Unit.

The project has included production of a demonstrator for a CDM system to share information amongst the operational participants in the project. Experiments were carried out to identify gaps and poor quality information flows between airlines and airports, focused on operations around Brussels Airport. Data providers included British Airways, Sabena and Swissair, Brussels Airport, and there were also inputs of CFMU data.

The results have demonstrated several areas for possible operational improvements, such as the need to give airports of arrival a better picture of events.

In parallel the process of building acceptance of CDM amongst the ATM user community has continued. The IATA-EUROCONTROL website (http://www.euro-cdm.org) is providing a key means of communication with a wider audience through frequent releases.

Economic Studies

In addition to the cost benchmarking study, 2 projects were launched in the economic domain:

- **PAMELA**
  A first version of the PAMELA tool, a macro-economic model of the European ATM system, was delivered. The validation and verification phase, which has started in 2000, will continue in 2001 on real cases/studies. The PAMELA model will help the ATNPs to take long-term strategic decisions.

- A study on the impact of changes in ATC costs (cost elasticity) on airline behaviour.
Since 1991, the EEC has developed its Safety Monitoring projects, with the objective to contribute to an increased understanding of safety risks in the European ATM System. In 2000, the scope of safety studies was enlarged beyond Airborne Collision Avoidance System (ACAS) to include studies related to metrics and costs, human factors, methodologies. The Safety activities are organised in two threads:

1) Monitoring: foster the collection of safety data in order to support a better understanding of key risk areas;
2) Studies: Assess safety in current and future ATM systems. Predictive models and safety assessment methodologies were used. Human factors analysis gave new perspectives on safety issues related in particular to controllers work.

Safety Monitoring

The projects aim to develop and harmonise the collection and analysis of safety occurrences in the ECAC area, using experiments when appropriate. The aim in the longer term is the development and testing of Safety Indicators.

ACAS

On 1st January 2000 the first phase of the ACAS implementation Mandate came into effect for aircraft with more than 30 passenger seats or more than 15 000 kg max take off weight. As a result, many new airlines equipped with ACAS and the number of reported incidents has steadily increased. 1713 events were recorded and analysed in 2000 (with several hundred still to be reported from the UK, France and Germany) compared with 1991 events in 1999. Based on this data an annual monitoring report for 1999 has been developed. When radar data was available for an event, it was closely analysed and feedback given to the airlines and ATC authorities concerned. In addition, tools were developed to assist Member States to do analyses of this type themselves. The aim is for these tools to be progressively distributed to operational sites.

ASMT

The project promotes for the purpose of safety improvement the concept of automatic monitoring of safety events in ATM Operations. It is supported by the ATM Automatic Safety Monitoring Tool (ASMT), developed in co-operation with Maastricht/ UAC and EATMP. In parallel, the ASMT/OPS Study is being conducted of the operational impact of automatic safety monitoring at various locations. The study lays particular emphasis on Human Factors and assists in the preparation of EATMP guidelines on automatic monitoring, as one element of an open and blame-free safety culture.
The first step of ASMT - proximity events - has been put in OPS Evaluation in Maastricht in August 2000. A second step, for ACAS events, has been developed in co-operation with the ACAS Group and will be demonstrated in London at the beginning of 2001.

The project will include co-operation with other interested ATC Units in Europe in 2001-03.

IREN-HEIDI

This project fosters the harmonised collection and exchange of reported safety occurrences; it aims to facilitate the eventual emergence of an Incident Reporting European Network (IREN) and the definition and development of European safety analyses and new safety indicators. It included contribution to the Harmonisation of European Incident Definitions Initiative (HEIDI), conducted within the EATMP Safety Group in 98-99.

In 2000, the project supported the inclusion of HEIDI into the European Commission Joint Research Centre aviation reporting tool ECCAIRS and in the ICAO/ADREP2000 standard for aviation safety reporting. In 2001, the project will support both data exchange between ATM organisations with an Interchange Format, and reporting to the Safety Regulation Unit in line with ESARR2.

Safety Analysis and predictive Studies

Contribution to INTEGRA for Safety Metrics
INTEGRA is a project initiated by the CARE consortium in 1999, in order to develop a methodology to evaluate through simulations the impact of future concepts on ATM Safety, Capacity, Environment and Efficiency. Safety metrics have been defined in 2000 and will be tested through simulations 2001.

Contribution to Aster
Started in 2000 up to 2001, in the context of the European Commission 5th Framework Program, the project performs TLS, Regulation & Costs studies, on the global European Air Transport system. The EEC contribution completes the multi-disciplinary approach with the ATM related aspects.

SpecRL for Safety analysis, the Medium Term Conflict Detection (MTCD) case
The project aims to elaborate a new safety analysis method based on executable specifications applicable to highly interactive functions of ATM in co-operation with the M.I.T. The Medium Term Conflict Detection (MTCD) Functional Hazard Analysis has started in 2000.

ACAS Analysis
In addition to co-ordinating the set of European ACAS studies, the EEC researched the interaction between RVSM and ACAS using real-time and fast-time simulation data. Also the ASMT was enhanced to capture resolution advisories and related data which is available from Mode-S ground stations.
Environmental Studies

Since forming a small group at the Experimental Centre in late 1998, significant results were delivered in 2000 for this new area of activity. Principally during this time, projects were divided into two distinct areas:
- noise nuisance around airports;
- fuel burn and emissions.

In addition to the work described here, the group made a significant contribution to international efforts within working groups of ICAO-CAEP (the ICAO Committee on Aviation Environmental Protection) and ANCAT (the ECAC committee for the Abatement of Nuisance caused by Air Transport).

Noise nuisance around airports

ENHANCE

The European Harmonised Aircraft Noise Contour modelling Environment (ENHANCE) is a partnership project sponsored by EUROCONTROL/Airports Operations, involving teams from several Eurocontrol member states. It complements the work already in progress through the ICAO/CAEP Noise Modelling working group (Model 1), with the objective to validate current noise modelling practices and tools with "real world" measured data.

ENHANCE project is working in three areas to improve European Aircraft Noise Modelling facilities:
- Validated aircraft noise, performance and procedure data;
- Impact of errors on the modelled noise values (what type of errors?);
- Provide an interface shell for PC-based noise models.

To date, initial data has been collected from Manchester and Madrid airports (and operators BA & Iberia), and preliminary results have been produced on error sources (published at Internoise 2000, Nice 29/8/00). New aircraft noise and performance data has been delivered by Aerospatiale for Airbus A340, A330 and A320 models, and made available to world noise modelling community. A first version of the ENHANCE tool, integrating the INM model, and permitting improved noise studies using radar or simulator track data, has been delivered to a number of National Administrations.
Noise impact studies

Using the advanced methodology developed through use of the ENHANCE tool (detailed modelling of aircraft movement and performance), a number of noise impact studies have been conducted in the last year at the Experimental Centre. In order to create realistic track data for proposed new procedures, real-time simulation data was sometimes used. The purpose was to evaluate dispersion on the ground resulting from the new procedures, and their impact on local populations. Notably, towards the end of 2000, work started on a study for the Paris region, examining the impact of proposed new flight paths around Orly. The study was requested by the French DGAC, recognising EUROCONTROL's neutral position in such a politically sensitive area of work.

Fuel burn and emissions

Quantifying current gaseous emissions & assessing the benefits of CNS/ATM

Work started in support of ICAO-CAEP WG 4 (Emissions and Global Fuel Burn), where EUROCONTROL worked with the FAA to develop a common methodology. Through this work, the EEC calculated the total fuelburn in the ECAC area for a baseyear (1999) and for future years (2005-2015), assuming fleet growth and fleet mix changes, and taking into account ATFM. In order to perform this work, it was necessary to adapt some in-house tools and develop new approaches for calculating fuelburn and emissions depending on phase of flight. Further refinement of this work is in progress, involving validating individual aircraft calculations with operational data. Using the newly developed methods, work started on taking output from fast time simulations for the Free Routes project and calculating fuelburn and emissions for the different scenarios. Other major EATMP projects are also expected to be clients for such an assessment.

Performance Assessment

Working in close collaboration with the Performance Review Unit, an initial set of environment performance indicators for ATM were developed during the year. These initial indicators will be implemented and published during 2001.

From left to right: Laurent Cavadini, Agnes Quesne, Ian Fuller, Sandrine Carlier, Frank Jelinek and Ayce Celikel.
ATM Concepts and Studies covers a number of subjects including controller tools and role development, free flight, human factors and concept studies. Sponsors included several EATMP programmes and services, and the European Commission.

Controller tools and role development

The final EATCHIP III simulation took place in March of 2000, with the principle objective to further examine the operation of Medium-Term Conflict Detection (MTCD). Results were globally positive, with general acceptance of the concept by participating controllers. MTCD now moves into a phase of 'shadow-mode' trials with the MTCD pre-operational trials project. For this the main activity in 2000 was to study the feasibility of installing a version of the MTCD for shadow-mode trialing at 3 locations: Malmo, Rome and Maastricht. Results in all cases showed that the exercise will be feasible, and work will continue in 2001.

The Multi-Sector Planning (MSP) project finally got off to a start in 2000. MSP potentially covers a number of concepts ranging from planning with extended trajectories through to the use of global synthetic views of traffic complexity. A study was launched to investigate the different options, and analyse potential cost and safety benefits. The study is seeking stakeholder views, and establishing interfaces with traffic flow (CFMU) and interoperability issues, and will report early in 2001. In addition, co-operation was established with Belgocontrol to develop a prototype of the Tactical Load Smoother tool for use at CANAC. Complexity parameters were developed for this difficult airspace, and a prototype will be installed in the operations room in 2001.

Other activities in this area included an EVP/CORA-1 simulation at the end of 2000, which set out to examine task redistribution within controller teams, and also to compared different types of conflict notification displays. The level-2 Conflict Resolution Assistant (CORA-2) project was launched to develop methods and tools to support the controller in the resolution of conflicts. More specifically, CORA-2 is investigating an advisory-based system, which will present the controller with ranked resolution advisories from which he can choose. The controller thus remains at the centre of any decision process.

The project started with an extensive feasibility study and stakeholder survey, and subsequently developed Operational Concept of Use and Safety Strategy documents. A by-product of this work is the development of a state-of-art user-centered requirement engineering process which will be usable in other projects.
Airborne operations and delegation of separation

**Freer-flight** continued as the key Agency-sponsored project in studies of airborne operations and delegation of separation. Its objectives are essentially to determine the operational feasibility, applicability, and potential benefits - in terms of safety, capacity and overall efficiency - of the delegation of separation assurance from ground ATC to aircrew. Highlights of 2000 included two EACAC (Evolutionary Air-ground Co-operative ATM Concepts) real-time simulations which examined limited delegation of separation assurance task for station keeping and crossing conflicts. Results show that from a controller perspective, the delegation allows for a significant reduction in the number of instructions given. This is thought to reflect a possible workload reduction. In terms of efficiency, time, distance and fuel consumption are reduced, and it appears that trajectories become more stable. The limited delegation concept was demonstrated to a wide audience at Maastricht 2000 and IATA European Technical Conference in Brussels.

The widespread interest in delegation of separation responsibilities to the cockpit (ASAS) has led to a number of European co-operative efforts being launched. During 2000 the Experimental Centre agreed to be an active partner in the Agency CARE-ASAS (Cooperative Actions of R&D in Eurocontrol - Airborne Surveillance Assurance Systems) initiative, Mediterranean Free Flight (MFF), Aircraft in the Future ATM System (AFAS), MA-AFAS and INTENT projects.

