STUDY ON BENCHMARKING FOR BEST PRACTICES IN AIR TRAFFIC MANAGEMENT (EUROPEAN COMMUNITY)

GENERAL REPORT

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1 EXECUTIVE SUMMARY

This benchmarking study was a first attempt at capturing the various internal practices used by air navigation service providers (ANSPs) across the world and relating these practices with achieved and expected levels of performance. A total of 21 ANSPs participated in the study from Australia, Austria, Belgium, Canada, Denmark, Eurocontrol (MUAC), Finland, France, Germany, Italy, Ireland, Luxembourg, The Kingdom of the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States of America.

The results of the benchmarking are based on the data and information collected by the Study Team from three main sources:

- Information in the public domain (mainly annual reports and aeronautical publications)
- A Benchmarking Questionnaire developed specifically for this Study and distributed to all the participants
- Information from Eurocontrol (PRU and CFMU data) made available by the providers

The outputs of the Study can be classified into four categories:

1) **Key indicators** that have been defined and validated to support the monitoring of improvements achieved by the providers both in terms of internal processes and performance

2) **Best Practices** that have been identified to support the development of targets and standards, if not for the industry as a whole, at least for the European ATM industry

3) Preliminary **insights** as to the possible drivers of performance and the possible **linkages** between inputs, internal processes, external factors, and performance

4) A **Framework** to institutionalise the benchmarking process, both at the industry level and at the individual service provider level

1.1 **Key Indicators**

Key Indicators have been selected, which will contribute towards the basis of future economic and performance regulatory framework at the Community level. The selected key indicators cover those already defined and validated by Eurocontrol’s PRC and other studies, as well as those which have been identified as part of this specific study.
1.2 **Best Practices**

At the level of benchmarking undertaken, it is not possible to identify clear, unique and unambiguous linkages between individual processes and performance. However, the study has identified best practices for individual processes through intra- and inter-industry comparison. These best practices will drive future performance, especially if they are accepted as industry standards, acknowledging that in some circumstances the best practice must be tailored to the specific external environment.

One of the key challenges for the industry is to balance increased integration with greater modularity. Higher modularity will mean that interfaces between providers must be better standardised, requiring a set of agreed compatible processes and systems, hence the importance of sharing best practices. Similarly, increased integration would mean that fewer independent processes and systems are used and that ultimately one specific set will become the standard, hence again the importance of identifying possible candidates for such a standard – or best practice.

Five high-level best practices have emerged from the Study highlighting key improvement opportunities consistent with the principal objectives of the Single European Sky initiative, both for the industry as a whole and for many individual providers in particular. Implementation of these best practices should lead to tangible improvements in the short and medium term. These best practices and their key attributes, as derived from the Study, are described in the following table:

<table>
<thead>
<tr>
<th>BEST PRACTICE AREA</th>
<th>BEST PRACTICE ATTRIBUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Management</td>
<td>Safety management process allowing for maximum accountability, transparency and awareness at all levels of the organisation, while continuously assessing the corporate performance and culture to further determine whether risk is being reduced to a level as low as reasonably practicable.</td>
</tr>
<tr>
<td>Customer Involvement</td>
<td>Highest degree of customer involvement, in the service delivery requirements definition and in the strategic and tactical decision-making process; customers are an integral part of the feedback loop as regards a provider’s performance (quality and cost of service provided). A customer-oriented culture is pervasive throughout the organisation. Customers include all users as well as key external stakeholders (airports, local communities, military, etc.)</td>
</tr>
<tr>
<td>Scope of Service, Service Definition and Delivery</td>
<td>Very clear and well-articulated mission, values and objectives communicated and shared throughout the organisation; transparent organisational and financial structure (including accounting process for cost and resources allocation), embedded organisational flexibility and systematic processes to unbundle or outsource services as appropriate.</td>
</tr>
<tr>
<td>Implementation of an accredited quality management process throughout the organisation.</td>
<td></td>
</tr>
<tr>
<td>Market testing with a view to unbundling of services, which do not naturally lend themselves to monopoly provision.</td>
<td></td>
</tr>
<tr>
<td>Tactical Flexibility</td>
<td>Flexibility to open and close sectors supplemented by the ability to change the configuration of active sectors by adding more working positions in order to react to changes in traffic demand without fragmenting the airspace further. Flexible rostering combining team and individual-based rostering frequently reviewed.</td>
</tr>
</tbody>
</table>
### BEST PRACTICE AREA

| Tasking of individuals for stand-by readiness in the case of non-availability of rostered staff, providing the flexibility for supervisors to man working positions with appropriately rated staff. |
| Flexible manning of rostered staff to adapt a sector to changing traffic conditions, in support of the operational concept. |
| Maximum situational awareness in the cockpit made possible by the use of English as the only language in ATC for IFR flights and on international airports. |

| Integrated Strategic Management |
| Full integration of all functional areas (business planning, HR management, Operations Planning and Infrastructure Planning) into a comprehensive Strategic Management Process; this process should be iterative and closed-loop, using a combination of top-down and bottom-up processes, with the embedded ability to monitor success against targets and standards, to identify improvement opportunities. |
| Implementation of a high level Air Navigation Architecture approach in support of such a process. |

### 1.3 INSIGHTS FROM THE STUDY

Three high level insights have emerged from the Study:

- The **fragmentation of the industry** is reflected in the **large variances and disparities in practices and performances** across all domains of analysis, without any clear relationship between practices and current performance.

- The **external environment** has a **significant impact on providers’ performance and internal processes**: the providers’ performance is primarily impacted by the operational environment, while internal processes are primarily impacted by the institutional environment.

- Even though larger providers tend to be better equipped (in terms of organisation, systems and processes) to deal with (typically) higher levels of service complexity, potential scale economies appear to be prejudiced by structural and operational rigidity, which prevents capture of potential benefits of scale. This reflects in some disconnects between the long-term, strategic, organisational set-up of some providers and their short-term, tactical, operational flexibility.

One of the key insights from the Study is a clearer understanding of the impact of external factors on performance and internal processes. Previous benchmarking studies, in particular the one performed by Eurocontrol’s PRU on cost effectiveness, have only been able to draw hypotheses as to the role of the external environment in explaining why some providers seem to under or over perform relative to expectations. For example, it is widely accepted that operational complexity is an important cost driver in delivering the service, but how this is related to internal processes has not been well substantiated.
The results of this Study in that respect are more clear: At provider level, the external environment (including both the operational and the institutional environment) in which the providers manage and deliver their services appears to be the overriding factor impacting differences in practices and performance. The operational environment tends to have a particularly strong influence on performance whereas the institutional environment tends to have a stronger impact on internal processes. However, these external factors do not fully explain the differences in practices and performance. In particular, the application of the best practices identified in this report will clearly help the future performance of the providers, irrespective of their specific external environment.

The analysis also leads to the identification of scale as a key driver of performance. In a similar environment in terms of operational complexity and institutional framework, a larger player tends to be better equipped to successfully handle complexity. However in Europe, in terms of cost effectiveness and cost of service, including delay costs, scale does not seem to give any clear advantage - there is even an inverse relationship between unit rates and delay costs.

This apparent diseconomy of scale might be explained by several factors:

- The ATM industry is not a market-driven industry. Therefore, there has so far been no incentive or opportunity for providers to capture economies of scale. Besides, the fragmented nature of the industry would not allow the bigger providers to reap the benefits of their scale as the organisation of service provision is mainly dictated by national boundaries.

- Another possible explanation might be that larger providers actually overspend and overuse resources in order to manage a large portfolio of activities not directly related to their core services. Such non-core activities would generate significant overhead costs that ultimately are charged to customers without directly benefiting them.

- There seems to be a disconnect for many providers between their overall organisational and managerial set up, and their operational set up. In other words, providers with a relatively sophisticated organisation and management structure do not necessarily have the tactical flexibility that players with a less sophisticated management structure may enjoy. This, in turn, impacts their cost effectiveness and their productivity.

Overall, the insights gained from the Study in terms of drivers for improvement are consistent with most of the European Commission’s Single Sky objectives, namely:

- Promotion and support of a high and uniform safety standard, not only in terms of performance but also in terms of management process

- A better relationship of service provision with the needs of users, in particular through increased customer involvement
- Enhanced **technical and operational efficiency** through higher modularity and compatibility of structures, systems and processes, in order to reduce the negative impacts of fragmentation

- Appropriate **economic regulation** to ensure that the level of user charges is proportionate to the actual cost incurred for a given service whilst providing incentives for cost efficiency and performance improvement.

### 1.4 Framework for Institutionalising the Benchmarking Process

One of the key objectives of the study was to propose a mechanism for institutionalising the benchmarking process so that it can be used effectively to support the monitoring of performance and other improvements in practices in line with the proposed regulatory framework of the Single Sky.

In doing so, the aim was to answer three main questions:

i. Is benchmarking the appropriate tool to improve processes in ATM, both at the regulatory and the service provision level?

ii. What are the criteria, conditions and process to be followed for a successful use of a benchmarking tool in the ATM environment?

iii. How can such a benchmarking process be institutionalised, meaning how can it be translated into a structured process fully accepted by the ATM community?

In answer to the first question, it clearly appears that benchmarking can be a significant contributor to the improvement of ATM processes, at least as long as providers are in monopoly situations and the market remains highly regulated. In the absence of objective and fully transparent measures of performance, benchmarking is an appropriate tool to understand the key performance drivers by allowing comparison of providers across a wide array of domains that play a role in the service delivery.

In answer to the second question, three critical conditions must be met for the benchmarking process to be successful in its future applications:

- Providers need to take “ownership” of the process

- The ATM community needs to agree on a set of definitions and best practices

- Benchmarking has to be implemented at a lower level than the provider level, in order to lead to actionable results. Lower level means at least service level, and ideally service level within a given operational unit (i.e. ACC/APP/TWR level).

In answer to the third question, an institutionalised benchmarking process should have at least three core attributes:

- Standard requirements for data and information disclosure
- Agreed standards and targets against which to analyse the data and evaluate the various improvement and performance levels
- A framework that captures the levers and identifies ways available to the providers to make improvements in the various areas where such improvements are expected

Ultimately, the way the various dimensions of this institutionalised benchmarking process will be implemented will determine the overall maturity level of the benchmarking process itself. The ultimate goal is to progress from what is today still viewed and practiced as an essentially **administrative** exercise towards a more **managerial** and **decisional** approach, whereby benchmarking is part of a fully integrated managerial and decision-making toolkit.
2 INTRODUCTION

2.1 FOREWORD

This document forms the final general report for the study on benchmarking for best practices in air traffic management and has been prepared by Booz Allen Hamilton Limited with its subcontractors Lufthansa Consulting GmbH. It covers service provision in the European Community\(^1\) and other States with developed infrastructure and processes. A Confidential Annex that captures all the results of the Study and that will be distributed exclusively to the participants to the Study complements this report. The results highlighted in this report have been sanitised to respect the level of confidentiality agreed with the participants. However, some references to specific providers are occasionally made to reflect the European Commission’s willingness to encourage transparency and openness in the ATM community.

This study forms one of two initiatives launched by the European Commission to explore the application of benchmarking in ATM and identify those processes that work well in a given environment. The second study covers the Candidate Countries for the European Union and has been undertaken by Helios Technology Limited.

2.2 OVERVIEW

The overall aim of the study was to establish the basis for a comprehensive benchmarking of ATM by identifying best practices and explaining the processes behind good performances. In doing so, the study has explored the use of benchmarking as a tool for improving processes in ATM at both the regulatory and service provision levels.

This report reviews the main results as well as a synthesised description of the methodology used.

2.3 BACKGROUND

The importance of aviation in fuelling and supporting economic growth is well recognised. Despite the recent downturn, air transport is still seen as one of the most prominent sectors in the world economy, essential for promoting business and leisure and one which is expected to continue on a long term growth path.

In the European region, there has been significant concern raised regarding the ability of the air traffic management (ATM) sector to meet the projected capacity

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\(^1\) Includes Norway and Switzerland in the context of the Single European Sky.
requirements and it has long since been recognised that the current levels of delay, inefficiency and costs directly attributable to ATM are in need of urgent reform.

This view is strongly supported by airspace users, particularly the airlines. Under the process of liberalisation of the air transport industry within the Community, the airlines undertook considerable reform to improve efficiency and now emphasise that the ATM sector has, so far, not been subjected to this much needed process. Additional pressure comes from the society and other stakeholders, in particular passengers as they call for an efficient and reliable air transport system in all components, including ATM.

In 1999 the Communication from the European Commission on the creation of the Single European Sky concluded that, irrespective of the legal and economic structure of ATM providers, there is need to establish an adequate overall European regulatory framework to ensure that services meet the necessary levels of safety, interoperability and performance, particularly if they remain to be provided on a monopolistic basis. In support of this, and with the support of the European Council, a High Level Group (HLG) bringing together civil and military representatives of the Community Member States, together with representatives of Norway and Switzerland, was formed.

This Group worked intensively over a 12-month period to advise the European Commission on needs and solutions for reform of the ATM sector. Amongst its conclusions, the HLG in its final report dated October 2000 underlines that “there is wide agreement that the ATM organisation [in the Community] suffers from significant handicaps standing in the way of more efficient performance”. The HLG recommended to “reinforce mechanisms to optimise the performance of European ATM as a whole” and that there is a need for an appropriate “regulatory framework to be established to cover the domains of safety, overall system performance, and required levels of service, airspace design, system design and economic aspects”.

2.4 PURPOSE AND SCOPE

From a Community perspective the use of benchmarking is foreseen not only as a complementary approach to regulation of the ATM sector but also as a tool to verify whether the regulatory measures meet expected objectives in terms of increased safety, capacity and efficiency and reduced cost.

In view of this, the European Commission launched this study to undertake a comprehensive exercise of benchmarking in the ATM sector, promote its establishment on a permanent basis and advise on how such a process could complement and support Community legislative initiatives in this field.

The European Commission believes that the needed improvement at the operational and regulatory levels should be promoted by indicating best practices to the stakeholders and that a suitable mechanism to achieve this is through the identification of best performances by analysing the reasons for performance differences and, later on, preparing and implementing change. As such, required
improvements of performances in ATM would strongly rely on the analysis of internal processes and the opportunity to implement the necessary steps to adopt identified best practices.

This study therefore was aimed at establishing such a basis of comprehensive ATM benchmarking by achieving the following tasks:

- Conducting analytical benchmarking of ATM covering the Community area and other countries which have well developed systems including Australia, Canada, New Zealand and the United States.
- Identifying relevant best practices underlying observed current performance levels or expected future performance requirements
- Ensuring co-ordination with a parallel study undertaken for the candidate countries for the Community
- Exploring and specifying opportunities for the use of benchmarking as a tool for improving ATM processes both at the regulatory level and service provision level
- Ensuring that this benchmarking process takes due account of all stakeholders in the ATM value chain and, in particular, that relevant operational interfaces with airlines and airports are taken into consideration in the scope of the analysis
- Detailing relevant indicators for disclosure and highlighting legislation needed to support the permanent exercise of performance review and economic regulation
- Ensuring implications of external factors such as geographical, institutional and operational specificities are duly considered throughout the assessment
- Ensuring that stakeholders are adequately involved throughout the assessment and that further developments or initiatives are co-ordinated with Eurocontrol (in particular the Performance Review Unit - PRU)

From the onset, the study team recognised that with the set up of the Performance Review Unit (PRU) at Eurocontrol, the opportunity and the benefit of defining suitable metrics to compare performance across ATM in Europe has already been partly realised. However, if the work of the PRU is to remain valuable and provide solution to the needed improvement in performance of the ATM system as a whole, the focus of the effort will have not only to identify the differences in performance but also to help understand the reasons behind the individual performance variations through meaningful comparison and benchmarking. The output of this study is therefore also aimed at providing essential extension to the ongoing activities of the PRU.
FIGURE 1: INTER-RELATIONSHIPS BETWEEN THE ONGOING TASKS
3 SUMMARY OF APPROACH AND METHODOLOGY

3.1 STUDY APPROACH

The study has proceeded according to a general approach described in the following chart:

This general approach was composed of three main phases:

**Phase I**
- Identification of relevant domains of analysis
- Definition of appropriate metrics (preliminary)
- Establishment of general data requirements

The selection of relevant domains of analysis has been the starting point of the study. For each of these chosen domains, specific dimensions to be benchmarked have been identified in order to focus the analysis on areas that are most relevant to future improvements.

**Phase II**
- Data Collection Process
- Benchmarking Framework Build-up
- Benchmarking Process Implementation
The three main work-streams developed in Phase II were progressed in parallel, since the development of one had implications on the others.

Lessons learned through experience of other benchmarking projects have assisted the study team in selecting the appropriate framework to be applied to each of the domains of analysis as identified in Phase I.

**Phase III**

- Analysis and Synthesis of Results
- Development of a Road Map for Improvement, in particular through the institutionalisation of the benchmarking process

The analysis of results in the second half of the study has been performed with the aim of investigating relationships between the various domains of analysis. These analyses have been essentially quantitative or qualitative, depending on the nature of the domain, although some of the analyses have required translation of qualitative results into quantitative indications.

Although basic statistical regression analysis methods have been used in such cases, their statistical representation should not be overestimated. The objectives of such analyses are to support “qualitatively” identified patterns, rather than give an accurate “quantitative” statistical representation of the situation.

The analyses performed have also opened further avenues that could be explored in future studies, particularly in the investigation of “cause and effect” relationships across the service delivery chain (“linkages”).

Even though, detailed identification of the relationships between current performance and current practices would require a more specific study at operational unit level, best practices have been identified, whose implementation should play a significant role in driving improved future performance. The impact of external factors on the overall service delivery chain has also been assessed and incorporated in the overall benchmarking analysis.

The insights derived and lessons learned from the benchmarking process have been combined and translated into a general road map, which should guide the Commission in promoting best practices and performance improvements in the Community along the lines of the high-level objectives of the Single European Sky.

### 3.2 Methodology

The overall analysis used a combination of inputs from three primary sources:

- The Study Questionnaire
- The CFMU flight list
- Other data in the public domain (including other studies, Eurocontrol and PRU activities etc.)
These three sources have been used to produce a combination of performance, process and strategic benchmarking that has led to the definition and validation of quantitative or qualitative Key Indicators as well as some of some Key Legislative Enablers (KLEs). An overall schematic of the approach is shown in Figure 3 below.

The overall approach follows the European Commission’s hypothesis that the needed improvement at the operational and regulatory levels should be promoted by indicating best practices to the stakeholders and that a suitable mechanism to achieve this is through the identification of best performances by analysing the reasons for performance differences and, later on, preparing and implementing change.

As such, the required improvements in performance will strongly rely on the opportunity to implement the necessary steps to adopt identified best practices through the tracking of qualitative Key Indicators. The identified quantitative Key Indicators will then provide the mechanism to monitor impact and shortfalls on future performance, whereas the KLEs will provide the tools towards implementation of improved processes where identified.

3.2.1 Domains of Analysis

Six groupings of domains of analysis have been selected to reflect and segment the full chain of ATM service delivery. Safety is the overarching process and principal goal driving the service. Inputs are the resources used to produce the service through the development and implementation of Internal Processes. These “processed” inputs then translate into Outputs (from the provider’s point of view), which are then translated into Outcomes (from the customers’ point of view). External Factors impact the service delivery at various points, be it at the input, internal process, output or even outcome levels. These domains are illustrated in the following chart:
3.2.2 Analysis of Internal Processes

The internal process domain has been broken down into 21 key capability areas. A series of key indicators has been selected for each capability area. A set of up to five qualifications for each key indicator has been defined in terms of the range of practices that could be applied in each capability area or process. The range of reasonable practices was determined by comparison of the various practices applied within the ATM industry and, where appropriate, in other similar industries. The qualifications for these key indicators have been combined to form “Cluster Charts” for each capability area. These cluster charts capture the whole range of possible or actual practices as determined by the Study Team for each capability area. Providers have then been positioned along the various indicators, according to the data and information provided in response to the Study Questionnaire. The cluster charts have thus been used to derive an overall picture of industry-wide practices as well as to identify the variances in practices across providers.

Best practices have also been defined for most domains according to:

- Lessons learned from other industries and generally accepted management best practices
- High level objectives of the Single European Sky
- Proven success in ATM environment

The 21 capability areas are summarised in Figure 5. The related cluster charts have been put together in Appendix 1 to this report.
3.2.3 Analysis of External Factors

It has long been understood that factors outside the direct control of the service provider may affect service delivery and therefore performance. In order to try and understand the impact of these ‘External Factors’, two distinct analyses have been undertaken for the Operational Environment and Institutional Environment.

The criteria used for these two areas of analysis were mainly descriptive and are still subject to discussion and revision amongst the providers participating in the study.

At this stage the criteria are used to provide a first indication of the linkage of internal processes with the external environment and whether there is consistency throughout the industry.

For consistency and further analysis, fact sheets for each provider have been developed and have been attached in the Appendix 2 to this report.

3.2.4 Analysis of Inputs, Outputs and Outcomes

This analysis has allowed comparison of quantitative variables across the majority of participating providers and was designed to assess performance differences and, where possible, the reasons behind such differences.

All linkages across the service delivery chain were not directly measurable in this first iteration of the benchmarking framework, but some have however been identified and incorporated into this report and in the Confidential Annex.
4 SUMMARY OF RESULTS

The following paragraphs summarise the results of the study for each domain of analysis. Full details of these results are available in the Confidential Annex to this report, which is available to each participant of the study.

4.1 SAFETY

A very high degree of importance is given by providers to processes related to safety assurance, although some providers are in a transitional state towards meeting requirements for regional standards (ESARRs). Compliance with ESARRs still allows significant variation between the various organisational models, tools and processes used and some providers have capabilities which are significantly more sophisticated than any internationally recognised standard. Such providers have taken onboard lessons learned from other industries and it may be possible to further develop the safety culture as better systems and processes are validated for use in the specific environment. For example, some providers (ENAV, Airways New Zealand and Skyguide) have an adopted a total safety management system as an integral part of their overall total quality management system.

Overall, most value is to be gained through increased visibility of the use of different approaches to safety management to identify possible opportunities for further improvement on a provider-by-provider basis.

4.2 ORGANISATION OF SERVICES

4.2.1 Separation between Regulator and Service Provider

Generally, regulation is separated from service provision to some degree, either functionally within an organisation or organisationally. However, there is a wide variation in the approaches taken to the definition of the regulatory interface, supporting processes, inspections and audits, with much scope for harmonisation, including definition of a pan-European set of standards when a competent body, such as EASA, is created.

4.2.2 Service Definition

There is a strong legacy of the origins of the ANSPs as state-monopoly providers following the conventional integration model of service provision. In most cases, the mission and objectives are taken as given or derived directly from ICAO obligations with limited inclusion of staff and/or customers/stakeholders. The mission is mainly aimed at fulfilling sets of standard requirements rather than differentiation between providers and/or services. This is to be expected given the monopoly status of the majority of the services.
There is little actual unbundling of services, other than outsourcing of some ancillary activities, such as MET, and specific aerodrome ATC services. In some cases, the organisational structure of the ANSP facilitates the potential unbundling of services, e.g. business units aligned with services, whereas in others the structure hinders the potential for unbundling, e.g. multiple services delivered from single business units.

As yet, no service provider has branched out into the provision of services unrelated to ANS, although some providers have the freedom to do this. Where non-ANS services are provided, they have a strong link either: 1) to ANS (consultancy, training...); or 2) to the historic background of the ANSP (fire & rescue, ground handling...).

Transparency is limited in two main respects:

1) organisational units contribute to or deliver multiple services with blurred or indistinct boundaries.

2) even where audited accounts are published, cost allocation to services is very problematic, with techniques varying from provider-to-provider.

4.2.3 Service Delivery

Service delivery domains show a high degree of diversity across the industry.

There is no obvious common thread concerning, for example, outsourcing policy across the service providers; there is also no common thread across domains within a service provider, e.g. an organisation with a common outsourcing policy would not necessarily have a quality management system in place.

There are, however, some trends in specific domains: For example, there appears to be a move to focus on ATS rather than ANS with non-core services, e.g. MET being divested. Finally, quality accreditation is being implemented, even if only for specific services, such as AIS.

4.2.4 Customer Relationship Management

The industry is extremely polarised in its approach to customer relationship management. There are two extremes, with very few organisations lying in between:

- On the one hand, many providers allow for very little direct customer involvement in service definition. Great reliance is placed on institutional approaches in defining (global and regional) requirements. Services are defined and delivered in line with legal obligations at various levels, e.g. ICAO, regional or national.

- On the other hand, some providers (NavCanada, NATS, Airways NZ, AsA, DFS, Austrocontrol, IAA) solicit a high degree of customer involvement and feedback. The approach builds on institutional approaches but tailors requirements and services to meet specific local and customer requirements, specifically defined in licences or through service level agreements between providers and customers.
4.3 OPERATIONAL CONCEPT

4.3.1 Airspace Design

The majority of providers have implemented between 75 – 100 % of the ICAO Annex 11 airspace requirements; however, with more than 90 possible variations and the addition of national procedures for the use of airspace, the classification of European Airspace is far from being uniform. Since classification of airspace also serves the purpose of segregating IFR from VFR and military traffic, classification will always have to be tailored to specific situations in a given environment (congested areas on the ground and in the air, prevailing weather conditions, role of general aviation and importance of military interests).

Generally, regional harmonisation and service requirements constitute the majority of drivers for airspace design, while some providers also consider technical capabilities as a motivation for design change.

The results indicated that conceptual options (the possibility of conducting other than traditional concepts of operation such as Free Routing etc.) motivate only a minority of providers (Austrocontrol, NavCanada, DFS, IAA, Airways New Zealand, Air Services Australia and NAV Portugal).

In was also found the involvement of customers in the airspace design and classification is far from being commonplace.

4.3.2 Airspace/Sector Management

Most providers have the capability to change their sector configuration with very little time constraints. This capability is mainly an organisational flexibility issue (opening and closing of sectors) and does not necessarily exploit the more flexible technical capabilities that are often available in Centres.

The possibility of increasing the number of controllers in a sector to meet increasing demand does not seem to be a viable option under present concepts of operation. The difference in the number of sectors open during rush hours compared to those in quiet hours varies between more than 85% to below 60 %. This practice of tailoring the number of active sectors constitutes an organisational and rostering challenge. Most providers have the technical means to allocate more work positions to sectors as required, however, this technical flexibility – with some exceptions such as Airservices Australia– does not seem to be widely utilised.

Nearly all providers are using the tools of the Flexible use of Airspace concept on a tactical level. It is unclear whether the concept itself is successfully applied beyond the responsibility of the providers and users. In particular, no conclusions can currently be drawn concerning the cross-border aspect of civil/military cooperation.
4.3.3 Air Traffic Flow Management

ATFM in Europe is highly standardised. With very few exceptions, it is executed through the CFMU with national support, mainly on ACC level through a normal sector position or dedicated Flow Management Positions (FMPs). NavCanada is using a similar structure with a national central flow to be introduced 2003. Other providers use or are planning flow management techniques concomitant with their specific requirements.

The conceptual tools (use of conditional routes, off-load routes, circumnavigation of congested areas etc.) have become common practice; it is noticeable, however, that most of these means are based on civil / military relations.

Customer involvement in ATFM is highly visible and is used beyond the level of CFMU in direct tactical decisions between ACCs and customers.

4.3.4 ATC Procedures

The main technology used for separation is, as expected, radar and, where coverage limitations require, procedural means, including manual position reporting. Automatic dependent surveillance techniques are used operationally in some oceanic and remote areas, where the local technology implementation allows, and is under development in other areas.

Transfer of Control, a sensitive area between ACCs in the past, no longer seems to be a limiting factor and silent transfers with little or no lead time required have become common practice. Some providers, however, only perform silent transfers within their own environment. Others (Luxembourg and Airways New Zealand) also perform silent transfers with the military. The lead time required varies from 15 minutes to less than 3 minutes. Longer times are typically required when oceanic interfaces are involved and for providers which operate in different long distance environments.

As regards to the preparation for emergencies, the handling of emergencies and unusual situations of aircraft varies from theoretical lectures in basic training to being an part of proficiency training, using simulators and results documented.

Although English is the principal language used for ATC, some providers use their own language to communicate with pilots of the same nationality.

4.4 Working Practices

4.4.1 Rostering

The majority of providers base their rostering system on an individual basis rather than as a whole team. Some providers use a combination of individual and team-based rostering. There is sometimes a tendency to vary rostering principles from facility to facility within a provider’s environment, driven by the flexibility required to meet and react to local traffic demand. For major ACCs in particular, software tools supporting the rostering process have become more and more common,
although some still develop such tools in-house, whereas other have utilised the
application of customised solutions based on COTS products.

The interval between rostering cycles has decreased over recent years to take better
account of seasonal and sub-seasonal fluctuations in demand levels.

The Personnel Factor\(^2\) shows a wide spread from less than 3 to more than 10,
indicative of the large variation in input assumptions and external factors from
service provider to service provider.

Rostering of stand-by staff is not considered by some providers but is performed
routinely by others. Providers might wish to look into this aspect and maybe draw
on lessons from the airline industry which regularly uses stand-by crews to maintain
service levels.

A limited number of providers roster standby teams, whereas others have an
organised system based on individuals in place, while the remainder have no
provision.

Annual working hours for ATC staff, and especially controllers, vary between less
than 1,500 hours per year to more than 1,800 hours, with support staff generally
working longer hours.

4.4.2 Manning

Flexible use of the rostered staff to react to changing traffic conditions seems to be
limited largely to opening and closing sectors. As mentioned earlier, the use of
additional staff in an already open sector is an exception rather than common
practice. The variation of manpower applied to a sector between peak and quiet
hours is low, typically at the level of one third and the usual approach is to
open/close the complete sector rather than to change its manning. Minimum
manning is generally prescribed, but supervisors have differing authority to go
below the minimum.

