REPORT

Status of Civil-Military Co-ordination in air traffic management

Phase I – Fact-finding

Joint study PRU-Agency

October 2001

Printed by EUROCONTROL, 96, rue de la Fusée, B-1130 Brussels, Belgium, Tel: + 32 2 729 3956, Fax: + 32 2 729 9108.

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EXECUTIVE SUMMARY

1.1 Introduction

1.1.1 This report is a fact-finding study, which assesses the actual status of civil-military co-ordination in Air Traffic Management. It is a study that has been jointly conducted by the Performance Review Unit and the EUROCONTROL Agency. It responds to the EUROCONTROL Provisional Council's decision, taken at its 8th Session (July 2000) which, inter alia, "*requests the Director General to examine the implementation status of the Flexible Use of Airspace (FUA) in European States*".

1.1.2 Based on the findings of this report, the second phase of the project will provide a programme to ensure best practice and to foster integration of civil-military air traffic services (ATS) as was requested by the Provisional Council in the same decision. However, these proposals should be incorporated into existing projects and programmes (e.g. The Transition Plan for the Implementation of the EUROCONTROL Airspace Strategy for the ECAC States).

1.1.3 It is recognised that European airspace planning is subject to numerous external factors and constraints that result in constant pressure, particularly in the core area of Europe.

1.1.4 While the military is mostly concerned with attaining the highest level of military capability, the first priorities for civil aviation are commercial, successful operation within the safety requirements. The question arises whether the European ATM System will be able to sustain civil traffic growth and military needs at the same time. In order to satisfy this requirement, Air Traffic Management has to provide the maximum level of ATM efficiency and effectiveness while maintaining or improving safety standards. However, in certain parts of European airspace, or at certain periods, it might not be possible to do so. Therefore, political authorities are invited to establish clear guidance in prioritising the trade off between the conflicting interests of these two major airspace users while still considering other airspace users.

1.1.5 EUROCONTROL, due to its status as a civil-military organisation, is uniquely placed to play a pre-eminent role in the field of civil-military co-ordination. However, an effective network of co-operation between international organisations (ICAO, ECAC, NATO, EU and EUROCONTROL) is not yet in place. Whenever international co-ordination would be necessary, the role of international organisations is still weak.

1.2 Key findings

1.2.1 There is significant scope for improvement in civil-military co-ordination. Improving the current FUA application in Europe will enable the ATM system to fully accommodate both military and civil demand. The need to operate a trade-off between these two requirements may only occur in a few parts of European airspace (e.g. the European core area) during specific periods.

Organisational aspects at State level

1.2.2 As required by the Airspace Management (ASM) Handbook, almost all States have established a Joint Committee which is responsible for all strategic ASM tasks and for defining the rule framework for the two following levels (pre-tactical and real-time operations).

1.2.3 The Joint Committee relies on a working structure, whose main component is the Airspace Design Unit. Although many arrangements are in place, the most efficient solution is a joint airspace design unit reporting to the Joint Committee.

1.2.4 At pre-tactical ASM level, the most efficient organisational solution for the Airspace Management Cell (AMC) is a joint civil-military unit, staffed by civil ATC experts and by representatives of military airspace users. Where this solution is implemented there is an efficient negotiation process.

1.2.5 With regard to real-time operations, it can be concluded that when civil and military ANS providers are separated, any kind of organisation may result, from the largest separation to the deepest integration. However, a single integrated provider naturally leads to an operationally integrated ATC .

1.2.6 When civil and military ATCs are located in the same centre, “co-located operations” or “one ATC sector” are two different operational arrangements. Either arrangement can be applied by one integrated ANS provider or by two civil and military service providers with operational effectiveness and maintenance of good safety levels.

1.2.7 In States where there is a single integrated ANS provider certain issues were identified by the survey: the provision of sufficient ATC capacity to military, the extent of the services provided (e.g. en route, airports, etc.) and the handling of Operational Air Traffic (OAT)[1] under specific circumstances.

1.2.8 It cannot simply be concluded that an integrated ANS provider is a better solution than two ANS providers. Each case must be considered in its own right, taking into account other non-operational factors (e.g. economic, political or social) where relevant. Further study on this subject is necessary.

Status of FUA application

1.2.9 Many European States comply with the Flexible Use Airspace (FUA) concept. However, as the civil-military organisation differs from one State to another, the FUA concept is implemented differently.

1.2.10 In general, FUA is well implemented at national level. The visited States have achieved efficiency gains, even if these gains vary from one State to another. However, at international level, co-ordination between neighbouring States is very limited when airspace structures are situated across or close to the border. The lack of co-ordination is detrimental at all three ASM levels (strategic, pre-tactical and real-time operations) in some parts of Europe.

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[1] Operational Air Traffic (OAT) is defined as *“all flights which do not comply with the provisions stated for GAT and for which rules and procedures have been specified by appropriate national authorities”*

1.2.11 The main outcome of implementing FUA is that segregated airspace is generally released to all users when it is not being used. However, making the airspace available certainly provides flight efficiency for the operators and flexibility for the controllers, but the benefits in terms of ATC capacity and valuable alternative routes are not yet well identified.

1.2.12 When ATC capacity enhancement is required, airspace design proposals tend to be the only solutions that are studied. However, it could be more beneficial for all users if the ATM organisations were optimised and the airspace was more efficiently managed according to the time of day as well as the duration of the segregation.

FUA at European level

1.2.13 At European level, the major constraints affecting the FUA implementation are:

- The role of EUROCONTROL in assessing the application of FUA throughout Europe and the implementation of airspace structures is still weak.
- Airspace requirements are not always properly co-ordinated. In addition, there is no international authority that can impose a trade off, when airspace requirements conflict at international level.
- The difficulty to disseminate and to process information of airspace status.
- The lack of data exchange between civil and military ATC units at the States' interface.

FUA at State level

1.2.14 At State level the different applications of the FUA concept can be generally explained by the need to cope with different levels of GAT and military demand. Some best practices and inefficiencies were noted during the survey.

1.2.15 The organisational structure to deal with strategic ASM tasks is in place. Jointly collecting and validating civil and military airspace requirements could certainly be considered as best practice. However, in a few States the collection of requirements is done separately before its conciliation in official forum.

1.2.16 With very few exceptions, the co-ordination and conciliation of airspace requirements is done properly. The absence of formal mechanisms for co-ordinating airspace requirements is not the main obstacle for negotiating conflicting requirements, but the lack of effective working relationships.

1.2.17 A joint civil and military airspace design unit is the most efficient and easiest solution for avoiding misunderstandings that may arise by the use of different tools and practices and to better understand mutual requirements.

1.2.18 For the pre-tactical airspace management there are two options which are both effective, but for different levels of General Air Traffic (GAT)[2] and military demand:

[2] The term GAT relates to military and civil flights that follow ICAO rules.

- The pre-tactical management of airspace provides a framework in which the military activity requiring segregated airspace must take place during the planning slot. This may influence ATC capacity and GAT distribution. The need to adhere strictly to the schedule is unavoidable for military operations, which are conducted in areas of high traffic complexity.
- In some other States, the pre-tactical management of airspace provides a framework for the activity to be the less penalising for GAT, knowing that real-time adjustments are always possible.

1.2.19 The civil and military ANS providers are jointly responsible to put in place real-time co-ordination including airspace management in real-time and the handling of GAT and OAT in the same controlled airspace. Different types of organisational arrangements lead to different levels of operational efficiency.

1.2.20 When civil and military ATC units are located in different centres the co-ordination may be efficient provided that a certain number of prerequisites with respect to systems and procedures are fulfilled. It was noted that GAT is often constrained to remain in the route network. Therefore, there is limited scope for further efficiency gains if airspace complexity increases.

1.2.21 The co-location of the civil control and military control in the same ATC unit provides the most natural framework to facilitate the ATC co-ordination process, even if in some States there is still scope for improvement.

1.2.22 The organisational arrangement in which OAT and GAT are controlled by a single team (one or two executive controllers) within the same sector is particularly suitable for the most complex airspace.

1.2.23 Regarding the management of segregated airspace, the main problem at State level relates to the dissemination and the presentation of the airspace status. Verbal dissemination, paper sheet planning, specific display or radar display which are not updated with real-time information are still common and may hamper the use of the available airspace.

1.3 Recommendations for the second phase

1.3.1 The recommendations contained in this report were supported by the CMIC and the PRC at their respective September 2001 sessions. It is proposed that they form the basis of the second phase of this project, intended to be conducted under the authority of the Director General.

Airspace Design Organisation and Process

Recommendation 1

Define common principles for effective airspace design and management to be adopted by all EUROCONTROL* Member States.

* with a possible extension to ECAC Member States

Recommendation 2

Identify mechanisms to ensure international co-ordination of airspace design and management.

Operational Rules

Recommendation 3

Identify which principles, rules and procedures for the conduct of military (OAT) operations and for OAT/GAT compatibility need to be commonly applied within EUROCONTROL* Member States.

* with a possible extension to ECAC Member States

Pre-Tactical and Real-time Airspace Management

Recommendation 4

Investigate methods to improve the usage of Conditional Routes.

Recommendation 5

Investigate a more effective method for the notification and dissemination of airspace status during pre-tactical (ASM Level 2) and real-time (ASM Level 3) phases.

Provision of Air Traffic Services

Recommendation 6

Investigate a common content, format and methods for automatic exchange of GAT and OAT flight data, both nationally and internationally, to be adopted by all EUROCONTROL* Member States.

* with a possible extension to ECAC Member States

Recommendation 7

Identify the most efficient civil/military en-route ATS operational arrangements in the high density airspace of EUROCONTROL Member States.

Safety

Recommendation 8

Investigate the need to address formally safety issues within ATM civil-military co-ordination at European level.

FUA Review

Recommendation 9

Develop both national and international review processes to ensure the most effective use and evolution of the FUA concept.

2 INTRODUCTION

2.1 Purpose of this report

2.1.1 The EUROCONTROL Provisional Council (PC), at its 8th Session on 13 July 2000, acting upon a recommendation of the Performance Review Commission (PRC), *"requested that the Director General examine the implementation status of the Flexible Use of Airspace (FUA) in European States and put in place a programme to ensure best practice and to foster integration of civil-military air traffic services, thereby making real-time information readily available to civil and military authorities to enable them to maximise the use of airspace and existing capacity".* The EUROCONTROL Commission has approved the Provisional Council's conclusions with respect to the recommendations of the PRC, including the request described above.

2.1.2 The Performance Review Unit was subsequently requested to initiate the Project to Improve Civil-Military Co-ordination. The project has been divided into two phases. The first phase, co-ordinated by the PRU, is the subject of this report and was governed by the project objectives and scope listed in Annex 1. Phase 2 "Improving Civil - Military Performance" will follow the adoption of this report and will involve the development of concrete proposals to implement the programme referred to in the Provisional Council's request. However, these proposals should be incorporated into existing projects and programmes (e.g. The Transition Plan for the Implementation of the EUROCONTROL Airspace Strategy for the ECAC States).

2.2 Background

Civil traffic growth and the evolution of military needs

2.2.1 Over the last 10 years, GAT flights grew by 60% and traffic volume (total IFR distance flown) by 80%.

2.2.2 Hub and spoke operations have become the prevalent airline operation mode, putting increased pressure around major European hubs. Arrival and departure traffic demand is concentrated in 3-4 waves during the day. Outside the wave, point-to-point connections keep traffic demand high. Capacity constraints at major European airports have favoured the growth of nearby regional airports. This fact has further increased traffic complexity in major European terminal areas, already under the pressure of traffic at major airports.

2.2.3 In addition, the new generation of regional transport aircraft has increased the flight level occupation around Flight Level 310.

2.2.4 Compared to the 1980's military activity has reduced considerably all over Europe, after the dissolution of the Warsaw Pact[3]. According to new military strategies, the volatility of military traffic (e.g. dramatic increase in a very short period of time during the Kosovo crisis) has increased due to the need

[3] 1st July 1991

to deploy forces at short notice. They also result in the requirement for larger training areas because of the need to conduct multinational exercises. Moreover the new generation of military aircraft also requires larger areas for day-to-day activity at upper flight levels, but generally for a reduced time.

2.2.5 The military authorities have progressively modified the location of military units in Europe in line with current military strategies, but decisions are often limited by other considerations:

- The military units are very well integrated in the social and economic life of the local community and the closure of a base can be detrimental for the local economy.
- The installation of military sites in new locations may raise environmental concerns.

2.2.6 In addition, each European State uses many different types of weapons systems and therefore must plan a broad range of military training activities, irrespective of the State's geographical size and location. This generates a high demand due to the diversity of the areas (in size, in altitude, in location) that may be requested by each State.

The pressure on European Air Traffic Management

2.2.7 First of all, the planning of land use installations (civil and military airports, surface-to-surface shooting, army exercises, etc.) has an impact on traffic complexity and on the location of military training areas. This planning is not harmonised at European level, so there is no supra-national filter to the traffic complexity which can be generated where you have very ordered land use planning at national level, but somewhat less ordered at European level.

2.2.8 The hub and spoke waves and the demand at regional airports require more airspace areas in order to create specialised routes, which reduce ATC workload. This has increased the interaction with military airports, which have become "suddenly close" to civil airports.

2.2.9 In order to locate larger military training areas at upper flight levels as requested by the new military aircraft generation, military airspace planners have increased cross-border initiatives. Some cross border areas have been implemented and many are going to be implemented in the near future. Many military areas are located at the boundary of States, so the merging of existing national areas into cross-border areas is a natural consequence. This merging is usually achieved by the addition of existing areas on both sides of the common border. However, the management of such airspace structures is more challenging in order to alleviate the pressure on civil traffic.

2.2.10 While military demand can be satisfied within national airspace with some cross-border arrangements, civil traffic demand cannot be satisfied unless planning the European airspace as a network. These two different perspectives could lead to different views on airspace design.