Human factors and controller working positions

EEC Human Factors (HF) expertise was distributed over a number of projects, partly providing direct support to simulation and other projects in order to ensure the full integration of HF considerations throughout the development process. In addition there were two projects specifically supported by the Agency HUM domain.

The **CoRe project** (*CORE requirements for ATM Working Positions*) continued to address current short-comings in workstation design, development, evaluation and acceptance processes. It focuses on problems that derive from difficulties of communication between users, designers and developers. With the help of the EEC SEU, a UML based process was put in place developing a "Glue Model" to integrate both functional and component views of the working position. In October the first release of the corresponding HMI platform was used to perform a simulation experiment addressing a number of issues in HMI evaluation (feasibility of gaze analysis, font quality). A sound foundation for requirements-based CWP evaluation is being established. This work, on developing evaluation as a key step in user acceptance, is complemented by studies on Controller Trust being carried out by a doctoral student from Trinity College, Dublin.

The **IMPACT project** developed methods and tools to assess the impact of future ATM system developments on the controller's job, and was successfully completed in 2000. Results include the MATOS (Modelling Actor’s Tasks to Organise Specifications) toolset capable of supporting a range of task analysis methodologies. The MACE study complemented this by developing a process for quantifying the impact of changes to controller working positions, whether they be tool developments or HMI upgrades, and the GET-IT subproject developed an advanced interactive computer-based training aid.

Concepts and validation

The Experimental Centre took an active role in the **EC TORCH project** (Technical, Economical and Operational Assessment of an ATM Concept achievable from the year 2005) both as expert consultants, and managers of some work packages.
The Eight States Free Routes Project (FRAP) executed four real-time simulations in 2000: three small-scale (8-10 positions) and one large-scale (25 positions). These studied various aspects of the free-route scenario including interfacing with non-free-route airspace, requirements for support tools, interfacing with military airspace etc. The large-scale simulation covered the entire northern part of the 8-states airspace. (A second large-scale simulation for the ‘southern’ part will take place in early 2001). Results, detailed in a number of reports, indicate that the concept is sustainable. The results will be further elaborated together with the other activities within the Eight States Free Routes Project, and a validation report will be produced in 2001.

Finally, the Experimental Centre played an active part in CARE-Integra, managing workpackages for this project which seeks to develop a set of universal metrics by which simulations can be assessed. There are four metrics designed to address capacity, safety, efficiency and environment, and these will be validated and exploited during the course of 2001.
The CNS Business Area has been created in year 2000. Under its cover a number of existing projects from the (Tele-) Communications, Navigation and Surveillance domains are executed. Some projects have been regrouped or reorganised during this period. In 2001 the Business Area will continue to concentrate on strategic projects, that means to emphasize on the cockpit part of CNS, and to enable synergy in bringing together the Communications, Navigation and Surveillance components.

**ATN Trials Infrastructure Project**

This year the ATN (Aeronautical Telecommunications Network) activity has mainly been focused on PETAL-II (Preliminary Eurocontrol Tests of Air/ground Datalink) project. The objectives of the EEC are to evaluate and integrate the ATN through different test steps with the project partners, in preparation of the final objective to fly the American Airlines Boeing B767 against Maastricht UAC and Miami Control.

The EEC has given support to validate the telecommunications infrastructure on the different levels. Applications (Controller-Pilot Datlink Communications) have been tested in several live trials involving other European research centers and their aircraft, i.e. BAC 1-11 from DERA (Defense Research Agency) and the Citation from NLR. These trials have been conducted using satellite communications. The ATN laboratory has successfully tested Rockwell Collins airborne interface against MADAP (Maastricht Automatic Data Processing and Display System) at Maastricht UAC in order to prepare end to end validation over VHF Datalink Mode-2 (VDL Mode2) infrastructure. The VDL Mode2 infrastructure will be provided by ARINC (Aeronautical Radio Inc). Successful interoperability tests have also been conducted with the ARINC ground infrastructure for ATN, deploying on the European side the ATN router implementation from the PROATN consortium.

**IPSky**

The year 2000 has been a very successful year for the IPSky (Internet Protocol in the Sky) project. It was part of the successful consortium (including Thomson, University of London and British Telecom) that completed the European Commission 4th framework project, that demonstrated IPv6 (Next Generation Internet Protocol) over satellite and Asynchronous Transfer Mode network. It was presented at the ATM R&D Conference in Naples sponsored by EUROCONTROL and the FAA. It was presented at the IPv6 Forum in London, and at Nice for the European Commission. It has been successfully demonstrated many times at the EEC showing security, mobility, quality of service and group communication using standard off the shelf software and products.
Total Information Sharing Project

The Total Information Sharing Project (TALIS) is an innovative air-ground datalink project that aims at research of mass-market commercial-off-the-shelf technologies as those known from the Web and the Internet in the context of the Aeronautical Telecommunications Network (ATN).

The year 2000 has been characterised by the preparation of a proposal for the European Union's 5th Framework Programme, in conjunction with an industrial consortium; and on some preliminary prototyping to evaluate the technological feasibility. Both activities continue in 2001: The proposal has been submitted at the end of the year and is under evaluation at the time of editing this document; and the prototyping has led to further architectural choices and will continue in 2001.

RVSM Height-Monitoring Project

Three main tasks can be distinguished for 2000:

- installation and operation of the Height Monitoring Units;
- development and operation of the RVSM (Reduced Vertical Separation Minima) Monitoring Cell;
- development of the RVSM compliant aircraft and height measurement databases.

All three HMU (Height Monitoring Units) became operational in 2000. The Linz HMU started operations in May and has since monitored over 100,000 aircraft tracks. Over 3000 airframes, based on distinct Mode-S addresses, were identified in Linz. The Geneva and Nattenheim HMU started operations in November.

All measurement results from the three HMUs, around 1500 daily, are automatically send to the RVSM Monitoring Cell at the Eurocontrol Experimental Centre. The measurement results are then stored in a tailor made database for further processing. To enable a flawless operation of the Height Monitoring System, all three HMUs are controlled and monitored by the Monitoring Cell. Whenever necessary, additional on site support is given by the Radio Luxembourg Group for the Nattenheim HMU and by the National Administrations of Austria, Switzerland and France for the Linz and Geneva HMU.

The databases used for the RVSM height-monitoring programme were made fully operational in 2000. Datalinks with the RVSM User Support Cell (USC) in Brussels were upgraded to a 2Mbps connection to facilitate the transfer of large amounts of data. Also a connection with the RVSM database used for the North Atlantic RVSM programme was realised. This connection allows both RVSM programmes to use each other’s measurement data.

ADS Studies and Trials Project

The ADS (Automatic Dependent Surveillance) Studies and Trials Project conducts a technical assessment of the three ADS-Broadcast candidate technologies (namely, Mode S Extended squitter, Universal Access Transceiver, and VHF Datalink Mode 4). This assessment is part of the Eurocontrol ADS programme which aims towards the harmonised implementation of an ADS infrastructure in Europe. In the year 2000 flight trials were conducted for all three datalinks. Extensive simulations are also being run to evaluate the capacity and performance of the links. Numerous results have already been disseminated to Eurocontrol Stakeholders, FAA, and various standardisation groups as well as on the Internet. There is close collaboration with the FAA Safe Flight 21 Programme through the joint Technical Link Assessment Team which meets monthly to evaluate the results of the trials and simulations. A joint report will be published at the end of March 2001. This report will provide the technical elements for the eventual datalink decision.
EEC-MEDUP

ADS-MEDUP (MEDiterranea Upgrade Programme) is a TEN (Trans European Network) funded Programme aiming to build up a CNS/ATM infrastructure that started at the end of the year 2000. It deploys components over a large area in the Mediterranean airspace. The infrastructure provides technical and application enablers based on ADS concept to support the investigation of new operational procedures and the related ATM services requested to cope with the current situation of air transport.

EEC-MEDUP is the EEC Project driving the EUROCONTROL participation to ADS-MEDUP. Its objectives are to facilitate experiments for Airborne Separation Assurance based on aircraft that are equipped with ADS-B. Therefore several cockpit simulators will be upgraded with the Traffic Information Service, a complement to ADS-B which uplinks surveillance information from the ground to the air. This will make use of the Advanced Radar Tracker 2 (ARTAS) prototype. In addition to the infrastructure, the EEC-MEDUP project will also issue safety studies and a cost-benefit analysis.

SURVITE

The SurvITE project continued the validation of ARTAS (ATM suRveillance Tracker And Server system) and experimentation of the advanced radar tracker 2 (ARTAS2) prototype. Integration and validation has been enabled through the delivery of live data for several projects, e.g. the ADS Studies and Trials Project, ARTAS Evaluation Programme, Inter ARTAS co-operation, the STORIA (Software Tool for Online Recording and Interactive Analysis) database and analysis tools, AVENUE (ATM Validation ENvironment for Use towards EATMS) platform and PROVE projects. For this means the ARTAS Tracker 2 was upgraded to operate with live data. Experimentations of ARTAS2 have been conducted for enhanced surveillance tracking testing using Downlink of Aircraft Parameters. The CNS Business Area enforced its ties to industry by the integration of ARTAS with industrial ATM systems, i.e. by a co-operation with Alenia-Marconi and Lockheed Martin.

MODE-S

The Mode-S project has continued its support to the Mode-S airborne implementation in supplying error reports on the transponders and the Pre-O perational European Mode S (POEMS) stations, and specifying and implementing a transponder test bench. Several transponders have been tested during the year, and the Trials-Ground Datalink Processor been updated for POEMS, for distribution to national administrations.

The contribution to edition of ADS-B documents for several regulatory authorities (EUROCAE, RTCA, and ICAO) has been continued. The range/ fruit/ pollution flight trials jointly conducted by FAA, DFS and EUROCONTROL for the Mode-S 1090 MHz ADS-B have successfully been supported.
The year of 2000 saw the birth of a new business area in the centre, dedicated to Innovative Research and Development, as a confirmation to its commitment to the future of Air Traffic Management. The mission of this new business area is to generate and to federate innovations, seeking further improvements in safety, capacity, efficiency and better protection of environments.

Pursuing the objectives that were set-up for innovative research at the Experimental Centre in the past years, new approaches for innovations are regrouped into three main threads:

- **Innovative Investigations**;
- **Doctoral and University Studies**;
- **Collaboration with other Research Institutes**.

### Innovative Investigations

Includes investigations from bottom-up viewpoint, with strengths on the changes to current applications and/or working methods, covering all segments of potential innovations, from application of emergent technologies to long-term operational concepts:

#### Sectorless, Flight-based ATM

Investigations have started to explore the concept following which a controller may control a limited number of flights, from a TMA (Terminal Control Area) to another, instead of concentrating on one sector with multiple flights entering and exiting the sector. This sector-less concept is based on the assumptions that air situations can be reconstructed without radar but is backed up by recent technological advances in satellite communications and navigation. Motivations for this investigation are led by the belief from which constraints imposed by sectors could be freed to allow growth in terms of capacity, without affecting safety and all by improving efficiency needed by airlines.