4.4.3 Licensing

It has become general practice for licences or ratings to be limited to one facility and
to be endorsed for multiple sectors. Combined licences are sometimes used where
APP and TWR facilities are collocated. The number of ratings a controller can hold in
a facility varies with the degree of complexity of the airspace; the more complex the
airspace, the fewer the ratings that can be held. All providers have implemented
programmes to assure that operations staff stays current.

\(^2\) P.F. is the factor, by which the number of ATCO on Duty must be multiplied to obtain the number of staff required to man working
positions. The factor caters for leave of absence, instructions and training, sick leave, special projects and other reasons for absence
4.4.4 OJT

Although the use of simulators in an operational environment – outside of ATC schools – has become more common, it is still not general practice. The balance of practical training versus simulator training is weighted very much in favour of practical training. The practicality of this approach hinges, to a degree, on the traffic levels experienced – sufficient traffic must be available to make the training meaningful but not so much as to make it impractical.

Generally, simulators have become more and more important in the application of proficiency training and for training for unusual occurrences. Proficiency policy standards are widely accepted, with time limits specified to retain currency.

4.4.5 Performance Monitoring of Proficiency

The degree of proficiency monitoring varies from minimal to very comprehensive. It should be noted that performance monitoring has an impact on flight safety and is needed to assess the quality of training in a facility.

4.5 Strategic Management

4.5.1 Business Planning

Relatively consistent business planning processes are in place across the industry with top-down and bottom up approaches. However, business planning is performed annually in most cases with limited updating or ability to iterate throughout the year, making the process still look very much like an “open loop”. Business planning is often performed as a stand-alone process with limited interaction with other areas of planning (e.g. capacity planning).

Moreover, providers typically do not document or communicate their business plan. Overall there are:

- a limited number of publications for the general public (annual report only for most providers)
- limited level of detail
- highly variable frequency.

Relationships with other providers seem to a large extent driven by geographical and cultural considerations (neighbouring countries tend to cooperate more with each other) and to a lesser extent by technological considerations (some joint R&D/technology projects). Beyond that, very few providers have taken the initiative to develop strategic relationships with other parties, be it customers, suppliers or other ANSPs. This is probably a result of the traditional national fragmentation of the industry.

With a few exceptions, sourcing strategies are not applied in the industry, implying a general lack of sophistication in supply-side management.
4.5.2 Human Resources Management

Most providers use a range of Human Resources (HR) tools and processes. However, it seems that this has been a relatively recent trend as many providers are just starting to implement many of them.

In terms of labour relationships, the ATM industry is highly unionised, with an average of 80% of staff being members of a trade union (the figure is even higher for controllers), and an average of 6 different unions per provider. Most providers have integrated the unions into their decision-making process, either by having a representative on the Board, or by mutually agreeing working practices or by using working groups. Consultation is used by most providers as the main means of cooperation with unions.

Career development practices vary significantly across the industry: some providers have individual performance-based rewards, some others have individual objectives only, some have management and leadership training. This seems to be an area with some improvement opportunity in terms of managing controllers’ careers more dynamically and more creatively.

As far as recruitment is concerned, a wide range of practices is applied, mixing bottom-up and top-down approaches to recruitment strategy and needs. This might partly explain why there are large differences in terms of the shortage of controllers across providers. Similarly, the mechanisms that providers use to measure recruitment performance are quite basic, which suggests some significant improvement opportunities.

Finally, most providers seem open to the recruitment of foreign controllers, provided it is allowed by legal or immigration laws; a minority identify local language and security clearance as restricting the hire of foreign controllers. There is some contradiction between the apparent openness to the hiring of foreign controllers without language constraints and the actual use of local language by some providers.

4.5.3 Operations Planning

Most providers use a combination of methods to forecast demand. However, forecasts do not cover all types of customers: usually it covers only scheduled commercial air transport, sometimes charter as well, and more rarely general aviation customers.

The level of resolution of the forecast is usually in line with industry-wide tools which allow demand to be forecast over a 5 to 10 year time horizon at regional, national and centre level.

Generally speaking, providers do not evaluate the effectiveness of their forecasts on a systematic basis although comparisons are made between predicted and actual traffic; it is as if forecasting was an open loop process with no real feedback or opportunity to validate the methods used.
In terms of capacity measurement and capacity requirement management, there are large variations in practices: from the use of simulation and/or historical data to the sector and/or centre level, and to the use of laboratory or operational simulation. This lack of standardisation probably reflects the lack of a clear definition of capacity and the lack of a clear method as to managing and measuring it on a European scale.

4.5.4 Crisis Management

Providers do not consistently apply the concept of crisis management planning; there does not seem to be any standard or agreed framework in that regard. A minority of providers have a comprehensive crisis management plan and organisation in place. The definition level varies widely from provider level down to sub-system level and neighbouring areas. Coordination with external parties also varies widely with most providers having limited defined procedures with external parties for crisis management.

4.5.5 Environmental Planning

Variations across providers have been observed in terms of the process used to take into account environmental impact and to monitor compliance. This probably reflects the lack of standard or agreed principles at industry level.

4.5.6 R&D Planning

The majority of providers do not perform any R&D to any great extent; for those, this is clearly not seen as part of the scope of activities necessary to deliver ATM services.

Those providers who are involved in R&D activities tend to dedicate significant resources and have a medium to long-term focus. Additionally, there seems to be a clear relationship between scale and complexity of operations and involvement in R&D work.

The main objective for those engaging in R&D is to improve operational efficiency or performance in the long-term. The underlying fundamental question is still open as to whether providers themselves are in the best position to do R&D or whether they would be better off sponsoring R&D through suppliers or other specialised organisations.

Ultimately, the drive towards more standardised systems and technologies should allow providers to pool resources together and drive an industry-level R&D effort.

4.5.7 Infrastructure Planning

Infrastructure Planning, which traditionally was part of the technical branch and limited itself to technical improvement or replacement of legacy systems, has developed to include operational and business requirements, considering users as
customers. The organisational structure of the providers reflects this change of paradigm.

Given the financial impact of CNS/ATM infrastructure decisions, the long time lines to publish intended changes within the framework of ICAO, and the long depreciation times of systems, a well defined organisation is a precondition for success.

Unlike other planning processes (demand forecast, business planning), it seems that there is a management process to organise, close the loop and evaluate the success/effectiveness of infrastructure planning through post-project audits and other performance measurements. This is probably related to the fact that infrastructure planning is more closely connected with operations, therefore more in line with traditional organisational culture.

Due to the numerous interdependencies in modern aviation between ground and air, vendors and purchasers, providers and customers, the scope of infrastructure planning has been extended to include operational concepts as well as business planning.

4.6 Inputs

4.6.1 Staff

Analysis of staffing across providers shows two clear groups: one consisting of larger providers (with over 1,500 employees) and one consisting of the smaller providers.
In spite of the large differences in the proportions of specific staff resources used, a strong relationship exists between total staffing, total ATCOs in Ops and IFR flights handled. Total Staff and ATCOs in Ops also show a strong relationship with the number of Sectors handled.

4.6.2 Technology

4.6.2.1 Observations on surveillance functionality

While the majority of providers claim the use of advanced multiradar tracking with only two using simple multiradar tracking, there appears to be some discrepancy in the technical definitions. The term “multiradar tracking” seems to be generally used for any system that employs more than one radar, and the term “advanced” seems to be used to reflect the construction year rather than the tracking algorithm.

Automatic assignment of SSR - codes has become general practice, widely assisted by an adequate code management. Some six providers, also in the core European area, are not using an automatic code management system. In the light of code shortages, there seems to be room for improvement here.

4.6.2.2 Observations on flight data processing

All European providers, except one, receive all flight plan messages from the IFPS. Updates are generally based on radar, automatic messages, and manual inputs. Only a very few providers have their databanks updated by adjacent units. The distribution of flight plans varies from a limited distribution to a full data sharing.
Trajectory predictions are generally in use, based on fixed and flexible routings. Standard or advanced aircraft profiles are the basis of trajectory calculations.

There is some inflexibility through the “one fits all” algorithm of a centralised FPN system using routing systems, be they flexible or fixed. Future operational concepts would require a system that can accept routings independent from any routing system. The implementation of area navigation already points in that direction. With the advent of data link, the basis for trajectory prediction could then be the individual aircraft than a standard profile.

4.6.2.3 Observations on flow support tools

Sequencing and metering systems are becoming more common, limiting their early application to initial departure management and final approach sequencing. Three providers only envisage the use of tools in a more strategic way.

Tools like those used by the FAA – e.g. URET, CTAS, TMA, are not yet used in Europe, although one reason might be the limited airspace available for the individual centres.

4.6.2.4 Observations on data distribution & coordination

Air-ground data processing & distribution is still at its early stages. Coordination traditionally is a standard bottleneck for ATM capacity and all but three providers have automated or system supported coordination procedures in place. Back-up voice systems based on separate communication links available provide a logical option.

4.6.2.5 Observations on operational systems

The first generation of automated ATM systems is in the process of being replaced by a newer generation based on modular functionalities. This supports the stepwise implementation of advanced features, but might also lead to interface problems. The perception of a general architecture level above system architecture is not very visible amongst providers.

4.6.2.6 Observations on controller assistance tools

Implementation of workload monitors and task schedulers are not planned. One European provider, however, has a limited functionality in that field, while some non-European providers (Air Services Australia, NavCanada) already use these functions operationally. However, reducing controllers’ workload by making inputs easier, and providing adequate display of vital information has become common practice.
4.6.2.7 Observations on navigation

With the implementation of Area Navigation, navigation has made an important step towards a better and more economical use of the airspace. All providers use the traditional means to support en route navigation. In their areas, some still use NDB for en route navigation, which seems to be based on requirements of different customers (Military and General Aviation).

Satellite navigation is becoming more acceptable, with an increasing number of providers using GNSS to support non-precision approaches either as overlay or stand-alone procedures. Around half the providers foresee the replacement of conventional navigation systems by satellite-based navigation. These intentions, however, are very cautiously voiced, mainly in connection with the ECAC navigation strategy.

Historical experience, such as NDB, shows that present systems will still be around for a long time. Changes can be expected should these means not be sufficient for the support of future operational concepts; however, this may require further regional co-ordination.

4.7 Outputs

4.7.1 Capacity

The number of sectors does directly not correspond with the number of flights and this illustrates that sectors across individual providers have differing capacities and use different operational concepts. In some countries, providers apply sectors to handle more traffic than in others. The general trend shows that traffic increases in a steeper way than the numbers of sectors as one moves from the European peripheral providers towards the core European area.

A higher average sector load generally also corresponds to the distribution of delays. Some exceptions are noticeable, however, and some providers report a high sector load but few delays (Austrocontrol, IAA, NATAM). However, there are also providers with a high level of delays in spite of a high proportion of overflights. The results therefore indicate that delays attributed to some providers may mask downstream affects caused by other providers, since the European delay statistics only identify the most penalising sector. This seems to be particularly true where there is a larger level of crossing traffic, although the results could also in-turn suggest that larger providers are better able to handle operational complexity.

4.7.2 Productivity

It seems that providers in general have a large variation in manning per sector in their working practices, with an average of 17.5 controllers per sector.

As expected, providers show varying balances between average transit time and number of flights controlled per on duty controller hour. This is based on the size of
airspace, although the analysis seems to indicate higher overall workloads in some providers. Comparing the number of hours in position based on the rostered quantity with the position time including overtime hours as well, there is a difference of less than one percent. This indicates that the calculated part of the ops time available as position time is realistic. It differs among providers between 15% and 25%, indicating that between 75% and 85% of the available time can be used in position.

The amount of overtime necessary to achieve the operational results varies from 0 to 440, with the average being at 139.5 hrs/yr. The total amount of overtime produced by 12 providers amounted to 1674 hrs per year.

### 4.7.3 Reliability

Only some providers use indicators to monitor technical reliability (e.g. Naviair, Finnish CAA, Luxemburg, IAA, AENA, LFV, UK NATS), while some others are making progress towards monitoring. The remaining number of providers that have not been able to contribute to this part of the study suggests significant room for improvement in this area.

It is important to recognise that technical reliability can only be assessed over a period of successive years. In that respect, a snapshot analysis cannot provide an accurate reflection of performance. It is clear, however, that a uniform set of key indicators would aid future improvement in this area. The following figure highlights such possible indicators.

<table>
<thead>
<tr>
<th>Grouping</th>
<th>Domain</th>
<th>Indicator and Metrics</th>
<th>Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outputs</td>
<td>Reliability</td>
<td>Number of unplanned service outage hours vs. planned service hours per ATSU per year</td>
<td>Equipment monitoring logs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AIP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of planned service outage hours vs. planned service hours per ATSU per year</td>
<td>Equipment monitoring logs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AIP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Variation of number of unplanned outage hours per year</td>
<td>Equipment monitoring logs</td>
</tr>
</tbody>
</table>

**FIGURE 8: POSSIBLE INDICATORS FOR TECHNICAL RELIABILITY**

### 4.8 Outcomes

Outcomes have been derived for the European providers from CFMU and CRCO data; the equivalent data was not available for the other providers.
CFMU data has been used to derive:
- Average delay and reason for delay
- Availability of service
- Predictability
- Cost of delay (using IATA approved figures for cost per minute of delay)

CRCO data has been used to derive the price of service
- Unit rate

Outcome results and analysis has been divided into two domains:
- Cost of service (key indicators: delay cost and actual cost charged)
- Quality of service (key indicators: delay, availability and predictability)

4.8.1 Cost of Service
There is some relationship between unit rate and unit delay cost. For many providers, the higher the unit rate, the higher the delay costs seem to be. This is interpreted as reflecting possible diseconomies of scale for some providers.

4.8.2 Quality of Service

Using 2001 CFMU data to reconstruct delay distribution for each European provider, three dimensions of the quality of service have been captured:
- The delay itself (average delay per delayed flight)
- The predictability (characterised by the standard deviation of the distribution which gives a confidence level that, should a delay occur, it will be in a certain set of bounds)
- The availability of the service (characterised by the proportion of flights delayed below a certain threshold or target level of delay).

Combining these three dimensions identified patterns of performance in terms of quality of service for European providers only (as comparable data were not available for non-European providers):
- Results for availability are relatively uniform across providers, with average availability of 94%.
- Results for delays and predictability follow a similar pattern, which was to be expected, with providers showing the lesser delay per delayed flight being the most predictable and visa versa.
- Surprisingly, providers in the core area tend to fair better on predictability and delay per delayed flight than providers in the periphery, with an exception for one.
– However, in terms of percentage of delayed flights themselves, providers on the European periphery show an acceptable level of less than 1% delay, but this result deteriorates as one moves towards providers in the core area.

Analysis of the actual causes of delay as declared in the CFMU data reveals that ATC capacity accounts for the most delay events by far. Other delay events are, aerodrome capacity, weather, ATC equipment and ATC staffing. Although these are relatively insignificant compared to ATC capacity, they demonstrate some major variations across providers as to the possible focus areas.

4.9 External Factors

External factors have been split into two categories: Operational Factors and Institutional Factors. With the intention of analysing the impact of the external environment and assessing whether the internal processes used are appropriately aligned, descriptive analysis has been used to allocate each provider into a general category for the operational and institutional environment within which it functions. These categories must be viewed as a first iteration and may be subject some reallocation based of subsequent discussion amongst the providers. The overall aim of this analysis is to determine overall trends as opposed to the relative positioning of one provider against another.

4.9.1 Operational Environment

Providers have been grouped in five categories for the operational environment, to take into account the properties of traffic and airspace in various dimensions. These dimensions include qualitative as well as quantitative factors. Since these factors are all interrelated and influence each other, there is no method known to mathematically compute an operational complexity factor and the grouping is based on the Study Team’s relevant experience and analysis with respect to:

– Traffic volume (its composition, dominating profiles, the distribution, and density), as well as airspace volume (its shape, structure, and the neighbouring airspace).

– Additionally, the geographical situation of the provider with regards to its location on the globe as well as its position with regards to traffic streams and orientation was considered.

The resulting five categories are as follow:
Providers have thus been allocated to one of these categories:

<table>
<thead>
<tr>
<th>Category 1*</th>
<th>Category 2</th>
<th>Category 3</th>
<th>Category 4</th>
<th>Category 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airways New Zealand</td>
<td>Austrocontrol</td>
<td>AENA</td>
<td>AsA</td>
<td>DFS</td>
</tr>
<tr>
<td>Nav -Portugal</td>
<td>Belgocntrol</td>
<td>ENAV</td>
<td>FAA</td>
<td>DNA</td>
</tr>
<tr>
<td></td>
<td>FCAA</td>
<td>Maastricht UAC</td>
<td>Nav Canada</td>
<td>NATS</td>
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<td></td>
<td>IAA</td>
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<td></td>
<td>Skyguide</td>
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<td></td>
<td>LFV</td>
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<td></td>
<td>Navair</td>
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<td></td>
<td>NVNL</td>
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</tbody>
</table>

* With TMA operations only, Luxembourg Airport Authority belongs in a special group before Category 1

Note 1: These groupings represent the Study Team’s first attempt to group Providers according to the Operational Environment. In doing so, it must be remembered that the leading factor in developing these groupings has been the influence the Operational Environment may have on the administrative complexity at a Provider level, i.e., the possible requirement for more developed, sophisticated or flexible Internal Processes’. The operational complexity groupings do not therefore represent a measure of the actual complexity of the airspace itself, more a measure of the complexity of administering air navigation services within that airspace from a business perspective. The categories defined are therefore not comparable with the Eurocontrol classifications.

Note 2: Further iteration of this exercise or use of this information should also take the following operational characteristics into consideration for any revised grouping:

Norway: NATAM provides services at 51 airports, which is higher than most other European Providers
Belgium & Netherlands: Airspace is of high complexity with a high traffic density and includes a high percentage of climbing and descending traffic
Maastricht: Airspace represents some of the most complex in Europe, with 7 major hubs in close proximity
USA: The FAA’s area of responsibility encompasses oceanic areas over the Atlantic and the Pacific Oceans, remote areas with very little density, some with a difficult geographical environment (Alaska), areas with a very high traffic density as in the areas along the Eastern seaboard. The FAA also operates, in terms of traffic, the world largest en route centre (Cleveland, Ohio).

A more detailed description of each category is given below
### Category 1:

<table>
<thead>
<tr>
<th>Relation of Airspace and Traffic</th>
<th>Distribution of Traffic</th>
<th>Traffic Profiles</th>
<th>Airports and TMA profiles</th>
<th>Coordination Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large area of responsibility Low Volume of Traffic per Square KM</td>
<td>Homogenous distribution of traffic over the whole area</td>
<td>Traffic mostly overflights Small percentage of climbing and descending traffic</td>
<td>No major hubs in the area of responsibility</td>
<td>Benign Coordination environment (Ample Flying Time, well defined procedures)</td>
</tr>
<tr>
<td>Area &gt; 2.000.000</td>
<td>Former complexity Medium or Low</td>
<td>1 Hub only</td>
<td></td>
<td>This does not preclude high coordination efforts with neighbours in other ICAO regions</td>
</tr>
<tr>
<td>Traffic &lt; 750.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density &lt; 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Category 2:

<table>
<thead>
<tr>
<th>Relation of Airspace and Traffic</th>
<th>Distribution of Traffic</th>
<th>Traffic Profiles</th>
<th>Airports and TMA profiles</th>
<th>Coordination Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Volume of Traffic per Square KM</td>
<td>Homogenous distribution of traffic over the whole area with some choke points</td>
<td>Uniform flight profiles in the area High percentage of overflights</td>
<td>Only few major hubs in the area Few TMAs to be served</td>
<td>Coordination volume with neighbours higher than within area of responsibility</td>
</tr>
<tr>
<td>Traffic &lt; 1.000.000</td>
<td>A higher percentage of climbs and descends are acceptable, when traffic orientation is not complicated</td>
<td>1 major hub Less than 3 major TMA</td>
<td></td>
<td>This means that a good part of the traffic climbs / descends through the area</td>
</tr>
<tr>
<td>Density &lt; 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Category 3:

<table>
<thead>
<tr>
<th>Relation of Airspace and Traffic</th>
<th>Distribution of Traffic</th>
<th>Traffic Profiles</th>
<th>Airports and TMA profiles</th>
<th>Coordination Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Volume of Traffic per Square KM</td>
<td>Traffic follows one or more main axis Choke points spaced sufficiently apart</td>
<td>Uniform flight profiles in the area High percentage of overflights</td>
<td>Several TMAs with more than one busy airport to be served</td>
<td>High Coordination volume inside the area of responsibility and with neighbours</td>
</tr>
<tr>
<td>Traffic &gt; 1.000.000</td>
<td>Domestic trunk routes do not coincide with international trunks</td>
<td>Former complexity varies between Medium and High, with High dominating</td>
<td>TMAs not necessarily in own area provided they are fed through it (Example Maastricht)</td>
<td></td>
</tr>
<tr>
<td>Density &lt; 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Category 4:

<table>
<thead>
<tr>
<th>Relation of Airspace and Traffic</th>
<th>Distribution of Traffic</th>
<th>Traffic Profiles</th>
<th>Airports and TMA profiles</th>
<th>Coordination Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Volume of Traffic per Square KM</td>
<td>Traffic follows more than one main axis</td>
<td>Traffic mix with high percentage of climbing and descending traffic</td>
<td>Several TMAs with more than one busy airport to be served</td>
<td>High Coordination volume inside the area of responsibility and with neighbours</td>
</tr>
<tr>
<td>Military Airspace influences Routing of Traffic</td>
<td>Interdependency of Choke points</td>
<td>Military Traffic is a factor</td>
<td>At least one major hub in the area</td>
<td></td>
</tr>
<tr>
<td>Traffic &gt; 3.5 Million Average Density &lt; 1</td>
<td>Great variance in density</td>
<td>Military traffic proceeds on Altitude Reservations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segregation of civil military requires route harmonisation to provide room for both, which is supported by airspace available</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Category 5

<table>
<thead>
<tr>
<th>Relation of Airspace and Traffic</th>
<th>Distribution of Traffic</th>
<th>Traffic Profiles</th>
<th>Airports and TMA profiles</th>
<th>Coordination Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large area of responsibility Combination of High Density and remote areas</td>
<td>Traffic mainly concentrates on few areas Technical challenge to serve remote areas</td>
<td>Traffic mix with high percentage of climbing and descending traffic Remote areas with mostly overflights</td>
<td>Several TMAs with more than one busy airport to be served Major hubs in the area</td>
<td>Higher Coordination volume inside the area of responsibility than with neighbours</td>
</tr>
<tr>
<td>High Density (Switzerland highest in Europe)</td>
<td>high degree of variation between centres of one provider (Germany between 3.6 and 17.5)</td>
<td>Greater London area with 5 airports</td>
<td>Caused by a great number of airports including major hubs, or due to short transit time (Switzerland)</td>
<td></td>
</tr>
<tr>
<td>Traffic between 1 and 2.5 million</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.9.2 Institutional Environment

The organisational and legal status of the providers has also been classified into categories reflecting five broad institutional models, as described in the figure here below.
FIGURE 11: INSTITUTIONAL ENVIRONMENT CATEGORIES

Once again the providers are allocated to each category, using the data available and the experience and knowledge of the Study Team. These categories are shown in the following diagram:

Note: As of 1st January 2003, NATAM transferred to a limited company named Avinor, with all shares owned by the Government. It should therefore be classed as a State Enterprise

FIGURE 12: ALLOCATION OF PROVIDERS TO THE INSTITUTIONAL ENVIRONMENT CATEGORIES
5 IDENTIFICATION OF BEST PRACTICES

Two levels of best practices have been identified:

1) At the industry level, the framework has also led to the definition of five high level best practices, which capture the key themes that should drive improvements in ATM service provision in the foreseeable future.

2) At a provider level, the Study framework has allowed detailed identification of best practices for each key indicator in the internal process domains (more than 50 in total).

5.1 HIGH LEVEL BEST PRACTICES

Based on our bottom-up assessment of best practices, five high-level best practices have emerged as being representative of key improvement opportunities under the principal objectives of the Single Sky initiative. The implementation of these best practices should lead to tangible improvements in the short and medium term. These best practices are described in the following table:

<table>
<thead>
<tr>
<th>BEST PRACTICE AREA</th>
<th>BEST PRACTICE ATTRIBUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Management</td>
<td>Safety management process should allow for maximum accountability, transparency and awareness at all levels of the organisation, while continuously assessing the corporate performance and culture to further determine whether risk is being reduced to a level as low as reasonably practicable.</td>
</tr>
<tr>
<td>Customer Involvement</td>
<td>Highest degree of customer involvement, in the service delivery requirements definition and in the strategic and tactical decision-making process; customers are an integral part of the feedback loop as regards a provider’s performance (quality and cost of service provided). A customer-oriented culture is pervasive throughout the organisation. Customers include all users as well as key external stakeholders (airports, local communities, military, etc.)</td>
</tr>
<tr>
<td>Scope of Service, Service Definition and Delivery</td>
<td>Very clear and well-articulated mission, values and objectives communicated and shared throughout the organisation; transparent organisational and financial structure (including accounting process for cost and resources allocation), embedded organisational flexibility and systematic process to unbundle or outsource services as appropriate.</td>
</tr>
<tr>
<td></td>
<td>Implementation of an accredited quality management process throughout the organisation.</td>
</tr>
<tr>
<td></td>
<td>Market testing with a view to unbundling of services which do not naturally lend themselves to monopoly provision.</td>
</tr>
<tr>
<td>Tactical Flexibility³</td>
<td>Flexibility to open and close sectors supplemented by the ability to change the configuration of active sectors in adding more working positions in order to react to changes in traffic demand without fragmenting the airspace further.</td>
</tr>
</tbody>
</table>

³ Tactical Flexibility stands for the ability of an ANS provider and his units to react in real – time, or near real – time, to changing traffic conditions in term of demand, volume, orientation and composition. This capability is mainly reflected for the purposes of this study in the ability to change sector configurations, reallocating resources, and using conceptual tools in ATFM, as well as the cooperation with military aviation.
<table>
<thead>
<tr>
<th>BEST PRACTICE AREA</th>
<th>BEST PRACTICE ATTRIBUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flexible rostering combining team and individual-based rostering frequently reviewed.</td>
</tr>
<tr>
<td></td>
<td>Tasking of individuals as stand-by readiness in the case of non-availability of rostered staff, providing the flexibility for supervisors to man working positions with appropriately rated staff.</td>
</tr>
<tr>
<td></td>
<td>Flexible manning of rostered staff to adapt a sector to changing traffic conditions, in support of the operational concept.</td>
</tr>
<tr>
<td></td>
<td>Maximum situational awareness in the cockpit made possible by the use of English as the only language in ATC for IFR flights and on international airports.</td>
</tr>
</tbody>
</table>

Integrated Strategic Management

<table>
<thead>
<tr>
<th>BEST PRACTICE AREA</th>
<th>BEST PRACTICE ATTRIBUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full integration of all functional areas (business planning, HR management, Operations Planning and Infrastructure Planning) into a comprehensive Strategic Management Process; this process should be iterative and closed-loop, using a combination of top-down and bottom-up processes, with the embedded ability to monitor success against targets and standards, to identify improvement opportunities.</td>
</tr>
<tr>
<td></td>
<td>Implementation of a high level Air Navigation Architecture(^4) approach in support of such a process.</td>
</tr>
</tbody>
</table>

**Table 1: High-Level Best Practices**

### 5.2 Detailed Best Practices

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>KEY INDICATORS</th>
<th>BEST PRACTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAFETY PROCESS</td>
<td>Safety Management</td>
<td>An independent office reporting directly to the head of the overall organisation, who is then accountable for safety performance</td>
</tr>
<tr>
<td></td>
<td>Function</td>
<td>The office should execute the safety policy for all safety related services</td>
</tr>
<tr>
<td></td>
<td>Safety Management</td>
<td>Provides audit of critical services, with defined indicators and also provides an ongoing assessment on the overall corporate performance and culture</td>
</tr>
<tr>
<td></td>
<td>System</td>
<td>The safety culture should be monitored at each level of the organisation, with performance objectives for middle and senior managers</td>
</tr>
</tbody>
</table>