2.2.11 The Kosovo crisis has highlighted the need to increase the flexibility of the European ATM system when faced with unexpected events. While the military authorities have expressed full satisfaction for the support of the ATM system

to the crisis operations, civil aviation experienced a dramatic year in terms of costs and loss of profits.

Civil and military requirements

2.2.12 It is important to recognise that military air traffic has similar airspace needs to civil traffic, with some specific exceptions (see Table 1).

	Civil Traffic	Military Users
Similar Needs	Safety, ATC capacity, Flight Efficiency, Cost-effectiveness	
Specific Needs		Temporary Segregated Airspace. Access to any part of the airspace at any time.

Table 1: Civil and Military Needs

2.2.13 Both civil and military aviation activity occurs during peacetime, but in the case of the military, airspace operations are conducted to prepare military forces for crises or war time. Consequently, military authorities evaluate their airspace needs from a different perspective than civil aviation.

2.2.14 While the military is mostly concerned with attaining the highest level of military capability, the first priorities for civil aviation are commercial, successful operation within the safety requirements. The question arises whether the European ATM System will be able to sustain civil traffic growth and military needs at the same time. In order to satisfy this requirement, Air Traffic Management has to provide the maximum level of ATM efficiency and effectiveness while maintaining or improving safety standards. However, in certain parts of European airspace, or at certain periods, it might not be possible to do so. Therefore, political authorities are invited to establish clear guidance in prioritising the trade off between the conflicting interests of these two major airspace users while still considering other airspace users.

2.2.15 The next section illustrates the main goal to be achieved by civil/military co-ordination.

2.3 Civil/Military co-ordination: main aspects

2.3.1 According to the ASM Handbook for the application of the FUA concept Civil-military Co-ordination refers to the communication between civil and military elements (human and/or technical) necessary to ensure safe, efficient and harmonised use of airspace. When reading this report, it is worthwhile to bear in mind the issues that civil military co-ordination should address. They are as follows:

1. Maintain high safety standards by providing separation assurance between GAT and OAT at all times and by preventing unauthorised penetration of temporary segregated airspace.
2. Manage the European airspace as one continuum by:
   - conducting a maximum of military operations without segregating the airspace, while taking due regard of safety for General Air Traffic;
   - segregating the airspace to accommodate hazardous activities on a temporary basis only during the necessary period in order to cause the minimum disruption for other users.

3. Establish adequate airspace structures and management rules to support day-to-day operations.

2.3.2 It is also necessary to implement the most efficient ATM organisation to support the tasks associated with the above-mentioned issues and to provide the capacity expected by both civil and military users. The cost effectiveness of such an organisation could be a matter of consideration in some States.

3 THE INSTITUTIONAL FRAMEWORK

3.1 Introduction

3.1.1 This chapter identifies the international institutional levers that could be used either to influence the external factors, or to remove the constraints, affecting civil-military co-ordination.

3.1.2 A number of institutions affect civil and military aviation with varying levels of authority and have an influence on airspace regulation and service provision. The key international institutions and their connection with civil and military ATC and airspace issues are outlined briefly below.

3.2 ICAO

3.2.1 Article 3(a) of the Convention on International Civil Aviation (the "Chicago" Convention) of the International Civil Aviation Organization (ICAO) states that: *"This Convention shall be applicable only to civil aircraft, and shall not be applicable to state aircraft"*. However, state aircraft are not completely outside the scope of the Convention since the Contracting States have expressly undertaken, *"when issuing regulations for their state aircraft, that they will have due regard for the safety of navigation of civil aircraft"* (Article 3(d) of the Chicago Convention refers. In order to fulfil this requirement, a State may decide to apply the Chicago Convention to state aircraft.

3.2.2 Safety also requires an interface between ATM and Defence. For instance, when Air Defence carries out exercises in segregated airspace, its surveillance equipment should be harmonised with that of ATM, in order to maintain the agreed separation of aircraft by the boundary of the segregated area. For this purpose, ICAO Annex 11 specifies (Articles 2.16 and 2.17) that air traffic services authorities and military authorities shall maintain close co-operation, and co-ordinate arrangements for activities potentially hazardous to civil aircraft.

3.2.3 The ICAO Assembly is considering civil military co-ordination as a key element for ATM. The 32nd Assembly (September/October 1998) approved Resolution A32-14. The Appendices attached to this resolution constitute the statement of the continuing policies and associated practices of ICAO. Appendix P of the Resolution, entitled "Co-ordination for Civil and Military Air Traffic" stipulates that whereas the integration of the control of civil and military air traffic may be regarded as the ultimate goal, an immediate approach shall be for States to arrange for the common use by civil aviation and military aviation of airspace as well as of certain facilities and services in order to ensure the safety, regularity and efficiency of international civil air traffic.

3.3 NATO

3.3.1 Generally NATO relies on Member States for Civil Aviation/Defence interface during peace-time. It does, however, actively promote the harmonisation of the European ATM System and OAT Rules in order to facilitate military activity, be it main multinational exercises, large scale military deployments,

or the handling of a crisis situation in a limited area of Europe. NATO may also appreciate an enhancement of ATM flexibility in order to provide ad hoc ATC capacity increases to cope with unexpected military deployments or the handling of crisis situations.

3.4 European Union

3.4.1 The European Commission's High Level Group's report on the Single European Sky (issued in November 2000) states that the civil and military ATM bodies should participate as equal partners in the regulation and management of European airspace. The European Commission envisages using Community instruments for the implementation of its Single Sky proposals. However, the European Union is still studying how military ATM issues and civil/military co-ordination will be dealt with.

3.5 ECAC

3.5.1 As stated in its Constitution, the overall objective of the European Civil Aviation Conference (ECAC) is to promote the continued development of a safe, efficient and sustainable European air transport system; as such, its involvement shall be confined to those matters relevant to this objective. Nothing prevents it from addressing military ATM issues, although ECAC provides a forum for the European Ministers of Transport and Directors General of Civil Aviation. In any event, the functions of ECAC are solely consultative and its resolutions, recommendations and other conclusions shall be subject to the approval of governments.

3.6 EUROCONTROL

3.6.1 EUROCONTROL is an intergovernmental organisation dedicated to the efficient organisation and safe management of airspace for both civil and military users. In this capacity, the Organisation takes due account of defence interests in a pan-European framework, operating beyond the territorial limits of individual Member States. Decisions taken are binding on the Member States and may affect the military interests of a State as a result. Consequently, the Revised Convention established the Civil-Military Standing Interface Committee (CMIC) to provide advice to the Provisional Council on any issue affecting the civil military interface in EUROCONTROL Member States. In addition, the EUROCONTROL Military Expert Unit (EMEU) was established in order to provide military expertise within the Agency to various programme managers.

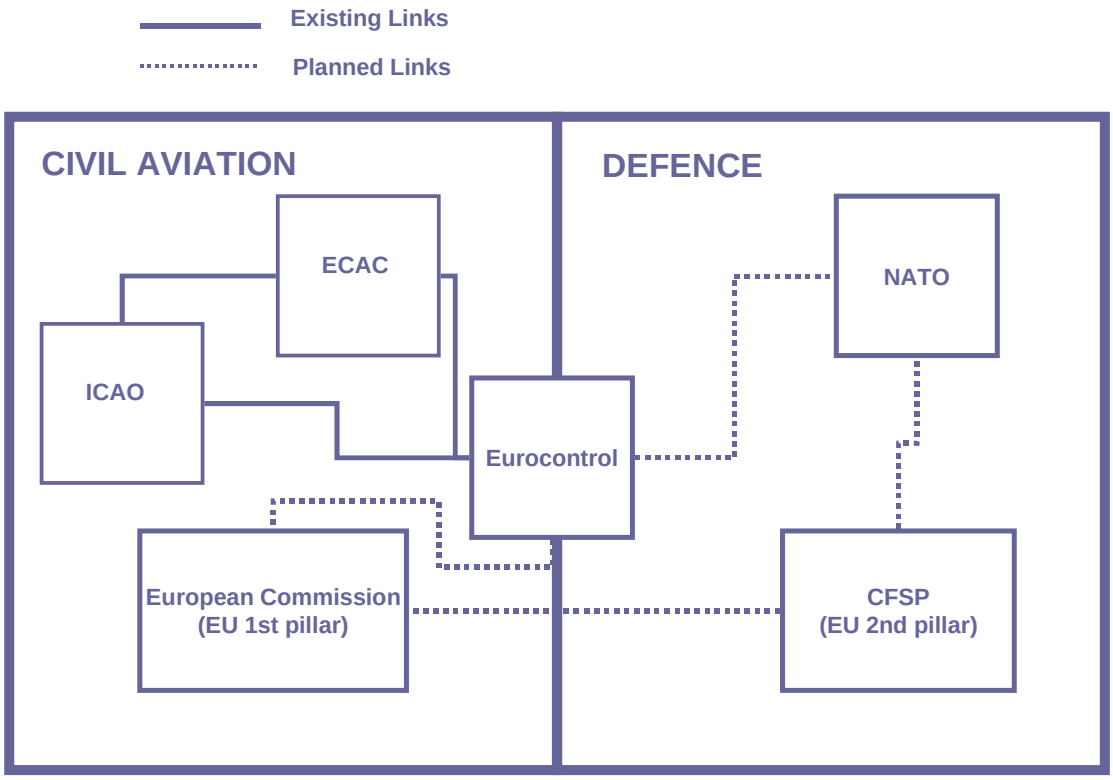

Figure 1: Actual network co-operation

3.7 Conclusion

3.7.1 All of the aforementioned international organisations (ICAO, NATO, European Union, ECAC and EUROCONTROL) have responsibilities that may affect the civil aviation/defence interface and air traffic management. However, EUROCONTROL, due to its status as a civil-military organisation, is uniquely placed to play a pre-eminent role in the field of civil-military co-ordination.

3.7.2 However an effective network of co-operation between international institutions (ICAO, ECAC, NATO, EU and EUROCONTROL) is not yet in place. Whenever an international co-ordination would be necessary, the role of international organisations is still weak.

4 THE FLEXIBLE USE OF AIRSPACE CONCEPT

4.1 Introduction

4.1.1 Article 2(m) of the EUROCONTROL Revised Convention requires the Organisation to support the improvement of flexibility in the use of airspace between civil and military users.

4.1.2 One of the major objectives of EATMP is the more efficient use of airspace by civil and military users and the potential for ATM to increase the capacity of the air traffic system through the implementation of the Flexible Use of Airspace (FUA).

4.1.3 The FUA concept provides that airspace should no longer be designated as either military or civil airspace but should be considered as one continuum and used flexibly on a day-to-day basis.

4.1.4 The survey reviewed the implementation status of FUA in Europe and has taken account of the related work of other EUROCONTROL groups such as the Airspace and Navigation Team (ANT). The programme of visits and questionnaires has addressed this issue in detail. Particular emphasis was laid on ascertaining day-to-day practical experience and application through site visits and meetings with airlines and other stakeholders.

4.1.5 The FUA Concept is based on three levels of airspace management (ASM) which are defined by the Airspace Management Handbook:

ASM Level 1: Strategic Airspace Management
ASM Level 2: Pre-Tactical Airspace Management
ASM Level 3: Tactical Airspace Management.

Airspace Management Phase	Time and Means of Publication	Priority Rules and Negotiation Procedures
ASM Level 1 Strategic Airspace Policy and Planning (e.g. co-ordination of major events such as large scale major exercises)	Until the day before operations (D-1, 0600) Any type of AIS publication can be used.	Established by the ASM level 1 in the State.
ASM Level 2 Pre-tactical Airspace Allocation	Day before operation D-1 0600 --- D 0600 AUP to be issued by D-1 1400 to cover the period D 0600 to D+1 0600.	Established by the ASM level 1 in the State.

Airspace Management Phase	Time and Means of Publication	Priority Rules and Negotiation Procedures
ASM Level 3 Real time use of airspace	Day of operations D 0600 --- D+1 0600. Any cancellation of airspace allocated in the AUP would be notified through a UUP issued at least one hour before change in affected airspace. However the airspace status in real-time may differ from the one published in the AUP or UUP. Thus ATC shall ensure that pilots in command receive pertinent information on the status of airspace. In such a case, arrangements shall be in place to inform both the military and civil ATC about the status of airspace in real-time, when such units are not directly responsible to manage the airspace.	Established by the ASM Level 1 and specified in local agreements.

Table 2: Time and means of publication

4.2 ASM Level 1: Strategic Airspace Management

4.2.1 According to the FUA concept, a permanent high-level policy body should be responsible for formulating a national policy and framework for airspace management matters. ASM Level 1 also spans the area from the collection of airspace requirements to the airspace design publication (see Figure 2 below).

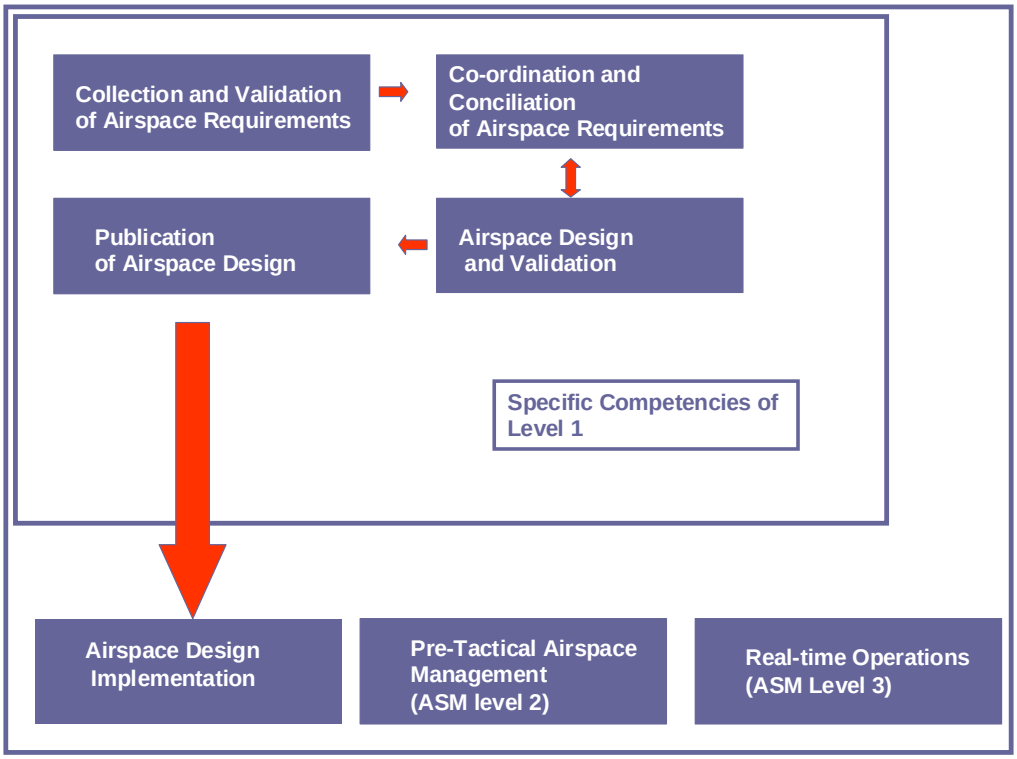

Figure 2: Airspace requirements and ASM process

4.2.2 The ASM Handbook lists and identifies the core functions of the Strategic ASM Level 1, disregarding issues relating to the separation between regulatory and service provision.