#### Added-Value Tools and Methodology

- **Advanced conflict modelling in HIPS (Highly Interactive Problem Solver)**. This work investigated the latest techniques in probabilistic conflict detection, and applied one of them to the HIPS conflict resolution support tool. A final report entitled “Comparative analysis of probabilistic conflict prediction approaches in ATM” was delivered in December 2000. This report followed two days of controller trials, when the combination of HIPS and NLR’s probabilistic collision detection techniques was examined from an operational perspective.

- **Use of new technologies for next generation CWP (Controller Working Position)**. This study proposed to examine new concepts for ATC Controller Working Position using British Telecom’s SmartSpace technology as a starting point and potential stimulator of ideas. The EEC version of this equipment will be known as SmartCWP. A version of the PHARE TLS was implemented on the platform.

- **Tactical Load Smoother (TLS) complexity display for supervisor support**. The TLS was developed as part of the PHARE program as a tool to calculate probable future traffic loading and complexity over several sectors. This investigation was successfully transferred to EATMP Automated Supports to ATC programme in late 2000.

### Applications of Emergent Technologies

- **IPSky - Internet Technology in the Sky** - is an investigation that encompasses simple technology watch. By setting its objectives to not only on the investigation of the availability of this next generation internet protocol, but also on the assessment of its features with respect to the particular needs of communications in Air Traffic Management applications, it also explores industry-driven type of standards. Year 2000 has seen its achievement in the experiments and tests on security encoding, service continuity, and service quality as an infrastructure for future communications needs in ATM.
Mobile Wireless Technology applied to Pilot-AOC (Aeronautical Operational Communications), via Personal Digital Assistants, to investigate potential applications for further collaborative decision process at airport level. This investigation will demonstrate the potential use of wireless technologies as a mean for more efficient communications.

Application of 3D Graphics Technology for Display Device - Work has been undertaken to explore the use of 3D-information space to be presented to controllers. A rapid model was built to experiment with controller’s look and feel. Application to Stack Management that requires levelling information has been identified as promising, and will be pursued.

Doctoral and University Studies

The second parallel approach for innovation at the Experimental Centre consists in collaborating with universities. This thread covers the topics that may need in-depth investigations and/or theoretical foundations. In the course of the year 2000, two PhD theses were concluded with the Technical University of Compiegne, France and to be started in early 2001:

- **Dynamic Reconfiguration of Sectors.**
  This study is starting with an analysis of traffic flow patterns and a theoretical approach exploring Operational Research techniques to dynamically reconfigure sectors with respect to their workload and flow continuity constraints.

- **Co-ordination of Conflict Resolution under Optimisation Constraints.**
  This thesis overlooks the current state-of-the-art in the field of planning and ordinal optimisation with a specific goal of defining the theoretical foundation for the co-ordination of conflict resolution in Autonomous Aircraft and in Flexible Used of Airspace Operations.

This category of studies will be increased in the future.

Collaboration with Other Research Centres

This thread includes the projects that are initiated from a promising technology, product or process developed at another research centre, combined with the operational expertise at the Experimental Centre, to explore its operational use in ATM.

**SkyTools & Digistrips**

This project pursues a tight CENA – EEC collaboration project for CW P tools initiated in 1998. CENA provides the technology while the EEC provides the operational environment and validation context. The technological concept used is based on technical mass-market products, innovative graphical design with animation, interactive modes, large flat screens and touch input facilities combined with gesture recognition. The idea is to emulate conventional paper flight strips with multimedia technologies, and thus to enhance the functionality offered to the controllers using the benefits of computerisation, especially in terms of information sharing and feedbacks. The challenge of this project is to make an ecological interface that respects controllers’ skills and know-how whereas it introduces new technologies. Year 2000 has been successful in terms of presentation, demonstration, exhibition (ATCA, IST2000), providing very positive feedback from several hundreds of controllers. Meanwhile, some discussions are in progress with the industry for the industrialisation and commercialisation issue. The Year 2001 will be dedicated to the validation of this concept through the LOOK project described hereafter.
Understanding and evaluation of controller working methods and controller environment in terms of safety, performance, automation limits are key issues for the design and validation of controller working position environment. Therefore, there is a strong need to develop a new psychosocial and multidimensional human factor approach.

The project objectives are twofold:

- Proposing and validating a new safety-oriented human factors multidimensional approach (physiology, psycho-sociology, cognitive ergonomic, HMI ergonomic, ...)
- Evaluating different alternatives of controller environment (paper strip, Digistrip and stripless) as a support of this approach.

In 2001, the project will focus on the preparation of the experimental methodology and the execution of the first validation exercises using real-time simulation facilities.

Partners involved are DFS, ENAV, DGAC, CENA, ROMATSA, Sienna University, IMASSA, LAA, and CETCO PRA.
The ATM Implementation Business Area provides:

- Simulations to explore the feasibility and benefits of new airspace organisations, new traffic flow management schemes, and new working methods and systems.
- Support to states for CWP specification in preparation for new system procurement.

Simulation Activities

While simulations remain a core activity at the EEC, following the reorganisation, simulation activities can now be found in several of the business areas. Partly as a result of this distribution process, and partly in response to a decrease in demand in the Simulation Partnership Scheme, during 2000 the EEC has been able to accommodate all requests for simulations without assistance from Partnership Scheme providers. With the refurbished operations room and extended experimental room we have provided a significant increase in simulation availability to our clients. We remain committed to partnership in this field and will make proposals for change to the principals of the Partnership Scheme that we hope will offer prospects for an even wider partnership.

In previous years we have spoken of our wish to provide performance indicators that are meaningful to our stakeholders. In the 1999 report, greater emphasis was placed on the qualitative implementation benefits that can accrue from our simulation activities. We have continued in the same direction for this report. During 2001 we shall review the two quantitative elements of our published indicators (number of simulations and availability of simulation time for our clients) to determine the added value they contribute to our Business Plan. Graphs of the progression of these indicators (encompassing simulation activities in all Business Areas) are shown below:
3 States (Austria, Hungary and Slovakia) real-time simulation - 10 January to 4 February 2000

A total of thirty-nine controllers (15 Austrian controllers, 13 Hungarian controllers and 11 Slovak controllers) participated in 51 simulation exercises.

This simulation examined the interface between the terminal areas around the airports of Bratislava, Budapest and Vienna, and studied the effects of the planned new lower and upper route network ARN V3 (ATS Route Network Version 3). The simulation also took into account the impact of Civil-Military co-ordination in line with the Flexible Use of Airspace concept for Slovakia and Hungary.

The resulting revised airspace was generally well received. However, some problems remain and further studies are required before the new route structure and sectorisation can be implemented.

Ireland 2000 real-time simulation - 6 to 31 March

The Irish Aviation Authority (IAA) plans to introduce a new ATM System – CAIRDE 2000 (Civil Aviation Integrated Radar Display Equipment). This system will enable the IAA to provide safe and cost-effective services to its customers in the first decade of the new millennium, in line with the forecast growth in air traffic.

The main simulation objectives focused on the evaluation of the operational impact of a new HMI (Human Machine Interface) and assessed the potential roles anticipated for executive and planning controllers. Secondary objectives concentrated on sectorisation configurations and operating procedures specific to the Shannon and Dublin air traffic control centres.

The airspace simulated included Enroute, TMA, Approach and Departure sectors as well as the Oceanic interface with the Shanwick Oceanic Control Area (OCA). This simulation was extremely important to Ireland, as part of the IAA installation plans of its new ATC system. The active involvement of the controllers in the design and evaluation of the system and airspace proposals was of enormous value for the long-term success of the CAIRDE project. The simulation output will be a significant contribution to the new system specification.

Evaluation of the Total Airspace and Airport Modeller (TAAM)

In our constant endeavour to ensure that the models used for fast-time simulations are the most appropriate for the task, in partnership with the Airport Operations Unit (AOP) we conducted a simulation with TAAM produced by The Preston Group/Boeing.

The EEC evaluated the airspace modelling capabilities and AOP the airport aspects. A limited comparison was made between the operational capabilities of TAAM and SIMMOD (an alternative airport model used by the agency) and between TAAM and the Reorganised ATC Mathematical Simulator (RAMS).

The results of this operational evaluation have shown that TAAM is the most appropriate modelling tool currently available to meet our needs to represent airport operations and assess airport capacity. It has also shown that it has attributes to model airspace issues that could be used effectively to obtain a view on economic, safety and environmental issues.

TAAM gives a good global workload assessment but does not provide as detailed and comprehensive breakdown of controller workload as RAMS. It would therefore be complementary to the use of RAMS and existing ATFM models.

The evaluation team recommended the purchase of TAAM licences and subsequently a contract has been negotiated for the purchase of five licences over a period of three years. The first three will be installed early in 2001 at the EEC and AOP unit in Brussels.
Common Simulation Project for the Balkans - CO SIBA

Initially, the CO SIBA project included the whole Greek and Former Yugoslav Republic of Macedonia’s (FYROM) airspace. The ATM providers concern was to improve the current air traffic situation and to cope with short and mid-term traffic forecasts related to:

- The implementation of new working methods resulting from the implementation of new ATC systems in both countries,
- The yearly traffic increase (30% from 1999 to 2000) and the traffic expected for the 2004 Olympic games,
- The implementation of the new Athens airport (March 2001),
- The re-opening of traffic flows over Serbia and Kosovo,
- Implementation of RVSM (with emphasis on RVSM/non-RVSM interfaces).

In this respect, two simulations were run at the EEC Brétigny in year 2000:

- A real-time simulation concentrating on Athens TMA operations with a particular focus on how to make the best possible use of the two parallel runways of the new airport (Elefterios Venizelos), the results of this element of the project should help the Greek authorities implement the appropriate changes to the airspace structure and procedures to ensure a safe and expeditious start to operations at the new airport.
- A model simulation to determine the most appropriate en-route airspace organisation within Greece and FYROM airspace. The output from this study will contribute to the 2001 real time simulation.

During the year, Albania was included in the Project and the model study was extended to accommodate their requirements. The real-time simulation covering the 3 FIR’s is planned for November/December 2001.
5 STATES (the Benelux countries, Germany and Northeast France)

The 5 States real-time simulation project is an airspace organisation project designed to investigate the effect of the proposal for airspace reorganisation.

This project comprises two sub-projects: a model-based study to be followed by a real-time simulation supplied with the results of the model-based exercises:

The model-based exercises were executed at the EUROCONTROL Experimental Centre from March 1998 to May 2000. This large study measured the radar controller workload for 88 core sectors from 10 ATC Centres. Traffic in the 5 States area is expected to grow by 50% between 1997 and 2005. Initially, promising results were achieved when the ATS route network version 3 (ARN v3) and its associated re-sectorisation including a division flight level between high- and low-level sectors of FL295 (FL265 in France), and RVSM. Unfortunately, when the same airspace structure was tested with a 2005 traffic sample the results showed that more than half of the radar controllers in the core area were heavily to severely loaded during their busiest three-hour periods.

Based on results supplied by the model-based study, a four week real-time simulation in March/April 2001 will explore a subset of sectors, different arrangements for the division of control between upper and lower airspace sectorisation. This simulation will explore five scenarios, using eight different airspace organisations to address the specific needs of individual states. It is hoped that the results will facilitate ATM capacity improvements and help in the realisation of benefit offered through the application of RVSM.