\(^4\) Air Navigation Architecture is the visualisation of a virtual organisation containing a network of businesses collaborating in Air Navigation. It contains the infrastructure of ANS, assets of users, and interrelation with organisations sharing interests in the use of airspace, and procedures. The boundaries have to be continuously revalidated to decide over the inclusion of other transport systems and the role of customers as passengers and shippers. This architecture enables ANS to deduct and validate requirements for their infrastructure. It is a multi-faceted framework and forms a model of reality, describing the overall Air Navigation System.
<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>KEY INDICATORS</th>
<th>BEST PRACTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education, training and testing</td>
<td>Education, training and testing</td>
<td>Education, training and testing should be applied at relevant levels for all staff:</td>
</tr>
<tr>
<td></td>
<td>- Every staff member should have</td>
<td>- Every staff member should have basic awareness of the safety nature of the</td>
</tr>
<tr>
<td></td>
<td>basic awareness of the safety</td>
<td>business and relevant issues through regular communication and workshops</td>
</tr>
<tr>
<td></td>
<td>nature of the business and relevant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>issues through regular</td>
<td></td>
</tr>
<tr>
<td></td>
<td>communication and workshops</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Regular training should be</td>
<td>- Regular training should be applied to all safety related staff: ATCOs,</td>
</tr>
<tr>
<td></td>
<td>applied to all safety related staff:</td>
<td>Assistants, Flight Data Personnel, Engineers</td>
</tr>
<tr>
<td></td>
<td>- Regular testing should be</td>
<td>- Regular testing should be applied to ATCOs as a minimum</td>
</tr>
<tr>
<td></td>
<td>applied to ATCOs as a minimum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Future developments could</td>
<td></td>
</tr>
<tr>
<td></td>
<td>include the application of ad-hoc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>testing</td>
<td></td>
</tr>
<tr>
<td>Safety occurrence reporting</td>
<td>Should allow mandatory, non punitive</td>
<td>Should allow mandatory, non punitive reporting of all safety related</td>
</tr>
<tr>
<td>process</td>
<td>reporting of all safety related</td>
<td>occurrences and should be automated wherever possible for consistent</td>
</tr>
<tr>
<td></td>
<td>occurrences and should be</td>
<td>application</td>
</tr>
<tr>
<td></td>
<td>be automated wherever possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>for consistent application</td>
<td></td>
</tr>
<tr>
<td>Risk identification</td>
<td>Should be proactive as well as</td>
<td>Regular assessments and audits should allow proactive and effective</td>
</tr>
<tr>
<td></td>
<td>reactive with full transparency</td>
<td>determination of risk potential risk areas; Staff and Infrastructure upgrades</td>
</tr>
<tr>
<td></td>
<td></td>
<td>should have direct visibility at the board level</td>
</tr>
<tr>
<td>ORGANISATION OF SERVICES</td>
<td>Separation between provider and</td>
<td>Clear separation, well-defined interfaces and comprehensive compliance</td>
</tr>
<tr>
<td></td>
<td>regulator</td>
<td>checking</td>
</tr>
<tr>
<td>Service definition (General)</td>
<td>Very clear and well-articulated</td>
<td>Very clear and well-articulated mission, transparent organisational and</td>
</tr>
<tr>
<td></td>
<td>mission, transparent organisation</td>
<td>financial structure and flexibility to unbundle services as appropriate</td>
</tr>
<tr>
<td></td>
<td>and financial structure and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>flexibility to unbundle services</td>
<td></td>
</tr>
<tr>
<td>Service definition - Clarity of</td>
<td>Statement of objectives and values</td>
<td>Statement of objectives and values (rather than a prescriptive mission)</td>
</tr>
<tr>
<td>mission</td>
<td>(rather than a prescriptive</td>
<td>formulated through consultation with employees, customers and other</td>
</tr>
<tr>
<td></td>
<td>mission)</td>
<td>stakeholders</td>
</tr>
<tr>
<td>Service definition - Degree of</td>
<td>In the context of the Single Sky,</td>
<td>In the context of the Single Sky, to have in place a structure and processes</td>
</tr>
<tr>
<td>service bundling</td>
<td>to have in place a structure and</td>
<td>that facilitate widespread unbundling of services, both core and ancillary</td>
</tr>
<tr>
<td>Service definition - Organisation</td>
<td>Freedom to provide any non-ANS</td>
<td>Freedom to provide any non-ANS service with functional and accounting</td>
</tr>
<tr>
<td>of non-ANS services</td>
<td>service with functional and</td>
<td>separation from core services</td>
</tr>
<tr>
<td>Service definition - Transparency</td>
<td>Maximum organisational and financial</td>
<td>Maximum organisational and financial transparency</td>
</tr>
<tr>
<td>Service delivery - Outsourcing</td>
<td>For outsourcing, it is not clear</td>
<td>For outsourcing, it is not clear whether it is better to have centrally</td>
</tr>
<tr>
<td></td>
<td>whether it is better to have centrally</td>
<td>controlled processes or freedom for individual business/operational units to</td>
</tr>
<tr>
<td></td>
<td>controlled processes or freedom for</td>
<td>have the autonomy to make their own decision</td>
</tr>
<tr>
<td></td>
<td>individual business/operational</td>
<td>However, uniform decision criteria and rules should be applied</td>
</tr>
<tr>
<td></td>
<td>units to have the autonomy to make</td>
<td></td>
</tr>
<tr>
<td></td>
<td>their own decision</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Service delivery - Quality</td>
<td>To have an accredited quality management process implemented across the whole</td>
</tr>
<tr>
<td></td>
<td>Management Process</td>
<td>organisation</td>
</tr>
<tr>
<td></td>
<td>Service delivery - Unbundling of</td>
<td>In terms of future Single Sky objectives, those organisations that are</td>
</tr>
<tr>
<td></td>
<td>services</td>
<td>unbundling services, e.g. from ANS to ATM, could be viewed as exhibiting best</td>
</tr>
<tr>
<td></td>
<td></td>
<td>practice</td>
</tr>
<tr>
<td>DOMAIN</td>
<td>KEY INDICATORS</td>
<td>BEST PRACTICE</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Civil – Military Relationship</td>
<td>From a civil perspective, best civil-military relationship process offers maximum flexibility in terms of airspace, infrastructure and services to the civil ANSP and end-user. This implies maximising civil control of these aspects. This may not be best practice from the military perspective. From that perspective, complete integration is considered best practice.</td>
<td></td>
</tr>
<tr>
<td>Customer Relationship Management</td>
<td>Highest degree of customer involvement in requirements definition, decision making and feedback with an institutionalised process in place to ensure that this occurs.</td>
<td></td>
</tr>
<tr>
<td>OPERATIONAL CONCEPT</td>
<td>Airspace Design - Application of ICAO Annex 11 Standards</td>
<td>Maximum adherence to ICAO classification with little or no national supplements to the Use of Airspace should be considered as Best Practice. But – since classification of airspaces also serves the purpose of segregating „desired“ (IFR) from „undesired“ (VFR and military) traffic, classification will always have to be tailored to specific situations in a given environment (congested areas on the ground and in the air, prevailing weather conditions, role of General Aviation and importance of military interests).</td>
</tr>
<tr>
<td>Airspace Design - Criteria and Drivers</td>
<td>Although regional harmonisation and service requirements should constitute the majority of drivers for airspace design, conceptual options to open opportunities for concepts of operation such as Free Routing etc should be considered.</td>
<td></td>
</tr>
<tr>
<td>Airspace Design - Customer Involvement</td>
<td>The involvement of customers including all users (General Aviation, Airlines and Military Aviation) of the airspace needs to be extended to include stakeholders and partners as airports, and local communities.</td>
<td></td>
</tr>
<tr>
<td>Airspace/Sector Management - Sector Configuration</td>
<td>When increase of traffic requires a change in sector configuration, common practice is to split existing sectors. Doing so adds to the overall number of sectors and thereby increases the existing fragmentation of the airspace. This organisational flexibility (opening and closing of sectors) does not exploit technical capabilities available that would require a change in the present concepts of operations. Authority to change sector configuration rests mainly at ACC level. It should be considered, however, to find a coordinated way to configure sectors in concert with the CFMU and neighbouring centres (within and between countries). Specially the time frames available, less than 5 minutes, would support a flexible cooperation. The flexible reallocation of working positions, possible through simple manipulations in the Operations Room, would support such a concept. Such a concept could also reduce the manning requirements due to the difference between open and closed sectors in the course of a traffic day.</td>
<td></td>
</tr>
<tr>
<td>DOMAIN</td>
<td>KEY INDICATORS</td>
<td>BEST PRACTICE</td>
</tr>
<tr>
<td>--------</td>
<td>----------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Airspace/Sector Management - Coordinating with Military Aviation through the tools of the Flexible Use of Airspace Concept</td>
<td>Unused military airspace should automatically be made available for civil use. In this context the cooperation between the tasking levels of the Armed Forces and a tactical level in the ATM organisation (FMP in ACC for example) could further improve the situation.</td>
<td></td>
</tr>
<tr>
<td>ATFM - Provision of Service and Conceptual Support Tools</td>
<td>The central ATFM service complemented on tactical levels through flow positions (FMP) in the ACC seems to be Best Practice. In addition the conceptual tools (use of conditional routes, off – load routes, circumnavigation of congested areas etc.) should be supplemented through the use of cross border civil / civil corporation, delegation of air space between centres etc.</td>
<td></td>
</tr>
<tr>
<td>ATFM - Customer Involvement</td>
<td>The involvement of customers through cooperation on a tactical level with AOC and military tasking levels and command posts was identified as best practice.</td>
<td></td>
</tr>
<tr>
<td>ATC Procedures - Technology used to provide Separation</td>
<td>Main technology used for separation is Radar. Coverage limitations, previously compensated through the application of procedural means, could in the future be bridged through use of modern technologies like ADS/B.</td>
<td></td>
</tr>
<tr>
<td>ATC Procedures - Separation Minima</td>
<td>The applied minima, 5 – 10 NM en route, 3 NM in TMA, and 2.5 – 3 NM on Final seem to constitute best practices.</td>
<td></td>
</tr>
<tr>
<td>ATC Procedures - Silent Transfer of Control</td>
<td>Transfers of aircraft also when crossing international boundaries, probably through the support of Data Link, with little or no lead time requirement, have become best practice.</td>
<td></td>
</tr>
<tr>
<td>ATC Procedures - Preparation for Emergencies</td>
<td>Staff training in preparation for emergency situations should be part of proficiency training and of routine testing.</td>
<td></td>
</tr>
<tr>
<td>ATC Procedures - Use of Languages</td>
<td>In the interest of flight safety all means to support situation awareness in cockpits should be used. English should be the only language used in ATC for IFR flights and on international airports.</td>
<td></td>
</tr>
</tbody>
</table>

**WORKING PRACTICES**

<p>| Rostering - Methodology | Flexible rostering combining individual and team-based methodology. In the light of complexity of different ratings for various sectors in an ACC, the use of software tools might be advisable. With the help of such means, the frequency of roster updates could be increased and a fair work share between operations staff be achieved, while at the same time capturing all seasonal variation requirements. |
| Rostering - Stand-by Crews | Reliability of Service could be increased, by rostering a stand-by team to prevent delays caused by staff shortages. |
| Rostering - Annual working hours | A best practice in regard to annual working hours could not be clearly identified, but is suspected to be in the region of 1650 hours per year. The amount would inevitably vary in connection with local customs and procedures. |
| Manning - Flexible Manning of Sector Positions | Flexible use of rostered staff to adapt a sector to changing traffic conditions seems not to be a common practice, although in other parts of the questionnaire providers identify this as a viable option. This would have to be regarded in connection with the operational concepts applied, which normally prefer the opening or closing of sectors as an easier way of adapting. |</p>
<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>KEY INDICATORS</th>
<th>BEST PRACTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manning - Minimum Manning</td>
<td>To mandate a minimum manning for ATSU by local management seems to be the best practice. It should be noted, however, that supervisors need to have the option to go below under certain, well-defined, circumstances</td>
<td></td>
</tr>
<tr>
<td>Licensing - Provision of Licences and Ratings</td>
<td>It seems to be best practice that ATC staff obtain a license for the type of service they are supposed to deliver, endorsed through a rating for that facility and sector of that facility from which they are going to deliver the service. The question of holding more than one license is important only in an environment that delivers more than one type of service from the same location i.e. Aerodrome Control Service and Approach Control Service from an ATSU on an airfield or Area Control Service and Approach Control Service from an ATSU operating in a common ACC. Due to the requirements to maintain proficiency this would in many cases be too much a burden for the individual and challenge any rostering system to the extreme. A certain amount of training required for this cross-training would also have to be considered. The number of ratings, a controller can hold in one ATSU, largely depends on local conditions and traffic complexity, a general best practice to fit all can not be identified.</td>
<td></td>
</tr>
<tr>
<td>OJT Training - Relation of Simulator Training versus Life Traffic Training</td>
<td>OJT is normally executed to train a controller in a new ATSU/Sector or to maintain proficiency after a time of absence respectively to practice new procedures. Using simulators in support of this training is best practice. It requires a simulator, tailored to the particular facility. This would normally be achieved by reconfiguring an operational sector for training purposes – operational simulator. Some ATSU have such simulators remote from Control rooms, which requires the projection of real traffic as background traffic to a different location. In order to keep the right balance between training on simulators and with life traffic, a relation of approximately 20% simulator versus 80% on actual traffic generally seems to be the best practice</td>
<td></td>
</tr>
<tr>
<td>OJT Training - Proficiency Training</td>
<td>Best practice is to assure proficiency of operational staff through well-defined proficiency programmes with documented tests. This programme should also contain the subjects of unusual situations and aircraft emergencies. This is particularly important where the proportion of military traffic is high. Monitoring the performance of operational staff and comparing it with others in the same organisation or even with others has become more and more of an accepted practice. Since this also has an aspect of Flight Safety, it should be considered as best practice</td>
<td></td>
</tr>
</tbody>
</table>

**STRATEGIC MANAGEMENT**

<p>| Business planning process | Integrated and iterative top-down and bottom-up process, fully integrated in the decision-making process and interfaced with other planning areas (capacity, technology, etc.) |
| Business planning documentation | Specific documents distributed to external audience, and updated frequently |
| Relationship with other parties | Strategic partnerships with suppliers are an interesting, potentially best practice, approach but its actual success and benefits will only become measurable over the long term |</p>
<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>KEY INDICATORS</th>
<th>BEST PRACTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sourcing strategy</td>
<td>To have an explicit sourcing strategy in place aimed at improving quality, delivery lead-time and total cost of ownership of supplies, both ATM-related and non ATM related</td>
</tr>
<tr>
<td></td>
<td>HR Management - HR tools and processes</td>
<td>To have a comprehensive accredited HR quality programme, comprehensive set of tools and processes, formal HR policies and procedures</td>
</tr>
<tr>
<td></td>
<td>HR Management - Integration with other business areas</td>
<td>Function fully integrated with the rest of the business; close involvement of business units/areas</td>
</tr>
<tr>
<td></td>
<td>HR Management - Labour relationships</td>
<td>“Convergence” mode; union sharing management vision for the future and discussions on change do not always focus on job security</td>
</tr>
<tr>
<td></td>
<td>HR Management - Career development</td>
<td>Strategic resource planning; fully interactive and systematic process at all levels; staff development for employability; performance management on an individual basis</td>
</tr>
<tr>
<td></td>
<td>HR Management - Recruitment</td>
<td>Manpower planning and skills requirements definition process at both corporate and business unit level in close cooperation as best practice; recruitment performance measurement</td>
</tr>
<tr>
<td></td>
<td>Operations Planning - Demand forecasting</td>
<td>Combination of in-house and external sources; forecasts done for most types of customers, not only commercial air transport customers, ability to assess the effectiveness of the forecast on a regular basis (monthly) and to improve the forecasting tool accordingly; resolution covers short to long term at national, centre and sector level</td>
</tr>
<tr>
<td></td>
<td>Operations Planning - Capacity measurement and requirement</td>
<td>Use of a combination of tools (laboratory or operational simulations, use of historical data at sector and/or centre level) to measure and manage capacity requirement</td>
</tr>
<tr>
<td></td>
<td>Crisis Management</td>
<td>Having a plan in place and responsibility fully distributed throughout the organisation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Having a dedicated crisis management unit or structure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The plan should include different levels of application down to the sub-system level and should also include neighbouring areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The plan should include the coordination procedures with other external parties (military, customers, airports, other ANSPs, etc.)</td>
</tr>
<tr>
<td></td>
<td>Environment Planning</td>
<td>Formal policy on environmental protection in place with relevant manuals and procedures, systematic application and appropriate training, monitoring through internal management and compliance with aviation and environment regulators</td>
</tr>
<tr>
<td></td>
<td>R&amp;D Planning (if applicable)</td>
<td>To have a fully separate R&amp;D department (maybe outsourced) and a mechanism in place to evaluate value provided to the business.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R&amp;D should focus on short-to-medium term projects with clear benefits in terms of operational performance and with the target of meeting customer requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Success of R&amp;D projects should be measured based on a set of well defined criteria, both on an individual project basis (based on cost, delivered performance, quality and time targets) and on a portfolio basis (contribution to the overall portfolio of projects)</td>
</tr>
</tbody>
</table>
## Domain: Infrastructure Planning - Organisation

The interdependencies require a supportive organisational structure, which enables infrastructure planning to stay abreast of operational concepts and planning as well as of scientific visions and R&D results. The structure should foresee that the rather short term planning cycles of business and operations (less than 3 years) provide the main input for the longer term planning cycles (longer than 5 years) of infrastructure. This might be achieved more easily in a matrix organisation with clear terms of reference than in a hierarchical structure. Infrastructure planning should be linked to operations and business planning, based on ANA perception, within a dedicated department, and using a comprehensive set of tools and processes to assess success (individual reviews, in-house TQM procedures, post project audit, financial and time targets, etc.).

## Domain: Infrastructure Planning - Scope

The traditional scope of planning, being CNS/ATM focussed, needs to be extended to encompass those activities, which are driven through the interdependencies of the modern aviation industry.

Operational aspects, initiated through capacity forecasts and change of concepts, will drive the inclusion of avionics into the infrastructure planning.

This inclusion might conflict with the standard organisational lay out of providers and will have to be considered very carefully.

The cooperation with other providers and partners in industry of a multimodal configuration require the inclusion of airline and airport operational considerations as well as those of other stakeholders, sharing the same airspace (as military) as well a bordering own airspace (other providers).

The cooperation on European level is only one means to support planning and does not replace bi- or multi-lateral activities.

### Table 2: Best Practices by Domain

<table>
<thead>
<tr>
<th>Domain</th>
<th>Key Indicators</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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</tr>
</tbody>
</table>
6 INTERPRETATION OF RESULTS

In the context of the benchmarking study, various analyses have been performed to identify any possible relationship between the various domains or capability areas throughout the service delivery chain. A selection of analyses is presented hereafter, which have led to interesting qualitative insights as to industry-level patterns and/or variations across providers. Most results consistently support three recurring patterns of the ATM industry:

1) The significant impact of the “institutional environment” on the providers’ internal processes
2) A high level of fragmentation and disparities in inputs and outputs
3) The significant impact of the “operational environment” on the providers’ performance

6.1 IMPACT OF THE INSTITUTIONAL ENVIRONMENT ON INTERNAL PROCESSES

Of the domains analysed for Internal Processes, the Safety Process domain shows the strongest relationship with the external environment. This overall pattern can be seen as an indication of the overall development of safety management processes within each provider, i.e., the more complex the operational environment or the more “corporatised” the provider, the more developed its safety process is likely to be. This relationship does not, however, give any indication on the providers’ actual safety performance as it is not possible to capture the correlation with performance without access to safety records of each provider.

The relationship is strongest with the Institutional Environment. This shows the benefits of a corporate culture and institutional framework that allows for maximum accountability, transparency and awareness at all levels of the organisation, and supports the high level best practice identified in this area.

FIGURE 13: SAFETY PROCESS VS. INSTITUTIONAL ENVIRONMENT

\[ R^2 = 0.55 \]
Similarly, the analysis shows weaker, but nevertheless, recognisable relationships between Organisation of Services and Strategic Management with the Institutional Environment. This is as expected as typically a change in the institutional environment will reach deep down into an organisation and influence various internal processes in different domains (service delivery, HR management, organisational interface, business planning, etc.).

The impact of the Institutional Environment was not expected to be relatable to operational processes such as the Operational Concept and Working Practices, and the results confirm this to be the case. In fact, of the internal process domains analysed, Operational Concept and Working Practices show the most variation, which is also, rather surprisingly, difficult to relate to the Operational Environment.

- Overall, the Operational Concept analysis shows room for improvement at industry level. The results show that providers may benefit from applying a more standard Operational Concept. For example, the relative inflexibility in changing sector configuration and closing or opening new sectors rather than increasing or decreasing their capacity shows that there is room for improvement. Modern technology can allow for a more flexible cooperation among controllers in the same airspace by identifying the controller working the traffic to everybody working in the same environment as well as making the control intention obvious to others.

- The fragmentation of European airspace is not only a result of the large number of different providers, given the geographical areas covered, but also of the increasing number of sectors. Operational concepts vary from centre to centre as well as provider-to-provider. A vision of a regional Air Navigation System containing all players, stakeholders, systems and procedures may merit further consideration. An architectural vision of such an environment in a modular composition would not only make the interactions within the industry transparent, and it would also allow for a more coordinated investment and infrastructure policy, not only on the level of providers but also airlines and airports alike.

- There are also many variations in Working Practices at industry level. The results show that the large differences across providers not only reflect different social environments but also indicate large variations in available manpower usage.

- Flexibility of supervisors to reduce manning, when no longer required, is generally limited to well-defined situations. It may be considered beneficial to arrange any changes in capacity in a coordinated way with adjacent units and central flow control. The variability of weather might also quickly lead to concentrations in location and times which are unpredictable on local level and the reduction to minimum levels should be a coordinated effort within a region rather than a local exercise.
In order to further understand specific patterns and results obtained for internal processes, an analysis of associated Key Indicators was rearranged along six selected high level differentiators, consistent with a standard organisational performance framework. These differentiators are:

- Clarity of Mission
- Alignment of Strategy across all functional areas
- Adequacy of the Structure, Systems and Processes with the level of complexity of business or service provided
- Internal Modularity (across the various units and areas of the organisation)
- External Modularity (with third parties)
- Tactical Flexibility

This analysis shows there is a relationship between Adequacy of Structure, Systems and Processes and their External Modularity

- This can indicate that the more providers are open and tuned towards their outside environment, the more their structure, systems and processes are likely to be adequate to meet their customers’ and other external requirements
- The results tend to show that external modularity is directly related to the way commercial practices are applied, and in particular the extent to which a provider is involving its customers into various aspects of its organisation
FIGURE 15: ANALYSIS OF ADEQUACY OF STRUCTURE, SYSTEMS & PROCESSES VS. EXTERNAL MODULARITY

There also seems to be a recognisable relationship between Clarity of Mission and Internal Modularity

- This tends to indicate that the clearer the provider’s mission, the easier it is to organise and manage the various internal activities of the organisation

- A high rank on internal modularity can be explained by the fact that a Provider who ranks high in terms of internal modularity is expected to have gone through an in-depth review of its business/activity portfolio and to have invested in aligning the various parts of the organisation. This is apparent in organisations that have been through an extensive business process redesign. High ranking in smaller organisations may correspond to the focus of the organisation on a small set of core services.

FIGURE 16: ANALYSIS OF CLARITY OF MISSION VS. INTERNAL MODULARITY

Overall this level of analysis further demonstrates how Internal Processes display a strong relationship with Institutional Environment. Providers which have been evolving in a commercially-driven / customer-focused institutional environment tend to display better internal processes, particularly in terms of:

- Alignment of their strategy across the various functional areas of the organisation (business planning, infrastructure planning, operations, HR management, etc.)
- **Adequacy** of their structure, systems and processes with the level of complexity of their business and services
- **External modularity** with third parties, in particular customers

![Figure 17: Internal Processes vs. Institutional Environment](image)

However, results for **Tactical Flexibility** are very different from the results across the other key differentiators: for a majority of providers, there seems to be a disconnect between the providers’ tactical flexibility in operations (or operational set up) and their organisational and managerial set up. In other words, those providers which have the most complete or sophisticated organisational and strategic management processes do not necessarily have the operational flexibility that providers such as the FAA tend to have. This shows that while it is important to have adequate organisational structure, systems and processes in place to cope with the **long-term, strategic requirements** of the service provision, it can lead to some disconnect with actual operational requirements and it can create some rigidities as far as **short-term, tactical flexibility** is concerned. This is once again very much in line with the finding of disparity in the Operational Concept and Working Practices domains.

### 6.2 Disparities Across Inputs and Outputs

ATCO productivity can be approached from either an Input perspective (number of ATCOs per flights handled) or an Output perspective (hours in position). Either way, the analysis highlights significant differences in productivity, with apparently two different scale curves for smaller and larger providers.
ATCO unit costs, when weighted with comparative price level indices, show significant differences across providers (up to a factor of 5), without any clear relationship with the country’s cost of living. Rather, this result has to be seen as indicating the large variation in controllers’ professional and social status in each provider’s country. This result therefore invalidates the notion that ATCO unit costs are related to the provider’s country cost of living and could impede significantly the mobility of controllers from one provider to another in the future.

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5 Hours in position constitute the genuine productivity and although these figures are logged, they are not yet readily available. The figure uses calculations and approximations since complete data sets were not available for evaluation. The entries assume a 30 minute briefing time and a 6 minute handover of position.
The evaluation of applied technology shows a uniformly high degree of application of state-of-the-art technology. Here Eurocontrol’s harmonisation effort through the EATCHIP and EATMP programmes shows notable benefit. The progress of automation in the flight plan processing domain, the centralised IFPS, and the links to ATFM through the CFMU allow an economical use of the airspace available. The highly developed surveillance systems with multiple radar coverage allow accurate positioning of aircraft and processing of this information for ATM purposes. Some differences do become apparent, in the processing of the acquired information further downstream, when it comes to linking flight plan to position information, SSR – Code Management, track projection, and distribution of a rectified picture of the traffic situation.

In terms of linkages between technology and performance, the technical environment does not seem to have any adverse affects on the delay situation. Generally speaking, European providers have a very modern technical infrastructure (although not as advanced as some non-European providers) capable of coping with the level of traffic. As the LCIPs show, more improvements, not only in the field of tools, are on the way. It is surprising to see, however, that the treatment of weather information is not given the importance its influence on the delay situation would justify. There seem to be gaps in the treatment of weather data processing and sharing. Only three European providers share this data on a wider scale while for overseas providers, giving weather a high importance, seems to be the norm.

Another area where improvement might support ATM development is the sharing of airspace data. In civil-military cooperation, the availability of military airspace is only useful when a sufficient timeframe to plan and route traffic can be used. Although the lead-time for using available airspace might be too short for a provider’s own traffic, traffic still under control of upstream centres could benefit from such development, if these units had the relevant data in time. Whereas the civil-military cooperation seems to work well on a tactical basis, longer term arrangements have yet to match the same level of cooperation. The sharing of airspace data could overcome some of the inconvenience caused by the lack of pre-
tactical civil/military coordination on a larger scale and a longer time horizon. In effect, only few providers use active modes on coordination.

6.3 Impact of the Operational Environment on Performance

Based on the delay cost data collected from CFMU for the European providers in 2001, a strong relationship between delay costs and operational environment can be identified. This confirms the impact of the operational environment on providers’ performance. However, it also shows that in order to understand the real drivers of delay costs and to quantify their impact, one needs to go beyond the operational environment considerations and understand the real linkages across the service delivery chain that drive delays and their associated costs for the customers. Such analysis could be the purpose of a future dedicated benchmarking study at industry level that would investigate delay costs at a more detailed level that the scope of this Study allowed.

![Figure 21: Delay Costs vs. Operational Environment (European Providers)](image)

6.4 Relationship Between Practices and Performance

One of the key aims of the study has been to determine whether there are any clear relationships between internal processes and current performance, both in terms of outputs (from the provider’s point of view) and outcomes (from the customer’s point of view).

The hypothesis was that this relationship might be difficult to find considering that most providers have only recently started to improve their practices and therefore it is probably too early to see the impact of such “better” practices on performance. Furthermore, the fragmented nature of the industry still allows providers to operate

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6 Delay costs are based on industry standard figures of 50 Euro per minute of delay incurred
to a large extent as “black boxes”, which means there are many ways to “offset” process inefficiencies in such a way that their effect on the performance itself is attenuated.

Another hypothesis was that the non-investigative nature as well as the scope and timeframe of the benchmarking exercise would bring some limitations in terms of establishing the relationship between internal practices and performance. The non-investigative nature meant that the Study Team would only be able to get information on “what providers did” rather than on “how well they did it”. In other words, the providers’ answers are taken at face value. The scope of the study meant that the analysis would have to stay at the ANSP level and therefore not necessarily focus on a level of detail that could generate significant insights into the key drivers of performance. Previous benchmarking experience in the air traffic industry has shown that, in many cases, the only way to really understand such “drivers” is to perform detailed analysis at the service and centre level.

These hypotheses have all been validated in the course of the project.

6.5 Framework for Linkage Analyses

Understanding to which extent (i.e. quantitatively) the various outputs and outcomes are driven by specific endogenous or exogenous factors requires a level of depth and of investigation that goes far beyond the scope of this Study. However, the Study’s approach can help drive such effort in the future, by offering a framework to map out the various linkages that exist throughout the service delivery chain and that are understood, qualitatively, to impact the various outputs and outcomes of the service.

The following charts display such a framework for the analysis of delay, technical reliability and staff productivity results, but the same framework can also be used for all the other measures of performance, such as cost of service and predictability or capacity.
**Figure 22: Framework for Delay Linkage Analysis**

**Figure 23: Framework for Staff Productivity Linkage Analysis**
FIGURE 24: FRAMEWORK FOR TECHNICAL RELIABILITY LINKAGE ANALYSIS
7 INSTITUTIONALISATION OF THE BENCHMARKING PROCESS:

The objective of this section is to draw conclusions from this Study as to the opportunity for institutionalising the benchmarking process in a way that will support the achievement of selected targets and monitoring the improvement in practices and performance.

In doing so, the following provides answer to three main questions:

1) Is benchmarking the appropriate tool to improve processes in ATM, both at the regulatory and service provision level?
2) What are the criteria, conditions and process to be followed for a successful use of a benchmarking tool in the ATM environment?
3) How can such a benchmarking process be institutionalised, meaning how can it be translated into a structured process, which is fully accepted by the ATM community?

7.1 RATIONALE FOR AN INSTITUTIONALISED BENCHMARKING PROCESS

In answer to the first question, it is clear that benchmarking provides an appropriate mechanism towards the systematic improvement of processes and performance in ATM, at least as long as providers are in monopoly situations and the market remains highly regulated. In the absence of objective and fully transparent measures of performance, there is no better opportunity to understand the key performance drivers than comparing providers across a wide array of domains that play a role in the service delivery.

7.2 CRITERIA AND CONDITIONS FOR SUCCESS

In answer to the second question, three critical conditions must be met for the benchmarking process to be successful in its future application:

i. Providers need to take “ownership” of the process
ii. The ATM community needs to agree on a set of standards and best practices
iii. Benchmarking has to be implemented at a lower level than the provider level, in order to lead to actionable results. Lower level means at least service level, and ideally service level within a given operational unit (i.e. ACC/APP/TWR level).
The “ownership” issue is the most important one. All previous benchmarking exercises have to some extent been imposed onto the providers. In return, they have responded in a very administrative fashion, as a way to “comply” with a request rather than an opportunity to truly drive internal improvements.

The feedback indicates that the majority of providers contributing to this Study clearly agree with the objective of making the framework a valuable tool for themselves, but a few have still participated somewhat reluctantly to the Study. This is unfortunate as the quality of the outputs of a benchmarking study is to a large extent driven by the quality of the inputs across the participants.