4.2.3 According to the ASM Handbook, this permanent national high-level policy body is required to establish a joint civil and military process to perform, at a minimum, certain functions. These include the following:

1. reassess the national airspace structure and ATS route network annually with the aim of planning (as far as possible) for flexible airspace structures and procedures;
2. validate activities requiring airspace segregation, and assess the level of risk for other airspace users;
3. periodically review the national airspace needs and (where applicable) cross-border airspace utilisation;
4. periodically review the procedures and efficiency of ASM Level 2 operations, the submission of airspace requests by the national Approved Agencies (AAs), the negotiating procedures and priority rules for AMC airspace allocation).

4.2.4 The ASM Level 1 policy body also has the task of co-ordinating major events planned long before the day of operation (such as large scale military exercises that require additional segregated airspace), and notify these activities by AIS-publication. Depending on the State's ASM organisation, this co-ordination may take place in the AMC or another ASM organisation. Major events are only occasional requirements, thus they require only 'temporary' airspace design implementation.

4.3 ASM Level 2: Pre-Tactical Airspace Management

4.3.1 ASM Level 2 is the act of conducting operational management within the framework of pre-determined airspace structure, priority rules and negotiation procedures defined by Level 1 (See Table 2)

4.3.2 The ASM Handbook recommends only the application of priority rules and negotiation procedures during the pre-tactical phase. This will be addressed in section 7.2.

4.3.3 ASM Level 2 involves the day-to-day management and temporary allocation of airspace and the communication of airspace allocation data to all parties involved through a daily Airspace Use Plan (AUP). National or sub-regional Airspace Management Cells (AMC) undertake ASM Level 2 activities. These may be full or part-time units jointly staffed by civil and military personnel.

4.3.4 In order to promulgate the Airspace Use Plan (AUP) at the agreed time (by 1400 on the day before operations), the planning of military activity (e.g. wing squadrons, naval shooting units, etc.) must be prepared in advance. Equally the organisation and technical systems of the ATFM, ATC, AIS and AO flight planning units should be adequate in order to make use of any airspace released for civil operations (i.e. Conditional Routes).

4.3.5 Upstream, during ASM Level 1 activities the design and categorisation of conditional routes should be done in such a way as to allow significant

reduction in flight time and significant savings in ATC delays. Where these benefits cannot be achieved, for instance, because the TSA/CBA is located in a zone of no interest for GAT, then a pre-tactical activity should not apply to such an area and military units should use the zone freely.

4.4 ASM Level 3: Tactical Airspace Management

4.4.1 The FUA concept provides that tactical operations conducted in real-time shall follow the rules decided at the Strategic ASM level 1.

4.4.2 Normal ATC tasks are carried out in real-time operations, and in particular the following in the context of FUA:

- Management of the airspace in real-time.
- Separation of GAT/OAT from temporary segregated airspace.
- Provision of separation between GAT and OAT, which fly in the same controlled airspace or when GAT penetrates an active military training area.

4.4.3 Many activities have to be conducted in accordance with the rules and procedures and be supported by specific technical systems in order to fulfil these tasks (co-ordination between ATC units and between ATC and Air Defence Units, monitoring of active military areas, etc.). The questionnaires, interviews and visits have assessed how these activities are conducted and whether the tasks are adequately completed.

4.4.4 The ASM Handbook only covers common aspects applicable at ASM Level 3, leaving the specifics to the definition by the ASM Level 1 body For example, OAT flight rules are decided at national level. Different rules from one State to another may have an impact on civil/military co-ordination. The point will be considered in section 6.8.

4.4.5 The method of conducting real-time operations has a direct impact on safety. For this reason, the link between civil/military and safety will be explored in Chapter 8, which reports on the status of real-time co-ordination.

5 STATUS REPORT ON FUA - INTRODUCTION

5.1 Introduction

5.1.1 This Status Report on FUA is based on visits to nine States (Belgium, France, Germany, Hungary, Italy, Netherlands, Spain, Sweden, United Kingdom) supplemented by interviews and questionnaires. All existing documentation was reviewed by the team, which deems that the findings and issues arising from this survey are a good representation of the status of FUA in Europe.

5.1.2 In this report there are additional facts that complete the picture of FUA which have already been provided in the Review of the Progress on FUA Implementation produced by the Airspace and Navigation Team (ANT) and in the EUROCONTROL Airspace Strategy for the ECAC States.

5.1.3 The Status Report on FUA only refers to the 30 out of 38 ECAC States that have implemented FUA.

5.1.4 In the following Chapters, the three ASM levels (strategic, pre-tactical and real-time) are presented.

6 STATUS REPORT ON FUA - ASM LEVEL 1

6.1 Introduction

6.1.1 Strategic airspace management has been assessed at the following crucial nodes:

- The political and organisational structure responsible for strategic airspace management (sections 6.2 - 6.4).
- A brief description of airspace design practices (section 6.5).
- The methods of assessing the national airspace structure (section 6.6).
- The misuse of FUA concept (section 6.7).
- The rules to handle the interaction of GAT/OAT (section 6.8).

6.2 The Political Level

6.2.1 In most States, the Minister of Transport and the Minister of Defence share responsibility for national airspace policy, while in other States the Minister of Transport is responsible for this policy in peacetime.

6.3 The Joint National High-level Policy Body (Joint Committee)

6.3.1 All of the States visited, with the exception of Sweden, have established a joint national high-level policy body as recommended by the ASM Handbook. The Swedish CAA, which is responsible for airspace in peacetime, has all the requisite skills to take into account, and to fulfil, the necessary military requirements. Therefore the High-level Policy Body is placed under the responsibility of the Swedish CAA. However, the Swedish armed forces can, if necessary, exercise their right of veto.

6.3.2 In the remaining eight States, the high-level body is divided into a Joint Committee and a working structure. The Joint Committee includes representatives from MoD and MoT and sometimes from ANS providers, and holds its meetings on a regular or ad hoc basis. Where authority has been delegated to the working structure, the Joint Committee does not meet very often.

6.4 Working Structure and Practices

6.4.1 At working level, working groups or task forces in most cases meet whenever necessary. They are tasked by the Joint Committee and in some cases they are granted delegations of decision. However, one State (the United Kingdom) has established the Directorate of Airspace Policy, a permanent joint unit staffed by both civil and military staff, in order to deal with these issues.

6.4.2 The delegation of competence from MoT and/or MoD to the national high-level policy body differs widely from State to State. In some States, for example, the ministerial level has retained responsibility for promoting the implementation, modification or cancellation of airspace structure. In others

this task has been delegated to the high-level policy body or even to its working level.

6.4.3 In Italy, the Operational Co-ordination Committee (Joint Committee) only meets to discuss and approve framework rules for airspace matters. The remaining Strategic ASM tasks are carried out by a 'Task Force', comprised of the Italian Air Force and Civil ANS[4] Staff.

6.4.4 In Germany, airspace design has been delegated to DFS (the civil-military ANS Provider) and AFSBw (the military airspace authority). DFS is responsible for publication of airspace design on behalf of the MoT. An airspace design issue will be submitted to the GeMA, the German joint committee, only if arbitration is necessary.

6.4.5 In France, all Strategic ASM tasks are endorsed at DNA (Air Navigation Directorate of CAA) and DIRCAM (Military airspace authority) level, both of which are the components of the French joint committee.

6.4.6 When Strategic ASM tasks are largely delegated by units/organisations responsible for providing ATS service, the strategic ASM is more responsive to changes in airspace requirements.

6.4.7 When Strategic ASM tasks are performed by a unit/organisation that has a mainly regulatory role, great importance is given to the equity and the fairness of the Strategic ASM process. For example, the Directorate of Airspace Policy in the UK has developed a sophisticated mechanism of consultation, which strives to ensure that any airspace modification is understood and accepted by all national parties involved.

6.4.8 International co-ordination of airspace domain subjects (concept, airspace management, airspace structures and ATM procedures) is performed by the Airspace and Navigation Team (ANT) in EUROCONTROL. The implementation of the agreed airspace design is then co-ordinated by regional groups, among which 6-States[5] and CHIEF[6] are the most relevant, since they operate in the core area of Europe.

6.5 Airspace Requirements and Design

6.5.1 The Strategic ASM tasks can be divided into the following categories:

- Collection and validation of airspace requirements.
- Conciliation of airspace requirements and Airspace Design.

6.5.2 Regarding the collection and validation of airspace requirements at national level, it is current practice in Europe to compile both military and civil airspace requirements together by the working structure of the Joint Committee. Only in the United Kingdom is each airspace requirement subject to formal validation before being co-ordinated with all airspace requirements. This reduces the risks of implementing an airspace design proposal that does

4 ENAV is the civil ANS Provider in Italy
5 Belgium, France, Germany, Netherlands, Luxembourg, United Kingdom
6 Switzerland (CH), Italy (I), Spain (E) and France (F).

not meet actual user' needs. *The joint collection of civil and military airspace requirements and their validation would appear to be best practice.*

6.5.3 However, in a minority of the States visited, these data are collected separately which means that each side does not know the other's requirements until they are addressed in an official forum. As a result, the effectiveness of an airspace design proposal may be reduced and create an excessive time lag between the formulation of an airspace requirement and its implementation.

6.5.4 It can happen that not all airspace requirements are taken into account when collecting them at international level. An example is the implementation of the CBA-1[7], which has clearly shown that not all airspace requirements were collected before designing and implementing it.

6.5.5 Equally the validation of each airspace requirement at international level can be problematic. For instance, there is some evidence that retaining specific routes and their associated revenue proved to be more important than improving the traffic flows alignment. This may affect military airspace requirements but certainly penalises route planning developed in a wider regional efficiency perspective.

6.5.6 The conciliation of airspace requirements, airspace design and its implementation cannot be analysed separately, as illustrated in Figure 3 below.

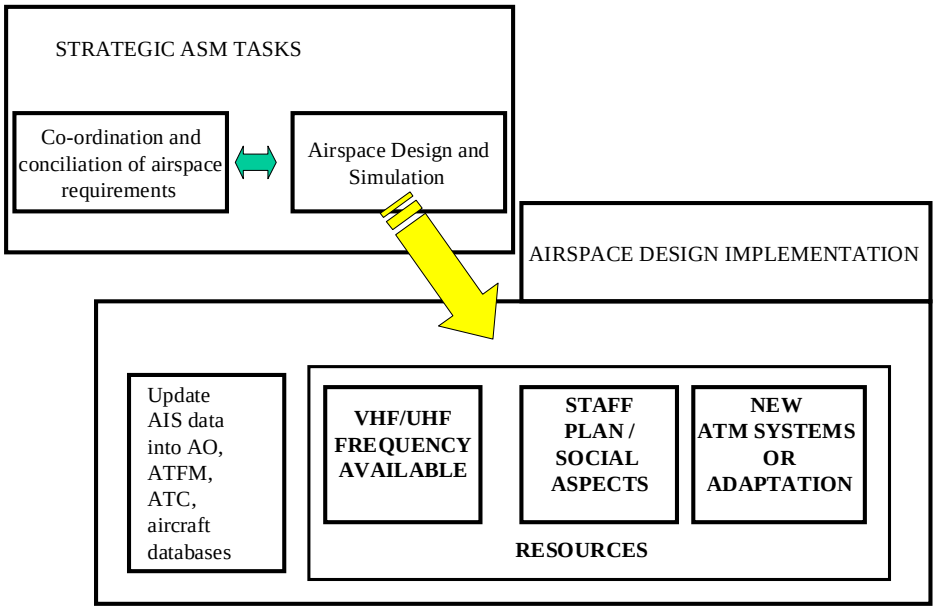

Figure 3: Airspace requirements and design process

6.5.7 Frequently a simulation exercise is used to assess one airspace requirement against another[8]. Showing expected reductions in ATFM delays or in ATC

[7] In 1999, the activation of CBA-1 in France-Belgium airspace resulted in ATFM delays experienced by UK traffic. The problem is currently under negotiation within the 6-States' Steering Group.

[8] For instance, in order to accommodate the requirements generated by the opening of Malpensa hub, a couple of proposals were developed: one with D44 area in place and the

workload is often the best way to convince decision-makers to favour one option against others, while the impact on the military is more difficult to quantify.

6.5.8 When an airspace design solution is agreed by responsible bodies, it sometimes implies the need for additional staff and the adaptation of technical systems. Also, the civil ANS provider may not have addressed staff implications through proper social dialogue.

6.5.9 At international level, States when committing themselves sometimes do not take into account the resource implications, the technical aspects and the deadlines for implementing the proposal. This could lead to delays in implementing a multinational airspace proposal.