Simulator Validation using Hungarian Airspace - 06 to 23 June

The primary objectives of this real time simulation were technical, and sought to validate operationally the ESCAPE (EUROCONTROL Simulation Capability and Platform for Experimentation) Platform on the OASIS (Open Architecture for Simulation Systems) middleware and to ensure, that the simulator running on the new middleware would be robust enough for future ATC real-time simulations. The secondary objectives were operational, and allowed for further evaluation and testing of scenarios common to the 3 States simulation in Hungarian airspace with some modifications to the traffic samples and to the new STARs for Budapest airport.

The simulation was successful in achieving many of the technical and operational objectives. The simulator is still running on the existing middleware. This exercise was instrumental in ensuring that the OASIS middleware will be used from September 2001 for all future real-time and R&D simulations.

RVSM6 CYPRUS Real Time Simulation - Sept 25 to 20 October

RVSM 6 was the sixth in a series of Real Time Simulations commissioned by EUROCONTROL, studying the effects of RVSM introduction and specifically transition issues for the airspace of Nicosia (Cyprus) and Southern Athens (Greece) Flight Information Regions (FIRs). The three-week simulation was the first to be carried out in the renovated EEC Operations room and involved the use of a modern HMI platform. Simulation participants included controllers from Cyprus, Egypt and Greece, and observers from the Lebanon, Morocco and Syria.

More information can be found at: www.eurocontrol.fr/projects/rvsm6/index.htm
Three of the sectors performed the transition from non-RVSM to RVSM levels and vice versa for aircraft entering/exiting RVSM airspace. The main problem associated with this task is that three flight levels (FL310/350/390) change parity thus, modifications are required to ATC procedures and the route network to avoid aircraft converging at the same flight level.

The simulation concluded that the use of unidirectional routes was considered to be the most appropriate method to handle transition. The controllers felt positive and confident using RVSM and the associated ATC procedures. The switchover from non-RVSM to RVSM planned for EUR RVSM airspace on the 24 January 2002 was also successfully simulated.

### Oslo ATCC Model Simulation

Started in April 2000, as a follow-up to an analytical evaluation undertaken by EUROCONTROL's AMN (Airspace domain), it concentrated on the OSLO UIR/FIR airspace, including the OSLO TMA. The objectives of the study were:
- To evaluate the existing traffic regulation system and related sector capacities at OSLO ATCC.
- To develop proposals in view of increasing capacity within OSLO ATCC taking into account possible interactions in the neighbouring FIRs (more particularly Stavanger and Trondheim).

This involved the investigation of:
- The current and future airspace structures: ATS routes, SID/STAR for OSLO Gardermoen airport, ACC and TMA sectorisation, holding procedures...
- The current and future working positions, in terms of sector manning (Executive ATCO, Planning ATCO and Assistant) and controller workload.
- Military activity;
- The results of the AMN evaluation of OSLO UIR/FIR.

The simulation working group decided in December 2000 that the objectives of the study were fulfilled after the run of 4 scenarios containing 11 exercises. The most promising exercises will be retained for evaluation using a real time simulation planned to take place in autumn 2001 in Oslo. Final presentation of the results will take place in February 2001.

### Support to states for CWP specification in preparation for new system procurement.

The objective is to place the results of developments at the EEC directly into Member State facilities to enable operational appraisal to take place, assist in industrial procurement and shorten the implementation phase.

### Italian Interface - ITI

The ITI project is the result of a request from ENAV - the Italian ATM provider - for the provision of HMI design specifications and prototypes for new Italian controller working positions. The new HMI specification includes Enroute and Approach requirements inline with EATCHIP Advanced ATM Functionality. The project started in November 1998 and was based on results of a similar project for Sweden and Denmark (DSI), as well as the results of the EATCHIP3 simulations programme.
The project will deliver:

- Detailed HMI specifications to clarify operational requirements to industry;
- Representative working prototypes of En-Route and Approach Control Working Positions;
- Risk reduction to potential delays in system deliveries;
- A forum to involve and co-ordinate with industry;
- Deployment of EUROCONTROL HMI research results.

The project will finish at the end of February 2001 following a validation through real time Simulation of the interface, with the delivery of HMI specifications and prototypes to ENAV.

Swisscontrol Interface - SWI

The SWI project is the result of a request to explore HMI issues for the future ATMAS system that is being specified for En-Route and Approach Controller Working Positions for Switzerland. The project started in 1999 and was based on results of a similar project for Sweden and Denmark (DSI).

The project has delivered:

- Detailed HMI specifications to clarify operational requirements to industry;
- Representative working prototypes of En-Route and Approach Control Working Positions;
- A highly adaptive, generic requirement capture and validation infrastructure available to industry and also swisscontrol;
- Risk reduction to potential delays in system deliveries;
- A forum to involve and co-ordinate with industry;
- Deployment of EUROCONTROL HMI research results.

The project terminated end of June 2000 following delivery of HMI specifications and prototypes to the bidders as specifications of the future system requirements.

Continued support to the Swiss ATMAS project during August-December 2000

Following SWI, further support was provided to swisscontrol during the review of the Airsys ATM core product which is based on the system currently being provided to Sweden known as Sweden 2000 or S2K. The EEC assisted Swiss experts in defining the system enhancements that will be required should Airsys emerge as the winner of the competition for the contract for ATMAS. Many improvements have now been specified for both HMI and system functionality with the aim of meeting the challenge facing Switzerland situated in the centre of the core area of Europe with ever increasing traffic volumes. The current planning foresees ATMAS contract signature during the 1st qtr 2001 with entry into service in the UAC Switzerland to be located in Geneva during 2004.

The European ATC Pre-Operational Validation and Experimental Trials Platform (PROVE)

PROVE is a project jointly funded by EUROCONTROL and the European Commission to install a dedicated live field trials validation infra-structure. The project was supported by Denmark (SLV) and Sweden (LFV) who hosted the infra-structure in their respective operational centres and assisted in a validation study of System-Supported Co-ordination (SYSCO). Two studies were conducted, one in Malmö (Sweden) only, during December 1999 - EEC Report 353, and one multi-centre trial between Malmö and Copenhagen (Denmark) in April/May 2000 - EEC Report 354.
The principle results were:

- The implementation of SYSCO between sectors within the same centre is not recommended as it reduces flexibility.
- SYSCO facilitated more flexibility in the Letters of Agreement that are established at FIR boundaries as the electronic co-ordination proved to be efficient.
- SYSCO has a significant impact on the HMIs and method of operations of even the most modern ATM systems.
- During 80 hours of “live” trials, an indication of significant workload reduction was observed but it was not possible to fully evaluate this and further investigation is required.
- Valuable engineering process lessons were learnt in moving prototypes from the experimental domain to the operational domain.
- A deepened understanding of how and when to conduct shadow mode trials was obtained.

PROVE phase II builds upon the success of the first phase and shall host field trial validation studies of Station Keeping based on ADS-B technologies followed by MTCD (Medium Term Conflict Detection) trials in Malmö, Rome and Maastricht and AMAN (Arrival Manager) and CORA (Conflict Resolution Assistant) trials in Arlanda.
Programme Start Up

ERIS, the EATMP Reference Industry-Based ATM Simulation and Trials Programme was formed in 2000 to provide Gate to Gate and integrated Air Ground simulation and trials validation capability to the European Air Traffic Management Programme (EATMP) and the European Commission (EC). It supports the recommendations expressed in the EUROCONTROL Supplier Relations and Policy (SR&P) Report concerning the ability to improve co-operation between EUROCONTROL and ATM Industry.

ERIS addresses increasing demand for concept, functional and performance requirement validation through co-operation with ATM Industry to provide a realistic validation environment whilst assisting Industry to understand and prepare for future system development and implementation. The programme will outsource component development to Industry and has developed a functional road map related to and agreed with validation projects’ expressed needs.

ERIS consolidates the IBP (Industry Based Pre-operational Prototypes Programme) and SDP (Simulator Development Programme).

A number of milestones were passed in 2000 during the programme’s formation:

- **May**: the final SDP Steering Group endorsed ERIS.
- **September**: the EEC and EC jointly presented ERIS at the inauguration of the EEC’s renovated buildings.
- **November**: ERIS was presented to Industry, the EC and EUROCONTROL Administrations during the SR&P workshop held at the Experimental Centre (EEC).
- **December**: the EATMP Management Committee (EMC) confirmed ERIS as an EATMP programme.

**ERIS Projects**

In order to facilitate its tasks ERIS is divided into the following work packages:

- **EAT** - (Experiments And Trials Platform): Providing for development of the EC/EATMP Gate to Gate Integrated Air-Ground validation platform and home of the platform component teams. Two versions per year are produced with intermediate prototypes.
- **AVENUE**: EC 4th Framework project providing an initial ATM pre-operational validation technical framework and architecture.
- **ACE** - (AVENUE Compliant ESCAPE): Upgrade of simulator capability to be compliant with AVENUE and integration of industry components.
- **Gate to Gate 2005**: EC 5th Framework providing the EC reference Gate to Gate Integrated Air Ground ATM validation facility for validation of TORCH concepts.
- **RPF** - (Rapid Prototyping Platform): Prototyping services and component development. An arrival manager component is under development.
- **Interops**: Providing for studies in interoperability and standardisation through Industry co-operation.
- **PROVE**: Adaptation, integration and implementation of platforms for field trials in Air Traffic Service Units aimed at providing realistic validation opportunities for emerging concepts. (PROVE: European ATC PRE-Operational Validation and Experimental trials platform)
Progress in 2000

In the course of 2000, ERIS started building its structures and delivered its first Experimental And Trials platform (EAT2000) which was successfully used in simulations during November and December. The programme agreed and planned a number of platform versions for the coming years with EC 5th Framework and EATMP validation projects.

AVENUE commenced integration of partners’ components with the objective to demonstrate its technical capability in March 2001. With an agreed AVENUE logical architecture available the ACE project (AVENUE Compliant ESCAPE) started adapting the current platform to be AVENUE compliant, expected in 2002. (ESCAPE, EUROCONTROL Simulation Capability AND Platform for Experimentation).

PROVE consolidated its position following successful field trials in May 2000 in support of the EATCHIP III SYSCO requirements (EEC Report 354) and started preparation for live MTCD and ADS-B trials planned in 2001.

Looking to 2001

2001 will be an important and challenging year for ERIS:

- Two major platform versions will be delivered;
- AVENUE will demonstrate its technical structure;
- AVENUE compliance and platform upgrade will be in full development;
- Negotiations for the EC Gate to Gate project will end followed by the start of this complex project;
- PROVE will start specification of an integrated air ground trials environment for field trials;
- The first Interoperability studies will start.
General

The year 2000 was a very eventful and important year for the GNSS activities. Following discussions in the Programme Steering Group (PSG) in the Autumn of 1999, a major exercise of rationalisation and re-structuring of the Programme was started and this continued well into 2000. The main objectives of the exercise were to ensure wide stakeholder support and wide stakeholder participation in the activities in order to maximise the use of available resources and minimise individual costs.

A new Programme structure was put in place consisting of three major projects, each one executed using a common methodology based on six strategic axes, which enable close interaction between the projects. Co-operation with the EATMP Navigation Programme was further increased, particularly in the areas of defining operational needs, requirements and procedures and fostering standards developments.

Following the restructuring and rationalisation exercise a Project Management Plan for the SBAS (Space Based Augmentation Systems) Project and an outline of the GBAS (Ground Based Augmentation Systems) Project were endorsed by the 2nd PSG meeting in March. The detailed GBAS Project Management Plan was endorsed at the 4th meeting of the PSG in October.