In terms of agreeing on a set of standards and practices, this is a task that will take time but one that is necessary in order to develop more efficient and effective (both in terms of quality and cost) ATM services in Europe and worldwide. For that purpose, the ATM community needs to designate an international coordinating body to drive such standardisation. It is therefore recommended that such a body have the following characteristics:

- Representative of all providers worldwide
- Not commercially driven
- Working in close cooperation with all stakeholders (Regulators, users, trade unions, etc.)
- Dedicated to improving the air navigation service provision worldwide in terms of safety, efficiency and economic viability
- Being a recognised forum for all providers to contribute to and agree upon industry-wide standards and practices

The final condition to be met is to perform the benchmarking at the appropriate level of detail. This Study was performed at the Provider Level only and the limitation of this was clearly understood when establishment of the linkages across inputs, outputs, internal processes and external factors was attempted. Because these linkages are extremely complex, the only way to really capture the whole chain of causes and effects is to narrow down the scope of the “object of reference” of the benchmarking and perform an in depth analysis. In other words, to understand for example the drivers of staff productivity, one needs to take a “sample” of all the processes involved as well as the underlying inputs and external factors, and then analyse the mechanisms of causes and effects within that sample to be able to first draw hypotheses then to validate them on a larger scale.

The combination of these three requirements (ownership, agreed standards and level of detail) leads to the conclusion that two benchmarking processes should co-exist:

- The first one, which to at large extent is already in place, is a relatively general benchmarking framework aimed at taking a snapshot of all the key elements of the providers’ performance and practices: this consists of the Information Disclosure Framework that has been developed by Eurocontrol, which should now be complemented with the benchmarking framework that has been developed for this specific study. The combination of the two frameworks should allow an appropriate regulatory body to have a clear picture, taken
annually, of the current practices and performance. It is recognised that some more work needs to be undertaken to fully integrate the two frameworks, but a large part of the work is already done as a direct result of this study.

The second benchmarking process should include some specific, one-off analysis into a given domain or dimension, with the participation of a few providers only (2, 3 or 4 maximum), in order to get the analysis and insights down to the necessary detail and depth. The problem with this type of benchmarking is that it is much more difficult to institutionalise because each has element has to be customised for the application. Besides, the overall value from such select analysis can only be driven by the willingness of individual providers to take the commitment to perform such exercise. In this respect, it would be difficult for an outside organisation, even with regulatory authority, to enforce such process. However, the current project undertaken by PRU with the FAA and comparing specific centres fits into this category, which shows such initiatives are possible.

Overall, the Study Team believes that the institutionalisation of the benchmarking process will only be successful if providers take ownership and integrate the procedure into their portfolio of management and decision-making tools.

### 7.3 Attributes of an Institutionalised Benchmarking Process

An institutionalised benchmarking process should have at least three core attributes:

1. **Standard requirements for data and information disclosure**
2. **Agreed definitions, standards and targets against which to analyse the data and evaluate the various improvement and performance levels**
3. **A framework that captures the levers and identifies ways available to the providers to make improvements in the various areas where such improvements are expected**

#### 7.3.1 Requirements for Data and Information Disclosure

The data requirements should support directly the Key Indicators identified and validated in the course of the study (please refer to list of Key Indicators in Section 8 for further details, including the cluster charts as detailed in Appendix 1). The study has validated that the domains of analysis identified provide a robust, structured framework, which allows representative analysis of the industry. It should therefore be used as the basis for any future exercise. Sub-domains for inputs, outputs and outcomes should incorporate some dimensions covered by the PRU activities. In particular, it is important to add cost effectiveness to the outputs’ sub-domains.

The frequency of the data collection should be annual for the data. This seems to be the right frequency because it allows reflection of material changes in the way the provider has been managing its business, gives enough time to implement some structural improvements and avoids any seasonal bias.
7.3.2 Agreed Standards and Targets:

It is also very important that the data requirements be agreed and set internationally, in such a way that providers can put into place their own process to track the data internally on a systematic basis and then make them readily available.

One important pre-requisite to the standardisation is the harmonisation of definitions across providers. A lot of effort has already been put in that direction, both by Eurocontrol and CANSO, but more needs to be done and an international terminology should be agreed upon at the earliest opportunity. For that purpose, there is a need for an independent international body to position itself as the repository and ultimately the driver of such common body of definitions.

7.3.3 Progress Monitoring and Improvement Framework

Once the data requirements and the data collection process are set, the key issue is to track and monitor progress against benchmarks or targets. This can be achieved by integrating benchmarking as a fully-fledged management support tool by the provider and as a legislative instrument by the Commission. In that respect, it is critical that the benchmarking process be understood and used by providers and by the Commission as a continuous process. The continuity is critical in order to build process maturity and organisational learning.

The benchmarking process should also allow for enough time to communicate after data collection. Data collection is often seen as a one-way process by the providers, and they have so far felt disconnected from the interpretation and analysis of data. That is why providers are and will always remain eager to understand how the data will be used and why.

In fact, one of the main aims of the ongoing benchmarking process framework is to ensure buy-in from relevant stakeholder groups and, in that respect, transparency is a key part to the success of such framework. Participants to any future benchmarking process need to see the returns from the exercise in terms of identifiable impacts and a clear prioritisation for strategic focus.

Therefore, the body responsible for undertaking the systematic analysis of the data provided needs to have credible evidence for the identification of improvement opportunities to make up for seen shortfalls in performance. The transparency element will lead to ownership of the improvement opportunities, where service providers will not only see the variances in performance amongst participants, but will also be able to identify reasons for such variations (in terms of shortcomings in linked internal processes) for themselves. The qualitative cluster charts, which will compare and contrast the internal process capabilities across the providers will hence provide a key tool in this framework.

However, these cluster charts are not enough to drive improvement. What is required is to have for each key indicator or target practice a clear road map describing how a provider can improve on a given dimension. This means that at least the levers of improvement will have to be identified and ideally an
improvement methodology should also be made available to the providers. This, however, can only be done once the linkages across the various domains are understood and validated, which is not the case yet.

The next step for the Commission should be to launch some specific initiatives around key performance and practice areas with the goal of identifying the levers that would help a provider to improve its performance or practice in the relevant areas. For example, as an illustration, if shift patterns (duration, starting times, etc.) are identified as a key lever to improve controller’s productivity, then options as to how to modify a shift pattern should be proposed to the providers and a road map to achieve such modification should be proposed. This however can only be done once the link between shift pattern and ATCO productivity is clearly established and validated.

Clearly, the institutionalisation of the benchmarking process will only be successful if it adds value to all stakeholders:

- To the providers by helping them improve their practices and performance and monitor their progress against relevant standards and realistic targets
- To the regulatory authority by giving them an instrument to support both the permanent exercise of performance review and economic regulation through the definition of representative indicators
- To the customers, by ensuring that everything is done to deliver an increasingly safer and more efficient service and that the resultant impact is duly considered
- To the employees, by giving them the opportunity to learn and to develop new skills, while highlighting current shortcomings

As such, this current study is to be seen as the beginning of a new process through which providers, regulators and other stakeholders will be able to refine their understanding of the current industry practices and performances, while being able make the necessary systematic improvements.
The institutionalised benchmarking framework should therefore lead to a more prescriptive type of benchmarking going forward, oriented predominantly towards decision-making. For service providers specifically, benchmarking should trigger a set of concrete actions to improve current performance and implement best practices. (see figure below).

![Institutionalisation of the Benchmarking Process Diagram](image)

**Figure 25: Institutionalisation of the Benchmarking Process**

Ultimately, the way the various dimensions of the institutionalised benchmarking process will be implemented will determine the overall maturity level of the benchmarking process itself. The ultimate goal is to progress from what is today still viewed as an essentially administrative exercise towards a more managerial and decisional approach, whereby benchmarking is part of a fully integrated decision-making process, as illustrated in the picture here below.
FIGURE 26: BENCHMARKING PROCESS MATURITY LEVELS
8  KEY INDICATORS AND KEY LEGISLATIVE ENABLERS

8.1  Key Indicators

Key Indicators (KIs) have been selected for all domains of analysis. They should form the basis of the future framework for benchmarking in ATM. The following table details indicators based on the selected domains of analysis. This list is exhaustive in detailing those KIs defined, identified and validated during this study, or other studies, all of which are relevant for application within the benchmarking framework, depending on the specific area being investigated.

Whereas key indicators for Inputs, Outputs and Outcomes are mainly quantitative, key indicators for Internal Processes are mainly qualitative. They have been captured in the form of “cluster charts” that show the range of possible positions in a given capability area. These cluster charts have been used to position the providers and cluster them accordingly. They are a useful tool to identify industry-level patterns as well as the variations in practices across providers. These charts are attached in Appendix 1 to this report and essentially form the basis of a future questionnaire for analysis of internal processes.
### GROUPING:
Safety –

### Domain of Analysis:
Fundamental objective of the Air Navigation Service

### Sub-Domain:
Safety -

#### Provision of safe separation of aircraft

### Metrics and Indicators:
- State annual traffic volume per movement
- State annual traffic volume per flight hours
- Total accidents in the State with associated level of damage and fatalities
- Total accidents per phase of flight, flight rules, type of operations and class of airspace, with either direct or indirect contribution from ATM
- Total accidents per category of accident: mid air collision, CFIT, collision between aircraft, collision between an airborne aircraft and vehicle / another aircraft on the ground, collision on the ground between aircraft and vehicle / person obstructions(s), with either a direct or indirect contribution from ATM
- Total number of incidents in the State classified into severity level, phase of flight, flight rules, type of operations and class of airspace, with either a direct or indirect contribution from ATM
- Total number of incidents per State per specific category in incidents: separation minima infringement, inadequate separation, near CFIT, runway incursion where avoiding action was necessary, runway incursion where no avoiding action was necessary, runway excursion by aircraft, aircraft deviation from ATC clearance, aircraft deviation from applicable ATM regulation
- Total number of ATM specific occurrences in the State classified according to severity
- Total number of ATM specific occurrences per specific category: inability to provide ATM services (ATS, AMS, AFTM), failure of communication function, failure of surveillance function, failure of data processing and distributing function, failure of navigation function, failure of ATM system security

### Required Data Sources:
A: AVAILABLE,
EO, ECAC ONLY

### Comments.
States have started implementation of ESARR 2 from 1/1/2000.

**SRC Doc 2 (A, EO)**

**ESARR 2 data disclosure (EO)**
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<tbody>
<tr>
<td>Safety Process (qualitative Key Indicators) -</td>
<td></td>
<td></td>
<td>• Safety Management Function</td>
<td>Database for this Study</td>
<td>This area is better analysed using process benchmarking, see relevant cluster chart for further details on criteria to be used.</td>
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<td></td>
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<td></td>
<td>• Safety Management System</td>
<td>EAMTP Safety Policy (A, EO)</td>
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<td></td>
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<td></td>
<td>• Education, training and testing</td>
<td>ESARR 3 (A, EO)</td>
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<td></td>
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<td>• Safety occurrence reporting</td>
<td>ESARR 4 (A, EO)</td>
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<td></td>
<td>• Risk identification process</td>
<td>ESARR 5 (A, EO)</td>
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<td>SRC Doc 8 (A, EO)</td>
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<tr>
<td>Outcomes - The results of the service for the providers' customers</td>
<td>Cost of Service - The cost incurred to the customers through using the service</td>
<td>ATC Charges (quantitative Key Indicators) -</td>
<td>• Cost per service unit per provider for en route services</td>
<td>ICAO Manual of Airport and Air Navigation Tariffs (A)</td>
<td>For a stakeholders view of cost effectiveness, it is not sufficient to focus on the service unit cost but also flight applicability of the unit costs and the corresponding impact for reference a/c in relation to a given traffic mix.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>• Airspace division level between en route and approach services per provider</td>
<td>Eurocontrol CRCO (A, EO)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Cost per service unit per provider for approach services</td>
<td>PRU and EEC analysis (A, EO)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>• Airspace division level between approach and aerodrome services per provider</td>
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<td></td>
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<td></td>
<td>• Cost per service unit per provider for aerodrome services</td>
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<td></td>
<td>• Total cost per aircraft type against distribution of aircraft weight category per provider</td>
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<td></td>
<td>ITA: Cost of Air Transport Delay in Europe (A)</td>
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<td></td>
<td>IATA statistics (A)</td>
<td>Actual cost incurred to airlines needs to be attributed per service provider.</td>
</tr>
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</tbody>
</table>
| Quality of Service – The quality of the service provided from the customer’s point of view | Delay (quantitative Key Indicators) - | | • Total min. of departure delay vs. total no. of flights  
• Total no. of delayed flights vs. total no. of total number of flights  
• Total min. of departure delay vs. total no. of delayed flights  
• Total mins. of gate to gate delay vs. total no. of flights  
• Total mins. of TMA delay vs. total no. of flights  
• Total mins. of arrival delay vs. total no of flights  
• Weekly mins. of ATFM delay by volume of traffic  
• Weekday vs weekend mins. of ATFM delay by volume of traffic  
• Average arrival delay per delayed flight  
• Number of traffic flow regulations per sector (as recording to CFMU), with category (capacity, ctrl. workload, staffing, etc.)  
• Evolution of average blocktime per airline at hubs  
• Total number delayed flights having same ‘most penalising regulation’ per provider airspace controlled  
• Total number delayed flights having same ‘most penalising regulation’ outbound from major airports per category  
• Total number of delayed flights having same ‘most penalising regulation’ to major airports per category  
• Total number of delayed flights having same ‘most penalising regulation’ between major city pairs per category  
• Distribution of delay per volume of traffic between major city pairs. | PRU and EEC analysis (A, EO)  
CFMU Flight list (A, EO)  
Airline Blocktime Information  
OOOI data of airlines able to provide information  
Actual time of departure  
Actual time of arrival | Analysis is required to allocate causes of delay on a provider specific basis. |
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Predictability (quantitative Key Indicators)</td>
<td>CFMU Flight List (A, EO) PRU analysis (A, EO) Airline OOOI data</td>
<td>Analysis needs to focus on downstream effects to understand impacts on a provider specific basis and their ability to deliver a predictable service.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Availability (quantitative Key Indicators)</td>
<td>CMFU Flight List (A, EO)</td>
<td>Analysis should allow comparison between providers and their ability to guarantee availability of the minimum service.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flight Efficiency</td>
<td></td>
<td>These Outcomes parameters are difficult to measure in a quantitative form and are better addressed in a qualitative analysis of internal processes.</td>
</tr>
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<td></td>
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<td>Flexibility</td>
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<td>Equity</td>
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<td></td>
<td></td>
<td>Environment</td>
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</tbody>
</table>

**Outputs -**

*Results of the internal activities which lead to the outcomes*

<table>
<thead>
<tr>
<th>Capacity – The effective capacity produced by the service providers and made available to the customers</th>
<th>Capacity (quantitative Key Indicators) –</th>
<th>• No. of flight flights handled by the ATSU per hour per year</th>
<th></th>
<th>Database for this Study</th>
<th>The dynamics of capacity produced by service providers has to be better understood to assess causes and effects.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Number of flights handled by the sector per hour per year</td>
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<tr>
<td></td>
<td>• Average available capacity produced vs. declared capacity</td>
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<tr>
<td></td>
<td>• Percentage of flight handled subject to delay</td>
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<tr>
<td></td>
<td>• Runway capacity produced vs. declared capacity per major airport per hour per year</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>• Evolution of ATSU capacity with demand</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Productivity – The number of service units made available by a unit of production</th>
<th>Productivity (quantitative Key Indicators) –</th>
<th>• Total number of ATCO in OPS hours on duty per total number of ATCOs on OPS per ATSU</th>
<th></th>
<th>PRU analysis (A, EO)</th>
<th>The impacts of ATCO productivity require more detailed assessment to understand variance of impacts between working practices between providers.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Average time controlled per flight</td>
<td>• Number of flights per flight hours controlled</td>
<td></td>
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<tr>
<td></td>
<td>• Number of flight movements per on duty controller hour per ATSU</td>
<td>• Kms controlled per on-duty controller hour per ATSU</td>
<td></td>
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<tr>
<td></td>
<td>• Average rostered hours per year vs average time in position per year</td>
<td>• Average rostered hours per year vs average overtime per year</td>
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</tr>
<tr>
<td></td>
<td>• Runway capacity produced vs. declared capacity for major airports</td>
<td></td>
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</tr>
</tbody>
</table>
### METRICS AND INDICATORS:

#### Reliability -
*The technical reliability of the system to meet the demand for services.*
- Number of unplanned service outages vs. planned service hours per ATSU
- Number of planned service outages vs. planned service hours per ATSU

#### Reliability (quantitative Key Indicators)

#### Service Providers and Regulator Relationship (qualitative Key Indicators) -
- Independence of regulation and service provision
- Degree of separation of regulation and service provision
- Organisation of regulation – service provision interface
- Processes supporting regulation – service provision interface
- Frequency of regulatory inspections and audits

#### Service Definition (qualitative Key Indicators) -
- Clarity of mission and objectives
- Degree of unbundling
- Organisation of non-ANS services
- Organisational transparency
- Financial transparency

#### Service delivery (qualitative Key Indicators) -
- Outsourcing Policy
- Coordination between service units
- Clarity in service provision
- Quality management process

### REQUIRED DATA SOURCES:
- A: AVAILABLE,
- EO, ECAC ONLY

### COMMENTS:
- Reliability of the systems elements needs to be assessed to determine impacts on overall performance and possible needs for investment between providers.
- This area is better analysed using process benchmarking, see relevant cluster charts for further details on criteria to be used.

### DATABASE FOR THIS STUDY:
- Annual Reports (A), PRU Analysis (A, EO)
- Database for this Study
|----------|---------------------|------------|------------------------|-----------------------|-----------|
|          |                     | Civil/military relationship (qualitative Key Indicators) - | • Institutional relationship  
• Structural relationship  
• Tactical relationship | AIPs, Annual Reports (A), PRU Analysis (A, EO)  
Database for this Study  
Eurocontrol Report 01-00-06 |          |
|          |                     | Customer Relationship Management (qualitative Key Indicators) - | • Degree of customer input/involvement in service definition  
• ANSP - customer relationship  
• Processes for customer involvement in service definition  
• Process used to capture customer satisfaction  
• Scope of customer satisfaction process | Database for this Study |          |
|          |                     | Operational Concept – The way the core ATM service is managed and operated by the service provider | | |          |
|          |                     | Airspace Design (qualitative Key Indicators) - | • Application of ICAO Standards  
• Criteria and Drivers  
• Customer Involvement | AIPs  
Database for this Study | This area is better analysed using process benchmarking, see relevant cluster charts for further details on criteria to be used. |
|          |                     | Airspace / Sector Management (qualitative Key Indicators) - | • Changing sector configuration  
• Time constraints for changing sector configuration  
• Difference between minimum and maximum manning  
• Reallocation of working positions  
• Release of military airspace for civil use | AIPs, ICAO 7030/4  
Database for this Study |          |
|----------|---------------------|-------------|-------------------------|------------------------|-----------|
|          |                     | Air Traffic Flow Management (qualitative Key Indicators) - | • Provision of service  
               • Mechanisms and conceptual support tools  
               • Customer involvement | AIPs, PRU Analysis  
               Database for this Study |          |
|          |                     | ATC Procedures (qualitative Key Indicators) - | • Applied technology to provide separation  
               • Longitudinal separation  
               • Radar separation  
               • Silent transfer of control  
               • Lead time required for transfer of control  
               • Preparation for emergencies  
               • Use of languages | Database for this Study |          |
|          |                     | Rostering (qualitative Key Indicators) - | • Applied rostering system  
               • Provision for standby staff  
               • Working hours for ATCOs  
               • Working hours for Flight Data Staff  
               • Personnel Factors for ATCOs  
               • Personnel Factor for Flight Data Staff | Database for this Study |          |
|          |                     | Manning (qualitative Key Indicators) - | • Control positions - rush hour vs. normal  
               • Support positions - rush hour vs. normal  
               • Reaction to changing traffic demand  
               • Regulation and authority of supervisors to reduce manning | Database for this Study |          |
|          |                     | Licensing (qualitative Key Indicators) - | • Combination of ratings available  
               • Minimum time in position to maintain currency | Database for this Study |          |

This area is better analysed using process benchmarking relevant cluster charts for further details on criteria to be used.
|-------------------------------|------------|-------------------------|------------------------|-----------|
| OJT and Monitoring            |            | • Relation of Position and Simulator training  
                          (qualitative Key Indicators) - | A: AVAILABLE,  
                          EO, ECAC ONLY | Database for this Study |
| Strategic Management – The way the service provider plans ahead the various resources and procedures to deliver the core ATM service | Business Planning (qualitative Key Indicators) - | • Business planning process  
                          • Business planning documentation  
                          • Relationship with other parties  
                          • Financial planning and budgeting  
                          • Sourcing strategy | Database for this Study | |
| HR Management (qualitative Key Indicators) - | • HR tools and processes  
                          • Integration with other business areas  
                          • Labour relationships  
                          • Career development  
                          • Recruitment | Database for this Study | |
| Recruitment (qualitative Key Indicators) - | • Recruitment / retention measurement  
                          • Recruitment of foreign Controllers | Database for this Study | |
| Operations Planning (qualitative Key Indicators) - | • Demand forecasting process  
                          • Forecasting resolution  
                          • Effectiveness measurement  
                          • Available capacity measurement  
                          • Required capacity measurement | Database for this Study | |

This area is better analysed using process benchmarking, relevant cluster charts for further details on criteria to be used.
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<td></td>
<td>Crisis Management (qualitative Key Indicators) -</td>
<td>A: AVAILABLE, EO, ECAC ONLY</td>
<td>Database for this Study</td>
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<td></td>
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<td></td>
<td>• Crisis management plan</td>
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<td>• Definition level</td>
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<td></td>
<td></td>
<td></td>
<td>• Interface management</td>
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<td>Environmental Planning (qualitative Key Indicators) -</td>
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<td>Database for this Study</td>
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<td></td>
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<td></td>
<td>• Process for incorporating environmental impact</td>
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<td></td>
<td>• Compliance monitoring</td>
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<td>R &amp; D Planning (qualitative Key Indicators) -</td>
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<td>Database for this Study</td>
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<td></td>
<td></td>
<td></td>
<td>• Organisation of R &amp; D</td>
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<td></td>
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<td>• Drivers for R &amp; D projects</td>
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<td>• Success measurement</td>
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<td>• Resource commitment</td>
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<td>Infrastructure Planning (qualitative Key Indicators) -</td>
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<td>Database for this Study</td>
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<td></td>
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<td></td>
<td>• Organisation and management of infrastructure planning</td>
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<td>• Success measurement</td>
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<td></td>
<td></td>
<td></td>
<td>• Scope of infrastructure planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inputs –</td>
<td>Staff – Resources committed by service providers</td>
<td>Staff (quantitative Key Indicators) –</td>
<td>No. of staff per category</td>
<td>PRU Analyses (A, EO)</td>
<td>Staff allocation should be transparently distributed between the en route, approach and aerodrome user charges and analysis needs to assess the effectiveness of staffing for each specific operational environment</td>
</tr>
<tr>
<td></td>
<td>Number and type of staff available to manage the organisation and deliver the services</td>
<td></td>
<td>• Relative breakdown of staff per ANS charge per provider</td>
<td></td>
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<td></td>
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<td></td>
<td>• Salary and associated costs per category per provider adjusted to cost of living</td>
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<td></td>
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<td></td>
<td>• Number of staff per 1000 flights controller vs number of flights</td>
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<td></td>
<td>• Number of ATCOs in OPS per flights per 1000 flights controlled vs. number of flights</td>
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<td></td>
<td>• Number of “active” controllers vs. number of overhead staff per provider</td>
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<td>• Number of Staff vs number of sectors</td>
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<td></td>
<td></td>
<td></td>
<td>• Number of ATCOs in OPS vs number of sectors</td>
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</tbody>
</table>
| Technology – | The amount and type of technology and infrastructure available to manage the organisation and deliver the services | Technology (quantitative Key Indictors) | • Achievements vs. EUROCONTROL technology targets (ECIP)  
• Degree of technology implemented vs. degree of technology used per provider  
• Variation on technology implementation vs. ACC | ECIP (A, EO)  
Database for this Study | Analysis needs to take into account the actual technology implementation and technology capability variation amongst providers. The ECAC references levels attempted previously by EEC form a key part of this analysis. |
| Institutional Factors – | External factors pertaining to the institutional environment in which service provider must perform | Descriptive | • Impact of the ownership structure  
• Impact of the governance structure  
• Impact of the authorisation / mandate for provision of services  
• Impact of financial provisions  
• Impact of audit and regulation  
• Overall degree of corporatisation per service provider | AIPs (A)  
Annual Reports (A)  
Balance sheets (A)  
Database for this Study | Compressive descriptive material required on a State by State basis to determine possible impacts on performance. |
| Operational Factors – | External factors pertaining to the operational environment in which service provider must perform | Descriptive | • Impact for airspace size and volume of traffic  
• Impact of the distribution of traffic  
• Impact of the traffic profile  
• Impact of the airports and TMA profile  
• Impact of the coordination requirements  
• Overall impact of operational complexity | AIPs (A)  
CFMU Reports (A, EO)  
Charts and Maps (A)  
Database for this Study | Compressive descriptive material required on a State by State basis to determine possible impacts on performance. |

**TABLE 3: KEY INDICATORS**
8.2 **Key Legislative Enablers**

KLEs are based on those high-level best practices that are representative of both the principal objectives of the Single Sky Initiative and of the biggest improvement opportunities for the industry as a whole as well as for many individual providers. The Study Team believes that the implementation of these best practices can lead to tangible improvements in the short and medium term and, as such, the KLEs are used identify and define opportunities for Community instruments to ensure, under the auspices of the Single European Sky, that:

- Air navigation services provided ensure uniform high safety standards for the air traffic
- Airspace is organised and managed efficiently and safely to meet needs of both civil and military users and allow equitable, non discriminatory allocation of the resources between all users
- The technical and operational solutions secure and increase safety standards, the overall capacity of the system, and full efficient use of capacity available
- The performance of the air navigation services system as a whole at the European level is constantly examined to check the effectiveness of the measures and propose further measures.

These KLEs are complementary to the Single European Sky proposals 2001/0235, 2001/0236 and 2001/0237.
<table>
<thead>
<tr>
<th>KLE</th>
<th>DOMAIN OF ANALYSIS</th>
<th>GOAL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Management</td>
<td>Safety Process</td>
<td>Further develop the safety performance and culture across the Community</td>
<td>Further development of guidelines to Safety management process allows for maximum accountability, transparency and awareness at all levels of the organisation, while continuously assessing the corporate performance and culture to further determine whether risk is being reduced to a level as low as reasonably practicable.</td>
</tr>
<tr>
<td>Customer Involvement</td>
<td>Organisation of Services</td>
<td>Increase and coordinate customer input and feedback across the Community</td>
<td>Guidelines to ensure the highest degree of customer involvement, among other things in the service delivery requirements definition (in particular in the airspace design and classification process) and in the strategic and tactical decision-making process. Guidelines should ensure customers are an integral part of the feedback loop as regards provider’s performance for outcomes (quality and cost of service provided) and that a customer-oriented culture is pervasive throughout the organisation. Customers should include all users as well as key external stakeholders (airports, local communities, military, etc.)</td>
</tr>
<tr>
<td>Scope of Service, Service Definition and Delivery</td>
<td>Organisation of Services</td>
<td>Harmonise the mission and organisation of ATS provision, through the facilitation of the definition and delivery of services, according to operational requirements on a Community scale.</td>
<td>Guidelines for a well-articulated mission to be communicated and shared throughout the organisation; implementation of transparent organisational and financial structures (including accounting process for cost and resources allocation) and embedded organisational flexibility and systematic processes to unbundle or outsource services as appropriate. Requirements for implementation of an accredited quality management process throughout the organisation. Guidelines for the unbundling of services which do not naturally lend themselves to monopoly provision.</td>
</tr>
<tr>
<td>Tactical Flexibility</td>
<td>Organisation of Services</td>
<td>Increase coordination of tactical flexibility on a Community scale</td>
<td>Guidelines for the flexibility to open and close sectors supplemented by the ability to change the configuration of active sectors in adding more working positions in order to react to changes in traffic demand without fragmenting the airspace further. Further increase situational awareness in the cockpit by using English as the only language in ATC for IFR flights and on international airports. Guidelines for the use of flexible rostering combining team and individual-based rostering frequently reviewed, and the tasking of individuals as stand-by readiness in</td>
</tr>
</tbody>
</table>
### Table 4: Key Legislative Enablers

<table>
<thead>
<tr>
<th>KLE</th>
<th>Domain of Analysis</th>
<th>Goal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated Strategic Management</td>
<td>Operational Concept</td>
<td>Improve the planning and implementation of resources on a Community scale</td>
<td>Guidelines for the integration of business planning, HR management, Operations Planning and Infrastructure Planning into a comprehensive Strategic Management Process; this process should be an iterative, closed-loop process, both using a combination of top-down and bottom-up processes, with the embedded ability to monitor success against targets and standards in order to identify improvement opportunities. Implementation of high level architecture approach in support of such processes in the area of infrastructure planning.</td>
</tr>
<tr>
<td>Information Disclosure</td>
<td>All</td>
<td>Systematic benchmarking of service provision / development and implementation of improvements</td>
<td>Continuation of the benchmarking process through an appropriate body to identify reasons for economic and performance variances and detail/implement opportunities for improvement across the industry.</td>
</tr>
<tr>
<td></td>
<td>Inputs, Outputs, Outcomes</td>
<td>Economic and performance regulation for ANSPs</td>
<td>Expansion of PRU activities in line with the development of economic and performance guidelines for the provision of air navigation services within the Community.</td>
</tr>
</tbody>
</table>
9 OVERALL CONCLUSION

9.1 INTERPRETATION OF RESULTS IN THE CONTEXT OF THE SINGLE SKY INITIATIVE

Under the framework for the creation of the Single European Sky, the European Parliament and the Council of the European Union have accepted that the Community Framework provides a means of establishing common rules to optimise use of the airspace as a whole and the performance of the air navigation services on which this depends, and that, inter alia:

- The air navigation services provided must ensure uniform high safety standards for the air traffic
- Use of airspace must be organised and managed efficiently and safely to meet needs of both civil and military users and allow equitable, non discriminatory allocation of the resources between all users
- The rules must cover provision of air navigation services, air navigation equipment and systems with the associated procedures
- The technical and operational solutions must secure and increase safety standards, the overall capacity of the system, and full efficient use of capacity available
- The performance of the air navigation services system as a whole at the European level must be constantly examined to check the effectiveness of the measures and propose further measures.