6.5.10 At national level, the co-ordination of conflicting airspace requirements is generally successful. Although in some States there are formal rules for conducting the co-ordination process, experience shows that a good working relationship between the civil and military ASM units is the key pre-requisite for identifying solutions, especially for very difficult problems. It became clear from the interviews that, where good relationships are in place, external intervention was never requested despite an almost total absence of a formal co-ordination process.

6.5.11 Working practices in airspace design activities were assessed during the survey and the following categories were identified:

- Airspace design is performed jointly by the same airspace design unit.
- Airspace design is performed by two units (civil and military) but frequent daily contacts ensure the consistency of the work.
- Airspace design suffers the lack of proper working practices, common expertise and tools between civil and military authorities.

6.5.12 The first category is the optimal one, since a common airspace design unit strengthens a common approach to problems and avoids any misunderstanding that could arise due to the use of different tools for airspace design and validation.

6.5.13 At international level, airspace requirements may not be properly co-ordinated. The recent implementation of new structures on Germany has had an unforeseen impact on Belgian, Dutch and French airspace.

6.5.14 Accommodating all civil and military airspace requirements in this interface appears to be too challenging. There is no international authority that can impose a trade off. Where such circumstances occur, the problem could remain unsolved indefinitely.

6.5.15 Also, the time taken to approve airspace design proposals can vary greatly from one State to another. When the airspace design proposals are part of a multi-national project, such delays may jeopardise the implementation of a complete project.

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other with D44 withdrawn. The comparison shown that the latter would have reduced dramatically the ATC workload, but military requirements would have remained unfulfilled.

6.6 Assessment of the National Airspace Structure

6.6.1 In accordance with the spirit of the ASM Handbook, ideally the assessment of national airspace structure should include:

- Identification of non-compliant airspace structure to FUA concept. It would appear that there is a need for strong effort in this direction (see section 6.7).
- The systematic review of the consistency between the airspace attributes (e.g. airspace classification, route categorisation, temporary segregated areas) and the use of the airspace structure. When an airspace structure is rarely used (e.g. a Conditional Route or a permanently restricted area) then it should be re-categorised or withdrawn.
- The quantification of the benefits (flight time and delay reduction) provided to GAT, when the airspace is available to them (see paragraph 7.6.2).

6.6.2 The survey found that in many States assessment of the national airspace structure is not done in a systematic way. The modification of an airspace structure or of its attributes is done in a reactive way (when a requirement becomes very obvious). A modification will rarely result from a systematic review.

6.6.3 Systematic and quantitative analyses are rarely undertaken. Of course there are exceptions, but no State completely covers the three points mentioned above. The EUROCONTROL ANT has recently recommended *"to update the FUA ASM Handbook to include a requirement for a central national body to conduct a periodic review of FUA principles and their application".* This initiative will encourage the States to review the national airspace structure.

6.6.4 In addition, it should be noted that despite all efforts put into ensuring co-ordination of action taken by all ECAC States, the EUROCONTROL Agency currently has no formal responsibility for assessing the European airspace structure at European level.

6.7 Misuse of FUA Concept

6.7.1 The survey highlighted many inconsistencies in the interpretation of the FUA concept, the implementation and the denomination of airspace structures at European level.

6.7.2 In some parts of European airspace there are apparently no Temporary Segregated Areas (TSA). In fact, two ways to provide "segregated like" airspace for military activities are used. In the first case, the military areas exist and are known only by the ATC. They are not published and not made known to the airspace user. In the second case, the airspace out of the route network is accessible to GAT during normal military activity only after prior co-ordination, thus freezing the "off route" airspace for GAT.

6.7.3 Some States only consider areas to be manageable when activation can be discussed at AMC level. Some areas that are activated part-time are disregarded in the pre-tactical phase. In this case, they are not published in

the Airspace Use Plan and/or not released when de-activated. This is often the case for Danger and Restricted areas.

6.7.4 Many States are reluctant to change the classification of the segregated airspace to meet the denominations agreed in the FUA concept (e.g. TSA, CBA). Some States do not publish any military training areas but report them in internal documentation only (e.g. LoAs). As such, the ATC units are the only bodies aware of the status of these areas.

6.7.5 The FUA definition of three categories of Conditional Routes (CDR)[9] covers all the user requirements to distinguish any kind of non-permanent route. However, States still publish "complementary route to be used under certain conditions" or "permanent route available by night or during week end only".

6.7.6 In spite of the introduction of the FUA concept, many States continue to use older practices and terminology. As a result, FUA is simply a toolbox in which States take only what they find interesting to improve "tried and trusted" national practices.

6.8 Interaction between OAT rules and ATC operations

6.8.1 The terms General Air Traffic (GAT) and Operational Air Traffic (OAT) have been introduced to differentiate aircraft operating in accordance with ICAO regulations and those operating in accordance with specific national regulations. Although not recognised by ICAO, the terms OAT and GAT are generally accepted and have been approved by the EUROCONTROL Commission.

6.8.2 Each national "high-level policy body" is responsible for setting the airspace management rules and civil/military co-ordination procedures, which shall be applied during real-time operations (ASM Level 3). It is therefore necessary that military authorities establish rules, with which the OAT aircraft and ATC units should comply.

6.8.3 Different OAT rules could hamper the handling of an OAT flight with implications for both civil and military ATC, in particular in case of cross-border operations.

6.8.4 The fact that there is not a harmonised set of OAT rules at European level may have implications in managing the GAT/OAT interaction. For instance, when a military aircraft formation flies as OAT across Europe, it has to fly in accordance with different OAT rules. The maximum required distance between aircraft in the same formation may vary from country to country, thus leading to possible inadvertent breaches of the rules.

6.8.5 Due to the lack of consistency of the rules from one State to another, many military pilots may choose not to fly OAT outside their country, thus increasing the GAT. This issue is particularly critical in crisis situations when, in addition, those flights also require flow management exemptions.

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[9] There are three categories of CDR: CDR-1 with a fixed time of opening and closure, CDR-2 whose opening periods are negotiated in the pre-tactical phase, CDR-3, which can be made available only in real time.

6.9 Conclusions

6.9.1 At national level, the organisational structure to deal with strategic ASM tasks is in place. When Strategic ASM tasks are largely delegated to units/organisations responsible for providing ATS service, the strategic ASM is more responsive to changes in airspace requirements.

6.9.2 However, airspace design is rarely performed by a joint civil-military ASM unit. Although frequent daily contacts between two ASM units (civil and military) provide good co-ordination results, a joint unit seems to be the most efficient and easiest solution for avoiding misunderstandings that may arise by the use of different tools and practices and for a better understanding of mutual requirements. It is not the absence of formal mechanisms for co-ordinating airspace requirements that is the main obstacle for negotiating conflicting requirements, but the lack of effective working relationships.

6.9.3 With few exceptions, at national level the collection, co-ordination and conciliation of airspace requirements is done properly.

6.9.4 In many States the introduction of FUA has been merely a formal adaptation of older ASM practices to the new concept. This is clearly reflected in current airspace structures.

6.9.5 The role of EUROCONTROL in assessing the application of FUA throughout Europe and the implementation of airspace structures is limited. Regional co-ordination provides a partial answer to solving the problems between States.

6.9.6 At international level, airspace requirements are not always properly co-ordinated. Moreover, States when committing themselves do not necessarily take into account resource implications, technical aspects and the time needed to implement the proposal.

6.9.7 The lack of harmonised OAT rules at ECAC level may also have an impact on the civil/military interface, not only with possible operational constraints but also with potential safety implications.

7 STATUS REPORT ON FUA - ASM LEVEL 2

7.1 Introduction

7.1.1 This chapter takes into account the "Review of the Progress on FUA Implementation" (issued by ANT) and the study "Conditional Route Implementation- Phase 1: AO use of CDRs" (study undertaken by University of Westminster) in which the AO perspective on pre-tactical ASM is presented.

7.1.2 The following subjects are presented:

- The priority rules applied in the nine States visited (section 7.2).
- The pre-tactical procedures and arrangements currently in use (section 7.3).
- Distribution of airspace status information in ASM Level 2 (section 7.4).
- The relationship between airspace management and ATM performance (sections 7.5 - 7.8)
- The interface between ASM Level 1 and ASM Level 2 (section 7.9).

7.1.3 It is important to note that the 'management of airspace' should be conducted at all three levels (strategic, pre-tactical and real-time) and that each level should be derived from the previous one and has an impact on the next one.

7.2 Priority Rules

7.2.1 When it is not possible to satisfy the requirements of both military activity and the level of ATC capacity for civil traffic, it is necessary to establish priority rules. This is done by the Joint Committee.

7.2.2 This section presents the priority rules applied at ASM Level 2 (pre-tactical phase). The ASM Handbook requests the "national high-level policy body" to formulate and review the priority rules for airspace allocation. Current practices for allocating the airspace in the strategic and real-time phases are presented in sections 7.9 and 8.6 respectively.

7.2.3 In two out of the nine States there are no priority rules during the pre-tactical phase. The remaining States apply priority rules (Table 3):

Priority Rule at ASM Level 2	Number of States
Military users always have priority over civil users	5
Civil users always have priority over military users	1
Priority is assigned either to civil or military users based on pre-defined criteria and circumstances.	1

Table 3: States that apply Priority Rules

7.2.4 It is worth mentioning the priority rule applied in France. Airspace allocation is based on a negotiation process, but in specific circumstances (i.e. when traffic demand in an elementary ATC sector far exceeds its capacity) the civil requirement may take precedence over the military activity, resulting in the latter being restricted (e.g. opening of a CDR, partial or total de-activation of a TSA).

7.3 Pre-Tactical Procedures and Arrangements

7.3.1 Airspace management at pre-tactical level can range from a minor to a major role in the context of the FUA application of each State. The role of AMC can vary according to the following parameters:

- The amount of GAT and its degree of complexity.
- The volume of the military traffic demand in term of OAT flights and training missions.
- The airspace design configuration and structures decided at ASM Level 1.
- The degree of maturity of the application of FUA at pre-tactical and tactical (real-time) level.

7.3.2 Using these criteria it is possible to identify four different applications of airspace management at pre-tactical level, as shown in Table 4 below.

Application 1: No pre-tactical management (2 States)
Main Characteristics
1. Military areas are located out of the main civil flows OR the traffic complexity and/or the military demand is relatively low. 2. Absence of CDR 2. Predominance of CDRs-1 and permanent routes. 3. Many training areas are not published but are allocated in real-time after previous co-ordination between civil and military units. 4. Some basic planning tasks concerning D and R areas could be performed outside the AMC. 5. GAT is not significantly penalised by last minute changes in flight profile OR is constrained on the route network. 6. Excellent civil & military co-ordination and airspace management in real-time. 7. The AMC is virtual. Some staff are designated as AMC members but do not have day-to-day ASM tasks to perform.

Application 2: The airspace is simply notified by the military units to the AMC (3 States)
Main Characteristics
1. There are insufficient alternatives for military users in terms of training areas OR the airspace management is still at an early stage OR the training areas are of little interest to GAT. 2. The priority rule gives precedence to military needs and is strictly applied. 3. ASM Level 2 does not aim at airspace planning but focuses only on opening slots of CDR-2. In one case, the whole airspace is not released when available. 4. The AMC **is not** a joint unit. Either the military or the civil ATC runs the AMC and compiles the data. 5. There is no negotiation process.

Application 3: The airspace allocation is negotiated in the AMC in order to facilitate airspace management during the day of operations (2 States)
Main Characteristics
1. The military demand in term of airspace does not appear to be very high. 2. There are many alternative options in terms of military areas and, in one State, areas located at a reasonable distance from the initial demand. Few CDR-2, predominance of CDR-1 and areas that are manageable at ASM Level 2. 3. Good civil & military co-ordination and airspace management in real-time. 4. The negotiation process aims at identifying airspace and time slots out of hours and in portions of airspace where the civil demand is high. Then the military activity is planned accordingly in areas and time of low-medium civil demand. There is a flexible application of the priority rule in order to facilitate the negotiation process. 5. Whatever the planning at ASM Level 2, there is scope for flexibility at ASM Level 3. 6. There is a joint civil-military AMC, which has a good interface with airspace design activities and real-time ASM.

Application 4: The airspace allocation is negotiated in the AMC, but strong emphasis is given to adherence to the schedule (2 States)
Main Characteristics
1. The GAT demand is high and the volume of military requirements is also important. 2. Significant numbers of CDR-2 and areas managed at ASM Level 2. 3. Military requirements can rarely be accommodated if they deviate from the scheduled time and area planned at pre-tactical level. 4. The negotiation process aims at accommodating all civil and military requests in the pre-tactical phase. There is a flexible application of the priority rule in order to facilitate the negotiation process. 5. There is a joint civil-military AMC.

Table 4: Applications of Pre-tactical Airspace Management

7.3.3 The following considerations can be drawn from Table 4:

1. When airspace is managed mainly in real-time, the AMC is ideally placed to collect all available airspace information and to prepare a plan which would be the basis for real-time management. In two States, this activity is currently performed but outside the AMC.

2. In some States there are airspace structures which are not permanently closed or restricted and which are not pre-tactically managed because they are not declared as manageable.

3. Where the AMC manages the airspace, the AUP provides a very comprehensive picture of the planned activation of the airspace structures, which is a good basis for all the parties involved in real-time airspace management.

4. Where military and GAT requirements are not too demanding, the AMC is a facilitator for preparing real-time airspace management with the aim of indicating when and where the military activities could take place. However changes in the schedule are still possible during real-time operations. This is typically the way the airspace is managed at ASM Level 2 in Italy. Since there is no CDR-2, the AMC focuses on the activation of the less-penalising TSA in a given portion of airspace, the consequence of

which will be the tactical closure of the associated CDR-1. In compensation, the other alternative areas and their CDR-1 will remain available for GAT.

5. A strong application of pre-tactical airspace management (Application 4) is unavoidable when GAT and military demand are high. However, it would appear that some adjustments should be explored. It is likely that an extension of the process as close as possible to real-time operations, or an increase in the number of available alternatives, may lead to improvements in real-time airspace management, but this may further exclude AOs from taking advantage of this information, unless they also move the flight planning closer to real-time operations.