Early in the year, EUROCONTROL worked with a group of Airspace User Associations (IATA, AEA, IACA, IAO PA, ERA, EBA) to identify operational needs. A similar approach to the group of Air Navigation Service Providers (ANSPs) known as the EGNOS Operations and Infrastructure Group (EOIG) resulted in a complimentary policy from their perspective. Discussions at PSG/4 confirmed the high degree of similarity between the user and provider perspectives. Action was then taken to merge them into ‘A Common Aviation Community Position on GNSS Aviation Needs’. This position was presented to the 10th meeting of the ATM/CNS Consultancy Group (ACG) in November where the members supported the approach of EUROCONTROL in the co-ordination of a Common European Aviation Position on GNSS. The GBAS project initiation was also welcomed by ACG members and several ANSPs and user representatives confirmed their support and participation in the Project.
During the inauguration of the renovated building of the Experimental Centre at the end of September, the GNSS Programme provided information displays of GNSS data recorded on-board of commercial aircraft and a real-time display of data received from the EGNOS Satellite Test Bed (ESTB) which was officially commissioned in early February. In addition, flight trials were carried out in conjunction with the ADS activities in the airspace around the Experimental Centre. Just prior to the Inauguration Ceremony, the GNSS Programme displays were visited by M. Jean-Claude Gayssot, the French Minister for Infrastructure, Transport and Housing and President of the European Union Transport Council. He showed particular interest in the GNSS activities because of his role as EU Transport Council Minister and the decisions which were to be taken on Galileo in December.

At the December meeting of the EU Transport Council, no decisions were taken officially to launch the Development and Validation Phase of Galileo. The subject will again be on the Agenda of the meeting of April 2001.

SBAS Project (Space Based Augmentation Systems)

During the year 2000 the SBAS project has been more clearly defined and a project management plan for the GNSS operational validation activities has been accepted. Since February the EGNOS System Test Bed has been broadcasting a live signal-in-space for users to gain experiences with the system. The GNSS Programme has developed a series of tools for the collection and evaluation of ESTB data. The prototype data evaluation tool, named Pegasus, was delivered in pre-operational form in July and used by a number of States to evaluate their measured data. The full delivery of the Pegasus tool was made in December. It is now being used by EUROCONTROL, ANSPs, ESA along with a number of academic and industrial partners and is rapidly becoming a European standard tool for experimental data evaluation and the presentation of results. Simulations and flight trials have been performed to evaluate the performance of EGNOS in the operational environment. A prototype SBAS approach was evaluated in a Flight simulator at Istres, in southern France while the performance of the ESTB was evaluated during flight trials in September and again in December. Links have been strengthened with the Navigation Programme to investigate the operational applications for which SBAS is expected to provide support.

GBAS Project (Ground Based Augmentation Systems)

During the year 2000, the GBAS Project has been defined and a project management plan has been accepted. The objective of the Project is to ensure the validation and safety appraisal of the GBAS system for CAT-I operations and an assessment of the feasibility of extending its use to both support other than precision approach operations and more stringent operations of CAT-II/III precision approach and landing. It will achieve its goal through the application of a methodology based on the strategic axes that have to be completed for each GNSS component.

The first activity that was initiated towards the end of 2000 was Safety. Since one of the top level objectives that the future ATM network will have to meet is “to improve safety levels by ensuring that the number of ATM-induced accidents and serious or risk bearing incidents do not increase and where possible decrease”, it was decided that the GBAS Safety Assessment would be based on a risk-based approach. This safety assessment process will bring into play the EATMP Air Navigation System Safety Assessment Methodology. Consequently, in order to initiate the three-step generic process (FHA, PSSA, SSA) for the safety assessment of GBAS to support Category I precision approach operations, an external contractual action was launched for the development of the Approval Plan that will be the basis for the initial agreements between the GBAS Service Providers and the regulatory authorities. Tenders have been received and evaluated and the Kick-Off Meeting to define and agree the details of the work will be held in early 2001.
Support to ICAO GNSS Panel

The Programme continued to support the ICAO GNSS-Panel Working Group B.

At the meeting in January 2000, a working paper was presented on validation material for the airborne multipath error component of GPS and it was based on the analysis of raw pseudorange data from 80 flights from the SAPPHIRE (Satellite Aircraft Data Base Project for System Integrity Research) database. The meeting accepted this material as a statistically sufficient basis to close the validation effort for the airborne multipath contribution for both the SBAS and GBAS sections of the GNSS SARPs (Standards and Recommended Practices). Related work on aircraft multipath influences during different phases of flight is contained in the EEC Report 357 published in December 2000.

For the meeting of the GBAS subgroup in March 2000, the GNSS Programme provided the validation of a mathematical proof required for overbounding GBAS errors. Based on this and other validation material, the validation of the proof was closed. Further validation work was performed for the meeting in June 2000.

The GNSS SARPs were completed in June 2000 and are being processed by ICAO. The ANC (Air Navigation Commission) made the final review of the SARPs in mid-November 2000, and a draft amendment to Annex 10, Volume I introducing the first package of GNSS SARPs and associated guidance material will be presented for approval by the ICAO Council in March 2001. The applicability date for SARPs, subject to approval by the Council, is expected to be 1 November 2001.

GLONASS (Global Navigation Satellite System) inclusion into the SBAS and GBAS parts of the SARPs is currently foreseen for the 2002 SARPs update cycle.

Current discussions centre on extensions of the GBAS System, one into Terminal and other RNAV operations, another into CAT II/III with a new methodology proposed by Industry Representatives. Galileo has been discussed at length, with debate on some critical issues, such as possible encryption and the frequency choice, deferred to future meetings.

EUROCONTROL has taken an action to co-ordinate the review of the navigation parts of the ICAO Doc 9750 “Global Air Navigation Plan for CNS/ATM” to be completed in Spring 2001.

Education and Awareness

The Programme continued to support the GNSS courses provided by the Institute of Air Navigation Services in Luxembourg. Two new courses were developed during the year, one in-depth and one overview of GNSS. These courses are available on the 2001 syllabus. Programme staff also supported the latest in a series of seminars which was held in Prague in October. The seminar was organised in co-operation with the European Commission for the CEATS and some neighbouring States.
Simulation Platform Management

ATC Real-Time simulations
During the course of the year 2000, a significant number of real-time simulations and experiments have been performed at the EEC:

- 3States, Ireland 2000, Spata 2000, RVSM6 and Free Routes using the large scale simulation facility;
- SIMVAL5, a real-time simulation aiming to validate technical evolution of the software platform;
- And R&D experiments within the context of projects such as Free Routes, EVP/ CORA, CORE, EACAC and EATCHIP III which have been running on the medium and small scale real-time simulation facilities of the EEC.

During the refurbishing phase of the EEC building, the equipment of the real-time simulation platform has been transferred to the renewed Operational Room. The two last simulations of the year 2000 – RVSM6 and Free Routes – have been realised by using this new room.

In addition, external deployments and installations of a full real-time simulation platform running the ESCAPE, IPAS and Audio-Lan systems developed at the EEC have been performed on the premises of the Maastricht UAC Centre and of the CRDS - CEATS Research, Development and Simulations – at Budapest.

Initial discussion for similar deployment in 2001 on the premises of Eurocontrol HQ at Brussels, ENAV at Rome, SICTA at Naples, LFV at Stockholm and SLV at Copenhagen have started.

ATC Fast-Time simulations
The model based facility of the EEC, the RAMS system, has been used in 2000 in order to run fast-time simulations for the 5 States (France, Germany and Benelux), Greece, CEATS and Norway.

Equally, the TAAM product has been evaluated as an alternative for running fast-time simulations and, according to the results of this evaluation, the decision has been taken to acquire this product and to use it in 2001.

Software Engineering

Software is the major tool used by the projects of the EEC. Depending on each project’s particular requirements software developed by or for the EEC can be of small or big size, of low or high complexity. Some software systems have a low life span, many of them, however, are maintained over many years. Quality requirements therefore vary significantly from one software system to another. This is systematically taken into account in the approach defined by the SEU team.

Productivity is also a major issue for the EEC given the large percentage of EEC budgets for software development and maintenance.

There is a long tradition of software engineering at the EEC and a small Software Engineering Unit (SEU) has existed for several years. The Mission of the SEU is:

- to improve the productivity of software development and;
- to provide effective assistance in achieving software quality requirements;
- development of a software engineering methodology for the EEC by selecting and adapting existing international standards;
- introducing and supporting software engineering tools and environments.

2000 has seen the generalisation in the use of object-oriented specification and design tools. This has been achieved by a major effort in training of software engineers. This training focused on UML (Unified Modelling Language), Design Patterns and the Rose tool. Furthermore the level of SEU day-to-day support that is provided to projects in this particular domain of expertise has been increased.
Configuration management has definitely become part of EEC’s software engineering culture. Special care has been taken during the year 2000 to further improve the use of the Continuus tool.

Change management tools (Remedy) are widely used at the EEC thanks to SEU’s efficient support in this domain. Many new projects, often not directly linked to software development, have become Remedy users.

A significant effort has been made to support project managers in their task of planning and estimating of software development work packages.

The SEU work is a well-considered and widely accepted part of the EEC culture.

**Continuous Improvement**

Continuous improvement contributes to increasing the productivity and performance of the EEC. It has played an important part in the reorganisations and continues to play an important part in the ongoing change process. It is now widely accepted that continuous improvement is a part of normal business practice and is an essential tool that enables an organisation to systematically adapt to a rapidly changing environment.

The EEC articulates its improvement strategy around 3 main points:
- carry out annual Self-Assessment against a reference Total Quality Management framework;
- develop improvement projects;
- build a Continuous Improvement culture at the EEC.

Each year, the EEC’s Self-Assessment against the EFQM Business Excellence model is undertaken, this having two aims: it enables to identify Strengths and Areas for Improvement, and it provides a benchmarking dimension by measuring progress against the previous years and the model itself. At the end of the process, the consensus meeting helps to prioritise efforts in Continuous Improvement.

For this third EEC’s Self-Assessment, the Pro Forma approach was used successfully. It provided deeper information about the EEC’s situation with regard to the various criteria of EFQM Business Excellence model, and allowed objective analysis of the results through a debriefing workshop. As well, the conduct of 34 interviews gave a human dimension to the process. The results were presented at the all-staff meeting and on the web.

The Self-Assessment showed a significant overall improvement at the EEC in terms of quality, and put into light a number of initiatives that were developed spontaneously.

Improvement Projects are created from a bottom-up strategy, coming from spontaneous suggestions of staff when a need is identified. To widen the scope of improvement actions and implement initiatives into a democratic process, the suggestion box was created on the intranet and started in June. This tool represents an objective communication channel where any employee can express a constructive idea considered as an improvement. A review board examines all propositions and facilitates their implementation.

In 2000 there were 54 suggestions posted through the box.

On a parallel side, another ambitious improvement project was conducted successfully in 2000: the re-organisation of the arrival/departure of personnel procedure, focusing on communication channels of the information for better efficiency of enabling services.