The overall results of the Study support most of the objectives, particularly in the following areas:

9.1.1 Ensuring High Uniform Safety

Under the Single Sky Initiative, verification of compliance, for air navigation service providers and other relevant operators, will remain a task for the Member States and certificates of compliance should be mutually recognised by all Member States in order to allow air navigation service providers and other relevant operators to provide services in a Member State other than where they obtain their certificates.

This process will ensure compliance of standards in line with recognised obligations. In particular, compliance with the ESARRs will enable a uniform application of minimum requirements for safety management. However, the study has shown that full compliance with the ESARRs will still allow some variation in the internal processes used and that there will remain opportunity for further improvement based on Community guidelines for identified best practices in Safety Management.
The overall safety of services may be further increased by the transfer of related better practices across the other domains for internal processes as each domain has an influence on the overall safety of services provided.

9.1.2 Meeting the Needs of Users

The organisation of the airspace must be improved to more effectively meet the needs of the users and the creation of a European flight information region in the upper airspace is desired as well as reconfiguration of such airspace into control areas across national boundaries. This is to provide for a more efficient use of airspace, systems and manpower, thus reducing the costs for airspace users.

User input in both the current and future organisation of service provision should be facilitated to the highest degree to allow coordinated approaches to service delivery and the strategic and tactical decision making processes. Implementation of Community guidelines for best practice in Customer Involvement should ensure uniform application of customer relationship management processes allowing customers to be an integral part of the feedback loop to ensure equitable and non discriminatory application of resources.

9.1.3 Organisation of Services

The rules applied by the national supervisory authorities must be coordinated on a Community scale to allow mutual recognition and facilitate a more effective organisation of airspace, services, equipment and systems. Community guidelines based on best practice in Scope of Service, Service Definition and Delivery should allow a clear harmonised approach allowing organisational and financial transparency across service providers, facilitating the unbundling / bundling of services in line with the specifics of the local environment, Community objectives and the needs of the users.

9.1.4 Technical and Operational Efficiency

As the air traffic management network is a complex, highly interactive structure involving large numbers of systems and components and operational processes, the Single Sky Initiative seeks to facilitate the definition and adoption of Community specifications defining the technical and operational constituents of the air traffic management network in view of complexity.

In this respect, the analysis shows clear opportunities for improvement through the development of Community guidelines for a coordinated approach to Tactical Flexibility. Development of guidelines for key elements of a Community operational concept should allow more consistent and effective application of the opening and closing of sectors, together with increased cooperation amongst controllers, which should now be achievable as a result of technological investments over recent years. Similarly, guidelines for rostering and manning of controllers, together with the conditions for capacity coordination on a tactical basis should allow more consistent application of working practices in relation to a specific environment.
Further, strategic planning of technical and operational improvements can be better coordinated through the implementation of Community guidelines for best practice in Strategic Management. The harmonised adoption of more integrated ‘closed loop’ business planning, HR management, operations and infrastructure planning process should allow the ability to plan, implement and monitor success, against targets on the local and Community scale.

9.1.5 Performance of the Overall System

Under the Single Sky Initiative, user charges should provide remuneration for the facilities and services provided by the air navigation service. As such services by their nature, can only be provided by air navigation service themselves, the level of user charges should be proportionate to the cost incurred, taking into consideration the objective of economic efficiency.

The systematic implementation of benchmarking will allow the performance of the overall system to be monitored and effects of specific external environments further quantified to ensure any incentives or penalties are fairly applied. As such, Information Disclosure requirements at Community level to allow systematic benchmarking to be progressed should be developed in line with the outputs of this study.

9.2 COMPARISON WITH NON-EUROPEAN PROVIDERS

The inclusion of non-European providers into the Study has been very valuable in several respects.

First of all, it has allowed capture of major differences in operational environments experienced by providers in other regions. For example, traffic patterns are very different, which explains and there is a much greater impact and focus on VFR for non-European providers partaking in the study.

Secondly, the case of several non-European providers has indirectly highlighted the impact of the so-called “network effect” on European operations. Due to the overall density of traffic over core European countries combined with the level of fragmentation of the service provision in these countries, there is an extremely high level of interdependency and of complexity in Europe that does not exist in other parts of the world. This would also make it very difficult to compare a large non-European provider with a group of European providers and it is recommended that care be taken to ensure any future comparisons duly consider network effects.

However, it is clear that this relative independence seems to have given non-European providers early freedom to innovate and more flexibility to change their operating models in line with requirements of the service. Interestingly, most of the non-European providers covered in the Study have had very good scores in the area of Internal Processes, which tends to illustrate their recent transformation into more commercially-driven /customer-focused organisations.
Finally, non-European providers seem to display a culture of openness that is still lacking in Europe. Most European providers are still fairly hesitant on the open sharing of information, which illustrates that the legacy of monopoly government organisations is well entrenched in many providers.

9.3 GENERAL LEARNINGS AND POSSIBLE NEXT STEPS

9.3.1 General Learnings

- This Study has shown the benefits of a continuous benchmarking process in order to track the various practices and performance levels as well as to monitor the improvements achieved in various areas. The results clearly demonstrate that this benchmarking project should not be a one-off exercise.

- The Study has also brought forward the need to investigate specific areas further with a more comprehensive view, in order to be able to make significant improvements in the overall understanding of the air navigation service provision dynamics. This is particularly valid for the concepts of Complexity and Capacity. The Study has shown that until these two concepts are clearly defined and investigated, there will be significant limitations to any collective and regulatory effort to set some industry-wide standards and performance targets. This task cannot be left to the providers or even Eurocontrol, which have too many vested interests or have too much of an insider’s view. This should be undertaken as much as possible by an outside organisation, possibly in academia.

- Large variations in practices and in performance have been identified. However, at this stage, no clear relationship has emerged between the two. This is mainly due to the fact that such relationships require a deeper level of analysis than the provider level (at least service if not centre level), to be correctly captured. This is also due to the fact that many providers have been experiencing significant changes in internal practices over the last few years, the impact of which has not yet been reflected in their current performance. Such impact is likely to become more obvious over the next few years.

- Finally, the benchmarking process itself, as experienced by the Study Team, has shown that many providers do not have a proper reporting process capturing data relevant to their business. This is clearly an area where an institutional benchmarking process would help by standardising data requirements and data collection processes that providers could incorporate into their own internal management toolkit.
9.3.2 Possible Next Steps

For the European Commission:
The following steps should be initiated:

- Harmonisation of the Study benchmarking framework with Eurocontrol EID’s framework
- Selection of priority areas for definition or standardisation (capacity, operational complexity, general definitions, etc.)
- Set-up of an infrastructure for the continuation of the benchmarking process (“institutionalisation”)
- Initiation of a legislative framework that will build upon the results of the benchmarking and of the identified high level best practices
- Extension of the application of the benchmarking framework to providers in the enlargement countries

For the Providers:
The following steps should be initiated:

- Coordinated selection of providers to take part in the identification and validation of key drivers through analysis at the service and/or centre level
- Identification of individual areas for improvement based on the analysis of identified best practices and benchmarking results in the context of their own specific strategic priorities
- Set up a reporting process adapted to the new benchmarking data requirements
- Development of a model to incorporate an institutional benchmarking process into their own managerial and decision-making process

*     *     *

*     *
Appendix 1 to the Final Report

Study on Benchmarking for Best Practices in Air Traffic Management

CLUSTER CHARTS

31st January, 2003
Introduction

The main focus of the Study and its results has been the qualitative benchmarking of Internal Processes – something which has not been attempted before.

21 key capability areas have been identified in the domains of Internal Processes, and a series of Key Indicators have been selected for each capability area.

The qualifications for these Key Indicators combine to form the ‘Cluster Charts’ for each capability area.

- These cluster charts have been developed to capture the whole range of possible or actual practices as determined by the Study Team.
- By positioning the Providers across the Cluster Charts, they provide illustration on the variance of individual processes and how individual implementations compare across the industry. They therefore provide visibility of potential development opportunities, which Providers can then further develop based on their individual experiences and the local environment.
- The Cluster Charts form the basis of a future Questionnaire for Internal Process
Cluster Charts for 21 capabilities areas within Internal Processes

**SAFETY**
- Safety Process

**ORGANISATION OF SERVICE**
- Provider / Regulator Relationship
- Service Definition
- Service Delivery
- Military / Civil Relationship
- Customer Relationship Mgt

**OPERATIONAL CONCEPT**
- Airspace Design
- Airspace/Sector Management
- Air Traffic Flow Management
- ATC Procedures

**WORKING PRACTICES**
- Rostering
- Manning
- Licensing
- Training
- Performance Monitoring

**STRATEGIC MANAGEMENT**
- Business Planning
- HR Management
- Operations Planning
- Crisis Management
- Environmental Planning
- R&D Planning
- Infrastructure Planning
## Domain: Safety

### Safety Process

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety Management Function</strong></td>
<td>• No dedicated function but covered across line management</td>
<td>• Dedicated function covering main services</td>
<td>• Dedicated function for all safety related services</td>
<td>• Category C Capability • Fully independent • Reporting directly to the Head of the Organisation</td>
<td>• Category D Capability • Assesses corporate performance &amp; culture</td>
</tr>
<tr>
<td><strong>Safety Management System</strong></td>
<td>• No specific system implemented</td>
<td>• Provides information on concepts &amp; policy • Basic monitoring</td>
<td>• Provides information on concepts &amp; policy • Provides audit of critical services • Use of specific tools</td>
<td>• Category C capability • Defined indicators</td>
<td>• Category D Capability • Ad-hoc testing of safety related staff</td>
</tr>
<tr>
<td><strong>Education, training and testing</strong></td>
<td>• High-level understanding of concepts • Routine communication of issues</td>
<td>• Category A • Routine Training of ACTOs • Workshops</td>
<td>• Category B • Routine training of all safety related staff • Routine tests for ATCOs</td>
<td>• Category C • Routine tests of all safety related staff • Ad-hoc testing of ATCOs</td>
<td>• Category D • Ad-hoc testing of safety related staff</td>
</tr>
<tr>
<td><strong>Safety occurrence reporting process</strong></td>
<td>• No formalised channels</td>
<td>• Confidential reporting or Voluntary reporting only</td>
<td>• Category B • Mandatory reporting</td>
<td>• Category C • Automated mandatory reporting</td>
<td>• Category D • Ad-hoc testing of safety related staff</td>
</tr>
<tr>
<td><strong>Risk identification process</strong></td>
<td>• No formal process</td>
<td>• Reactive only</td>
<td>• Reactive only • Transparent accountability</td>
<td>• Proactive and reactive</td>
<td>• Category D • Transparent accountability</td>
</tr>
</tbody>
</table>
# Provider / Regulator Relationship

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independence of regulation and service provision</td>
<td>Same institution responsible for all ops &amp; regulation activities</td>
<td>Same institution responsible for most ops &amp; regulation activities</td>
<td>Same institution responsible for most ops &amp; regulation activities</td>
<td>Separate institutions responsible for ops &amp; regulation</td>
<td>Separate institutions responsible for ops &amp; regulation, little overlap</td>
</tr>
<tr>
<td></td>
<td>Same line management for ops &amp; regulation</td>
<td>Separate line management for ops &amp; regulation</td>
<td>Separate line management for ops &amp; regulation</td>
<td>Institutions have same reporting lines at government level</td>
<td>Institutions have independent reporting lines at government level</td>
</tr>
<tr>
<td></td>
<td>Same governance lines for ops &amp; regulation</td>
<td>Same governance lines for ops &amp; regulation</td>
<td>Separate governance lines for ops &amp; regulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of separation of regulation and service provision</td>
<td>Same institution responsible for all ops &amp; regulation activities</td>
<td>Same institution responsible for most ops &amp; regulation activities</td>
<td>Same institution responsible for most ops &amp; regulation activities</td>
<td>Separate organisations for ops &amp; regulation with limited overlap in some areas</td>
<td>Separate organisations for all ops &amp; regulation</td>
</tr>
<tr>
<td></td>
<td>Ops and regulation integrated into same functional units throughout the organisation</td>
<td>Ops and regulation in separate functional units throughout the organisation</td>
<td>Organisation set up to ensure functional separation of ops &amp; regulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organisation of regulation – service provision interface</td>
<td>No clear interface or demarcation between roles and responsibilities</td>
<td>Interfaces organised on an ad-hoc basis at both strategic and operational levels</td>
<td>Well-defined strategic or operational level interfaces</td>
<td>Well defined strategic and operational interfaces</td>
<td>Specialist function within ANSP dedicated to managing interface with one or more of the regulators</td>
</tr>
<tr>
<td></td>
<td>Overlap of ops &amp; regulatory activities</td>
<td>No central coordination</td>
<td>Ad-hoc interfaces at the other level</td>
<td>No central coordination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No central coordination</td>
<td></td>
<td>No central coordination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processes supporting regulation – service provision interface</td>
<td>No clear processes other than setting strategic or political objectives</td>
<td>Review and approval of strategic level objectives and requirements</td>
<td>Review and approval of strategic level objectives and requirements</td>
<td>Review and approval of all processes, procedures and requirements</td>
<td>Continuous and well-defined oversight process at all levels</td>
</tr>
<tr>
<td></td>
<td>Inspections at operational level</td>
<td>Compliance monitoring against requirements</td>
<td>Inspections and audits at operational level</td>
<td>Comprehensive compliance monitoring and audit at all levels at discrete intervals</td>
<td></td>
</tr>
<tr>
<td>Frequency of regulatory inspections and audits</td>
<td>No regular independent inspections or audits at operational level.</td>
<td>Fixed calendar of operational audits and inspections on an infrequent basis</td>
<td>Fixed calendar of operational audits and inspections on frequent basis</td>
<td>Fixed calendar of operational audits and inspections on frequent basis</td>
<td>Continuous and ongoing oversight process</td>
</tr>
<tr>
<td></td>
<td>Strategic level assessment of plans and procedures only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Service Definition

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarity of mission and objectives</td>
<td>• No clear mission statement other than general principles in line with Chicago Convention obligations</td>
<td>• Clear mission statement in line with general Chicago Convention and/or other principles, e.g. ECAC</td>
<td>• Clear mission statement differentiating ANSP from others</td>
<td>• Clear mission statement differentiating ANSP from others developed with input/buy-in from employees and key stakeholders</td>
<td>• Mission defined through declaration of objectives and values derived through consultation with employees and key stakeholders</td>
</tr>
<tr>
<td></td>
<td>• Limited communication internally and externally</td>
<td>• Mission communicated internally and publicised externally</td>
<td>• Mission statement developed with input/buy-in from staff</td>
<td>• Mission delineated extensively to stakeholders</td>
<td></td>
</tr>
<tr>
<td>Degree of service bundling</td>
<td>• Complete bundled portfolio of ANSs is provided following the Conventional Integration Model</td>
<td>• Some non-ATM services are provided by third party providers, e.g. MET, AIS, SAR</td>
<td>• Some non-ATM services are provided by 3rd parties</td>
<td>• Some non-ATM services are provided by 3rd parties</td>
<td>• Most non-ATM and ancillary services are provided by 3rd parties</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Some ancillary services are outsourced, e.g. fixed communications</td>
<td>• Some ancillary services are outsourced</td>
<td>• ATC services are extensively unbundled</td>
</tr>
<tr>
<td>Organisation of non-ANS services</td>
<td>• No non-ANS services are provided</td>
<td>• Non-ANS services limited to those with strong links to ANS</td>
<td>• Non-ANS services limited to those with strong links to ANS</td>
<td>• Non-ANS services limited to those with strong links to ANS</td>
<td>• ANSP free to provide any non-ANS services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No clear separation of non-ANS and ANS services</td>
<td>• Functional separation of non-ANS and ANS services</td>
<td>• Functional and accounting separation of non-ANS and ANS services</td>
<td></td>
</tr>
<tr>
<td>Organisational transparency</td>
<td>• Clear organisational &amp; functional structure</td>
<td>• Clear organisational &amp; functional structure</td>
<td>• Clear organisational &amp; functional structure</td>
<td>• Clear organisational &amp; functional structure</td>
<td>• Clear organisational &amp; functional structure</td>
</tr>
<tr>
<td></td>
<td>• Functional units map onto multiple operational units</td>
<td>• Functional units map directly onto individual operational units</td>
<td>• Functional units map directly onto individual operational units</td>
<td>• Functional units map directly onto individual services</td>
<td>• Functional units map directly onto individual services</td>
</tr>
<tr>
<td></td>
<td>• Operational units map onto multiple services</td>
<td>• Operational units map onto multiple services</td>
<td>• Operational units map directly onto individual services</td>
<td>• Operational units map directly onto multiple services</td>
<td></td>
</tr>
<tr>
<td>Financial transparency</td>
<td>• Bespoke accounting or budgeting procedures</td>
<td>• GAAP</td>
<td>• GAAP</td>
<td>• GAAP</td>
<td>• GAAP</td>
</tr>
<tr>
<td></td>
<td>• No published accounts</td>
<td>• Audited accounts, not published</td>
<td>• Audited, published accounts</td>
<td>• Audited, published accounts</td>
<td>• Externally audited accounts</td>
</tr>
<tr>
<td></td>
<td>• Total costs allocated between services using simple rules of thumb</td>
<td>• Total costs allocated between services using simple rules of thumb</td>
<td>• Direct costs allocated using specific drivers</td>
<td>• Costs allocated using formal methodology, e.g. ABC</td>
<td>• Costs allocation is fully traceable and transparent, including overheads</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Ad-hoc overhead allocation</td>
<td>• Cross- charging readily identified</td>
<td>• No cross- charging</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Any cross-charging is readily identified</td>
<td>• SLAs for internal trading</td>
<td>• SLAs for internal trading</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
## Domain: Organisation of Services

### Service Delivery

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
</table>
| Outsourcing policy                  | • General policy to perform all activities in-house  
• No outsourced services            | • No overall policy. Individual units have freedom to outsource on an ad-hoc basis based on their own criteria  
|                                    |                                        | • No overall policy. Individual units have freedom to outsource based on standard criteria, e.g. general economic and efficiency factors, CBA  
|                                    |                                        | • Policy restricts outsourcing to non-core activities. Individual units have freedom to outsource these activities on an ad-hoc basis based on their own criteria  
|                                    |                                        | • Policy restricts outsourcing to non-core activities. Individual units have freedom to outsource based on standard criteria, e.g. general economic and efficiency factors, CBA  
| Coordination between service units  | • No clear process                      | • Defined in operations manuals         | • Letters of agreement                  | • Centrally administered procedures    | • Combination of letters of agreement and centrally administered procedures |
| Clarity in service provision        | • Wide range of services, including non-aviation, delivered by ANSP  
• Significant deviation of services from ICAO specifications  | • Wide range of aviation services delivered by ANSP including non-ANSs  
• Compliance with ICAO specifications  | • Focus on whole range of ANS and closely associated services  
• Compliance with ICAO definitions  
• Units deliver wide range of multiple services  | • Focus on ATM and closely related services services  
• Compliance with ICAO definitions  
• Units deliver wide range of multiple services  | • Focus on ATM and closely related services services  
• Compliance with ICAO definitions  
• Units focus on well-defined service bundles  
• Unbundling facilitated  |
| Quality management process          | • No quality assurance or management procedures in place  | • In-house procedures followed with no external accreditation  | • Some parts of organisation have quality certification related to specific activities  | • A wide range of the ANSP organisation has quality certification covering multiple services  | • The entire ANSP organisation has quality certification  |
## Domain: Organisation of Services

### Civil Military Relationship

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional relationship</td>
<td>• Defence/military takes full control for all air navigation service matters</td>
<td>• Coordination between relevant ministries • Separate organisations responsible for civil and military service provision • Limited coordination at operational level</td>
<td>• Coordination between relevant ministries • Separate organisations responsible for civil and military service provision • Coordination between civil and military service providers</td>
<td>• Coordination between relevant ministries • Integration of military into single civil service provider</td>
<td>• Civil authorities take full control for all air navigation service matters through delegation at government level</td>
</tr>
<tr>
<td>Structural relationship</td>
<td>• Separate infrastructure • Separate services</td>
<td>• Cross-use of infrastructure • Separate services</td>
<td>• Cross-use of infrastructure • Cross-provision of services</td>
<td>• Cross-use of infrastructure • Integrated services</td>
<td>• Integrated infrastructure • Integrated services</td>
</tr>
<tr>
<td>Tactical relationship</td>
<td>• Permanent allocation of airspace • Direct funding/subsidy for provision of services to military</td>
<td>• Permanent allocation of some airspace • Flexible use of other airspace on a day-to-day basis • Reimbursement by the military for use of civil infrastructure and/or vice versa</td>
<td>• Flexible use of all airspace on a day-to-day basis • Reimbursement by the military for use of civil infrastructure • Reimbursement by civil for use of military services/infrastructure</td>
<td>• Flexible use of airspace on a tactical level • Reimbursement by the military for use of civil infrastructure/services • Reimbursement by civil for use of military services/infrastructure</td>
<td>• Flexible use of airspace on a tactical level • Integrated infrastructure/services</td>
</tr>
</tbody>
</table>


# Customer Relationship Management

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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</thead>
</table>
| Degree of customer input/involvement in service definition | • No customer involvement in the service definition process at local level. Reliance on the EATMP or other international process) | • Specific customer input at strategic level (e.g. participation in ANSP board)  
• Limited direct consultation with main customers at operational levels on specific issues | • Specific customer input at strategic level (e.g. participation in ANSP board)  
• Direct consultation with main customers on wide ranging issues at operational levels | • Specific customer input at strategic level (e.g. participation in ANSP board)  
• Direct consultation with all customers at operational levels | • Customer involvement as ANSP shareholder  
• Direct consultation with all customers at operational levels |
| ANSP – customer relationship               | • No specific definition of relationship other than ICAO obligations | • Relationship defined in national legislation in general terms | • Relationship defined in the licence/authorisation of the ANSP or in the legislation of its establishment | • Relationship defined in the licence/authorisation of the ANSP or in the legislation of its establishment  
• Contracts/SLAs with specific customers in place or planned | • Contracts/SLAs with the majority of customers on place or planned  
• Customer relationship plans implemented |
| Processes for customer involvement in service definition | • No formal local mechanism (other than through the EATMP process) | • Ad-hoc consultation at local level  
• Information feedback provided to customers | • Formal, regular consultation at local level | • Formal, regular consultation  
• CDM at either strategic or technical and operational levels | • Formal, regular consultation  
• CDM at all of strategic, technical and operational levels |
| Process used to capture customer satisfaction | • No formal local mechanism other than ad-hoc reaction to complaints  
• Reliance on EUROCONTROL mechanisms, e.g. PRC | • Regular surveys and questionnaires | • Regular surveys and questionnaires  
• Institutionalised complaint handling procedures | • Regular surveys and questionnaires  
• Institutionalised complaint handling procedures  
• Regular workshops with customer management | • Regular surveys and questionnaires  
• Institutionalised complaint handling procedures  
• Regular workshops with customer management and line aircrew |
| Scope of customer satisfaction process       | • No formal local mechanism other than ad-hoc reaction to complaints | • Restricted to main commercial customers (airlines and airports) | • Includes all commercial customers (airlines and airports) | • Includes all commercial customers (airlines and airports) and general aviation or the military (i.e. some exclusion) | • Addresses all types of customer |
## Domain: Operational Concept

### Airspace Design

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application of International – ICAO – Standards</td>
<td>• Mainly implemented (75 – 100% adherence) with few exceptions</td>
<td>• 100 % adherence to ICAO classification</td>
<td>• 100 % adherence to ICAO classification</td>
<td>• 100 % adherence to ICAO classification</td>
<td>• 100 % adherence to ICAO classification</td>
</tr>
<tr>
<td></td>
<td>• Few national supplements to the Use of Airspace</td>
<td>• Few national supplements to the Use of Airspace</td>
<td>• No national supplements to the Use of Airspace</td>
<td>• No national supplements to the Use of Airspace</td>
<td>• No national supplements to the Use of Airspace</td>
</tr>
<tr>
<td>Criteria and Drivers</td>
<td>• Regional Harmonisation</td>
<td>• Technological Drivers additional to A</td>
<td>• Conceptual Drivers additional to C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Service Delivery Requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Involvement</td>
<td>• No clear process (occasional involvement)</td>
<td>• Selected Customers are involved</td>
<td></td>
<td></td>
<td>• All customers are involved</td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>Indicators</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Changing Sector Configuration</td>
<td></td>
<td>• Sectors can be combined either horizontally or vertically or in both dimensions</td>
<td>• Technical means are available</td>
<td>• The authority on central level</td>
<td>• B with authority on local level</td>
</tr>
<tr>
<td>Time Constraints for changing Sector Configuration</td>
<td>• Less than 30 minutes prewarning required</td>
<td></td>
<td>• Changes possible within 5 minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference between Minimum and Maximum number of open Sectors</td>
<td>Reduction by up to 40-59%</td>
<td>• Reduction by 60 – 74%</td>
<td>Reduction by 75 – 84%</td>
<td>• Reduction by 85+%</td>
<td></td>
</tr>
<tr>
<td>Reallocation of Working Positions i.e. Technical Flexibility</td>
<td>Reallocation possible with System support but with some adaptable tools (display or communication ) missing</td>
<td>• As previous with all tools</td>
<td></td>
<td></td>
<td>• C plus identification of controller</td>
</tr>
<tr>
<td>Release of Military Airspace for Civil Use</td>
<td>• Very few options for the release of military airspace</td>
<td>• Unused military airspace is released for civil use on an as requested basis</td>
<td></td>
<td></td>
<td>• Unused military airspace automatically released for civil use</td>
</tr>
</tbody>
</table>
## Domain: Operational Concept

### Air Traffic Flow Management

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Service</td>
<td></td>
<td>• Provision of ATFM on regional level (CFMU in Europe)</td>
<td>• Transfer of blocks of airspace between centres</td>
<td>• Provision of ATFM on regional level (CFMU in Europe)</td>
<td>• Ad – hoc delegation of airspace between centres also cross - border</td>
</tr>
<tr>
<td>Mechanisms and Conceptual Support Tools</td>
<td>• Use of conditional routes and airspace, Use of off – load routes to circumnavigate congested areas</td>
<td>• Tactical co-ordination in line with the FUA concept (Europe only)</td>
<td>• Involvement on a tactical level (through CFMU)</td>
<td>• In addition to A and/or C</td>
<td>• Involvement on a tactical level (direct through ACC) • Agreeing on alternate routings</td>
</tr>
<tr>
<td>Customer Involvement</td>
<td>• Involvement on a strategic level (planning)</td>
<td>• Involvement on a tactical level (through CFMU)</td>
<td>• • Defining the rules</td>
<td></td>
<td>• Involvement on a tactical level (through CFMU) • Agreeing on alternate routings</td>
</tr>
</tbody>
</table>
## Domain: Operational Concept

### ATC Procedures

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Technology to provide Separation</td>
<td>• Radar Separation</td>
<td>• Radar Separation</td>
<td>• Radar Separation supplemented by new Technology (also on an experimental basis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal Separation</td>
<td>• Enroute 10 minutes +</td>
<td>• Enroute 5 minutes +</td>
<td>• Enroute 5 minutes +</td>
<td>• Enroute 5 minutes +</td>
<td>• Enroute 5 minutes +</td>
</tr>
<tr>
<td></td>
<td>• Approach 5 minutes +</td>
<td>• Approach 3 minutes +</td>
<td>• No timed separation on Final</td>
<td>• No timed separation on Final</td>
<td>• No timed separation on Final</td>
</tr>
<tr>
<td></td>
<td>• No timed separation on Final</td>
<td>• No timed separation on Final</td>
<td>• Crossing border as enroute or more</td>
<td>• Crossing border as enroute or more</td>
<td>• Crossing border as enroute or more</td>
</tr>
<tr>
<td>Radar Separation</td>
<td>• Enroute 10 NM +</td>
<td>• Enroute 10 NM +</td>
<td>• Enroute 10 NM +</td>
<td>• Enroute 5 NM -</td>
<td>• Enroute 5 NM -</td>
</tr>
<tr>
<td></td>
<td>• TMA 3 NM +</td>
<td>• TMA 3 NM +</td>
<td>• TMA 3 NM +</td>
<td>• TMA 3 NM</td>
<td>• TMA 3 NM</td>
</tr>
<tr>
<td></td>
<td>• Final 3 NM</td>
<td>• Final 3 NM</td>
<td>• Final 3 NM</td>
<td>• Final 2.5 NM</td>
<td>• Final 2.5 NM</td>
</tr>
<tr>
<td>Silent Transfer of control</td>
<td>• Not yet implemented</td>
<td>• Intra ACC co-ordination and between own ACC</td>
<td>• Between ACC, APP and TWR plus B</td>
<td>• With military ATC and with A/D units plus C Data Link</td>
<td>• Crossing international boundaries Data Link</td>
</tr>
<tr>
<td>Lead time required for transfer of control</td>
<td>• 15 minutes+ between own centres</td>
<td>• 1o minutes between centres</td>
<td>• 5 minutes</td>
<td>• 3 minutes or less</td>
<td>• 3 minutes or less</td>
</tr>
<tr>
<td>Preparations for Emergencies</td>
<td>• Procedures are taught and where available practised in simulators</td>
<td>• Shorter between ACC and APP/TWR</td>
<td>• 5 minutes</td>
<td>• No lead time required</td>
<td>• No lead time required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Procedures are part of proficiency training</td>
<td>• Fully automated</td>
<td></td>
<td>• Fully automated</td>
</tr>
<tr>
<td>Use of Languages</td>
<td>• English is used for non – nationals, but mother tongue is used for nationals also at international airports</td>
<td>• English is used for non – nationals, but mother tongue is used for nationals in the IFR service</td>
<td>• English is used for non – nationals, but mother tongue is used for nationals in the IFR service</td>
<td>• English is the only language used for IFR service</td>
<td>• English is the only language used for IFR service</td>
</tr>
</tbody>
</table>
# Domain: Working Practices