6. The negotiation process needs reliable forecasts to support civil requirements; they are not always available.

7. The adherence to the schedule clearly becomes more and more relevant when GAT demand increases.

8. In most of the States the pre-tactical management ends with the provision of information to the CFMU for the establishment of the CRAM, while in some States it may be refined nearly until the day of operations as long as CDR-2 is not concerned.

7.4 Distribution of airspace status information in ASM Level 2

7.4.1 There are two types of messages that give airspace status information during the pre-tactical phase. They are described in the table below[10].

Type of message	Acronym	Content	Area of promulgation	Issued
Airspace Use Plan	AUP	It notifies the daily decision of an AMC on the temporary allocation of the airspace within its jurisdiction.	State(s) concerned.	Day before operation at 1400 UTC
Conditional Route Availability Message	CRAM	A consolidated ASM message, which promulgate the AMC decisions on Conditional Routes (CDR) availability notified by the AUPs.	ECAC-wide and also available worldwide through internet.	Day before operation at 1500 UTC.

Table 5: Airspace status information

7.4.2 Airspace status information is useful for:

- ATFM pre-tactical (e.g. use available airspace in traffic distribution and re-routing).
- ATC capacity management (e.g. decide the ATC sector configuration of an ACC and the declared ATC capacity of each sector).
- Flight planning purposes (i.e. choose the optimal available route).

[10] Information extracted from the ASM Handbook.

7.4.3 The detailed information on the planning of military training areas is not always described in the AUP. Some States only include CDR information in their AUP. The AUP is not continuously updated. UUPs (Update Airspace Use Plan) can be released on the day of operations to notify any cancellation of airspace allocated in the AUP with at least one hour's advance notice.

7.4.4 The AUP is usually not available to neighbouring States. This makes the management of ATC capacity uncertain, particularly when the military areas are close to the border or where the areas are shared by more than one State (i.e. cross-border areas). For instance the planning of TSAs in Southwest Germany has an influence on capacity management in Amsterdam, Bruxelles, Maastricht and Reims ACCs.

7.4.5 The area of promulgation of the CRAM message is adequate to support flight planning activities. Provided that time synchronisation is enhanced, it could also support pre-tactical ATFM activities (see Annex 2 and section 7.8).

7.4.6 It has to be noted that both CRAM and AUP aim at reporting the planned use of airspace. However, this planning can be modified on the day of operations if there is no adverse impact on ATFM measures in force[11].

7.5 Airspace Management and ATM Performance

7.5.1 Military authorities are not very keen to release airspace unless they can be assured that it will be effectively used. Civil Aviation is also interested in knowing that the temporary segregated airspace is used effectively.

7.5.2 The measurement of airspace utilisation is an important way of increasing confidence between civil and military users and providers. For instance, when a military mission is cancelled in order to allow ATC capacity increases or for civil airspace use, the military units should have proper feedback showing that the airspace was effectively used. The measurement of airspace utilisation is also an essential feedback for improving AMC operations and the airspace design conducted at ASM Level 1. Many States collect information about airspace utilisation, but there is no comprehensive and standardised report at European level.

7.5.3 Figure 4 overleaf puts ASM pre-tactical in the wider context of ATM. The relationship between ASM pre-tactical and the other boxes of the diagram will be described in subsequent paragraphs.

[11] See Annex 7 of the ASM Handbook.

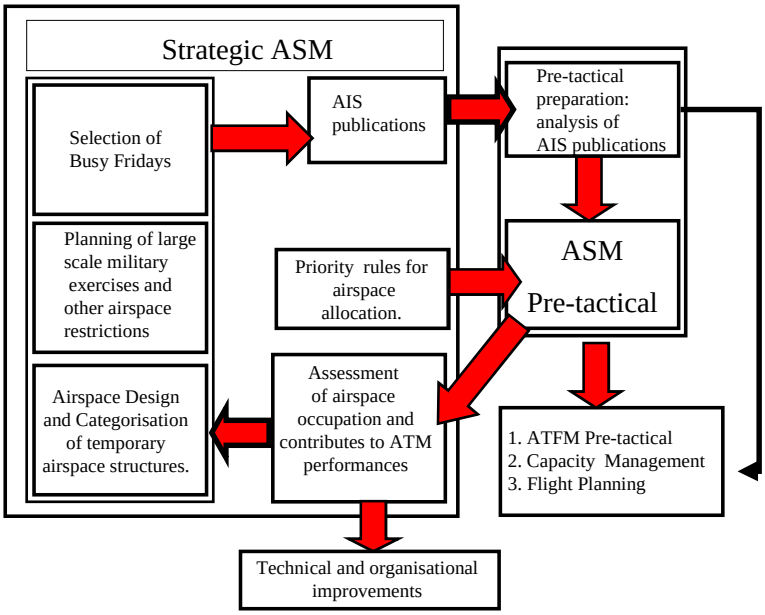

Figure 4: Strategic ASM and Pre-tactical ASM

7.6 Benefits Provided by Conditional Routes

7.6.1 The availability of airspace, and in particular of Conditional Routes, should provide the following benefits to GAT:

- Flight time reduction.
- ATFM Delay reduction (due to traffic redistribution and/or ATC capacity increase).

7.6.2 However these benefits should be assessed alongside the need to maintain a certain level of military capability and readiness, which is ultimately related to each State's security policy. The measurement of "Flight Time" and "ATFM Delay" reduction should be considered within the context of each State's priority rules, where they exist.

7.6.3 Considering that CDRs-1 are available most of the scheduled time and that CDRs-3 are not available for flight planning, the analysis was concentrated on CDR-2.

7.7 Analysis of CDRs-2 usage

7.7.1 The CDRs-2, when available, are not used to the maximum extent either in the ATFM process or in the flight planning.

7.7.2 At the moment, it is somewhat difficult to assess the benefit in terms of ATC capacity increase, because there is no common and objective way to link ATC capacity increases, CDRs-2 availability and the activation of military areas.[12]

[12] For example in two States, there are TSAs which are not crossed by any CDRs. In the first case the de-activation of such areas determines an ATC capacity increase, while in the latter it does not. Another example refers to the TSAs that are crossed by Conditional Routes. Their opening should have an impact on ATC workload and consequently on ATC capacity declared in the pre-tactical phase. In some States the opening of CDRs leads to an ATC capacity increase, while in others it does not.

7.7.3 Equally there is not a consolidated view on the contribution of CDRs-2 to delay reduction.

7.8 Major Constraints Affecting the Usage of CDRs-2

7.8.1 The University of Westminster's scoping study (referred to in paragraph 7.1.1) highlighted several reasons for the low usage[13] of CDRs 2. These are summarised below:

- Primarily, AOs interviewed have a general lack of confidence in the operation of CDRs 2 and remain unconvinced of the benefits.
- Most airlines have not equipped themselves to handle the CRAM message, variously due to its format, length and timing.
- Current AIS data inconsistencies have direct and indirect impact on the quality of CDR-associated data. Flight dispatchers often prefer permanent routes (and CDRs 1) as these are perceived to be more reliable.
- When the availability of airspace is notified through a CRAM message, the ATFM managers and flight dispatchers have already taken their decisions, based on permanent route structures and not-updated ATC capacity. None of the processes (ASM, ATFM and AO Flight Planning) is adequately time synchronised (see Annex 2 and 8.10). The issue is not only to synchronise ASM, ATFM and AO Flight planning, but to keep them synchronised (i.e. to move them closer to real-time operations at the same pace).
- The current CDR 2 'network' does not provide robust solutions for ATC/ATFM purposes, and is based too heavily on local solutions between waypoints, instead of addressing ATC capacity problems and offering complementary routes for pre-tactical or tactical flow management. AOs need city-pair-focused solutions which offer real ATFM delay reductions and/or flight time savings.

7.8.2 It is also necessary to consider carefully the implications of designing conditional routes across many military areas and States. Flight Dispatchers examine options based on integral routes, instead of viewing isolated segments of conditional routes. When an intra-European city-pair is under consideration, the CDR-2s national segments are not seen separately, but in the context of the whole city-pair flight plan. Designing Conditional Routes that pass through many military areas and States generate false expectations in term of route availability for the city pair served. This is due to two factors (see Annex 3):

- Different priority rules and negotiation processes apply in European States. A similar airspace gets higher priority in one State than in another. So one segment of a trans-national CDR could be opened, while the other remains closed.
- Military training activities of different States cannot be synchronised, so a CDR which crosses over different military areas, is open for a minimum time (as above some segments would remain open, while others remain closed).

[13] According ASM-SG estimate, around 50 % of potential users don't plan CDRs-2.

7.9 Interface between ASM Level 1 and Level 2

7.9.1 At strategic level, there are consolidated practices for dealing with civil requirements when planning large-scale military exercises. ANT informs the civil and military authorities at NATO NATMC, up to one and a half years in advance, of the foreseen busy days in the summer period to assist the planning of large military exercises.

7.9.2 Once military exercises are planned, the information is distributed through AIS publications (NOTAM, AIPs, etc.) some time in advance of the pre-tactical ASM phase. Many AMCs start the preparation of the ASM pre-tactical by analysing the existing airspace restrictions. The knowledge of existing airspace restrictions is also beneficial in the preparation of the ATFM Strategy and Pre-tactical phases. The survey did not assess either whether proper arrangements are in place between AMCs and FMPs, or whether the CFMU takes such information into account in preparing the ATFM plans. This point is important and it should be clarified in the second phase of the project.

7.9.3 Another activity in the strategic phase is the identification in advance of the Busy Fridays in the Summer season for which early access to Weekend/Conditional Routes could be agreed in principle, subject to recall four days in advance. These routes are known sufficient time in advance to be used for ATFM pre-tactical and AO flight planning activities.

7.9.4 The aviation community's views on the "Busy Fridays" initiative are mixed. Some AO and ANS providers consider this activity very fruitful. Others have raised concerns. In some cases, military activity was terminated to provide early access to CDRs on the Fridays arranged, but in the end there was no effective use of the airspace by GAT. In other cases the opening of CDRs provides an ATC capacity increase on Friday, which is not as necessary as it would be on other days of the week. The benefits provided by the "Busy Friday" initiative have not been quantified.

7.10 Conclusions

7.10.1 The finding of the survey can be summarised in the following points:

- The fundamental role of the ASM pre-tactical in the general context of ATM (ASM, ATC and ATFM).
- Different styles of ASM pre-tactical at a national level, which are justified from an airspace management viewpoint by different volumes of GAT and military demand and by different airspace structures.
- Some inefficiencies of the ASM pre-tactical management.

7.10.2 ASM Level 2 is the necessary step to prepare temporary airspace structures to support ATC, ATFM and flight planning activities.

7.10.3 Irrespective of whether or not there is negotiation, the ASM Level 2 process can provide all parties with a very comprehensive plan (i.e. the AUP) of temporary airspace-structures activation in order to conduct real-time airspace management at maximum efficiency. However, when such a plan is available, it is mainly communicated and used at national level. Where areas are very close to the border, or where cross-border structures exist, the

planning of the airspace is generally not forwarded to all the foreign ATC units involved.

7.10.4 ASM Level 2 is the most appropriate ATM process to provide extra ATC capacity, when problems are identified in advance because it enables negotiations and the implementation of mature solutions provided that:

- The design of temporary airspace structures enables ATC capacity increase and valuable alternative routes.
- Reliable forecasts are available for AMCs.
- All ATM processes (ATFM, ATC, AO Flight planning) are synchronised at regional or European level in order to exploit the airspace made available.

7.10.5 AMC staff play an important role in airspace management and rule making activities (Strategic ASM level). They provide valuable expertise, since they appreciate how rules and airspace structures impact on pre-tactical ASM and they have a good knowledge of the usage of airspace.

7.10.6 Each State has chosen a different style of pre-tactical operations according to the level of traffic complexity, military demand and the main characteristics of the national airspace structures. Clearly there is not a single pre-tactical style which is the best one in all circumstances. However, it must be emphasised that inefficiencies still exist and that the pre-tactical process is terminated, in many cases, too much in advance of the operations.

7.10.7 In some States, the pre-tactical management of airspace provides a framework in which the military activity requiring segregated airspace must take place during the planning slot. This may influence ATC capacity and traffic distribution. The need to adhere strictly to the schedule is unavoidable for military operations, which are conducted in areas of high traffic complexity. However, in some cases the pre-tactical ASM style may compensate for deficiencies at ASM level 3.

7.10.8 In some other States, the pre-tactical management of airspace provides a framework for the activity to be the less penalising for GAT, knowing that real-time adjustments are always possible.

7.10.9 Where the availability of the airspace is simply notified by the military units to the AMC, the negotiation process is not in place and the Level 2 management is limited to the notification of the CDRs availability.

7.10.10 The low usage of CDRs-2 is influenced by inefficiencies of pre-tactical ASM, and, additionally, by:

- Lack of AO confidence in operation and benefits of CDRs-2.
- Lack of technical tools/resources for AOs to process airspace status information.
- Lack of city-pair focus on CDRs-2.
- Shortcomings of content and distribution of AIS data (e.g. route availability).

8 STATUS REPORT ON FUA - ASM LEVEL 3

8.1 Introduction

8.1.1 As indicated in section 4.4, real-time operations provide for two different and complementary tasks:

- Airspace management in real-time.
- The handling of GAT and OAT in the same controlled airspace.

8.1.2 In each of the nine States visited (following interviews and the questionnaire), it was possible to visit at least one en-route ATC unit in order to observe real-time operations. It was therefore possible to make a high-level assessment of rules, procedures and technical systems that are used currently to accomplish the tasks.

8.1.3 As mentioned in paragraph 2.3.1, civil/military co-ordination should aim at conducting a maximum of military operations without segregating the airspace, except where necessary to minimise disruption for other users.