At the Agency level, the EEC participates to the Agency Quality Group and to Agency wide projects, such as the coordination of stakeholders surveys throughout all Eurocontrol directorates, the creation of an AQG intranet site, ...
Development Platform and Information Technology Services (IT)

During the year 2000, the EEC’s Technical Services underwent major evolution. On the one hand, the outsourcing contract was extended to the whole range of areas managed by Technical Services: Core Business IT, Office IT, network, telephony and conference rooms. On the other hand, following the re-organisation of the EEC, Technical Services became the IT Management Centre of Expertise (ITM CoE), in charge of the management of the Centre’s entire IT activities.

This change has enabled us to reinforce our communication with the users by associating them with all of the IT projects in hand and by informing them of our activities and our strategy. This currently takes place at two levels: via the users' group (Comité des Correspondants Informatiques) for overseeing IT activities and projects and via project committees for the EEC’s major IT projects.

In the General IT field we have passed three major contracts through call for tender and manage a budget of 6.4M EUR.

In the Admin IT (or Office IT) area we have installed 10 Windows NT servers and 410 PCs. We have migrated the flexitime server and the Informix database server on behalf of the AMI CoE. Our internet line has been upgraded to 2Mb in preparation for the Remote Access project (remote access to EEC IT resources by staff at home or on mission) and the explosion in the use of the Internet as a business tool.

As for the Software development platform (Core Business IT) field, we have installed 25 servers, 64 workstations and 600GB of disc additional space. Our most important achievements have been:
- the bringing on stream, in co-ordination with the SFM CoE, of a cluster (redundant server) system for the real-time simulator;
- the installation and putting into production of simulation and development platforms for the AVENUE and PROVE projects;
- the installation of a fixed link between the EEC and Langen (DFS-Germany) to enable multi-site simulations to be run in the AVENUE project.

Other main projects have been the migration of the NOVELL servers to Windows NT and the installation of mobile telephones to replace the pager systems used until now.

Certain projects started in 2000 will continue through 2001:

- **E-mail Replacement**: Installation of a homogeneous mail and calendar system throughout the Agency. This migration from Netscape to Exchange started in October 2000 and is expected to end in April 2001. The project is run in close co-operation with DF/MIS;
- **Remote Access**: Remote access to the EEC’s IT resources is one of the Centre’s critical projects. The current system is very limited both in terms of evolution and power. The goal of this project is to replace the old system by more modern, flexible, Internet-based methods;
- **FAX**: A project of re-organisation and replacement of our fax systems is currently in progress with the aim of providing a homogeneous, stable fax environment. This project is managed in close co-operation with the MIM CoE.
New Core Business Organisation

The process

The Core Business (that is, all non-support activities) of the Experimental Centre underwent a major reorganisation during the course of 2000. The primary purpose was to put in place a structure that better corresponds to current business practice, that allows greater flexibility for both staff and projects, and that embodies the strategic orientations of the EEC.

In order to reduce uncertainty amongst staff, the reorganisation process itself was to be executed from start to finish as rapidly as possible. At the end of April 2000 a “Reorganisation Working Group” (RWG) was established, and charged with delivering, within six weeks:

- a new organisational structure together with the underlying reasoning;
- job descriptions for the key roles in the new structure;
- an outline of any new procedures to be applied;
- initial proposals for staff allocations;
- a transition and implementation plan.

Ideally the new organisation would minimise change to the existing formal EEC structure (in an attempt to avoid the need for formal HQ approval), maximise alignment with Business Plan objectives, and maximise ability to respond to future changes in EEC orientation. Transparency and wide consultation with staff was also demanded of the process.

In the event the RWG delivered as required at the end of May. Refinement of staff allocations (one of the more sensitive issues) was carried out during June, and the final organisation was launched on 1st July. The process included a number of consultation mechanisms: the Staff Committee was represented on the RWG; an open forum was held; specific problem cases were targeted and talked through with the individuals concerned, and finally an intranet discussion group was initiated. The latter gathered around 150 contributions.
The new organisation is depicted above. Despite initial requests, the changes were, in fact, relatively profound: although Centres of Expertise (CoEs) were retained as the basic staff management units, their number was reduced to five. This meant that each now included a larger range of skills. Contract staff were no longer assigned to CoEs, but were allocated directly to projects.

Projects were no longer managed in an ad-hoc fashion within Centres of Expertise, but were grouped together into nine Business Areas. EEC Business Plan, reports, presentations and so on will henceforth be characterised by this structure. The Business Areas were carefully identified to be an embodiment of the strategic axes of the Experimental Centre. Some significant choices were made here: for example, Safety, Environment and Innovative Research were launched as “startup” business areas. Simulation activities disappeared as a separate entity, to be replaced by Business Areas that focused on solutions rather than method.

Three key individual roles were identified in the new structure:

The **Head of Centre of Expertise** is tasked with all activities related to staff management, allocation and development. The Centre of Expertise is seen as a pool of specialist knowledge to be maintained and developed in order to provide for the immediate needs of the EEC, and those in years to come.

The **Business Area Manager** is responsible for a logical group of projects. He provides cohesion and direction in his area of interest, and support for project leaders as required. Business Areas are to be under constant development in line with current strategic choices.

Last, but not least, projects remain the productive part of core business, so the **Project Leader** remains a key person in the organisation. He/she plans and organises tasks and resources, and assures that milestones and deliveries are met to the customer's satisfaction. He is helped in this task by the Business Area Manager who ensures appropriate links with other projects both within and across business areas, and provides other support where necessary.

**Summary**

The introduction of a cleaner matrix organisation that separates ‘staff’ on the horizontal axis from “activities” on the vertical axis has brought immediate benefits with few drawbacks. The structure gives greater flexibility, allowing staff to migrate more easily between projects and Business Areas, and this has already been exploited by many. The Business Areas give clearer and more visible sense of strategy and direction for the EEC, and reporting lines have simplified, particularly for Core Management.
Building Renovation

The project of the renovation of the EEC building started in 1998 and was successfully completed according to the original planning. The third and last phase of this project started January 2000. Two zones of the building were concerned, the entrance hall and the north wing.

Works in the north wing followed a scheme well established during earlier phases, particularly the renovation of the south wing. Works were even easier this time, as all three floors were empty simultaneously, while during the works in the south wing the cafeteria and the computer centre, situated in the basement, remained occupied.

In the first place the demolition team took away all interior walls and other equipment while leaving the facade in place.

Then the asbestos clearing operations were realised rather quickly and in a spectacular manner considering the complete isolation of the team in application of strict safety rules to protect human beings.

Once the building was "clean", the facade was removed, which provided a bizarre view of a nude structure consisting only of pillars, concrete slabs and the roof. But soon, with the installation of the new facade, the wing received its new look identical to that of the south wing.

In the meantime, rather spectacular works took place in the entrance hall.

At first the demolition of the partitions and the old staircase, followed by important cuttings into concrete for the cavity of the new staircase leading to the basement, and the cage for the lift. Then followed a real art-work: the construction of the wooden framework for the new staircase, all in concrete from the basement, through the hall and up to the first floor.

Once the heavy work was finished, the area started to receive its final layout, which relieved the security agents as their office remained in operation in the middle of the works, as alarm and fire detection equipment had to stay in their office.

It is always spectacular to observe the speed in which finalisation works are realised. Only a few weeks before the end of the works, false floors, separators, ceilings and the woodwork in the hall were installed. At the same time the technicians tested the heating, the air conditioning, electricity and water supply. In fact, gradually the building came to life.

Finally, only a few days before delivery of the works, the provisional separators were removed and the different zones were connected.

At the end of June, on the planned date, the works were delivered, notwithstanding, as is usual, a long list of small repairs, to be soon made by the companies concerned. The most important part, however, was realised within time and without exceeding by a single Euro the budget agreed on by the Committee of Management in 1997.

Thus in July 2000 the final removal took place and everyone moved into a normal office space, having endured 22 months of the construction work.

But one thing is certain: the efforts spent are now largely compensated by working conditions which are consistent with the ambitions of the Experimental Centre.

The inauguration of the renovated building took place in September 2000, as reported on below.
Inauguration of the renovated EEC Building

The Inauguration of the renovated EEC Building has been one of the most important milestones in EEC history. Therefore this report contains a reprint of the article covering this event, which was published under "Happenings" in Volume 5, Number 19, Winter 2000 edition of the EUROCONTROL SKYWAY publication.

On 29 September 2000, the renovated EUROCONTROL Experimental Centre building in Brétigny-sur-Orge, France, was inaugurated.

The ceremony was honoured by the presence of Mr Jacob Buksti (President of the EUROCONTROL Commission and Danish Minister for Transport), Mr Jean-Claude Gayssot (French Minister for Infrastructure, Transport and Housing), Mr Ole Asmussen (President of the EUROCONTROL Provisional Council and Director General of the Danish Civil Aviation Authority), Mr Michel Ayral (Director of the European Commission's Air Transport Directorate), Mr Yves Lambert (Director General of EUROCONTROL), local dignitaries and the diplomatic corps of various Member States of EUROCONTROL.

The renovation of the building has been tailored to support the Centre's vital experimental work.

Committed since the early 1960s to carrying out research and development activities to improve air traffic management (ATM) in Europe, the Centre has proven over the years its ability to provide innovative pan-European solutions.

Suitably equipped and with the necessary expertise, the Centre is prepared to continue its mission - a mission which is essential to any future effort to enhance capacity and reduce delays in European airspace.

The main strength of the Experimental Centre lies in the way it conducts its activities - its emphasis on cooperation and partnership with all the other European R&D centres and institutions. Projects and ideas are shared and solutions proposed in unison. After all, transport is all about connecting people and nations.

The renovation of the EUROCONTROL Experimental Centre building is emblematic of a renewed commitment to tackle future challenges.
The inauguration of the renovated EEC building, a milestone in the history of the Experimental Centre, was celebrated with a number of events. A two-day ATM Research and Development Symposium took place on 27-28 September. This consisted of a series of technical presentations and demonstrations by the EUROCONTROL Experimental Centre and the aviation industry. The Symposium concluded on 29 September with round-table discussions hosted by high-level representatives of industry, the airlines and the EUROCONTROL Agency.

The official inauguration ceremony concluded the celebrations.
THE R&D SYMPOSIUM

The theme of the R&D Symposium was "Partnership in European ATM". The presentations focused on projects being developed in cooperation with various partners: other EUROCONTROL Directorates, the European Commission, various national research centres, the airlines, industry and the universities. Approximately 200 participants attended the Symposium.

The presentations were delivered in the new auditorium, while the demonstrations were mainly run in the central area of the building, around the atrium. Guided tours of the demonstrations were also organised for participants.

The presentations tackled issues concerning ATM system design, airspace capacity optimisation, autonomous aircraft, ASAS, controller environment and safety.

The presentations on "System Design" included the EATMP Reference Industry-Based ATM Simulation and Trials Platform (ERIS) animated by Christopher North (European Commission) and Robert Graham (EEC). Cesare Bernabei (EC) presented DEFAMM, the Demonstration Facilities for Airport Movement Management tool.

Xavier Fron (PRU) and Sönke Mahlich (seconded from EEC to Swisscontrol) presented "Airspace Capacity Optimisation" and illustrated it via FAP (Future ATM Profile). Marcel Richard (Central Flow Management Unit, CFMU) and Marc Bisiaux (EEC) provided an overview of ATFM studies.

Eric Hoffman (EEC) presented "Autonomous Aircraft and ASAS" via the Freer Flight project, while the partnership in this domain between the EEC and the Technische Universität Berlin was outlined by Professor Gerhard Hüttig (TUB).