## Rostering

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
</table>
| **Applied Rostering System**        | Combination of Team and Individual based rostering  
• Frequently reviewed          |                  | Independent of Season  
• Team based                      |                  | Seasonal variations  
• Individual based                |                  |
| **Provision for Standby Staff**     | Depending on the availability of individuals (ATC staff normally on other duty or available in their off-time) |                  | Organised system with Individuals on call |                  | Staff routinely rostered for standby |                  |
| **Working Hours ATCO**              | Less than 1500 hrs/yr                  | 1500 - 1650 hrs/yr  
| **Working Hours Flight Data**       | Less than 1500 hrs/yr                  | 1500 -1650 hrs/yr  
| **Personnel Factor ATCOs 24 hrs requirement** | More than 9 | More than 7.5 | More than 6.5 | 6,5 or less | 6,5 or less |
| **Personnel Factor Flight Data Staff 24 hrs requirement** | More than 9 | More than 7.5 | More than 6.5 | 6,5 or less | 6,5 or less |
## Domain: Working Practices

### Manning

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Positions Rush hour / normal</td>
<td>• 0</td>
<td></td>
<td>• 1</td>
<td></td>
<td>• 2</td>
</tr>
<tr>
<td>Support Positions Rush hour/normal</td>
<td>• 0</td>
<td></td>
<td>• 1</td>
<td></td>
<td>• 2</td>
</tr>
</tbody>
</table>
| Reaction to changing traffic demand (Busy/Low) Configuration Changes      | • Opening / closing sectors | • Opening / closing sectors  
• Extention of dimensions (horizontally and vertically) | • C + increasing / decreasing manning in existing sectors |
| Regulation and Authority of Supervisors to reduce below minimum          | • Prescribed by local Management | • A + Authority of supervisor to go below at own discretion |            | • A + No authority of supervisor to go below, or in well defined situations only |
# Licensing

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination of Ratings i.e. TWR/APP Centre/APP, or one only possible</td>
<td><strong>• One Rating for one Type of facility</strong></td>
<td><strong>• Combination of APP and TWR</strong></td>
<td><strong>• Combination of Centre and APP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum time in position to keep current</td>
<td><strong>• Not defined</strong></td>
<td><strong>• Defined (Ops Staff) up to 360 hours/year</strong></td>
<td><strong>• Defined (Ops Staff) more than 360 hours/year</strong></td>
<td><strong>• Defined (Ops Staff) more than 600 hours/year</strong></td>
<td></td>
</tr>
</tbody>
</table>
## Domain: Organisation of Services

### Training & Performance Monitoring

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Level A</th>
<th>Level B</th>
<th>Level C</th>
<th>Level D</th>
<th>Level E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relation of Position-and Simulator Training</td>
<td>• No simulator training in OJT</td>
<td>• Simulator only to train special situations</td>
<td>• Relation Position / Simulator 50/50</td>
<td>• Relation Position / Simulator 60 - 79/40 – 21%</td>
<td>• Relation Position / Simulator 80/20 or more than 80%</td>
</tr>
<tr>
<td>Procedures to maintain proficiency</td>
<td>• Not defined</td>
<td></td>
<td>• A defined programme</td>
<td></td>
<td>• C+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Results are documented or</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• This training is performed in ATC schools</td>
</tr>
<tr>
<td>What monitoring tools and processes are in place, what indicators are used</td>
<td>• Planned</td>
<td>• Programmes (tools and processes) in place</td>
<td>• Programmes (tools and processes) in place</td>
<td>• C + Readiness to compare with other providers and/or</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No indicators defined</td>
<td>• Indicators defined</td>
<td>• Dedication to Performance expressed</td>
<td></td>
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</tr>
</tbody>
</table>

- **Level A**: No simulator training in OJT; Simulators only in basic training.
- **Level B**: Simulator only to train special situations.
- **Level C**: Relation Position / Simulator 50/50.
- **Level D**: Relation Position / Simulator 60 - 79/40 – 21%.
- **Level E**: Relation Position / Simulator 80/20 or more than 80%.
- **Procedures to maintain proficiency**:
  - Level A: Not defined.
  - Level B: A defined programme.
  - Level C: C+.
  - Level D: Results are documented or.
  - Level E: This training is performed in ATC schools.
- **What monitoring tools and processes are in place, what indicators are used**:
  - Level A: Planned.
  - Level B: Programmes (tools and processes) in place.
  - Level C: Programmes (tools and processes) in place.
  - Level D: C + Readiness to compare with other providers and/or.

**Notes**:
- C+ indicates a high level of performance.
- ATC stands for Air Traffic Control.
# Domain: Strategic Management

## Business Planning

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Planning Process</strong></td>
<td>• No business planning process</td>
<td>• Top-down, high level business planning</td>
<td>• Bottom up business planning</td>
<td>• Integrated top-down and bottom-up approach</td>
<td>• Fully integrated and multi-phase business planning process</td>
</tr>
<tr>
<td><strong>Business Planning documentation</strong></td>
<td>• Limited documentation, mainly for internal audience</td>
<td>• Basic documentation, mainly for internal audience except annual report</td>
<td>• Specific documentation for various parts of the business mainly for internal audience</td>
<td>• Specific documentation for various parts of the business</td>
<td>• Specific documentation for various parts of the business mainly for internal audience</td>
</tr>
<tr>
<td><strong>Relationship with other parties</strong></td>
<td>• No strategic relationship with other parties</td>
<td>• Some cooperation with third parties but mainly indirect (via other organisations)</td>
<td>• Direct, formal relationships with other ANSPs on specific projects or under framework agreements</td>
<td>• Range of direct, strategic-level partnerships with other ANSPs</td>
<td>• Structural long-term strategic partnerships with other ANSP and/or suppliers and/or customers</td>
</tr>
<tr>
<td><strong>Financial planning and budgeting</strong></td>
<td>• Only high level planning and budgeting, done once a year</td>
<td>• Top down process with little input from business areas, review limited to top management/ Board of Directors</td>
<td>• Mainly bottom-up process with aggregation at the top</td>
<td>• Mix of top-down and bottom up process</td>
<td>• Planning used as a fully integrated decision-making tool</td>
</tr>
<tr>
<td><strong>Sourcing strategy</strong></td>
<td>• No sourcing strategy nor organisation</td>
<td>• No formal strategy</td>
<td>• Formalized sourcing strategy but only for core service-related spend</td>
<td>• Strategic sourcing approach (i.e. long-term relationship with strategic suppliers)</td>
<td>• Exhaustive sourcing strategy in place covering total spend</td>
</tr>
</tbody>
</table>


# Human Resource Management

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR tools and processes</td>
<td>• No dedicated HR unit</td>
<td>• Dedicated HR unit</td>
<td>• Comprehensive HR quality programme</td>
<td>• Comprehensive set of tools and processes</td>
<td>• Comprehensive set of tools and processes</td>
</tr>
<tr>
<td></td>
<td>• Limited number of HR tools and processes in place</td>
<td>• Limited number of HR tools and processes in place</td>
<td>• Comprehensive set of tools and processes</td>
<td>• Formal HR management policies</td>
<td>• Comprehensive accredited HR quality programme</td>
</tr>
<tr>
<td>Integration with other business areas</td>
<td>• No integration, back office role only</td>
<td>• Some integration but only as administrative support role</td>
<td>• HR manager is member of executive decision making process</td>
<td>• HR manager is member of executive decision making process</td>
<td>• Function fully integrated with the rest of the business; close involvement of business units/areas</td>
</tr>
<tr>
<td>Labour Relationships</td>
<td>• Conflict avoidance mode; unions suspicious of changes but management can make proposals</td>
<td>• Consultation mode; ad-hoc working groups, collective bargaining</td>
<td>• Cooperation mode; consultation, working groups, mutually agreed working practices</td>
<td>• No rep. on exec. board</td>
<td>• Staff representation at executive board level</td>
</tr>
<tr>
<td></td>
<td>• No career development process</td>
<td>• Formal feedback and training programmes</td>
<td>• Management and leadership training</td>
<td>• Management and leadership training</td>
<td>• Management and leadership training</td>
</tr>
<tr>
<td></td>
<td>• No formal training or feedback</td>
<td>• No individual goals</td>
<td>• Formal feedback and training programmes</td>
<td>• Formal feedback and training programmes</td>
<td>• Formal feedback and training programmes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Performance-based reward</td>
<td>• No leadership training</td>
<td>• Individual goals but no performance-based reward</td>
<td>• Performance-based rewards and individual goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No leadership training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Career Development</td>
<td>• No internal recruitment process</td>
<td>• Manpower planning and skills requirements mainly defined centrally / at corporate level</td>
<td>• Manpower planning and skills requirements mainly defined by business units</td>
<td>• Manpower planning and skills requirements defined at corporate level based on inputs from business units</td>
<td>• Manpower planning and skills requirements defined both at corporate and business unit levels in close cooperation</td>
</tr>
<tr>
<td>Recruitment</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Domain: Strategic Management**
## Demand forecasting process (method and customer types included)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Internal process through a dedicated forecasting department</td>
<td>• Adapting forecasts produced by external sources within the industry • Commercial air transport (CAT) customers included (schedule and charter)</td>
<td>• Adapting forecasts produced by external sources within the industry • More than CAT customers included</td>
<td>• Combination of methods used to forecast demand • CAT customers included (scheduled and charter)</td>
<td>• Combination of methods • More than CAT customer types included</td>
<td></td>
</tr>
</tbody>
</table>

### Resolution

<table>
<thead>
<tr>
<th>Resolution</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>• National and airport level • 10 year horizon</td>
<td>• National, Centre, Sector, Airport, Individual Route • 10 year</td>
<td>• National, Centre, Sector, and/or Airport • 5 year</td>
<td>• Centre • 1-5 year horizon</td>
<td>• National and centre, and/or sector, and/or airport and/or individual route level • 1-5 year horizon</td>
<td></td>
</tr>
</tbody>
</table>

### Effectiveness assessment

<table>
<thead>
<tr>
<th>Effectiveness assessment</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>• None</td>
<td>• Basic actual vs. forecast comparison • Or yearly review</td>
<td>• Some retrospective statistical analysis</td>
<td>• More sophisticated analysis (statistical analysis) • Monthly monitoring</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Capacity measurement

<table>
<thead>
<tr>
<th>Capacity measurement</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Rule of thumb or historical data</td>
<td>• Simulation at sector or centre level</td>
<td>• Simulation at centre level and historical at sector level</td>
<td>• Mix of simulation and historical at sector level</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Capacity requirement management

<table>
<thead>
<tr>
<th>Capacity requirement management</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Other</td>
<td>• Simple link to traffic demand forecasts</td>
<td>• Laboratory simulation using traffic demand forecasts</td>
<td>• Operational simulation using traffic demand forecasts</td>
<td></td>
<td>Combination of tools</td>
</tr>
</tbody>
</table>
### Domain: Strategic Management

#### Crisis Management

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crisis management plan</td>
<td>• No plan</td>
<td>• No ANSP-specific plan or Plan at supra national level, or Plan in place but no dedicated unit</td>
<td>• Plan in place within dedicated unit</td>
<td>• Plan in place and responsibility distributed throughout the organisation</td>
<td>• Plan in place and responsibility distributed throughout the organisation</td>
</tr>
<tr>
<td>Definition level</td>
<td>• None or airport specifications or service orders</td>
<td>• ANSP level and/or ATSU level</td>
<td>• System level</td>
<td>• Sub-system level</td>
<td>• Most levels including neighbouring areas</td>
</tr>
<tr>
<td>Interface management</td>
<td>• No interface with external parties</td>
<td>• Some coordination with selected parties</td>
<td>• Coordination with several parties (police, military, customers and airports) but not with other ANSPs or customers</td>
<td>• Coordination with other parties including other ANSPs</td>
<td>• Coordination with other parties including other ANSPs and customers</td>
</tr>
</tbody>
</table>
### Environmental Planning

#### Indicators

<table>
<thead>
<tr>
<th>Process for incorporating environmental impact</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>• No formal process for considering service impact on environment</td>
<td>• Environmental factors are considered on a case by case basis</td>
<td>• Formal policy on environmental protection in place but high level only (minimum legal requirements)</td>
<td>• Formal policy on environmental protection in place with relevant manuals and procedures, systematic basis and training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance monitoring</td>
<td>• Internal management only</td>
<td>• Internal management and compliance with environment regulator</td>
<td>• Compliance with aviation and/or environment regulator guidelines</td>
<td>• Internal management and compliance with aviation and environment regulators</td>
<td></td>
</tr>
</tbody>
</table>

**Domain: Strategic Management**
## R & D Planning

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation of R&amp;D</td>
<td>• No R&amp;D activity</td>
<td>• R&amp;D mainly outsourced to outside supplier</td>
<td>• Some R&amp;D activity performed in-house but no specific department</td>
<td>• R&amp;D department/division in place</td>
<td>• R&amp;D department/division in place</td>
</tr>
<tr>
<td>Drivers of R&amp;D projects</td>
<td>• Fundamental research related</td>
<td>• Applied Research</td>
<td>• Customer requirements in priority</td>
<td>• Development</td>
<td>• Mix of applied research and development</td>
</tr>
<tr>
<td></td>
<td>• Long term focus</td>
<td>• Medium term focus</td>
<td></td>
<td>• Short term focus</td>
<td>• Short-medium term focus</td>
</tr>
<tr>
<td></td>
<td>• No direct focus on operations-related projects</td>
<td>• Focus on projects relevant to operations</td>
<td></td>
<td>• Focus on project relevant to operational performance or efficiency</td>
<td>• operational performance related projects</td>
</tr>
<tr>
<td>Success measurement</td>
<td>• Not defined</td>
<td>• Annual project review process on a portfolio basis</td>
<td>• Individual project reviews against milestones as part of the project management procedure</td>
<td>• Post project audit</td>
<td>• Combination of criteria</td>
</tr>
<tr>
<td>Resource Commitment</td>
<td>• No resource</td>
<td>• Limited resources (less than 2% of total)</td>
<td>• Some resources (2-5%)</td>
<td>• Significant resources (5-10% of total)</td>
<td></td>
</tr>
</tbody>
</table>
## Infrastructure Planning

**Organisation and management of infrastructure planning**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure planning integrated in R&amp;D planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No dedicated Infrastructure planning department</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linked to operations planning and/or business planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dedicated infra planning department</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure planning linked to operations and/or business planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replacing of legacy systems depends on operational requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Success measurement**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer reaction and meeting predicted timelines for operational availability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual reviews</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post project audit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting financial forecast and predicted timelines for operational availability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual reviews and/or post project audit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer reaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting financial forecast and/or predicted timelines for operational availability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Scope of infrastructure planning**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited scope (mainly CNS, ATM systems and tools, training systems, buildings and grounds)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Limited scope but covers at least operational concept, interface with customer or implication of airborne avionics on ground systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wide scope except a few areas (GMP, Environment, Operational Concept or CDM, and/or Military Systems, etc.)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Complete scope except one or two of the most difficult areas (interface with customers and partners, implication of airborne avionics, and/or operational concepts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete scope</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Appendix 2 to the Final Report

Study on Benchmarking for Best Practices in Air Traffic Management

FACT SHEETS

31st January, 2003
Introduction

- This appendix offers a template for providers’ fact sheets aimed at providing a snapshot of each provider, in terms of key organisational and financial data, as well as key institutional and operational environment data.

- These fact sheets have been formed by combining existing data from Eurocontrol’s PRR5 fact sheets (Annex 8) as well as new data collected from the providers’ answers to the Study’s Benchmarking Questionnaire.

- The remaining gaps reflect areas where there is room for update of information.
Institutional, organisational and legal factors

Institutional Arrangements and Links
- Federal Ministry of Defence (MoD)
- Air Navigation
- Federal Ministry of Transport, Innovation and Technology as supreme CAA (MoIT)

Civil – Military Relationship
<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal cooperation between the relevant Ministries</td>
<td>Cooperation takes place between Austro Control GmbH and the responsible organisations of the Ministry of defence in most cases; examples of formal cooperation between the ministries: restricted areas, controlled airspace The use of civil ANS-equipment by military ANS is regulated by contract between Austro Control and Military according to law</td>
</tr>
</tbody>
</table>

Corporate Governance Structure
- General Assembly (MoIT)
- Supervisory Board (9 Members)
- Managing Board (2 members)
  - CEO - 1 member
  - Members appointed by MoIT.

Staff Breakdown
- ATCO in Ops: 238
- ATCO in other duties: 15
- Ab-initio trainee: 53
- On the job trainee: 22
- ATC assistants & flight data personnel: 19
- Technical support staff: 238
- Administration: 161
- Ancillary: 139
- Other: 128

Financials
<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>164</td>
<td>145</td>
<td>168</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>118</td>
<td>100</td>
<td>121</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>72%</td>
<td>69%</td>
<td>72%</td>
</tr>
<tr>
<td>Assets</td>
<td>205</td>
<td>208</td>
<td>222</td>
</tr>
</tbody>
</table>

Scope of Services
- Area control
- Approach control
- Air traffic flow management
- Aeronautical information
- Flight information
- Aiding service
- Meteorological information
- Airspace management
- Search and rescue
- Surveillance
- Navigation
- Aeronautical fixed & mobile comms
- Training
- Consultancy
- Flight inspection
- Ground handling / apron control
- Met services
- Maintenance
- Standardisation
- IT services
- Governmental Services

General Country Data
- GDP per capita: $25,000
- Total population (2000): 8,106,000
- Purchasing power parities for GDP: 0.910

References
- OECD Statistics
- www.austrocontrol.at

Name:
AustroControl GmbH

Legal Personality:
Limited liability joint-stock company
100% state owned (Law makes provision for Austrian Airports to own up to 49%)

Date of Establishment in Current Status: 1994
Operational factors

Size of Airspace: 83.862km²

Operational Units
1. AAC (Wien
6. APPs (Wien, Graz, Innsbruck, Klagenfurt, Linz, Salzburg)
6. TWRs
0. AFIs

Number of FIRs/UIRs – 1

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 861,926
Visual Flight Rules (VFR) 310,578
Commercial air transport n/a
General aviation n/a
Aerial work
Military flights operating as GAT 45,668
Military flights operating as OAT
Flights operated using jet aircraft
Flights operated using turboprops
Others (UAV etc.)

Specific Features of Airspace
Number of boundaries with adjacent airspace blocks (7 units). Wide variation in traffic density across FIR (in 2000, due to Kosovo crisis; main traffic in the north of FIR (east-west direction)

Traffic Mix Related Restrictions/Constraints
LOWW VFR Traffic restricted to certain hours, Traffic density, runway capacity

Topography and Metro Related Complexity
Topography complications: Airports in the Alps
Fog: CAT III/ LOW VIS PROC
Thunderstorms over the Alps: FDEN

Services Delegated to Others

ANSP | Area delegated
---|---
All neighbouring providers | Strengthening of L.s.Rs; West Parts of Austria
Germany & Switzerland | West Parts of Austria

Areas Jointly Managed: None
# Institutional, organisational and legal factors

## Institutional Arrangements and Links

- **Name:** Airservices Australia
- **Legal Personality:** Commonwealth Authority
- **Date of Establishment in Current Status:** 1995

### Civil – Military Relationship

Strategically co-ordinated through the Air Co-Ordinating Committee hosted by Airservices Australia and the Department of Defence – also includes invitees from Civil Aviation Safety Authority (CASA), Department of Transport & Regional Services (DOTARS), Airlines and Regional Airspace Advisory Committee (RAPAC).

Procedures are tactically co-ordinated through supplements to the Manual of Air Traffic Services. Further integration is being actively pursued through the development of an Integrated Operating Concept sponsored at government level.

## Corporate Governance Structure

- **BOARD OF DIRECTORS** (8 members)
  - Chairman + CEO + 6 members
  - (All appointed by the Minister for Transport & Regional Services)

- **EXECUTIVE COMMITTEE** (5 members)
  - CEO + 4 members

## Staff Breakdown (as of 2001)

- **ATCO in Ops/ ATCO in other duties** 1067
- **Flight data personnel** 68
- **Technical support staff** 356
- **Administration** 1032
- **Other (fire fighters)** 487

## Financials

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>583</td>
<td>511</td>
</tr>
<tr>
<td>Enroute</td>
<td>312</td>
<td>267</td>
</tr>
<tr>
<td>% Total</td>
<td>54%</td>
<td>52%</td>
</tr>
<tr>
<td>Assets</td>
<td>592</td>
<td>589</td>
</tr>
</tbody>
</table>

## General Country Data

- **GDP per capita:** $26,333
- **Total population (2000):** 19,485,000
- **Purchasing power parities for GDP:** 1.33

Source: OECD Statistics

## Reference Documents and Links

- Annual Report

## Scope of Air Navigation Services

- Air Traffic Management (ATM)
- Area control (ACC)
- Approach control (APP)
- Aerodrome control (TWR)
- Oceanic Control
- Flight information (FIS)
- Alerting service
- Air traffic flow management (ATFM)
- Air Space Management (ASM)
- CNS (en-route infrastructure)
- Aeronautical information Service (AIS)
- Aeronautical Radio Navigation Service
- Aeronautical Telecommunications Service
- Aviation Rescue & Fire Fighting

## Staff Breakdown (as of 2001)

- ATCO in Ops/ ATCO in other duties 1067
- Flight data personnel 68
- Technical support staff 356
- Administration 1032
- Other (fire fighters) 487

## Financials

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>583</td>
<td>511</td>
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<tr>
<td>Enroute</td>
<td>312</td>
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</tr>
<tr>
<td>% Total</td>
<td>54%</td>
<td>52%</td>
</tr>
<tr>
<td>Assets</td>
<td>592</td>
<td>589</td>
</tr>
</tbody>
</table>
Operational factors

Size of Airspace – 56,000,000 km²

Operational Units
2. ATCCs (Brisbane, Melbourne)
8. APPs
38. TWRs

Number of FIRs/UIRs – 2 FIRs

Airspace Structure (map)

Complexity Level per ATCC “Area of Responsibility”: Brisbane – Medium, Melbourne - Medium

Division Level Between Upper and Lower Airspace: None.

Specific Features of Airspace
Large areas of oceanic airspace are covered
Australian FIRs are adjacent to 11 other FIRs
Majority of traffic is concentrated in the East and South East
Large proportion of airspace also covers remote continental areas.

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 1,159,547
Visual Flight Rules (VFR) 990,285
Commercial air transport
General aviation
Aerial work
Military flights operating as GAT
Military flights operating as OAT
Flights operated using jet aircraft 419,671
Flights operated using turboprops
Others (UAV etc.)

Other Traffic Data
Ratio of descending-climbing to overflights:
Very few overflights

Topography and Metero Related Complexity
Infrastructure concentrated in East Coast areas – all other continental coverage focused >FL200
Perth encounters windshear in summer. Fog is encountered at some aerodromes.

Services Provided to Areas Outside National Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Areas where services are provided</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solomon Islands</td>
<td>Upper Airspace</td>
<td>ATM</td>
</tr>
</tbody>
</table>

Traffic Mix Related Restrictions/Constraints
Service levels are adjusted to variations in sector volumes by introducing Class A, Class , Class E and Class G airspace.

Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Services delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAAF</td>
<td>ATM in certain airspace associated with military activity</td>
</tr>
</tbody>
</table>
Institutional, organisational and legal factors

**Institutional Arrangements and Links**

**Civil – Military Relationship**

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal cooperation between the relevant Ministries</td>
<td>BAF – CAA - Belgocontrol</td>
</tr>
</tbody>
</table>

**Sharing of Responsibilities and Type of Separation**

**Corporate Governance Structure**

**Staff Breakdown**

**Financials**

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>132</td>
<td>156</td>
<td>154</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>108</td>
<td>113</td>
<td>120</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>81%</td>
<td>72%</td>
<td>78%</td>
</tr>
<tr>
<td>Assets</td>
<td>275</td>
<td>297</td>
<td>318</td>
</tr>
</tbody>
</table>

**Scope of Services**

Area control  
Approach control  
Aerodrome control  
Air traffic flow management  
Aeronautical information  
Flight information  
Alerting service  
Meteorological information  
Airspace management  
Surveillance  
Navigation  
Aeronautical fixed comms  
Aeronautical mobile comms

**General Country Data**

GDP per capita: $25,300  
Total population (2000): 10,251,000  
Purchasing power parities for GDP: 0.924

**Reference Documents and Links**

www.belgocontrol.be  
Annual Report

**Name:** BelgoControl  
**Legal Personality:** Public Autonomous Enterprise under a management contract. 100% state owned  
**Date of Establishment in Current Status:** 1998
Operational factors

Size of Airspace: 36,000 km²

Operational Units
1. AAC (Brussels)
3. APPs (Brussels, Antwerp, Oostende)
5. TWRs (Brussels, Antwerp, Liege, Charleroi, Oostende)
0. AFIs

Number of FIRs/UIRs – 1/1

Airspace Structure (map)

Complexity Level per FIR/UIR: High

Division Level Between Upper and Lower Airspace: FL245

Specific Features of Airspace
Upper airspace served by Maastricht
8 neighbouring blocks in the Upper and Lower Airspace

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 570,255
Visual Flight Rules (VFR)
Commercial air transport
General aviation
Aerial work
Military flights operating as GAT
Military flights operating as OAT
Flights operated using jet aircraft
Flights operated using turboprops
Others (UAV etc.)

Traffic Mix Related Restrictions/Constraints

Topography and Metero Related Complexity

Services Provided to Areas Outside Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luxembourg</td>
<td>Luxembourg outside CTR</td>
<td>Enroute and parts of the Approach Service</td>
</tr>
</tbody>
</table>

Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurocontrol</td>
<td>Brussels UIR</td>
</tr>
</tbody>
</table>

Areas Jointly Managed: Nil
Institutional, organisational and legal factors

Institutional Arrangements and Links

Sharing of Responsibilities and Type of Separation

Name: NavCanada

Legal Personality: Private Company

Date of Establishment in Current Status:

Civil – Military Relationship

Corporate Governance Structure

Scope of Services

Area control
Approach control
Aerodrome control
Oceanic control
Air traffic flow management
Aeronautical information
Flight information
Alerting service
Meteorological information
Airspace management
Search and rescue
Surveillance
Navigation
Aeronautical information

Staff Breakdown

Staff Breakdown

Revenues
Assets

CAN$K

2000
2001

900 879
907 649

232 840
230 530

907 649
230 530

30
450
538

2001
223
1253
1108

30
450
538

General Country Data

GDP per capita: $24,800
Total population (2000): 30,750,000
Purchasing power parities for GDP: 1.20
Source: OECD Statistics

Reference Documents and Links

www.navcanada.ca/
Annual Report
Business Plan 2000-2003
Safety Plan 2001-2002
RVSM Implementation Plan 2001

Financials

Products

% 1

Services

% 1

Total

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Total

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Total
Operational factors

Size of Airspace: 21,352,689km²

Operational Units

Number of FIRs/UIRs – 8

Traffic Data

Traffic Breakdown
- Visual Flight Rules (VFR): 864,102
- Air Carriers: 2,921,948
- Gov. Civil: 31,566
- Military Flights: 12,880
- Military Flights
- Flights operated using jet aircraft: 2,196,062
- Flights operated using turboprops: 1,249,303
- Private: 1,232,737
- Private
- Others (UAV etc.): 3,193
- Total: 4,507,861

Other Traffic Data

Ratio of descending-climbing to overflights:

Topography and Metro Related Complexity
- Mountainous regions complicate arrival or departure procedures: Vancouver FIR
- Large areas (land or water) that create coverage problems for terrestrial systems (Remote Areas): Edmonton FIR, Winnipeg FIR, Montreal and Gander
- Windshear/microbursts: All FIRs
- Clear air turbulence/mountain waves: All FIRs
- Fog: All FIRs
- Other features (please specify): Winter conditions

Services Provided to Areas Outside Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>See attachment 9</td>
<td>Enroute</td>
</tr>
</tbody>
</table>

Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area delegated</th>
<th>Observed advantages or disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAA</td>
<td>See attachment 9</td>
<td>Enroute</td>
</tr>
</tbody>
</table>

Specific Features of Airspace

Upper airspace only: All FIRs
Lower airspace only: All FIRs
Oceanic airspace: Gander Oceanic FIR
Interface to oceanic airspace: Edmonton, Toronto, Montreal, Moncton, Gander
Institutional, organisational and legal factors

Institutional Arrangements and Links

Civil – Military Relationship

Corporate Governance Structure

Staff Breakdown 2001

Financials

General Country Data

Name: Naviair
Legal Personality: State Enterprise
Date of Establishment in Current Status: 2001
Scope of Services TBD

EXECUTIVE BOARD (6 members)
CEO + 5 members
The CEO is appointed by the M of T.