8.1.4 This can be achieved in different ways:

- Establish OAT rules and co-ordination procedures for conducting military operations in the same controlled airspace used by GAT.
- Reduce the period of airspace segregation to a minimum and establish "mobile" airspace reservations[14] to cover specific military operations such as air refuelling.

8.1.5 The selected solutions shall be safe and maintain the ATC workload at an acceptable level. However in some States, non-optimum procedures and systems used to manage real-time operations may result in an excessive period of airspace segregation.

8.2 The Handling of GAT/OAT in Controlled Airspace

8.2.1 The survey identified four types of en-route ATC organisational arrangements, described in Table 6 below. Some States apply both the third and fourth type either in different geographic zones or in different traffic situations.

TYPE 1: Segregated ATC System Segregated ATC Units (1 State) Main Characteristics
1. There are different ATC service providers (civil and military).
2. The military ATC and the Air Defence Control are located in the same operational room and they use the same system.
3. Therefore, there are two ATC architectures with poor data exchange between them. Military and Civil ATC units are located in different places.
4. Military ATC units are responsible for OAT and civil ATC units for GAT. The military

[14] ICAO ATS Planning Manual (Doc. 9426), par. 3.3.2.5

ATC unit is always responsible to provide the GAT/OAT separation.

5. The airspace under the responsibility of a civil ACC corresponds with portions of airspace under the responsibility of more than one military ATC unit.
6. The way to provide the ATC service is fundamentally different. In the civil ATC unit the controller is responsible to provide the ATC service in a specific portion of airspace (the ATC sector). In the military ATC unit, a certain number of flights are assigned to a controller from the entrance to the exit of the airspace under the responsibility of the unit.
7. Co-ordination between civil and military ATC controllers is done through third parties. There is no direct verbal or system co-ordination between controllers. The civil flight plan data are provided to the military units but they are not systematically updated and they do not provide any controller's intention. Controller's intention can be obtained through a third party (a position, which provides a lengthy co-ordination process and thus limited in the number of possible co-ordinations).
8. The displayed radar data differs between military and civil ATC units. In general, OAT is not displayed on the civil controller's positions.
9. The competency on specific portions of controlled airspace is rigidly defined. Although it is less and less used (RCA procedure) the GAT may be constrained to remain on the route structures when required in order to alleviate the military controllers workload in case military activity is high.

TYPE 2: (2 States)	**Integrated ATC Systems Segregated ATC Units**
	Main Characteristics

1. There are two ATC service providers (civil and military). Military and ATC units reside in different locations.
2. The military and civil ATC systems have similar functions and the level of data exchange is good. Updated flight plans and controllers intentions are exchanged.
3. Civil and military ATC positions use the same data and have the same display presentation. Active co-ordination is performed directly between the ATC positions involved using telephone or automated tools.
4. The airspace under the responsibility of a civil ACC unit corresponds with the area of responsibility of just one military ATC unit.
5. Military ATC controllers are responsible to provide the ATC service either to assigned flights within the ATC unit or for a given portion of airspace (ATC sector).
6. Military and civil ATC units are responsible for OAT and for GAT respectively, with minor exceptions. Military units are responsible for GAT/OAT separation, but this could be delegated to civil ATC in specific circumstances.
7. The GAT is generally constrained to remain on the route structure during military operations. The competency on specific portions of controlled airspace is, in general, rigidly defined during the hours of military activity. In addition in one State the military ATC is responsible for the airspace "off route", Civil ATC is responsible for the airspace "in the route network". When military demand is low or absent such procedures can be suspended (Reduced Co-ordination procedure–RCA).
8. Civil controllers keep the flight plan constantly updated and input their ATC intentions into the system. In addition "pre-defined windows" are used.

The need to keep both civil and military ATC workload at an acceptable level is strongly considered in defining ATC procedures. Some of these (e.g. the use of predefined "windows") alleviate the co-ordination tasks for both military and civil controllers.

TYPE 3: A single ATC System Co-located operations (3 States) Main Characteristics
1. There are either two ATC service providers (civil and military) or one ATC civil-military integrated service provider. The ATC staff is co-located in the same ATC unit.
2. There is a single ATC system with a good level of data exchange. In general, the OAT flight plans are inputted and updated in the Flight Data Processing system. However controllers' intentions are usually not inputted.
3. The military and civil components of the ATC unit are responsible for the same area of responsibility.
4. There are few military ATC sectors, each of them overlapping few civil sectors. Military ATC sectors are generally responsible for OAT and civil ATC sectors for GAT. However, in some cases traffic may be exchanged between controllers, if required, in order to alleviate the co-ordination tasks.
5. The military ATC is responsible for providing the GAT/OAT separation, but this can be returned to the civil ATC in specific circumstances.
6. The controllers decide tactical solutions aimed at reducing ATC workload and constraints for aircraft manoeuvres at the minimum. Co-ordination is done directly between the controllers involved using telephone, automated tools or side-to-side communication.
7. In 2 States GAT is not constrained to fly in the route structure: it can be vectored off-route without specific co-ordination. When an OAT flight needs to access the common controlled airspace, verbal co-ordination is often sufficient. In other cases a "corridor" or "pre-defined windows" can be used.

TYPE 4: A single ATC System One ATC Sector, one ATC team (3 States) Main Characteristics
1. There are either two ANS providers (civil and military) or an ANS integrated service provider. ATC staff are located in the same operational room of the same ATC unit.
2. There is a single ATC system with a good level of data available. The Flight Data Processing system needs to keep an update of OAT flight plans.
3. There is only one ATC sector, which serves a given block of airspace.
4. Each sector deals with GAT and OAT and the controller may be a single controller rated for handling both GAT and OAT or a team of two executive controllers (usually one civil and one military).
5. In addition a special handling position may be activated to control specific military activities (e.g. air refuelling or missions participating in real operations). In that case the co-ordination is of the same nature as in the aforementioned model.
6. In general, GAT is not constrained to fly in the route structure; it can be vectored off-route. Controllers decide tactical solutions aimed at reducing ATC workload and constraints for aircraft manoeuvres to a minimum.

Table 6: Four Types of En-route ATC Organisation

8.2.2 The following considerations can be drawn from Table 6.

1. It would appear that the existence of two ATC architectures seriously constrains the effectiveness of real-time operations.

2. ATC systems with similar functions and advanced data exchange or a single system enabling civil and military controllers to work with the same radar picture and the most accurate flight plan information is the prerequisite for an effective and safe handling of GAT and OAT using the same airspace.

3. Where the ATC units are segregated and the co-ordination is efficient, the following functionalities are in place:
   - The same radar picture: all the fights displayed with the same minimum level of information to both civil and military controllers.
   - The availability of permanently updated flight plans and controllers' intentions from the civil ACC for the benefit of the military units (the ones in charge for the GAT/OAT separation).
   - A direct telephone line between controllers operating in the same or neighbour airspace.

4. The use of the airspace "off route" by GAT is less constrained, when operations are co-located (third model) or when there is a single ATC unit (fourth model). OAT keeps at least the same degree of freedom.

8.2.3 In Type 2 (integrated ATC systems, but segregated ATC units) and Type 3(integrated ATC systems and co-located operations), the efficiency of the overall ATM system depends very much on the co-ordination tools and procedures which have been established. The solutions identified during the visits are described in section 8.4.

8.2.4 The co-ordination process is more complex and difficult when the civil and military ATC units have different areas of responsibility. The ATC controllers might have difficulty to identify with whom to co-ordinate. This complexity could be further exacerbated, when the ATC units apply different working methods.

8.2.5 In Type 3 (co-located operations), civil and military controllers may be qualified to handle both OAT and GAT. Currently the OAT flight may be handed over to the civil controller or vice versa in order to alleviate the co-ordination when the situation is complex. This possibility would be probably also applicable to the handling of non-compliant military aircraft flying GAT (e.g. BRNAV, RVSM) when the civil controller workload is very high or to the handling of some OAT flights by civil controller in particular circumstances.

8.2.6 As has been established in some German centres, Type 4 could enable a lot of flexibility in addition to the effectiveness of operations. The controllers are rated for both types of traffic. If the cumulated GAT and OAT demand stays at a reasonable level the sector is controlled by one executive controller, while during normal military activity, the sector may be handled by a "civil" controller and a "military" controller. When some specific activities cannot be easily accommodated by the standard sector, a special position maintaining close co-ordination with the correspondent sectors, can be activated to handle such an activity (e.g. large scale exercises, air refuelling involving two or more sectors).

8.2.7 When real-time civil/military co-ordination is efficient, ATCOs normally agree to move the aircraft generating the least trajectory change in order to prevent potential conflicts.

8.3 Cross-border co-ordination

8.3.1 The survey has identified frictions at States' borders, particularly between organisations that do not use the controlled airspace in the same manner. This is particularly the case when cross-border areas have been implemented or delegation of ATS is in place. Procedures to manage the interaction between GAT and OAT in these portions of airspace are not always defined and applying national practices may be inconsistent with the other State's way of working.

8.3.2 Real time co-ordination also suffers from the lack of flight plan information and controllers' intent when other States are involved although being very efficient when dealing with national data.

8.4 ATC co-ordination procedures and tools

8.4.1 The objective of such tools and procedures are two-fold:

- Provide the appropriate information to the controllers in order to maintain a high level of safety when managing the GAT/OAT interaction.
- Reduce the ATC workload and constraints for aircraft manoeuvres to the minimum.

8.4.2 Although the tools and procedures described hereunder are applied in specific ATC organisations, they could be adopted and implemented in other contexts. However, their efficiency strongly relies on the level of compatibility and the communication capabilities between ATC technical systems.

8.4.3 When GAT and OAT are managed by two different ATC positions it is necessary, before issuing an ATC clearance, that both OAT and GAT controllers know the actual position of the interfering flights, and assess their future position with the maximum information available.

8.4.4 Once both controllers are working with the same picture, the basic co-ordination relies on the permanent provision of the most accurate information to the other partner. This information is based on the current flight plan which must be permanently updated and on the controllers' intent that are inputted into the system before the clearance is delivered to the pilot.

8.4.5 The most widely used information is the cleared flight level. It is inserted in the system with a certain lead-time which varies according to the procedures in place before the controller clears the aircraft. The same process could be applicable for other kinds of intent.

8.4.6 When required, this passive co-ordination may be supplemented by direct dialogue between controllers. This active co-ordination is currently achieved by telephone, system supported co-ordination is not yet implemented, at least in the States visited.

8.4.7 The implementation of a good level of passive co-ordination significantly reduces the need for verbal communication, and thus reduces the workload. In some States where co-located operations are in place, the civil controller may ask the military controller to hand over to him an OAT flight if he finds that solution easier than demanding verbal co-ordination.

8.4.8 The survey also identified three procedures which ensure the transfer of information between different ATC positions:

- Use of pre-determined trajectories for GAT flights.
- Activation of pre-defined windows to let an OAT flight cross an airway.
- Activation of "corridors" to let an OAT flight cross a complex airspace structure (e.g. a terminal area).

8.4.9 *Use of pre-determined trajectories:* ATC positions responsible for GAT flights shall keep flights along pre-determined routes and flight profiles (e.g. arrival traffic should not descend below a certain FL before a certain point) Should the civil ATC be required to deviate the vertical/horizontal plane from the trajectory defined then the controller has to co-ordinate with military ATC before instructing the aircraft. Having regard to the civil traffic growth, this arrangement may progressively increase the ATCOs workload.

8.4.10 *Activation of pre-defined windows:* The window is used to enable military aircraft to cross the most important civil flows. Each window has been established at a certain flight level which complies with the military requirement and corresponds to rarely used trajectory by GAT. A certain pre-defined time before it is used, the window is opened by the military ACC, displayed on the radar screen of involved controllers and the SSR code of the military aircraft communicated to the civil ATC position. The task of the military ATCO is to maintain the flight in the window while the task of the civil controller is keep its traffic outside the window. However, he may clear a flight through it, the responsibility of the separation is then reversed.

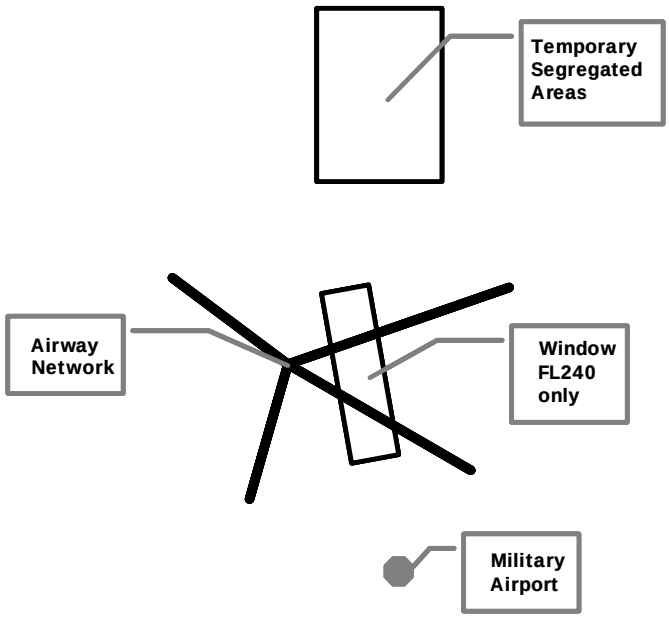

Figure 5: Activation of windows

8.4.11 This procedure is quite effective in reducing ATCO workload. However it can only be applied to cross a traffic stream, not to fly across a complex airspace structure.

8.4.12 *Activation of "corridors"* [15]*.* The survey identified this procedure as the most frequently applied. Its activation and condition of usage (e.g. flight level restrictions) are co-ordinated between OAT and GAT controllers. When these conditions are met, OAT flights along the corridor have priority over the rest of the traffic. Basic data of the flight (e.g. call sign, SSR code, Estimated Time Over the reporting fixes, etc.) are communicated to all relevant ATC positions. Where controllers agree, a change in the flight profile may be revised, even when the flight is already active.