The topic of satellite navigation focused on the GNSS project. The members of the Tripartite Group - Alex Steciw (ESA), Cesare Bernabei (European Commission) and John Storey (EEC) reported on developments in this field.

The presentations on "Controller Environment and Safety" involved explanations of the Automatic ATC Safety Monitoring Tool (ASMT) by Wim Janssen (Maastricht UAC) and Brian Hickling (EEC), the EUROCONTROL ASMT impact study by Tony Joyce, and the human domain in ATM risk Management by Sylvie Figarol (CEN A). Michael Woldring (EATMP) and Alistair Jackson (EEC) presented human factors issues in ATM.
Demonstrations

The demonstrations illustrated a wide spectrum of projects developed either by the EEC alone, or in cooperation with partners:

- Innovation at the EEC (Digistrip, AudioLAN, IPSKY and SMARTCWP);
- Human Domain (IMPACT and CORE);
- Full Autonomous Separation Transfer (Freer Flight with e-Cockpit and FAST);
- Satellite navigation (ESTB and SAPPHIRE);
- Aeronautical Telecommunication Network (PETAL2, Datalink Simulator - EO LIA / PETAL 2 - and TALIS - Total Information Sharing);
- Simulations with real-time simulation (RVSM/6 Cyprus), fast-time simulation (RAMS) and EATCHIP III;
- Air Traffic Flow Management (CARAT - Computer-Aided Route Allocation TOOL);
- Innovation at C.E.N.A (Airport and Surface Assistance Systems, ADAGIO, SALSA, MOGADOR and AIDA).

Round Tables

Yves Lambert, Director General EUROCONTROL, chaired the first round-table discussions on "Airspace capacity optimisation and autonomous aircraft". He was assisted by Eric Watkins (EEC). The participants were Marc Baumgartner, Executive Vice President Europa (IFATCA), Phil Hogge, Director Infrastructure Europe (IATA), Aslaug Haraldsdottir, Principal Engineer (Boeing), Alain Bourrez, Chairman AECMA, ATM Committee, Henri-Georges Baudry, Director of Air Navigation (DGAC, France), Michel Ayral, Director Air Transport (European Commission) and Ben Berends, ATM Management (KLM).

The second round table tackled the issue of "System design, controller working environment and safety". Mr Wolfgang Philipp, Senior Director, EUROCONTROL, acted as moderator with the assistance of Mr Pusch (EEC). The participants were Joel Cariou, Secretary ATCEUC, Gerry Selves, Manager Technical Projects (British Airways), J. Ruano, ATM Division (Indra), John Fearnides, Senior Consultant (Lockheed Martin), Derek MacLauchlan, Secretary General (CANSO).

The inauguration ceremony and the ATM R&D Symposium will remain an unforgettable experience. The Symposium, in particular, was a perfect demonstration of the transparency and dialogue that characterises the Centre. Suitably equipped, the Centre is now poised to develop, together with its partners, with the much-needed solutions to improve the current European air traffic management situation.
THE CEREMONY

Excerpts from speeches:

**Jakob BUKSTI**, Danish Minister of Transport and President of the EUROCONTROL Commission

(…) “Without continual improvement, redesign and innovation, systems rapidly age and decline. Responsible research is an essential element in the development and maintenance of effective systems. Experimentation is a cornerstone of aviation and aviation safety: it is a vital activity and must be continually supported and encouraged to make sure that the skies stay open and free in the future”.(…)

**Jean-Claude Gayssot**, French Minister for Infrastructure, Transport and Housing

(…) “J’ai (…) toujours pensé que les réponses concrètes les plus efficaces aux problèmes de saturation que nous rencontrons en Europe, passent avant tout et de façon inévitable par les progrès techniques que nous saurons mettre en œuvre conjointement. C’est de cette façon que nous maîtriserons au bout du compte les retards. (…) La France considère qu’une organisation EUROCONTROL forte est le meilleur vecteur actuel du progrès et qu’il faut achever ce qui a été engagé en mettant en œuvre la nouvelle convention d’EUROCONTROL, conférant ainsi à cette organisation beaucoup plus de possibilité d’action.” (…)

**Yves Lambert**, Director General of EUROCONTROL

(…) Nombreux sont ceux que nous devons remercier d’avoir contribué à la réalisation de cette entreprise : nos États membres, qui ont compris le besoin urgent de rénovation et approuvé le projet, René Bulin, premier Directeur général d’EUROCONTROL et fondateur du Centre, par un accord conclu avec Louis Bonte, alors Directeur du CEV, en 1964. Depuis, le CEV et la Base aérienne ont été de réel partenaires pour EUROCONTROL” (…)

---

from left to right: Yves Lambert, Jakob Buksti and Jean-Claude Gayssot
**Michel Ayral**, Director Air Transport Directorate of the European Commission

“(...) le Centre expérimental de Brétigny a joué un rôle précurseur dans le développement de la coopération entre la Commission et EUROCONTROL. (…)”

Je voudrais en particulier souligner le rôle que le Centre expérimental a joué pour forger, dans le cadre de ces projets de recherche, un solide partenariat avec les industriels européens de la gestion du trafic aérien, en parallèle avec les prestataires de service, chose qui me semble essentielle pour assurer une solide progression vers le ciel unique. Le rôle du Centre dans la création de la CFMU suffit à illustrer la contribution qu'il peut jouer dans la création du ciel unique.” (…)

**Jean-Marc Garot**, Director of the Experimental Centre

“(...) “The building is a special one. It represents an immense amount of meticulous planning and careful preparation; many of you here celebrating this occasion were involved in that painstaking process: although you have my gratitude for your diligence and foresight, I am sure that the concrete results of your endeavours are thanks enough!” (…)”
The Experimental Centre communicates its research activities, product documentation, simulator development and simulation results through EEC internal publications as well as through participation in international conferences, publication of results in conference proceedings and publications in scientific journals.

### EEC Publications

All EEC publications are classified as Reports, a document which conforms to strict quality criteria regarding both scientific content and presentation, or as Notes, a more informal document. All publications, including this annual report, are available on our web site http://www.eurocontrol.fr. The Reports and Notes in the list below are grouped by Business Areas. They have unique identifiers in the format “nnn” (Report) and “nn/00” (Note).

### ATM Support to Implementation (ATI)

#### Real-Time Simulations

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<td>6/00</td>
<td>Eight-States Free Route Airspace Project - 2nd small Scale Real-Time Simulation</td>
<td>P. Eriksen</td>
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<td>347</td>
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<td>R. Lane, R. Deransy</td>
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<td>14/00</td>
<td>Eight-States Free Routes Airspace Project, 3rd Small Scale Real-Time Simulation</td>
<td>P. Eriksen</td>
<td>October 2000</td>
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<td>356</td>
<td>SIMVAL5 R Real-Time Simulation</td>
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<td>Eight-States Free Route Airspace Project - 4th Small Scale Real-Time Simulation</td>
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#### Model Simulations

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<td>351</td>
<td>TAAM Operational Evaluation</td>
<td>L. Sillard, F. Vergne, B. Desart</td>
<td>August 2000</td>
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<td>1/00</td>
<td>SIMMOD Study of ATHINAI TMA and the New Eleftherios Venezelos International Airport (SPATA)</td>
<td>J-L Janszen, V. Tagalos, M.J. Morrow</td>
<td>February 2000</td>
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Support to ATFM

10/00 1999 ATFM Simulations (A. VIDAL) ................................................................. June 2000

Communication Navigation Surveillance (CNS)

345 GNSS Performance Validation - Summary
(A. van den BERG, J. VERMEIJ, S. LAN NELONGUE) ........................................... April 2000

357 Investigation of Multipath Effects in the Vicinity of an Aircraft dependent on different Flight Profiles
(R. STOLZ, A. LIPP, B. TIEMEYER, C. DISCHER) .................................................. December 2000

4/00 Squitter Evaluation (H.P. ENGLMEIER) ............................................................. March 2000
Version 2 ................................................................. July 2000

ATM Concept and Studies (ACS)

348 Facteurs Sociaux dans la Simulation du Contrôle Aérien
(G. DUBEY, CETCOPRA, Université de Paris I) ....................................................... July 2000
Report available in both English and French language Version

350 Gaze Analysis and Psychophysiological Parameters: A Tool for the Design and
the Evaluation of Man-Machine Interfaces Feasibility Study
(R. MO LLA RD, P. CABO N / B. FARBOS, LAA, Université, René Descartes - Paris V) .............. July 2000


5/00 Stochastic Conflict Detection for Air Traffic Management (K. BUN) .................. April 2000

8/00 COIAS Project (Convergence of Internet, Asynchronous Transfer Mode and Satellite) - EEC Final Report
(L. CROUZARD, O. ROBERT, P. SMITH) ................................................................. July 2000

16/00 Situation Awareness, Synthesis of Literature Search (E. JEANNOT) .............. December 2000

21/00 Requirements for the Implementation of Automatic and Manual Label Anti-Overlap Functions
(A. DO RBES) ................................................................. December 2000

EATMP Reference Industry-based ATM Simulation and trials platform Programme (ERIS)

12/00 Coverage of 1999 European Air Traffic for the Base of Aircraft Data (BADA) - Revision 3.1
(C. SHEEHAN) ................................................................. July 2000

18/00 Aircraft Performance Summary Tables for the Base of Aircraft Data (BADA) - Revision 3.3
(A. NUIC) ................................................................. December 2000
19/00 Revision Summary Document for the Base of Aircraft Data (BADA) - Revision 3.3
(A. N. UIC) December 2000

20/00 User Manual for the Base of Aircraft Data (BADA) - Revision 3.3
(A. N. UIC) December 2000

355 EATCHIP III Evaluation and Demonstration - PHASE 3 Project Experiment 3Abis: MTCD Final Report
(A. Harvey, C. Costello) December 2000

Performance Flow management Economics and efficiency (PFE)

2/00 Load Capacity Constraint Regulation (LCCR)
(J. Degrand, E. Mercier) February 2000

3/00 Delay Forecast 2000 - Based on National Capacity Enhancement Plans
(M. Dalichamp, J-C. Hustache) March 2000

7/00 Progress towards Cost-Benchmarking of the European ATM System
(J-C. Hustache) July 2000

9/00 Analysis of Unused ATFM Slots

11/00 Investigating the Air Traffic Complexity: Potential Impacts on Workload and Costs
(T. Chaboud, R. Hunter, J-C. Hustache, P. Tullett) July 2000

13/00 FAST: 1999 Pilot in the Loop Evaluation
(S. Grand-Perret) July 2000

15/00 Short-Term Capacity Targets 2001 for the European Air Navigation Services
(M. Dalichamp, J-C. Hustache, A. Marsden) October 2000
Contributions to Conferences and Journals

A selection of contributions of the Experimental Centre to conferences and journals is given below and grouped by Business Areas.