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreement on Integration of civil and military flights in CPH ACC</td>
<td>Naviair responsible for the management of CPH ACC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>729</td>
<td>851</td>
<td>888</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>429</td>
<td>455</td>
<td>473</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>59%</td>
<td>54%</td>
<td>53%</td>
</tr>
<tr>
<td>Assets</td>
<td>232</td>
<td>230</td>
<td>335</td>
</tr>
</tbody>
</table>

ATCO in Ops | 194.5
ATCO in other duties | 89.9
Ab-initio trainee | 43.3
ATC assistants & flight data personnel | 112.7
Technical support staff | 138.6
Administration | 157.7
Others, on the job training | 24.2

GDP per capita: $25,500
Total population (2000): 5,337,000
Purchasing power parities for GDP: 8.34
Source: OECD Statistics

Reference Documents and Links
http://www.naviair.dk
Naviair

Operational factors

Size of Airspace – 134,048 km² (excluding Greenland)

Operational Units
1. AACs (Copenhagen)
4. APPs
8. TWRs
1. AFIs

Number of FIRs/UIRs – 1

Airspace Structure (map)

Complexity Level per FIR/UIR: Medium,
Division Level Between Upper and Lower Airspace: FL285

Specific Features of Airspace

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 581,088
Visual Flight Rules (VFR)
Commercial air transport
General aviation
Aerial work
Military flights operating as GAT
Military flights operating as OAT
Flights operated using jet aircraft
Flights operated using turboprops
Others (UAV etc.)

Other Traffic Data
Ratio of descending-climbing to overflights: 58%

Traffic Mix Related Restrictions/Constraints

Topography and Metroo Related Complexity
Fog: Lower capacity at airports.
Thunderstorms: CB-activities lower the capacity

Services Provided to Areas Outside Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24,213 skm</td>
<td>ATS</td>
</tr>
</tbody>
</table>

Areas Jointly Managed: Nil

Services Delegated to Others
N/A
Institutional, organisational and legal factors

Institutional Arrangements and Links

- **COUCHE, C.E.AT** (Government)
  - Chaired by the Prime Minister

- Ministry of Transport and Communication (MofT)
- Flight Safety Authority
- Civil Aviation Administration (CAA)
- Airport Dept.
- CAA BOARD OF DIRECTORS (6 members)
  - Chairman + 5 members
  - All members are appointed by the Council of State. (Chairman + 2 members are Executive Directors, 1 member represents staff).
  - DG of the CAA is not a member of the Board of Directors.

  - Director General of CAA: M. Talvitie
  - Director of ANS Dept.: H. Jaakkola
  - Deputy Director of ANS Dept: M-A. Nyberg

Sharing of Responsibilities and Type of Separation

- Functional
- Regulation

Civil – Military Relationship

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal cooperation between the relevant Ministries</td>
<td>CAA and FAF, ANS provided by CAA ANSP services for FAF are based on the commercial agreement between the CAA and the MIL Authorities</td>
</tr>
</tbody>
</table>

Corporate Governance Structure

Name: Civil Aviation Administration (CAA)
Legal Personality: State Enterprise
Date of Establishment in Current Status: 1991

Scope of Services

- Area control
- Approach control
- Aerodrome control
- Air traffic flow management
- Aeronautical information
- Flight information
- Aiding service
- Meteorological service
- Airspace management
- Surveillance
- Navigation
- Aeronautical fixed comms
- Aeronautical mobile comms
- Training
- Consultancy
- Flight inspection
- Search & Rescue

Financials

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (€M)</th>
<th>Enroute Revenues</th>
<th>Total Revenues</th>
<th>Assets (€M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>181</td>
<td>15</td>
<td>9%</td>
<td>556</td>
</tr>
<tr>
<td>1999</td>
<td>184</td>
<td>17</td>
<td>9%</td>
<td>594</td>
</tr>
<tr>
<td>2000</td>
<td>195</td>
<td>20</td>
<td>10%</td>
<td>639</td>
</tr>
</tbody>
</table>

Staff Breakdown 2001 (ANS Only)

- ATCO in Ops: 233
- ATCO in other duties: 34
- Ab-initio trainee: 42
- ATC assistants & flight data personnel: 55
- Technical support staff: 133
- Administration: 13
- Others

GDP per capita: $22,900
Total population (2000): 5,181,000
Purchasing power parities for GDP: 0.992
Source: OECD Statistics

Reference Documents and Links

- http://www.fcaa.fi

Note: Figures for total CAA
Operational factors

Size of Airspace – 439,790 km²

Operational Units
2. AACs (Rovaniemi, Tampere)
5. APPs (Helsinki, Jyväskylä, Kuopio, Tampere-Pirkkala, Rovaniemi)
2. Mil-APPs (Halli, Kauhava)
19 TWR
6. AFIs

Number of FIRs/UIRs – 2 (EEPS, EFES)

Airspace Structure (map)

Complexity Level per FIR/UIR: EEPS: low, EFES: medium

Division Level Between Upper and Lower Airspace: FL245

Specific Features of Airspace
Finland has an Air Defence Identification Zone protecting its continental airspace and Territorial Sea
Finland has the Border towards non-ECAC airspace and is therefore i.a. RVSM transition zone

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 221,996
Visual Flight Rules (VFR)
Commercial air transport
General aviation
Aerial work
Military flights operating as GAT
Military flights operating as OAT
Flights operated using jet aircraft
Flights operated using turboprops
Others (UAV etc.)

Other Traffic Data
Ratio of descending-climbing to overflights:
EEPS: 80%, EFES: 70%

Topography and Metro Related Complexity
Fog: Low layer morning fog at sunrise time.
Snow

Services Provided to Areas Outside Airspace
Nil

Areas Jointly Managed: Nil

Traffic Mix Related Restrictions/Constraints

Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>Kvarken on Gulf of Bothnia</td>
</tr>
<tr>
<td>Norway</td>
<td>A small portion of the Northern part of Finland</td>
</tr>
</tbody>
</table>
Institutional, organisational and legal factors

**Institutional Arrangements and Links**

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

**Civil – Military Relationship**

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Corporate Governance Structure**

- Head of Ministry of Transport: D. Bussereau
- Director General of Civil Aviation: M. Wachenheim
- EXECUTIVE BOARD DNA
  - Director of DNA: F. Morisseau
  - Director of STNA: J.M. Faysse
  - Director of CENA: A. Printemps
  - Director of SIA: A. Grandclaude

**Financials**

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>948</td>
<td>1017</td>
<td>997</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>770</td>
<td>826</td>
<td>799</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>81%</td>
<td>81%</td>
<td>80%</td>
</tr>
<tr>
<td>Assets</td>
<td>606</td>
<td>660</td>
<td>585</td>
</tr>
</tbody>
</table>

**Staff Breakdown (2001)**

- ATCO in Ops: 2381
- ATCO in other duties: 186
- Ab-initio trainee: 449
- Technical support staff: 4082
- Administration: 1057
- Others: 449

**Scope of Services**

- Search & Rescue
- Area control
- Approach control
- Aerodrome control
- Oceanic control
- Air traffic flow management
- Aeronautical information
- Flight information
- Alerting service
- Airspace management
- Surveillance
- Navigation
- Communications
- Training
- Consultancy

**General Country Data**

- GDP per capita: $24,400
- Total population (2000): 58,892,000
- Purchasing power parities for GDP: 0.941

Source: OECD Statistics

**Reference Documents and Links**

- www.aviation-civile.gouv.fr
- Annual Report
- Plan Strategique DGAC
- French Civil Aviation National Budget 2003
Operational factors

Size of Airspace – 1,159,347 km²

Operational Units
5. AACs (Paris, Bordeaux, Marseille, Brest, Reims)
11. APPs
66. TWRs
0. AFIs

Number of FIRs/UIRs

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 2,501,025
Visual Flight Rules (VFR) Commercial air transport
General aviation
Aerial work
Military flights operating as GAT
Military flights operating as OAT
Flights operated using jet aircraft
Flights operated using turboprops
Others (UAV etc.)

Other Traffic Data
Ratio of descending-climbing to overflights: 62.5%

Airspace Structure (map)

Complexity Level per FIR/UIR: Bordeaux: Medium, Paris: High

Division Level Between Upper and Lower Airspace: FL195

Specific Features of Airspace
Numerous military areas
Interface to oceanic airspace
Large number of boundaries with adjacent airspace blocks

Topography and Metro Related Complexity
Fog: Regular phenomena
Thunderstorms mostly in Bordeaux ACC area

Traffic Mix Related Restrictions/Constraints

Services Provided to Areas Outside Airspace

Third party State Area delegated Services provided

Areas Jointly Managed:

Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jersey</td>
<td>Channel Islands Control Zone</td>
</tr>
<tr>
<td>Skyguide</td>
<td>Geneva delegated area</td>
</tr>
</tbody>
</table>
Deutsche Flugsicherung (DFS) Germany

**Institutional and Organisational Factors**

**Institutional Arrangements and Links**

- **Name:** DFS Deutsche Flugsicherung GmbH (DFS)
- **Legal Personality:** Limited liability company, governed by Private Company Law
- **100% state Owned**
- **Integrated civil/military ANSP**

**Date of Establishment in Current Status:**

**Corporate Governance Structure**

- **SHAREHOLDER Meeting with M of TBH**
- **SUPERVISORY BOARD (12 Members)**
  - Chairman = 11 Members
  - Chairman appointed by the Government.
  - Members represent: 3 (including Chairman) M of TBH, 2 M of D, 1 M of F, 6 staff reps.
  - Chairman has a casting vote.
- **EXECUTIVE BOARD (4 Members)**
  - CEO + 3 Members
  - CEO appointed by the Supervisory Board

**Civil – Military Relationship**

- **Formal co-operation between Ministries**
  - MoD and MOT by an Interdepartmental agreement
- **One ministry takes responsibility for all services**
  - Agreement concerning ANS in crisis or war
- **Other mechanism**
  - Follow – on Agreements on execution level

**Scope of Services**

- Flight inspection
- Apron control
- Area control
- Approach control
- Air traffic flow control
- Aeronautical information
- Flight information
- Alerting
- Airspace management
- Surveillance
- Navigation
- Training
- Consultancy

**Financials**

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>884</td>
<td>898</td>
<td>894</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>554</td>
<td>551</td>
<td>567</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>63%</td>
<td>61%</td>
<td>63%</td>
</tr>
<tr>
<td>Assets</td>
<td>1 181</td>
<td>1 157</td>
<td>1 244</td>
</tr>
</tbody>
</table>

**Staff Breakdown**

- ATCO in Ops: 1756
- ATCO in other duties: 182
- Ab-initio Trainee: 170
- ATC Assistants & Flight Data Personnel: 523
- Technical support staff: 1042
- Administration: 1044
- Other: 457

**General Country Data**

- GDP per capita: $23,400
- Total population (2000): 82,205,000
- Purchasing power parities for GDP: 0.946

**Reference Documents and Links**

- [http://www.dfs.de/dfs/english/index.html](http://www.dfs.de/dfs/english/index.html)
- Annual Report

*Except functional in economics, organisational in accident investigations*
Deutsche Flugsicherung (DFS) Germany

Operational factors

Size of Airspace: 386,421 km²

Operational Units
1. UAC (Karlsruhe)
2. ACCs/UACs/APPs (Berlin, München)
3. ACCs/APPs (Bremen, Düsseldorf, Langen)
4. ACC for OAT in upper airspace in North-Western Germany (co-located with Maastricht UAC)
17 TWRs

Number of FIRs/UIRs – 5/3

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 2,561,153
Visual Flight Rules (VFR)
Commercial air transport
General aviation
Aerial work
Military flights operating as GAT 40,037
Military flights operating as OAT 54,407
Flights operated using jet aircraft 80 %
Flights operated using turboprops 15 %
Others 5 %

Other Traffic Data
Ratio of descending-climbing to overflights:
Climb 18.7 %
Level 58.6 %
Descend 22.7 %

Airspace Structure (map) Upper Airspace

Complexity Level per FIR/UIR:
Bremen and Berlin low/medium
Duesseldorf, Rhein, Frankfurt, Muenchen high

Division Level Between Upper and Lower Airspace: FL 245

Specific Features of Airspace
Large number of neighbouring airspace blocks of different complexity

Topography and Meteo Related Complexity
Ratio of descending-climbing over flight: Topography complications: Alpine area in the south, no radar over parts of the North Sea
Clear air turbulence: Over Southern Germany
Fog: Regular phenomena

Services Provided to Areas Outside Airspace
N/A

Areas Jointly Managed: Nil

Services Delegated to Others
<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maastricht UAC</td>
<td>Hannover UIR</td>
</tr>
<tr>
<td>Sky Guide</td>
<td>Small parts of Rhein UIR, Frankfurt FIR</td>
</tr>
<tr>
<td>Reims</td>
<td>Small part of lower airspace in the</td>
</tr>
<tr>
<td></td>
<td>Frankfurt FIR</td>
</tr>
</tbody>
</table>

Traffic Mix Related Restrictions/Constraints
High amount of Temporary Segregated Areas, Glider areas, high number of VFR traffic
Irish Aviation Authority

Institutional, organisational and legal factors

Institutional Arrangements and Links

- Ministry of Defence
- Department of Transport
- Department of Finance
- Commission for Aviation Regulation
- Ministry of Defence
- Irish Aviation Authority
- Standing Civil Military ANS Committee

Standing Civil Military ANS Committee

Irish Aviation Authority

Safety Regulation Division

ANS Division

Sharing of Responsibilities and Type of Separation

- Governmental Responsibilities
- Functional and Organisational
- Service Provision
- Functional and Organisational
- Regulation

Civil – Military Relationship

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved / Description of Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal co-operation between the relevant Ministries</td>
<td>Co-ordination between IAA and the Dept of Defence on ANS</td>
</tr>
</tbody>
</table>

Corporate Governance Structure

- Board of the Authority (9 members)
  - Chairman + CEO + 7 Members
  - Chairman and other members are appointed by the Minister of Transport with the consent of the Minister of Finance
  - Board appoints CEO after consultation with Minister of Transport

Staff Breakdown: (year 2000)

- ATCO in Ops: 236
- ATCO in other duties: 40
- Ab-initio trainee: 14
- ATC Assistants & Flight data personnel: 27
- Technical support staff: 71
- Administration: 132
- Others: 104

Financials

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>74</td>
<td>76</td>
<td>75</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>47</td>
<td>50</td>
<td>49</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>64%</td>
<td>66%</td>
<td>65%</td>
</tr>
<tr>
<td>Assets</td>
<td>71</td>
<td>67</td>
<td>76</td>
</tr>
</tbody>
</table>

General Country Data

- GDP per capita: $21,600
- Total population (2000): 3,787,000
- Purchasing power parities for GDP: 0.989

Source: OECD Statistics

Reference Documents and Links

www.iaa.ie/

Annual Report

Name:
Irish Aviation Authority

Legal personality:
Commercialised Public entity, wholly owned by the Irish State

Date of Establishment in Current Status: 1994

Scope of Services
TBD
Operational factors

Size of Airspace – 358,411km²

Operational Units
2. AACs (Dublin, Shannon)
3. APPs (Dublin, Shannon, Cork)
3. TWRs (Dublin, Shannon, Cork)
0. AFIs

Number of FIRs/UIRs – 1 Shannon FIR, 2 Shannon UIR, 3 SOTA

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 430,490
Visual Flight Rules (VFR) 23,062
Commercial air transport
General aviation
Aerial work
Military flights operating as GAT
Military flights operating as OAT
Flights operated using jet aircraft
Flights operated using turboprops
Others (UAV etc.)

Other Traffic Data
Ratio of descending-climbing to overflights: 48%-52%

Airspace Structure (map)

Complexity Level per FIR/UIR:
1. Medium
2. Medium to high
3. Medium to high

Division Level Between Upper and Lower Airspace: FL245

Specific Features of Airspace
Fog: Upper airspace: Variable traffice density depending on Oceanic track structure, Lower airspace: Various regional airports. Dublin airport close to FIR boundary, Interface to oceanic airspace: Large interface with oceanic airspace, Wide variation in traffic density across FIR: Very large variation in traffic density across the FIR, Other features: Short term traffic levels are not easily forecast and actual traffic levels vary twice daily with only 12 hours notice of numbers and orientation

Topography and Metero Related Complexity
Large areas (land or water) that create coverage problems for terrestrial systems (Remote areas)

Traffic Mix Related Restrictions/Constraints

Services Provided to Areas Outside Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICAO</td>
<td>SOTA</td>
<td>Full ATS</td>
</tr>
<tr>
<td>UK</td>
<td>Irish/UK/French boundary</td>
<td>Full ATS</td>
</tr>
<tr>
<td>France</td>
<td>Irish/UK/French boundary</td>
<td>Full ATS</td>
</tr>
</tbody>
</table>

Areas Jointly Managed:

Services Delegated to Others
N/A
Institutional, organisational and legal factors

**Institutional Arrangements and Links**

- Government chaired by the Prime Minister
- National Agency for Flight Safety (ANSV)
- Ministry of Infrastructure and Transport (M of IT)
- Ministry of Defence (M of D)
- Operational Coordination Committee (CCO)
- Italian Civil Aviation Authority
- Company for Air Navigation Services (ENAV S.p.A.)

**Sharing of Responsibilities and Type of Separation**

- Governmental Responsibilities
  - Service Provision
  - Organisational
  - Regulation
- No Separation

**Civil – Military Relationship**

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-ordination between the Military authorities and the ANS provider</td>
<td>Italian Air Force and ENAC/ENAV</td>
</tr>
</tbody>
</table>

**Corporate Governance Structure**

- ADMINISTRATION BOARD (8 members)
  - Chairman + MD + 6 members
  - Board appointed by the Ministry of Economy in consultation with the M. of IT, from a list of experts in civil aviation matters. The Board delegates its executive power to one of its members who is appointed as Managing Director. The MD then appoints the Director General in charge of all operational and coordination units who acts as a Chief Operating Officer (COO) or CEO.
  - In case the Director General is not appointed as CEO, the Managing Director operates both as M.D. and CEO.

**Staff Breakdown**

<table>
<thead>
<tr>
<th>Category</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATCO in Ops</td>
<td>1366</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATCO in other duties</td>
<td>187</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ab-initio trainee</td>
<td>110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATO assistants &amp; flight data personnel</td>
<td>942</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical support staff</td>
<td>210</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td>406</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Informatics</td>
<td>92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meteorologist</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilots + inspection operators</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supports</td>
<td>62</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Financials**

<table>
<thead>
<tr>
<th>Category</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>464</td>
<td>523</td>
<td>422</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>348</td>
<td>387</td>
<td>401</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>75%</td>
<td>74%</td>
<td>77%</td>
</tr>
<tr>
<td>Assets</td>
<td>1389</td>
<td>1560</td>
<td>1707</td>
</tr>
</tbody>
</table>

**Scope of Services**

- Area control
- Approach control
- Aerodrome control
- Air traffic flow management
- Aeronautical information
- Flight information
- Alerting service
- Meteorological information
- Airspace management
- Search and rescue
- Surveillance
- Navigation
- Aeronautical fixed comms
- Aeronautical mobile comms

**General Country Data**

- GDP per capita: $22,100
- Total population (2000): 57,189,000
- Purchasing power parities for GDP: 0.790

**Name:**
ENAV S.p.A. (Ente nazionale di Assitenza al Volo)

**Legal Personality:**
Joint stock company (shares are held by the government)

**Date of Establishment in Current Status:** 2001

**Reference Documents and Links**
www.enav.it/
Operational factors

Size of Airspace: 726,500 km²

Operational Units
4. AACs (Milan, Paudua, Rome, Brindisi)
19. APPs TWRs
25. TWRs
14. AFIs

Number of FIRs/UIRs – 3 FIR/1 UIR (4 ACCs)

Airspace Structure (map)

Complexity Level per FIR/UIR: ML – H – H + ML

Division Level Between Upper and Lower Airspace: FL195

Specific Features of Airspace
Milano ACC only works Lower Airspace

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 1,355,251
Visual Flight Rules (VFR) 96,581
Commercial air transport
General aviation
Aerial work
Military flights operating as GAT
Military flights operating as OAT
Flights operated using jet aircraft
Flights operated using turboprops
Others (UAV etc.)

Other Traffic Data
Ratio of descending-climbing to overflights:

Topography and Metero Related Complexity
Mountainous regions (Limitations for IFR - procedures and coverage problems)
Large Areas over water east of Sardinia and south of Italy

Traffic Mix Related Restrictions/Constraints
Mix of OAT and GAT

Services Provided to Areas Outside Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland, France, Tunisia, Malta, FYROM, Slovenia, Austria</td>
<td>Parts of TMA and along airways</td>
<td>ATS including AFTM</td>
</tr>
</tbody>
</table>

Services Delegated to Others
N/A

Areas Jointly Managed: No
Institutional, organisational and legal factors

Institutional Arrangements and Links

Sharing of Responsibilities and Type of Separation

Name: Luxembourg Airport Administration
Legal Personality: Government Agency
Date of Establishment in Current Status:

Civil – Military Relationship
No military air navigation service

Corporate Governance Structure

Scope of Services
Area control
Approach control
Aerodrome control
Air traffic flow management
Aeronautical information
Flight information
Alerting service
Meteorological service
Search and rescue
Surveillance
Navigation
Aeronautical fixed comms
Aeronautical mobile comms
Fire and rescue

Financials

Staff Breakdown
ATCO in Ops 40
ATCO in other duties 5
Ab-initio trainee 0
ATC assistants & flight data personnel 43
Technical support staff 7
Administration 59
Other

General Country Data
GDP per capita: $36,400
Total population (2000): 439,000
Purchasing power parities for GDP: 0.956
Source: OECD Statistics

Reference Documents and Links
**Operational factors**

### Size of Airspace
- 300,000 km²

### Operational Units
- Number of FIRs/UIRs: 1

### Traffic Data
- **Traffic Breakdown**
  - Visual Flight Rules (VFR): 4,809
  - Commercial air transport: 55,110
  - General aviation: 5,195
  - Aerial work: 150
  - Military flights operating as GAT: n/a
  - Military flights operating as OAT: n/a
  - Flights operated using jet aircraft: 37,869
  - Flights operated using turboprops: 23,257
  - Others (UAV etc.):

### Services Provided to Areas Outside Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Above boundary from 2,500 feet to FL 135</td>
<td>ATC, Flight Information, Alerting Service</td>
</tr>
<tr>
<td>France</td>
<td>Above boundary from 2,500 feet to FL 160</td>
<td>ATC, Flight Information, Alerting Service</td>
</tr>
<tr>
<td>Belgium</td>
<td>Above boundary from 2,500 feet to FL 135 + 2 Airways</td>
<td>ATC, Flight Information, Alerting Service</td>
</tr>
</tbody>
</table>

### Specific Features of Airspace
- Lower Airspace only up to FL 135, Neighbours are France, Germany, and Belgium, 80% of the traffic is transiting the airspace

### Topography and Metro Related Complexity
- Narrow and small airspace
- Fog – Requiring CAT 2 and 3 operations

### Traffic Mix Related Restrictions/Constraints
- None

### Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgocontrol</td>
<td>Luxembourg territory from FL 135 to FL 245</td>
</tr>
<tr>
<td>Eurocontrol Maastricht</td>
<td>Luxembourg territory above FL 245</td>
</tr>
<tr>
<td>Eifel Control (USAFE)</td>
<td>Area for Tacan Approach ETAD Rwy 05</td>
</tr>
</tbody>
</table>

### Complexity Level per FIR/UIR
- Medium

### Division Level Between Upper and Lower Airspace
- 195
Institutional, organisational and legal factors

**Institutional Arrangements and Links**

- Permanent Commission of EUROCONTROL
- EUROCONTROL Committee of Management (CoM)
- Maastricht Co-Operation Group
- Maastricht Upper Area Control Centre (MUAC)

**Civil – Military Relationship**

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military objectives dealt with at national levels</td>
<td>Four Member States Concerned</td>
</tr>
</tbody>
</table>

**Corporate Governance Structure**

- Permanent Commission of EUROCONTROL
- Director General of EUROCONTROL
- Director of MUAC
- CoM
- MCG

**Staff Breakdown - 2001**

<table>
<thead>
<tr>
<th>Category</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATCO in Ops</td>
<td>76</td>
<td>83</td>
<td>89</td>
</tr>
<tr>
<td>ATCO in other duties</td>
<td>72</td>
<td>78</td>
<td>85</td>
</tr>
<tr>
<td>Ab-initio trainee</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
</tr>
<tr>
<td>ATC assistants &amp; flight data personnel</td>
<td>69</td>
<td>71</td>
<td>74</td>
</tr>
<tr>
<td>Technical support staff</td>
<td>135</td>
<td>131</td>
<td>131</td>
</tr>
<tr>
<td>Administration</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Other</td>
<td>47</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>Assets</td>
<td>175</td>
<td>175</td>
<td>175</td>
</tr>
</tbody>
</table>

**Financials**

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues</th>
<th>Enroute Revenues</th>
<th>% Total Revenues</th>
<th>Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>76</td>
<td>72</td>
<td>95%</td>
<td>69</td>
</tr>
<tr>
<td>1999</td>
<td>83</td>
<td>78</td>
<td>95%</td>
<td>71</td>
</tr>
<tr>
<td>2000</td>
<td>89</td>
<td>85</td>
<td>95%</td>
<td>74</td>
</tr>
</tbody>
</table>

**Scope of Services**

- Area control
- Air traffic flow management
- Aeronautical information
- Flight information
- Alerting service
- Airspace management
- Surveillance
- Navigation
- Aeronautical fixed comms
- Aeronautical mobile comms

**General Country Data**

- GDP per capita: NA
- Total population (2000): NA
- Purchasing power parities for GDP: NA

Source: OECD Statistics

**Reference Documents and Links**

- **Name:** Maastricht UAC, EUROCONTROL
- **Date of Establishment in Current Status:**
  At the request of the Benelux States and Germany, MUAC is operated as a EUROCONTROL Agency’s Service according to the Maastricht Agreements of 25.11.1986
**Operational factors**

**Size of Airspace:**
261.392 km²

**Operational Units**
1. ACC (Maastricht-UAC)

**Number of FIRs/UIRs – 1/2**

**Airspace Structure (map)**

Note: Maastricht UAC covers upper airspace over Northern Germany and Benelux

**Complexity Level per FIR/UIR:**
High Complexity

**Division Level Between Upper and Lower Airspace:**
FL245 (with upper limit FL 660 and unlimited in the case of German airspace)

**Specific Features of Airspace**
Upper Airspace only.
Airspace delegated by Four Member States.

**Traffic Data (2001)**

**Traffic Breakdown**
Instrument Flight Rules (IFR) 1,229,413

**Other Traffic Data**
Ratio of descending-climbing to over flights: 75%

**Topography and Meteo Related Complexity**
High Complexity

**Traffic Mix Related Restrictions/Constraints**

**Services Provided to Areas Outside Airspace**

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>Above Brussels FIR</td>
<td>ANS</td>
</tr>
<tr>
<td>Germany</td>
<td>Hannover UIR and parts of the airspace above Berlin FIR</td>
<td>ANS</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Upper part of Amsterdam FIR</td>
<td>ANS</td>
</tr>
</tbody>
</table>

**Areas Jointly Managed:**
Northern Germany with DFS for Control of German OAT

**Services Delegated to Others**
N/A
Institutional, organisational and legal factors

Institutional Arrangements and Links

- Ministry of Transport, Public Works and Water Management (M of TPWWM)
- General Directorate of Civil Aviation (DGU)
- Transport, Communication, Public Works Inspectorate (IVW)
- LVNL

Sharing of Responsibilities and Type of Separation

Governmental Responsibilities

- Functional and Organisational

Service Provision

- Functional and Organisational

Regulation

* Except for economic (no separation)

Name: LVNL

Legal Personality: Corporatised, 100% state owned

Date of Establishment in Current Status: 1993

Civil – Military Relationship

Formal cooperation between the relevant Ministries: CAA NVNL Military NRAF HQ and MIL/ATC

Corporate Governance Structure

- SUPERVISROY BOARD
  - Chairman + 4 Members + 1 observer
  - 4 Members representing Scheduled Airline, Charter Airline, One Dutch Airport, Ministry of Defence
  - And an observer from the Ministry of Transport

- EXECUTIVE BOARD (4 Members)
  - Chairman + 2 members
  - Executive Board is appointed by the M of TPWWM, on the recommendation of the Supervisory Board

Scope of Services

- Area control
- Approach control
- Aerodrome control
- Air traffic flow management
- Aeronautical information
- Flight information
- Alerting service
- Airspace management
- Surveillance
- Navigation
- Aeronautical fixed comms
- Aeronautical mobile comms

Financials

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>309</td>
<td>338</td>
<td>362</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>224</td>
<td>183</td>
<td>257</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>72%</td>
<td>53%</td>
<td>70%</td>
</tr>
<tr>
<td>Assets</td>
<td>565</td>
<td>539</td>
<td>554</td>
</tr>
</tbody>
</table>

Staff Breakdown

- ATCO in Ops: 159
- ATCO in other duties: 28
- Ab-initio trainee: 20
- ATC assistants & flight data personnel: 70
- Technical support staff: 356
- Administration: 256
- Others: 50

General Country Data

- GDP per capita: $24,400
- Total population (2000): 15,926,000
- Purchasing power parities for GDP: 0.933

Source: OECD Statistics

Reference Documents and Links

www.lvnl.nl/
Operational factors

Size of Airspace – 90,324 km²

Operational Units
1. AACs (Amsterdam)
4. APPs (Schiphol, Rotterdam, Eelde, Beek)
4. TWRs (Schiphol, Rotterdam, Eelde, Beek)
1. AFIs

Number of FIRs/UIRs – 1 (EHACC)

Airspace Structure (map)

Complexity Level per FIR/UIR: High

Division Level Between Upper and Lower Airspace: FL245

Specific Features of Airspace
Upper airspace only: UAC MAS
Lower airspace only: LVNL

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 542,929
Visual Flight Rules (VFR)
Commercial air transport
General aviation
Aerial work
Military flights operating as GAT
Military flights operating as OAT
Flights operated using jet aircraft
Flights operated using turboprops
Others (UAV etc.)