8.4.13 Where compatible ATC systems are in place, a good level of data exchange exists and co-ordination procedures are defined, then the need for direct co-ordination between ATC positions is reduced to the minimum. However, the effectiveness of such direct co-ordination is also influenced by other factors:

- First, the GAT and OAT controllers are not always able to clearly and quickly identify the ATC position which they need to co-ordinate with. When there are two ATC units whose areas of ATC responsibility do not coincide the identification may be difficult. GAT controllers are generally responsible to provide the ATC service in a specific portion of airspace within the area of responsibility of the ACC, while military ATC controllers often provide the service to a certain number of flights within the whole airspace assigned to the ATC unit.
- In addition, military ATC positions may need to be equipped with tools which allow a simultaneous co-ordination with many ATC sectors.

8.5 The Handling of OAT Data

8.5.1 One of the prerequisites for efficient co-ordination is to make maximum information available through the systems for sharing between civil and military controllers, including OAT flight plans. This data transfer may be limited due to security reasons under certain circumstances (crisis operations) or in a multinational environment (data transfer to a foreign centre for co-ordination close to the border).

8.5.2 In the nine States visited, the handling of OAT data differs widely. In some States the OAT flight data provided to the civil ANS provider are very limited, while in others they are sufficient to plan a transfer of control in case of need. In some States OAT flight data are automatically handled in the FDPS, while in others the information is only made available via telephone or strip support.

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[15] A definition of corridor has been established by the Belgian Air Force: "A defined passage through an ATS route and/or Control Area (CTA) of which the use is co-ordinated between OAT and GAT controllers. The OAT traffic using the corridor has priority on all GAT traffic. Note: Specific conditions for the use of a corridor will be agreed upon. When these conditions are met by the OAT controller, GAT controllers may not refuse the request for the use of a corridor, however they may propose an alternate flight level which should be as close as possible to the requested flight level".

8.5.3 Clearly the amount of available flight data information has an impact on the efficiency of civil-military operations. For instance, when the intended route of an OAT flight is not available in the ATC system, system supported co-ordinations are not in place, thus the ATC controller will need verbal co-ordinations, which will increase its workload.

8.5.4 The survey noted that there is still reluctance to include OAT flight data in the civil ATC systems, although it would improve significantly real-time operations.

8.6 Airspace Management in Real Time

8.6.1 In some States, the airspace cannot be activated in real-time, unless it had been planned during the pre-tactical phase. In other States it is current practice to activate a segregated area even when it was not planned during pre-tactical operations. In the latter case a pre-notification message or an ATC clearance is always required before activating the military area.

8.6.2 A pre-notification message and an ATC clearance before activating the segregated airspace are both efficient because the period of airspace segregation is limited to the minimum.

8.6.3 There are three methods used to activate a segregated airspace:

1. The airspace is considered active from the starting time published in the Airspace Use Plan (AUP) or the Updated Airspace Use Plan (UUP). After that time, the airspace will not be used by the ATC units. This practice represents a limitation in managing the airspace in real-time.
2. The airspace is activated through a notification to the ACC supervisor and/or directly to the ATC sectors that are affected. When a pre-notification is requested, GAT can continue to use the airspace until the pre-notified time.
3. The Air Defence Unit requests an ATC clearance before activating the segregated area. The ATC unit frees the airspace from GAT and then clears the Defence Unit to use the airspace.

8.6.4 In some States it is not possible to extend the planned period of segregated airspace, except in specific circumstances (e.g. security reasons). In other States this is current practice and a specific procedure has been defined. Finally, in some States there is no pre-defined procedure, but tactical co-ordination is requested.

8.6.5 In eight out of the nine States the airspace is released to ATC units according to the updated real-time, when military training activity is completed. Therefore the actual de-activation time is notified by the Defence Units, by the military ATC units or by AMC to the civil ATC unit.

8.7 ATC Monitoring of Segregated Airspace

8.7.1 The Military Units in charge of the areas (Air Defence controller, tactical aircraft controller, etc.) are responsible for keeping military activity within the segregated airspace.

8.7.2 When the area is activated, the ATC is responsible for monitoring the trajectory of the traffic out of this area in order to prevent any unauthorised penetration into segregated airspace. However, in most of the States, GAT may be allowed to cross active TSA but only after co-ordination and in fact only when the nature of the activity within the area is compliant. When high-energy manoeuvres are performed the area cannot usually be penetrated.

8.7.3 Clearance for a civil flight to cross an active military training area is co-ordinated directly between the civil controller and the unit in charge of the area or through the military ATC unit. In one State it is performed through a co-ordination cell.

8.8 Airspace Status Information at ASM Level 3

8.8.1 The quality of the distribution and of the presentation of airspace status has a direct impact on the efficiency of real-time operations (i.e. when the airspace status is not known precisely the airspace may simply not be used) and is a key pre-requisite for implementing the Area Proximity Warning (APW), a safety net tool which advises the controller that an aircraft is about to penetrate an active segregated area.

8.8.2 In most of the States the information relative to the status of the airspace is delivered by the military ATC unit to the supervisor who forwards it to the control positions. Where there is no military ATC, the information may come from the military unit in charge of the area, from a co-ordination cell or even from the AMC if real-time management is also in its remit.

8.8.3 The dissemination of information in real-time is almost everywhere achieved verbally. It is sometimes inputted into the system, but it is generally limited to the end of the process when inputted by the local supervisor to provide the information to the positions for which he is responsible.

8.8.4 In some parts of Europe, TSA or CBA may be of interest for up to 8 ATC centres. It is a challenge to disseminate the correct information to all the partners within the appropriate timeframe. In addition, since military areas often consist of 3 or 4 subsets which may be activated separately, the risk of mistakes and discrepancies between the different centres is high.

8.8.5 The information of airspace status is presented to the ATC controllers in different ways: directly on the radar map, in a specific display PC-terminal, in hard paper copies or simply communicated verbally via telephone.

8.8.6 In some States the airspace status information is not live, but generally refers to the one published in the AUP or even sometimes to the schedule published in the AIPs and NOTAMs. In other States, airspace status information is made available only on request and in some cases it may be inconsistent with other visual information.

8.8.7 In one State, airspace status information is system supported and available for the military ATC positions. It is highly accurate, reliable and continuously updated against the actual and the scheduled occupation time, but it is not communicated to the civil ACC.

8.9 The Application of "Mobile" Airspace Reservation

8.9.1 As suggested by the ICAO ATS planning manual, in some States specific military activities (e.g. air refuelling) are protected by a "mobile" airspace reservation. In other States this technique is not applied.

8.9.2 When the impact on safety and ATC workload is properly assessed and managed, the application of "mobile" airspace reservation appears to be best practice.

8.10 The Evolution of Real-time Airspace Management

8.10.1 From on-going studies (e.g. Future ATFM Measures) projects which are being implemented (e.g. ETFMS, EAD, etc.) and modern flight dispatcher tools, it is clear that pre-tactical and real-time operations (in ASM, ATFM and AO Flight Planning) are getting closer and closer.

8.10.2 Real-time airspace monitoring solutions developed by the Belgian Air Force (AMP-2 software) will soon be made available in the civil ACC. Based on these data, the availability of some portions of TSA or of some CDR on a tactical basis could improve operations in Belgian airspace. France is also developing tools for real-time airspace management applications.

8.10.3 Only a concerted implementation of such projects will allow ASM, ATFM and AO Flight Planning to interact properly, and to provide an effective exchange of data.

8.11 Safety Aspects

8.11.1 The EUROCONTROL Safety Regulation Commission has been developing Safety Regulatory Requirements (ESARR). There is a strong relationship between the reporting and assessment of safety occurrences (ESARR 2), the risk assessment and mitigation (ESARR 4) and the use of safety management systems (ESARR 3). This relationship is illustrated in the figure below.

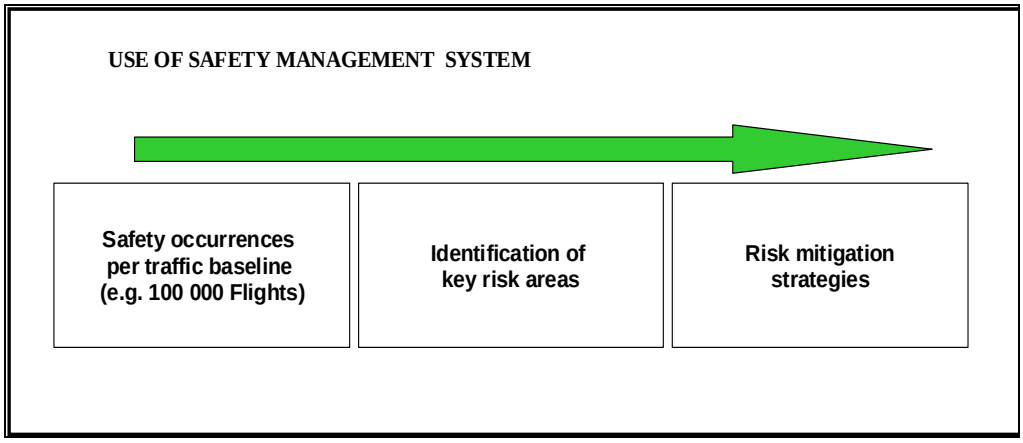

Figure 6: The safety process

8.11.2 The European safety reporting system is still at an early stage, so there is insufficient evidence to identify with certainty safety key risk areas or trends[16] at European level. This is also the case for the ATM civil/military interface.

8.11.3 Some partial and not yet validated ATM safety occurrences[17] are available for the year 1999 and 2000 (shown in Table 7 below). They must not be used to draw conclusions, but simply to stimulate further investigations and analyses.

ATM Safety data (related to the GAT/OAT interaction only)	1999[18]	2000[19]
Number of airprox reports investigated	24	20[20]
ACAS reports investigated	5	18[21]
ACAS/TCAS False R.A.s investigated	Not reported	11[22]
Other incident reports investigated[23]	Not reported	6[24]
Number of unauthorised penetrations of airspace	3[25]	56

Table 7: ATM safety data

8.11.4 These data cannot support a precise identification of key risk areas. However from the survey it would appear that a negative impact on safety may arise in the following circumstances:

- No common picture, insufficient data exchange and inefficient real-time co-ordination between civil and military controllers.
- Inadequate distribution and presentation of airspace status information.

8.11.5 In the context of safety assurance for ATM civil-military co-ordination a number of issues are relevant. These include:

- Safety assurance documentation and risk assessments when implementing FUA actions at Levels 1, 2 and 3.
- Safety assurance documentation and risk assessments when establishing or categorising CDRs, TSAs and other special use airspace.
- Safety assurance documentation and risk assessments when establishing OAT/GAT separation minima and procedures.

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16 Performance Review Report for the calendar year 2000 (PRR 4)

17 An ATM safety occurrence is composed of the following sub-categories: fatal accident, accident, incident, ATM specific occurrences (e.g. technical failures).

18 In 1999 the ESARR 2 (Safety reporting regulation) was not in force, thus the report was made on a voluntary basis.

19 Not all EUROCONTROL States have implemented ESARR 2 yet.

20 In 2000, some 300 Airprox reports were investigated. At the moment only 110 reports were classified either GAT/GAT or GAT/OAT. Some 200 reports were not classified as GAT/GAT or GAT/OAT.

21 In 2000, some 620 ACAS reports were investigated. At the moment only 185 were classified as GAT/OAT or GAT/GAT. Some 450 ACAS reports were not classified as GAT/GAT or GAT/OAT.

22 In 2000, there were 102 False RAs investigated, 7 of them are not classified yet as GAT or OAT.

23 It refers to incidents reported through the ATIR/APDGSG templates.

24 In 2000, there were 60 air traffic incident reports. 6 of them referred to GAT/OAT traffic.

25 Provisional figure.

8.11.6 At present, there is no safety assurance documentation for ATM civil/military co-ordination at European level.

8.12 Conclusions

8.12.1 The ANS providers are jointly responsible to put in place real-time co-ordination including:

- Airspace management in real-time.
- The handling of GAT and OAT in the same controlled airspace.

8.12.2 The real-time management of the airspace is very dependent on Level 2. For instance, where at Level 2 a strong emphasis is given to adherence to the schedule, the goal of Level 3 management is to release the airspace as soon as available but the satisfaction of new military requirements outside the planned slots is almost impossible.

8.12.3 However, the main problem relates to the dissemination and the presentation of the airspace status. Verbal dissemination, paper sheet planning, specific display or radar display which are not updated with the real-time information are still common and may hamper the use of the available airspace. While such elementary means may be considered as sustainable at national level when only two ATC units are involved, they are inefficient to manage airspace across or close to the borders where many ATC units are concerned.

8.12.4 The handling of GAT and OAT in the same controlled airspace is a key issue of the real-time co-ordination in order to ensure a high level of safety with respect to both types of traffic and to avoid as far as practicable the need to segregate the airspace to conduct some missions

8.12.5 The co-location of the military ATC with Air Defence seems to be an atypical solution and its impact on the efficiency of the co-ordination is questionable.

8.12.6 When civil and military ATC units are located in different centres the co-ordination may be efficient provided that a certain number of prerequisites with respect to systems and procedures are fulfilled. However GAT is often constrained to remain in the route structure. There is limited scope for further improvements, in the face of airspace complexity increases.

8.12.7 The co-location of the civil control and military control in the same ATC unit provides the most natural framework to facilitate the ATC co-ordination process. However in many cases there is scope for improvement, as was recognised by some States in which such an organisation is implemented.

8.12.8 Two different types of operational organisation within a single centre are in force. Where a military position controls OAT in a sector overlapping few civil sectors, this organisational arrangement enables GAT and OAT to be efficiently handled, and is perfectly adapted to almost all the European airspace. The organisational arrangement in which OAT and GAT are controlled by a single team (one or two executive controllers) within the same sector is particularly well adapted to the most complex airspace. However, when the second type of organisation is in place, it seems also necessary to retain the possibility to activate positions to handle military traffic under specific circumstances.

8.12.9 Both types of operational organisations are operated either by two civil and military ATC units, or by a single integrated ANS without significant differences in terms of operational efficiency.