**ATM Concept and Studies (ACS)**

The effect of depicting predicted aircraft flight paths as moving pulses on perception of conflicts presented on a Cockpit Display of Traffic Information (CDTI) published as NASA Draft Report
(C. Shaw, W. Johnson) ........................................ April 2000

Is Limited Delegation of Separation Assurance Promising? at the 3rd USA/Europe Air Traffic Management R&D Seminar, Napoli, Italy
(E. Hoffman, K. Zeghal, A. Cloerec, I. Grimaud, J-P. Nicolaon) ......................... June 2000

Striving for Adequacy: The Importance of Rich HMI Requirements at the 3rd USA/Europe Air Traffic Management R&D Seminar, Napoli, Italy
(A. Jackson, A. Dorbes, I. Pichancourt) ........................................ June 2000

A Stochastic Conflict Detection Model Revisited at the AIAA Guidance, Navigation and Control Conference, Denver, Colorado, USA (in collaboration with INRIA)

Influence of Speed and Altitude Profile on the Dynamics of In-trail Following Aircraft at the AIAA Guidance, Navigation and Control Conference, Denver, Colorado, USA (in collaboration with TUDelft and STERIA)
(P. Vinken, E. Hoffman, K. Zeghal) ........................................ August 2000

Delegation of Separation Assurance to Aircraft: towards a Framework for Analysing the Different Concepts and Underlying Principles at the 22nd International Council of the Aeronautical Sciences Congress (ICAS), Harrogate, UK
(K. Zeghal, E. Hoffman) ........................................ August-September 2000

Potential co-operations between the TCAS and the ASAS at the International Conference on Human-Computer Interaction in Aeronautics (HCI-Aero 2000), Toulouse, France (in collaboration with TUDelft)
(A. Abeloos, M. Mulder, R. van Paassen, E. Hoffman) ........................................ September 2000

Pilot-in-the-loop Evaluation of Cockpit Assistance for Autonomous Operations at the SAE/AIAA World Aviation Congress, San Diego, USA
(E. Hoffman, S. Grandperret, K. Zeghal) ........................................ October 2000

Evaluation of Delegation of Sequencing Operations to the Flight Crew from a Controller Perspective - Preliminary results at SAE/AIAA World Aviation Congress, San Diego, USA
(K. Zeghal, I. Grimaud, E. Hoffman) ........................................ October 2000

Traffic Analysis with Fast-Time Simulations to Evaluate Delegation Potentialities of Sequencing Operations at the 9th Digital Avionics and System Conference, Philadelphia, Pennsylvania, USA (in collaboration with SYSECA)
(E. Hoffman, J. Bellman, S. Grandperret, K. Zeghal) ........................................ October 2000

A Stochastic Conflict Detection Method Integrating Planned Heading and Velocity Changes at the 39th IEEE Conference on Decision and Control, Sydney, Australia (in collaboration with INRIA)

**ATM Support to Implementation (ATI)**

(S. Dubuisson, X. Cousin & M. Chiesa Steria France) ........................................ January 2000
Environment (ENV)

**ENHANCE - an evolutionary improvement to aircraft noise modelling** at Internoise 2000, Nice, France, 2000
(I. Fuller, T. Elliff, L. Cavadini) ........................................................... January 2000

EATMP Reference Industry-based Simulation and trials platform Programme (ERIS)

**Controller Roles - Time To Change** at the 3rd USA/Europe Air Traffic Management R&D Seminar, Napoli, Italy
(R. Graham, A. Marsden, I. Pichancourt, F. Dowling) ................................. June 2000

Innovative R&D (INO)

**IPv6 and Internet Technology for the Aeronautical Telecommunication Network A New Networking Approach**
at the 3rd USA/Europe Air Traffic Management R&D Seminar, Napoli, Italy
(L. Crouzard, G. Gawinowski, O. Robert, P Smith) ....................................... June 2000

Satellite Navigation (GNSS)

**Safety Case Development for GBAS, ISPA 2000** at the International Symposium on Precision Approach and Automatic Landing, Munich, Germany
(B. Tiemeyer, A. Lipp) ..................................................................................... July 2000

**How could GBAS CAT I Precision Approach be Approved for Civil Aviation?** at ISPA 2000, International Symposium on Precision Approach and Automatic Landing, Munich, Germany
(A. Lipp, B. Tiemeyer) ..................................................................................... July 2000

**SAPPHIRE - A Tool to Analyse World-wide GNSS Performance on Commercial Airlines** at NAVSAT 2000, Paris, France
(N. Bondarenco, S. Remark, A. Lipp, B. Tiemeyer) ......................................... June 2000

**The EGNOS Safety Case - Setting the Safety Standard & Current Status** at ESREL 2000 European Safety and Reliability Conference, Edinburgh, UK
(B. Tiemeyer, R. Farnworth, A. Johnstone, B. Gilmartin) ................................. May 2000

**Safety Regulation of Air Traffic Services Based on SBAS and GBAS** at GNSS 2000, Edinburgh, UK
(B. Tiemeyer, A. Johnstone, R. Farnworth, A. Lipp) ........................................ May 2000

**Effects of Aircraft Surfaces on GPS Signal Reception** at GNSS 2000, Edinburgh, UK
(A. Lipp, R. Stolz, C. Discher, B. Tiemeyer) ..................................................... May 2000

**GPS Signal Reflection in the Vicinity of an Aircraft - a Statistical Approach** at ION National Technical Meeting 2000, Anaheim CA, USA
(C. Discher, R. Stolz, A. Lipp) ......................................................................... January 2000

(B. Tiemeyer) .................................................................................................. March 2000

**Flying EGNOS - the GNS-1 Testbed** published in Galileo’s World
(E. Breeuwer, R. Farnworth, P. Humphreys) .................................................. Winter 2000
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<tr>
<td>ACAS</td>
<td>Airborne Collision Avoidance System</td>
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<td>A-CDM-D</td>
<td>Air Collaborative Demonstrator (EC project)</td>
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<td>ACE</td>
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<td>ACE</td>
<td>AVENUE Compliant ESCAPE</td>
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<td>ATM/CNS Consultancy Group</td>
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<td>ACS</td>
<td>ATM Concepts &amp; Studies (EEC)</td>
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<td>ADREP</td>
<td>Accident Data Reporting</td>
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<td>ADS</td>
<td>Automatic Dependant Surveillance</td>
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<td>AFS</td>
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<td>AMAN</td>
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<td>Airspace domain EUROCONTROL</td>
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<td>ANC</td>
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<td>FPS</td>
<td>(Fifth) Framework Programme</td>
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<td>FRAP</td>
<td>Eight States Free Routes Project</td>
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<td>FREER</td>
<td>Free Route Experimental Encounter Resolution</td>
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<td>Acronym</td>
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<tr>
<td>GBAS</td>
<td>Ground Based Augmentation Systems</td>
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<td>GLONASS</td>
<td>Global Navigation Satellite Systems (Russia)</td>
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<td>GNS</td>
<td>Satellite Navigation (EEC)</td>
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<td>HEIDI</td>
<td>Harmonisation of European Inciden Definitions Initiative for ATM</td>
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<tr>
<td>HIPS</td>
<td>Highly Interactive Problem Solver</td>
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<td>HLG</td>
<td>High Level Group of the European Commission</td>
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<td>HM1</td>
<td>Human Machine Interface</td>
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<td>HMU</td>
<td>Height Monitoring Units</td>
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<td>IAIA</td>
<td>Irish Aviation Authority</td>
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<td>IANS</td>
<td>Institute of Air Navigation Services</td>
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<td>IAOPA</td>
<td>International Aircraft Owners and Pilots Association</td>
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<td>IATA</td>
<td>International Air Transport Association</td>
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<td>IBP</td>
<td>Industry Based Pre-operational Prototypes Programmes</td>
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<td>ICAO</td>
<td>International Civil Aviation Organisation</td>
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<td>ICAO-CAEP</td>
<td>ICAO Committee on Aviation Environmental Protection</td>
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<tr>
<td>IFATCA</td>
<td>International Federation of ATC Association</td>
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<td>IFPS</td>
<td>Initial Flight Plan Processing System</td>
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<td>IFPUI2</td>
<td>Initial Integrated Flight Plan Process Unit - 2</td>
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<td>IPA5</td>
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<td>IPSky</td>
<td>Internet Protocol in the Sky</td>
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<td>IPv6</td>
<td>Next Generation Internet Protocol</td>
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<td>IREN</td>
<td>Incident Reporting European Network</td>
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<td>IST</td>
<td>Information Society Technology</td>
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<td>IT</td>
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<td>LFV</td>
<td>ATS (Sweden)</td>
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<td>LRI</td>
<td>Hungarian ATS provider</td>
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<td>MADAP</td>
<td>Maastricht Automatic Data Processing and Display System</td>
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<td>Modelling Actor's Tasks to Organise Specifications</td>
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<td>MEDUP</td>
<td>Mediterranean Upgrade Programme</td>
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<td>MFF</td>
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<td>MIM</td>
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<td>MTCOD</td>
<td>Medium Term Conflict Detection</td>
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<td>MUAC</td>
<td>Maastricht Upper Area Control</td>
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<td>MSP</td>
<td>Multi-Sector Planning</td>
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<td>NATS</td>
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<td>NLRA</td>
<td>Nationaal Luchten Ruimtevaartlaboratorium (Netherlands)</td>
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<td>OCA</td>
<td>Oceanic Control Area</td>
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<td>OPQ</td>
<td>Occupational Professional Questionnaire</td>
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<td>OPS</td>
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<td>Preliminary EUROCONTROL Tests of Air/ground Data Link</td>
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<td>PRC</td>
<td>Performance Review Commission</td>
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<td>PROVE</td>
<td>European ATC Pre-Operational Validation and Experimental Trials Platform</td>
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<td>Performance Review Unit (HQ)</td>
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<td>Air Traffic Services (Romania)</td>
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<td>RPF</td>
<td>Rapid Prototyping Platform</td>
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<td>RVSM</td>
<td>Reduced Vertical Separation Minima</td>
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<td>SAPPHER</td>
<td>Satellite &amp; Aircraft Data Base Project for System Integrity Research</td>
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<td>Standards and Recommended Practices</td>
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<td>SBAS</td>
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<td>SID/STAR</td>
<td>Standard Instrument Departure/Standard Arrival Route</td>
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<td>EUROCONTROL Supplier Relations and Policy</td>
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<td>Safety Regulation Unit</td>
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<tr>
<td>STCA</td>
<td>Short Term Conflict Alert</td>
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<td>STORIA</td>
<td>Software Tool for Online Recording and Interactive Analysis</td>
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<td>SurvITE</td>
<td>ATM Surveillance Tracker And Server System</td>
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<tr>
<td>SYSCO</td>
<td>System-Supported Coordination</td>
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<td>TAAM</td>
<td>Total Airspace and Airport Modeller</td>
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<td>TAUS</td>
<td>Total Information Sharing</td>
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<td>Terminal Control Area</td>
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<td>TEN</td>
<td>Trans European Network</td>
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<td>TLS</td>
<td>Tactical Load Smoother</td>
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<td>Terminal Manoeuvre Area</td>
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<td>TO RCH</td>
<td>Technical, Economical and Operational Assessment of an ATM Concept Achievable from the year 2005</td>
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<tr>
<td>UML</td>
<td>Unified Modelling Language</td>
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</table>
Contact Information

How to Contact the Experimental Centre:

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Web: http://www.eurocontrol.fr

How to Travel to the Experimental Centre:

The EUROCONTROL Experimental Centre is conveniently situated 36 kilometers south of Paris just off the A 6 «Autoroute du Sud», close to the Brétigny-sur-Orge railway station, which gives rapid access to the heart of Paris on the RER-C line, and has easy connections to the two main Paris airports Charles-de-Gaulle and Orly.