Other Traffic Data
Ratio of descending-climbing to overflights:

Topography and Metrolo Related Complexity
Windshear/microbursts: Use of runways
Fog: Use of runways

Services Provided to Areas Outside Airspace
None

Areas Jointly Managed:
UAC MAS – MAS agreement – Upper Airspace
MIL/ATC – None – Civil aviation in military airspace

Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAC MAS</td>
<td>Upper Airspace</td>
</tr>
</tbody>
</table>

Traffic Mix Related Restrictions/Constraints
Institutional, organisational and legal factors

**Institutional Arrangements and Links**

**Sharing of Responsibilities and Type of Separation**

Name: Airways New Zealand  
Legal Personality: State enterprise  
Date of Establishment in Current Status: 1987

**Civil – Military Relationship**

There are no military air navigation services – Airways provides all services

**Corporate Governance Structure**

**Scope of Services**

Area control  
Approach control  
Aerodrome control  
Oceanic control  
Aeronautical information  
Flight information  
Aereting service  
Surveillance  
Navigation  
Aeronautical fixed comms  
Aeronautical mobile comms  
ADS (CNS)  
Training  
Consultancy

**General Country Data**

GDP per capita: NZD 28,700  
Total population (2002): 3.95 million  
Purchasing power parities for GDP: ?

Source: OECD Statistics

**Staff Breakdown (as at 2001)**

<table>
<thead>
<tr>
<th>Category</th>
<th>2000</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATCO in Ops</td>
<td></td>
<td>292</td>
</tr>
<tr>
<td>ATCO in other duties</td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>Ab-initio trainee</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>ATC assistants &amp; flight data personnel</td>
<td></td>
<td>73</td>
</tr>
<tr>
<td>Technical Staff</td>
<td></td>
<td>97</td>
</tr>
<tr>
<td>Administration</td>
<td></td>
<td>136</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

**Financials**

<table>
<thead>
<tr>
<th>Category</th>
<th>2000</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>49,</td>
<td>50</td>
</tr>
<tr>
<td>Assets</td>
<td>40</td>
<td>42</td>
</tr>
</tbody>
</table>

**Reference Documents and Links**

[www.airways.co.nz/](http://www.airways.co.nz/)  
Annual Report  
CAA Act 1990
## Operational factors

### Size of Airspace
- Size: 27,922,900 km²

### Operational Factors

#### Services Provided to Areas Outside Airspace
- Third party State: ICAO
- Area delegated: Oceanic FIR
- Services provided: Oceanic services

#### Complexity Level per FIR/UIR
- Low to medium

### Airspace Structure

- **Division Level Between Upper and Lower Airspace:** FL290

### Specific Features of Airspace
- Oceanic has an interface to domestic and other oceanic FIRs.
- Oceanic traffic mainly traverses the Tasman Sea and is subject to peaks.
- Domestic traffic is dominated by a few trunk routes.
- There is seasonal variation in Antarctic traffic.

### Traffic Data

- **Traffic Breakdown:**
  - Instrument Flight Rules (IFR): 304,004
  - Visual Flight Rules (VFR): 181,523
  - Military flights: 15,980

- **Ratio of descending-climbing to overflights:**

### Topography and Meteorological Complexity
- **Clear air turbulence/mountain waves:** Level changes are sometimes needed to avoid turbulence.
- **Others:** Controllers are taught of the extreme conditions that might apply. Special procedures apply at Wellington to monitor separations on finals.

### Traffic Mix Related Restrictions/Constraints
- Traffic mix containing large proportions of both IFR and VFR traffic has an impact on capacity at airports. A training booking system is in place to limit the total number of training flights that can take place.

### Services Delegated to Others

#### ANSP

<table>
<thead>
<tr>
<th>Area delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Air Force</td>
</tr>
<tr>
<td>Antarctic McMurdo Sector below 60S</td>
</tr>
</tbody>
</table>

### Services Provided to Areas Outside Airspace

- **Third party State:** ICAO
- **Area delegated:** Oceanic FIR
- **Services provided:** Oceanic services

### Areas Jointly Managed
- None
Institutional, organisational and legal factors

Institutional Arrangements and Links

- Ministry of Transport and Communications (MoTC)
- Civil Aviation Authority Norway (CAA)
- All Shuttle Services
- Airports
- NATAM
  - Oslo Airport (OSL / AAR)
  - Northern Airports (BWR)
  - Airport Partners (JIAA)

Sharing of Responsibilities and Type of Separation

- Governmental Responsibilities
- Service Provision
- Regulation

Name:
NATAM

Legal Personality:
Government Agency under Ministry of Transport and Communication

Date of Establishment in Current Status:
2001 (separation of NATAR from CAP)

Civil – Military Relationship
Cooperation between ministry and service provider – NATAM provides military air nav. services

Corporate Governance Structure

- Supervisory Board (7 members)
  - Chairman + 6 members
  - Members represent: 5 M of TC, 2 staff

- Executive Board (13 Members)
  - CEO + 12 members
  - CEO appointed by M of TC.

Financials

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>3,049</td>
<td>2,486</td>
<td>2,350</td>
</tr>
<tr>
<td>Enroute</td>
<td>436</td>
<td>484</td>
<td>487</td>
</tr>
<tr>
<td>% Total</td>
<td>14%</td>
<td>19%</td>
<td>21%</td>
</tr>
<tr>
<td>Assets</td>
<td>11,512</td>
<td>11,923</td>
<td>12,358</td>
</tr>
</tbody>
</table>

Staff Breakdown (ANSP Only)

- ATCO in Ops: 431
- ATCO in other duties: 38
- Ab-initio trainee: 85
- ATC assistants & flight data personnel: 216
- Technical support staff: 184
- Administration: 204
- AFIS: 119
- Other: 31

Scope of Services

- Area control
- Approach control
- Aerodrome control
- Oceanic control
- Air traffic flow management
- Flight information
- Alerting service

General Country Data

- GDP per capita: $27,700
- Total population (2000): 4,491,000
- Purchasing power parities for GDP: 9.05

Source: OECD Statistics

Reference Documents and Links
## Operational factors

### Size of Airspace – 2,079,007 km²

4: Operational units: 45 airports owned and operated by NATAM:
- 27 Regional airports with AFIS (incl. one heliport).
- 2 main airports with AFIS.
- 1 regional airport with ATCO’s.
- 15 main airports with ATCO’s.

Units providing ATC and FIS:
- 29 AFIS.
- 12 TWR/APP. (incl. one airport owned by a private limited company)
- 8 TWR (incl. 3 TWR at military airports).
- 4 APP. (incl. One APP at a military airport)
- 4 ATCC (incl. 5 APP and Bodø Oceanic).

### Airspace Structure (map)

Note: Stavanger and Bodø are not shown in this map

### Complexity Level per FIR/UIR:

?  

### Division Level Between Upper and Lower Airspace: Division between upper and lower information region: FL 245

Operational sectors stretch from sea level and unlimited upwards (FL 460)

### Specific Features of Airspace: NATAM is responsible for ATS at 45 airports. 29 of these have AFIS only. The traffic at the AFIS airports range from 8000 to 285,000 IFR movements annually. NATAM is also responsible for providing all ATS for military aircraft

### Topography and Meteo Related Complexity: Very rugged terrain and severe weather conditions in many areas. Dark during daytime in the winter in the north

### Traffic Data

#### Traffic Breakdown

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total IFR flights controlled</td>
<td>425,880</td>
</tr>
<tr>
<td>IFR helicopter continental shelf*</td>
<td>33,531</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>459,411</strong></td>
</tr>
<tr>
<td>IFR airport movements controlled by the ANSP</td>
<td>669,772</td>
</tr>
<tr>
<td>IFR helicopter continental shelf*</td>
<td>33,531</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>492,942</strong></td>
</tr>
<tr>
<td>Total flight hours controlled (by ATCC and APP)</td>
<td>244,684</td>
</tr>
</tbody>
</table>

* This traffic is not accounted for by Eurocontrol (IFR movements at Sola, Flesland and Kverberget)

### Other Traffic Data

**Ratio of descending-climbing to overflight:**

### Services Provided to Areas Outside Airspace

See services delegated to others.

### Areas Jointly Managed:

### Traffic Mix Related Restrictions/Constraints:

High level of domestic traffic, especially at the smaller airports, thus Norwegian airspace has a disproportionately high share of climbs and descents.

### Services Delegated to Others:

When travelling between Oslo and the northern part of our country the border between Norway and Sweden is crossed many times. Thus some adjustments along the border where Sweden provide ATC over Norwegian territory in some areas are made, and vice versa. Similar adjustments with the Scottish sector in the North Sea for off-shore helicopter operations are also made.
Institutional, organisational and legal factors

Institutional Arrangements and Links

- Ministry of Transport (M of T)
- National Institute for Civil Aviation (INAC)
- Secretary of Transport
- Aircraft Accident Prevention and Investigation (GPIAA)
- Ministry of Finance (M of F)
- Airports of Portugal (ANA SA)
- NAV-Portugal

Sharing of Responsibilities and Type of Separation

- Governmental Responsibilities
  - Organisational
  - Regulation
- Service Provision

Civil – Military Relationship

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal cooperation between the relevant Ministries</td>
<td>NAV-EP, Ministry of Transports, Ministry of Defence</td>
</tr>
<tr>
<td>Other mechanism (please specify)</td>
<td>Formal and day-to-day peacetime co-operation between civil and military ANS providers, based on bilateral agreements at their own level</td>
</tr>
</tbody>
</table>

Corporate Governance Structure

BOARD OF ADMINISTRATION (5 members)
- Chairman + 4 members
- All members are appointed by M of T for a 3 year term. Each member has executive functions within NAV-Portugal. Each member is responsible to supervise one or several NAV-Portugal Directorates and Advisory Bodies to the Board. There are 7 Directorates and 6 Advisory Bodies.
- There is neither CEO nor COO within NAV-Portugal

Note: NAV-Portugal has also a Board of Auditors composed by 3 members which are appointed by M of T for a 3 year term.

Financials

<table>
<thead>
<tr>
<th>€M</th>
<th>1998 *</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>274</td>
<td>122</td>
<td>163</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>86</td>
<td>101</td>
<td>137</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>31%</td>
<td>82%</td>
<td>84%</td>
</tr>
<tr>
<td>Assets</td>
<td>739</td>
<td>140</td>
<td>182</td>
</tr>
</tbody>
</table>

Staff Breakdown (31/12/2001)

- ATCO in Ops: 240
- ATCO in other duties: 87
- Ab-initio trainee *: 20
- ATC assistants & flight data personnel: 219
- Technical support staff: 183
- Administration: 311
- Other: 44

* Ab-initio trainee are not considered as effective staff, although they are reflected in the staff costs

Scope of Services

Area control
Area control Oceanic
Approach control
Aerodrome control
Air traffic flow management
Aeronautical information
Flight information
Alerting service
Meteorological information
Airspace management
Aeronautical fixed communications
Aeronautical mobile communications
Surveillance
Navigation

General Country Data

- GDP per capita: $15,800
- Total population (2000): 10,008,000
- Purchasing power parities for GDP: 0.656

Source: OECD Statistics

Reference Documents and Links

http://www.nav.pt/
Operational factors

Size of Airspace:
- Lisbon FIR: 683,683 km²
- Santa Maria FIR: 5,126,635 km²

Operational Units
- 2 ACCs (Lisboa, Santa Maria)
- 5 TMAs (Lisboa, Porto, Faro, Madeira, Santa Maria)
- 10 TWRs (Lisboa, Cascais, Porto, Faro, Madeira, Porto Santo, Ponta Delgada, Santa Maria, Horta, Flores)

Number of FIRs/UIRs: 2 (Lisbon FIR and Santa Maria FIR)

Airspace Structure (map), excluding Santa Maria

Complexity Level per FIR/UIR:
- Lisbon FIR: Medium – high, Santa Maria OCA FIR: Medium

Division Level Between Upper and Lower Airspace:
- Lisbon FIR/UIR - FL245, Santa Maria OCA FIR.

Specific Features of Airspace
- Oceanic airspace: Yes – Santa Maria OCA FIR
- Interface to oceanic airspace: Yes – Between Lisbon FIR and Santa Maria OCA FIR.
- Wide variation in traffic density across FIR: Yes – More density in continental sectors.

Traffic Data

<table>
<thead>
<tr>
<th>Traffic Breakdown</th>
<th>Lisbon FIR</th>
<th>Santa Maria FIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument Flight Rules (IFR)</td>
<td>326,924</td>
<td>88,305</td>
</tr>
<tr>
<td>Visual Flight Rules (VFR)</td>
<td>44,576</td>
<td>1,801</td>
</tr>
<tr>
<td>Commercial air transport</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>General aviation</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Aerial work</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Military flights operating as GAT</td>
<td>11,093</td>
<td>9,164</td>
</tr>
<tr>
<td>Military flights operating as OAT</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Flights operated using jet aircraft</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Flights operated using turboprops</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Others (UAV etc.)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Other Traffic Data

- Ratio of descending-climbing to overflights: Lisbon FIR 151.3%, Santa Maria FIR: 39.1%

Topography and Meteo Related Complexity
- Mountainous regions complicate arrival or departure procedures: Yes – LPMA, LPHR and LPFL.
- Mountainous regions require additional ground-based infrastructure for coverage: Yes. Large areas (land or water) that create coverage problems for terrestrial systems (Remote Areas).
- Due to large water area there are some problems of radar coverage in the Western limit of Lisbon FIR/UIR expected to be solved with future ADS, namely in Santa Maria OCA FIR.
- Clear air turbulence/mountain waves: At LPMA. Requires the imposition of minimum training requirements and wind limitations as described in Portuguese AIP AGA 2-5-4A and next.
- Fog: At LPPR and LPPT. Low visibility operations procedures and capacity reduction.

Traffic Mix Related Restrictions/Constraints
- OAT flights, moreover Air Defence flights introduce some operational complexity since they have priority and are conducted by military units. Thus, sometimes there is the need to impose restrictions to the GAT traffic. Military flights operating as OAT.

Services Provided to Areas Outside Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>Area limited by: 3911N 00708W – Portuguese/ Spanish border to 3953N 00652W – 3947N 00638W to 3927N 00625W – south limit of UN175’s to origin</td>
<td>ATC</td>
</tr>
</tbody>
</table>

Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>AENA</td>
<td>ATS route UW106</td>
</tr>
</tbody>
</table>
Institutional, organisational and legal factors

Institutional Arrangements and Links

- Ministry of Development (M of Dev.)
- Secretary of State for Infrastructures
- AENA
- Spanish Civil Aviation Authority (DGAC)
- Airports
- Air Navigation

Sharing of Responsibilities and Type of Separation

- Functional and Organisational
- Governmental Responsibilities
- Functional and Organisational*
- Service Provision
- Regulation

* Except ...

Civil – Military Relationship

Formal cooperation between the relevant Ministries: Some agreements in specific areas (share airports...)

Other mechanism (please specify): RD 12/1978 about the delimitation of faculties between Ministry of Defence and Ministry of Development. Aena makes the control and proposes the sanctions. There are specific agreements about working of fulfilment of state, community and international rules.

Corporate Governance Structure

- SUPERVISORY BOARD (17 members)
  - Chairman + 16 members
  - Members appointed by the M of Dev.
  - Chairman is the CEO.

- EXECUTIVE BOARD (15 Members)
  - CEO
  - CEO + 14 members
  - CEO appointed by the M of Dev.

Staff Breakdown

- ATCO in Ops: 1,501
- ATCO in other duties: 197
- Ab-initio trainee: 92
- ATC assistants & flight data personnel: 92
- Technical support staff: 92
- Administration: 92
- Others, on the job training: 92

Financials

<table>
<thead>
<tr>
<th>€M</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>341</td>
<td>406</td>
<td>518</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>309</td>
<td>3</td>
<td>404</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>91%</td>
<td>83%</td>
<td>78%</td>
</tr>
<tr>
<td>Assets</td>
<td>477</td>
<td>479</td>
<td>525</td>
</tr>
</tbody>
</table>

Date of Establishment in Current Status: 1991

Name: AENA

Legal Personality: Corporatised, 100% state owned

General Country Data

- GDP per capita: $18,000
- Total population (2000): 39,466,000
- Purchasing power parities for GDP: 0.773

Source: OECD Statistics

Reference Documents and Links

- www.aena.es
- Annual Report
Operational factors

Size of Airspace – 2,287,023 km²

Operational Units
4. AAC (Barcelona, Madrid, Canarias, Sevilla)
9. APPs
34. TWRs
0. AFIs

Number of FIRs/UIRs –
1. Madrid
2. Barcelona
3. Canarias

Airspace Structure (map)

Complexity Level per FIR/UIR:
1. High
2. Medium-high
3. Medium

Division Level Between Upper and Lower Airspace: FL245

Specific Features of Airspace
Upper airspace only no: Both upper and lower
Interface to oceanic airspace: YES (Santa Maria & Shanwick)
Large number of boundaries with adjacent airspace blocks: YES
Wide variation in traffic density across FIR: There are major and secondary traffic flows
Other features (please specify): See AIP

Topography and Metero Related Complexity
Mountainous regions complicate arrival or departure procedures: Specific airports (ex. Granada, La Palma). Mountainous regions require additional ground-based infrastructure for coverage: Specific areas (ex. Vitoria, Pamplona, Santiago, Vigo, Malaga, Granada). Large areas (land or water) that create coverage problems for terrestrial systems (Remote Areas): Canary Islands (over sea)
Windshear/microbursts: Yes, occasionally
Clear air turbulence/mountain waves: Yes, occasionally
Fog: Yes, occasionally

Traffic MIX Related Restrictions/Constraints

Services Provided to Areas Outside Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
</table>

Areas Jointly Managed:

Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Institutional, organisational and legal factors

**Institutional Arrangements and Links**

- Ministry of Infrastructure, Transport and Water Management (MoITW)
- Civil Aviation Administration (LFV)
- Aviation Safety Authority (AFA)
- Aviation and Public Sector Dept.
- Airport Divisions
- Air Navigation Services Division

**Sharing of Responsibilities and Type of Separation**

- Functional and Organizational Responsibilities
- Governmental
- Service Provision
- Functional and Organizational
- Regulation

**Name:**
LUFTFARTSVERKET (LFV)
SWEDISH CAA

**Legal Personality:**
Government Agency

**Date of Establishment in Current Status:**
1967

**Civil – Military Relationship**

One Administration (LFV) under one ministry takes responsibility for all Air Navigation Services (ANS) – LFV is responsible for all ANS matter for all users (civil and military) during peacetime. Formal consultation with the Swedish Armed Forces (SAF) is required when they are affected by a LFV decision in the ANS field. Consequently there are formal agreements between LFV and SAF with regard to ANS, both from regulatory and service provision point of view.

**Corporate Governance Structure**

- Supervisory Board: 10 members
  - Chairman + DG = 8 members appointed by the Government
  - 2 members are appointed by Trade Unions
- Executive Board: 3 members
  - DG + 7 members appointed by the Government

**Financials (ANS Division)**

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>141</td>
<td>160</td>
<td>172</td>
</tr>
<tr>
<td>Enroute</td>
<td>99</td>
<td>107</td>
<td>119</td>
</tr>
<tr>
<td>% Total</td>
<td>70%</td>
<td>67%</td>
<td>69%</td>
</tr>
<tr>
<td>Assets</td>
<td>123</td>
<td>158</td>
<td>179</td>
</tr>
</tbody>
</table>

**Staff Breakdown**

- ATCO in Ops: 457
- ATCO in other duties: 198
- Ab-initio trainee: 82
- ATC assistants & flight data personnel: 108
- Technical support staff: 73
- Administration: 160
- Other: 72

**Scope of Air Navigation Services**

- Air Traffic Management (ATM)
  - Area control (ACC)
  - Approach control (APP)
  - Aerodrome control (TWR)
  - Flight information (FIS)
  - Alerting service
- Air traffic flow management (ATFM)
- Air Space Management (ASM)
- CNS (en-route infrastructure)
- Aeronautical information (AIS)
- Search and Rescue (SAR)

**General Country Data**

- GDP per capita: $22,200
- Total population (2000): 8,872,000
- Purchasing power parities for GDP: 9.53

**Reference Documents and Links**

- www.lfv.se/
- Annual Report

**Source:** OECD Statistics.
Operational factors

Size of Airspace – 610,000 km²

Operational Units
3. ATCCs (Stockholm, Sundsvall, Malmö)
10. APPs
36. TWRs
1. AFIS

Number of FIRs/UIRs – 1/1

Complexity Level per ATCC “Area of Responsibility”:
- Sundsvall: Low
- Stockholm and Malmö: Medium-High

Division Level Between Upper and Lower Airspace: FL285

Specific Features of Airspace
- Wide variation in traffic density across FIR
- Very low traffic density in the northern part of Sweden FIR/UIR

Traffic Data
Traffic Breakdown
- Instrument Flight Rules (IFR): 657,200
- Visual Flight Rules (VFR): 502,000
- Commercial air transport: 141,000
- General aviation: 14,000
- Military flights operating as GAT: 14,000

Traffic Mix Related Restrictions/Constraints
- Different civil and military measurement systems e.g. speed in knots and km/h, heights in feet and meters

Topography and Metro Related Complexity
- Mountainous regions require additional ground-based infrastructure for coverage; However it’s decided, due to the very low density of traffic and the high cost, not to invest in such infrastructure

Services Provided to Areas Outside National Airspace

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Areas where services are provided</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF, DK, NO, PL</td>
<td>Different areas along common FIR/UIR boundaries</td>
<td>ATC</td>
</tr>
</tbody>
</table>

Services Delegated to Others

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Services delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK, NO</td>
<td>ATC in different areas along common FIR/UIR boundaries</td>
</tr>
</tbody>
</table>

Area Jointly Managed:
Institutional, organisational and legal factors

Institutional Arrangements and Links

Ministry of Defence (MoD)
Ministry of Environment, Transport, Energy and Communications (MoETEC)
Swiss Air Force (Swiss AF)
Federal Office for Civil Aviation (FOCA)

Skyguide

Corporate Governance Structure

GENERAL ASSEMBLY of the Shareholders

SUPervisory Board (7 Members)
Chairman + 6 Members
All members are appointed by the General Assembly for their expertise.

EXECUTIVE BOARD (8 Members)
CEO + 6 Members
The CEO is appointed by the Supervisory Board.

Civil – Military Relationship

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Actors involved/description of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full integration</td>
<td>Civil and military ATS are fully integrated</td>
</tr>
</tbody>
</table>

Scope of Services

Area control
Approach control
Air traffic flow management
Aeronautical information
Flight information
Airspace management
Training
Consultancy

Name:
Skyguide

Legal Personality:
State owned private law company

Date of Establishment in Current Status: 2001

Staff Breakdown (2001)

<table>
<thead>
<tr>
<th>Category</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATCO in Ops</td>
<td></td>
<td></td>
<td>365</td>
</tr>
<tr>
<td>ATCO in other duties</td>
<td></td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Ab-initio trainee</td>
<td></td>
<td></td>
<td>62</td>
</tr>
<tr>
<td>ATC assistants &amp; flight data personnel</td>
<td></td>
<td></td>
<td>52</td>
</tr>
<tr>
<td>Technical support staff</td>
<td></td>
<td></td>
<td>249</td>
</tr>
<tr>
<td>Administration</td>
<td></td>
<td></td>
<td>81</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td>215</td>
</tr>
</tbody>
</table>

Financials

<table>
<thead>
<tr>
<th>Category</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>258</td>
<td>265</td>
<td>276</td>
</tr>
<tr>
<td>Enroute</td>
<td>348</td>
<td>387</td>
<td>401</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td></td>
<td>75%</td>
<td>77%</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td></td>
<td>74%</td>
<td></td>
</tr>
<tr>
<td>Assets</td>
<td>232</td>
<td>244</td>
<td>242</td>
</tr>
</tbody>
</table>

General Country Data

GDP per capita: $28,600
Total population (2000): 7,185,000
Purchasing power parities for GDP: 1.90

General Country Data

Source: OECD Statistics

Reference Documents and Links

www.skyguide.ch/
Annual Report
Operational factors

**Size of Airspace:** 63,726 km²

**Operational Units**
1. AACs (Geneva, Zurich)
2. APPs (Geneva, Zurich)
3. TWRs (Geneva, Zurich, Bern)
4. AFIs (Geneva, Zurich, Bern)

**Number of FIRs/UIRs –** 1 FIR, 1 UIR

**Traffic Data**

**Traffic Breakdown**
- Instrument Flight Rules (IFR) 1,877,621
- Visual Flight Rules (VFR) 130,754
- Commercial air transport
- General aviation
- Aerial work
- Military flights operating as GAT
- Military flights operating as OAT
- Flights operated using jet aircraft
- Flights operated using turboprops
- Others (UAV etc.)

**Other Traffic Data**
- Ratio of descending-climbing to overflights: 66%

**Topography and Metero Related Complexity**
Mountains: Alps, MRT, First IFR level available regarding QNH

**Services Provided to Areas Outside Airspace**

<table>
<thead>
<tr>
<th>Third party State</th>
<th>Area delegated</th>
<th>Services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>East</td>
<td>Full ATC</td>
</tr>
<tr>
<td>Germany</td>
<td>South</td>
<td>Full ATC</td>
</tr>
<tr>
<td>Italy</td>
<td>North</td>
<td>Full ATC</td>
</tr>
</tbody>
</table>

**Services Delegated to Others**

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Area delegated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>South of Lugano</td>
</tr>
</tbody>
</table>

**Services Jointly Managed:** Nil
Institutional, organisational and legal factors

Institutional Arrangements and Links

Civil – Military Relationship

Relationship | Actors involved/description of relationship
--- | ---
Contractual | NATS supplies services to the military under a commercial contract with the Ministry of Defence

Corporate Governance Structure

Note: DTLR has now been replaced by Department for Transport (DfT)

Staff Breakdown (2001)

<table>
<thead>
<tr>
<th>Category</th>
<th>1999/2000</th>
<th>2000/01</th>
<th>2000/02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>£M</td>
<td>£M</td>
<td>£M</td>
</tr>
<tr>
<td>Enroute Revenues</td>
<td>479</td>
<td>511</td>
<td>466</td>
</tr>
<tr>
<td>% Total Revenues</td>
<td>84.4%</td>
<td>85.9%</td>
<td>84.4%</td>
</tr>
<tr>
<td>Assets</td>
<td>£M</td>
<td>£M</td>
<td>£M</td>
</tr>
<tr>
<td>574</td>
<td>618</td>
<td>936</td>
<td></td>
</tr>
</tbody>
</table>

Financials

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues</th>
<th>Enroute Revenues</th>
<th>% Total Revenues</th>
<th>Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999/2000</td>
<td>568</td>
<td>479</td>
<td>84.4%</td>
<td>574</td>
</tr>
<tr>
<td>2000/01</td>
<td>595</td>
<td>511</td>
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<tr>
<td>2000/02</td>
<td>553</td>
<td>466</td>
<td>84.4%</td>
<td>936</td>
</tr>
</tbody>
</table>

General Country Data

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP per capita</td>
<td>$22,800</td>
</tr>
<tr>
<td>Total population (2000)</td>
<td>59,766,000</td>
</tr>
<tr>
<td>Purchasing power parities for GDP</td>
<td>0.651</td>
</tr>
</tbody>
</table>

Source: OECD Statistics

Reference Documents and Links

www.nats.co.uk

Annual Report

Name: NATS

Legal Personality:
Part privatised (Government retains 49% including Golden Share)

Date of Establishment in Current Status: 2001
Operational factors

Size of Airspace: continental 878,430 km², oceanic 2,192,000 km²

Operational Units
4 AACs (London, Manchester, Scottish)
1. OAC (Shanwick)
11. APPs
14. AFIs (Geneva, Zurich, Bern)

Number of FIRs/UIRs – 2/2+1

Traffic Data
Traffic Breakdown
Instrument Flight Rules (IFR) 2,022,538
Visual Flight Rules (VFR) n/a
Commercial air transport 1,894,094
General aviation 106,068
Aerial work n/a
Military flights operating as GAT 22,379
Military flights operating as OAT n/a
Flights operated using jet aircraft Approx. 83%
Flights operated using turboprops Approx. 17%
Others (UAV etc.) n/a

Other Traffic Data
Ratio of descending-climbing to overflights: London FIR 89%, Scottish FIR 82%

Topography and Metero Related Complexity
Mountainous regions require additional ground-based infrastructure for coverage
Large areas of water that create coverage problems for terrestrial systems (Remote Areas)

Services Provided to Areas Outside Airspace
1. North Sea from Iceland, Norway
2. Within the Shannon UIR from Irish Republic
3. Areas of Dutch airspace around REFSO from Netherlands
4. Reims airspace north of RATUK from France

Services Delegated to Others
1. Irish Sea delegation of ATS to Dublin on L975 and B39
2. North east corner of North Sea lower airspace to Norway, Denmark, and Amsterdam
3. North East corner of North Sea Upper Airspace to Denmark
4. Southwest corner of London UIR to France and Irish Republic
5. Airspace at 61N to Iceland

Services Managed
Ireland/France – Southern Oceanic transition area – Radar
Control Service
Ireland – Shanwick OCA – Communications
MoD – London and Scottish FIRs – Joints ATC services

Complexity Level per FIR/UIR: London High, Scottish Medium, Oceanic Medium

Division Level Between Upper and Lower Airspace: London FL245, Scottish FL245, Oceanic FL0

Specific Features of Airspace
Upper airspace: Total controlled environment Lower airspace: Segmented controlled environment
Oceanic airspace: Bordering Norwegian, Icelandic, Canadian, Portuguese and French controlled airspace
Interface to oceanic airspace: Both FIRs Large number of boundaries with adjacent airspace blocks Wide variation in traffic density across FIR Civil/military service with dedicated military airspace

Traffic Mix Related Restrictions/Constraints
Interaction of civil and military - mix of OAT and GAT traffic - Numerous military agencies, communications between all agencies and subsequent co-ordination

Areas Jointly Managed:
Ireland/France – Southern Oceanic transition area – Radar
Control Service
Ireland – Shanwick OCA – Communications
MoD – London and Scottish FIRs – Joints ATC services