8.12.10 As for the information on the status of the airspace, the real-time co-ordination between two flights is generally efficient at national level but it becomes critical between a military ATC unit and a civil one situated on different sides of a border. This is typically the case when ATS delegations, Cross border-areas and TSA close to the borders are implemented. Comprehensive flight plan information on both GAT and OAT is not available.

9 STATUS REPORT ON FUA - CONCLUSIONS

9.1 General conclusions

9.1.1 Civil-military co-ordination is generally consistent and coherent at national level although it differs from one State to another. In fact, it would appear that instead of implementing the FUA concept, States have adapted or are still progressively adapting their current airspace management methods with principles defined in the concept. The result is therefore heterogeneous.

9.1.2 The fact that segregated airspace is generally released to all users when it is not being used is the main result of implementing FUA. However, making the airspace available certainly provides flight efficiency for the operators and flexibility for the controllers, but the benefits in terms of ATC capacity and valuable alternative routes are not yet well identified.

9.1.3 When ATC capacity enhancement is required, airspace design proposals tend to be the only solution studied. This rarely takes into account the benefits of managing airspace according to the time-factor and of optimising the ATC organisations, although the study shows that such improvements are possible.

9.1.4 A comprehensive management at all levels, and great coherence between the three levels, is to be found in very few States although each level should naturally derive from the preceding one.

9.1.5 As currently implemented, the FUA focuses on civil military co-ordination at national level. Efficiency gains have been achieved in the visited States even if they vary from one State to another. At international level, co-ordination between neighbouring States when airspace structures are situated across or close to the border is very limited. This lack of co-ordination is detrimental at all three FUA levels.

9.1.6 The limited co-ordination with neighbouring States regarding the different requirements, the airspace design and the validation process may create some problems for the neighbouring ATC centres once airspace changes are implemented. The availability of information on airspace, which is a problem at national level, be it at Level 2 or at Level 3 is even more crucial when many foreign ATC units are involved.

9.1.7 It can be concluded that there is significant scope for improvement in civil-military co-ordination. Improving the current FUA application in Europe will enable the ATM system to fully accommodate both military and civil demand. The need to operate a trade-off between these two requirements may only occur in a few parts of European airspace (e.g. the European core area) during specific periods.

10 ORGANISATIONAL ASPECTS

10.1 Introduction

10.1.1 It is not possible to characterise as integrated or separated the different ATM organisations in each State. When using these terms, the analysis usually refers to the ANS provider. If we consider the three levels of airspace management, the situation is much more complex. It is therefore necessary to assess the level of integration for any of the three different levels of airspace management.

10.1.2 Of the nine States visited, Sweden is the only one where a single organisation is responsible, in peacetime, for providing all tasks related to civil-military co-ordination according to the requirements of both parties. In the other States the ASM tasks are fulfilled by many organisations.

10.2 The Organisation of Strategic Airspace Management

10.2.1 With the exception of Sweden, all of the other States have established a joint civil-military Committee to endorse the structures which are necessary for civil and military aviation and the rules related to the use of airspace.

10.2.2 The working structure of the Joint Committee differs widely from country to country, because it is closely linked with the political organisation of the State, the allocation of responsibility to the different ministers, and with political perspectives. The composition of the Joint Committee may also vary depending on the extent of trade-offs between the level of military capability and readiness to be attained and civil air transport requirements.

10.2.3 In most of the States, no permanent organisation exists to deal with airspace design projects. The typical organisational structures are “task forces”, “ad-hoc working groups”, or regular meetings between civil and military representatives. Only one State, the United Kingdom, has established a permanent and integrated civil-military body, the Directorate of Airspace Policy (DAP) to manage the regulation and the design of the airspace.

10.2.4 From the various organisational solutions identified by the survey, a joint airspace design unit dealing with all users’ requirements is probably the most effective way to prepare the airspace.

10.2.5 Joint airspace design is currently performed at a regulatory level (e.g. DAP in the United Kingdom) or at ANS provider level (e.g. DFS in Germany, ENAV and Italian Air Force in Italy). The nature of this activity (regulation or service provision), and thus the level at which to achieve it, could be an issue.

10.3 The Organisation of Pre-tactical Airspace Management

10.3.1 In the four States where there is very comprehensive pre-tactical management, the AMC is a joint unit consisting of both civil and military staff. According to the workload of the AMC, the staff in some States may have additional tasks to perform. For example, in one State the AMC is also

responsible for the real-time management of the airspace. In conclusion, where there is a negotiation process and thorough management, the AMC is a joint civil-military unit.

10.3.2 In the three States where military activity is simply notified in order to establish the AUP, the tasks are performed, depending on the States, by the civil or military ATS provider in addition to other tasks. In the remaining two States, the AMC is 'virtual' because the airspace is not managed at pre-tactical level.

10.3.3 The question arises should an AMC unit consist of representatives from two different organisations or should it be within the structure of a single integrated organisation? Both models currently exist. While civil requirements are always presented by the ATS provider, military requirements are presented either by the ATS provider or by the operational user of the airspace.

10.3.4 The military need for airspace arises directly from operational users (air defence units, training centres, etc.) through the operational centres in charge of planning. These units co-ordinate individual demands and prepare consolidated military airspace requirements. These are then presented and negotiated within the AMC. It appears that the representatives of the operational centres are best placed to conduct these negotiations on behalf of military users.

10.3.5 For this reason, an integrated organisation does not appear to be realistic in the context of pre-tactical management. In addition, from a theoretical point of view, it is difficult to imagine two contradictory requirements presented for negotiation by staff belonging to the same integrated ATM organisation.

10.3.6 Therefore, the ideal scenario appears to be a joint unit consisting of representatives from the civil ATS provider and the military organisation in charge of air operations, both well aware of users' requirements.

10.4 The organisation of ATC Services

10.4.1 Section 8.2 described the four different operational arrangements for accommodating GAT and OAT requirements in the States visited.

Segregated ATC Systems and ATC Operational Segregation

10.4.2 In the first and second operational models the ATC units are located in different sites.

10.4.3 In the first model, which is applied by one State, the two ATC systems are segregated and the military air traffic control is performed in the Air defence control centres. Military ATC controllers and Air defence controllers use the same system which receives minimum information from the civil ATC system.

10.4.4 It is worth mentioning that in all of the other States visited, this model was either rejected or abandoned because they judged these two activities to be fundamentally different in nature. As a result, they estimated that these activities would require different training and skills and two different types of data processing system.

10.4.5 According to the level of real-time co-ordination, which is achieved where this model is implemented, the influence on civil military co-ordination of an integrated military ATC and Air defence activity may be questionable.

10.4.6 In the second model, the ATC systems are equivalent and supplemented by direct communications tools. Provided that the level of information exchange is adequate, that enhanced co-ordination procedures are in place, and that goodwill exists on both sides, the ATM system then works satisfactorily. However, the following questions may arise:

- Above which level of airspace complexity (e.g. Free route airspace) should such an organisation be converted into a more integrated one in order to keep an efficient level of real-time operations?
- Would the degree of mutual understanding be higher between staff working in the same ATC unit or between staff working in separated ATC units?
- Is it not more cost-effective to develop and implement a single ATC system to be used by both civil and military controllers?

Operationally integrated ATC service

10.4.7 The survey showed that the third and fourth operational models (co-located operations or one ATC sector dealing with all OAT and GAT) can be operated equally by either two separate ATC service providers (civil and military) or by a single integrated provider, as shown in Table 8 below.

	Two ANS Providers (Civil and Military)	One Integrated ANS Provider
Co-located Operations	2 States	1 State
One ATC Sector, One Team	1 State	2 States

Table 8: Two Models of Operational Integration

10.4.8 It would appear that the co-located operational model, rather than the “one ATC sector” model, is the one most frequently applied in Europe. However, the “one ATC sector” model is applied in very complex traffic situations (e.g. London terminal area).

10.4.9 From an organisational point of view, the main characteristic of co-located operations is the clear distinction between the ATC capacity provided to OAT and that provided to GAT.

10.4.10 Both operational models are based on a single ATC technical system, with civil and military controllers exercising their functions in the same ATC unit. This feature enables GAT and OAT to be handled more efficiently. Therefore, both operational models achieve fully integrated operations independently of how the service provision is organised.

10.5 Integrated ANS Providers

10.5.1 A single integrated ANS provider is not a fundamental enabler for increasing operational efficiency. Indeed, other factors can explain why some States have adopted such a service provision model.

10.5.2 The most obvious area affected by an integrated service provision is cost effectiveness. The development and implementation of a single system and the systematic avoidance of duplication (e.g. common ATC centres and surveillance equipment) certainly lead to cost savings for both partners. Sweden estimates that savings of some 30% can be made on costs by operating with a single ANS provider. A portion of these cost savings also results from the flexibility in staff management enabled by the integration of the service providers.

10.5.3 In Sweden, the funding of investments is based on an agreed principle. For the operational costs there is a yearly settlement done where the operational costs are apportioned amongst the parties in accordance with their actual use of service. The cost sharing mechanisms are very well consolidated in Sweden, since it is the oldest integrated ANS provider in Europe.

10.5.4 However, as stated in the Introduction, although Defence and Civil Aviation are both interested in improving cost-effectiveness, they approach this issue from different perspectives. Some specific issues were identified during the visits.

10.5.5 Where civil and military ATC providers exist, each ATC supervisor is responsible for providing adequate ATC capacity for GAT and OAT respectively. When there is an integrated ATC provider, the configuration of the operational room (i.e. opening of ATC sectors and/or special handling positions) should provide ATC capacity equitably. However, this may not be possible at all times. The need to establish rules for the allocation of ATC capacity and the necessity of a monitoring mechanism based on external staff should be assessed.

10.5.6 Once the assignment of ATC capacity has been clarified, staff flexibility provides additional operational benefits. Most (if not all) controllers are rated to handle both OAT and GAT. In specific circumstances (for example, during daily operations), a controller assigned to OAT may be used to deal with GAT peaks when military demand does not require the opening of a specific position. For example, when fog keeps military aviation on the ground, military controllers may be reallocated to handle GAT stacking due to the low landing rate.

10.5.7 Another issue identified by the survey concerns the scope of the integrated ANS provider, which differs between States. As civil military co-ordination generally refers to en-route control, the question of the integration also relates to en-route ATC. However, in one State this also includes aerodrome ATC services. In such a case the result is that all ATC skills are within civil aviation: MOD staff did not retain any ATC competence either at unit or at headquarters level. In the two other States visited, where an integrated service provider operates, there are still military staff at headquarters and at approach/airport ATC units. This is justified by the fact that ATC is a full component of the range of military means necessary to deliver air power. According to their political perspectives, some States wish to retain this capability in order to support the handling of a crisis situation in whatever theatre of operations, within the framework of NATO or the European Union.

10.5.8 The recent Kosovo crisis highlighted some of the difficulties that arise when military aircraft make extensive use of airspace configured for peacetime. The portion of restricted airspace was limited and many flights participating in the operations were re-routed to airspace normally open to civil traffic. The flights involved in these military operations required confidentiality with regards to the data process, the other flights controlled on the same frequency and the ACC staff. These issues are very delicate when an integrated organisation model is used.

10.5.9 Since these aircraft also need to fly according to their optimum flight profile and require absolute priority, there may be the need for integrated service providers to maintain special positions or special procedures to handle these kinds of situations and the associated exercises.

10.5.10 Specific arrangements also need to foresee circumstances in which military authorities need to have direct links to the controllers in charge of OAT when such a situation exists. For example, directives on the conduct of the operations should be forwarded directly to the military positions, thus avoiding the usual cumbersome procedures through the hierarchy of the service provider.

10.5.11 An integrated organisation may encounter certain staff problems in these types of situations.

- As jobs become more open to foreign controllers, it is possible that some staff might be faced with a conflict of interest if their own State is involved in a particular crisis. Their presence within the ACC may have detrimental consequences if information is not under strict control.
- Flights participating in such operations must be handled by absolutely reliable and specifically trained staff; at present, these are military controllers released to the ANS provider or civil controllers with reserve officer contracts.

10.6 Conclusions

10.6.1 As required by the ASM Handbook, almost all States have established a Joint Committee which is responsible for all strategic ASM tasks.

10.6.2 The Joint Committee relies on a working structure, whose main component is the Airspace Design Unit. Although many arrangements are in place, the most efficient solution is a joint airspace design unit reporting to the Joint Committee.

10.6.3 At pre-tactical ASM level, a joint civil-military unit, staffed by civil ATC experts and by representatives of military airspace users leads to an efficient negotiation process.

10.6.4 With regard to real-time operations, based on the evidence provided in this chapter, it can be concluded that when civil and military ANS providers are separated, any kind of organisation may result, from the largest separation to the deepest integration. However, a single integrated provider results in an operationally integrated ATC.

10.6.5 Co-located operations or “one ATC sector” can be provided by one integrated ANS provider or by two civil and military service providers with operational effectiveness and maintenance of good safety levels. Therefore, the creation of an integrated ANS provider is driven by other factors, amongst which were identified potential cost savings and potential increase in flexibility.

10.6.6 However, in any State where a single integrated ANS provider has been implemented certain issues have arisen: the provision of sufficient ATC capacity to military, the scope of the integration and the handling of OAT under specific circumstances.

10.6.7 In summary, all things being considered, it cannot simply be concluded that an integrated ANS provider is a better solution than two ANS providers. Each case must be considered in its own right, taking into account other non-operational factors (e.g. economical, political or social) where relevant. Further study on this subject is necessary.

11 RECOMMENDATIONS

11.1 Recommendations for the second phase

11.1.1 The recommendations contained in this report were supported by the CMIC and the PRC at their respective meetings in September 2001. It is proposed that they form the basis of the second phase of this project, intended to be conducted under the authority of the Director General.

11.2 Airspace Design Organisation and Process

Recommendation 1

Define common principles for effective airspace design and management to be adopted by all EUROCONTROL* Member States.

* with a possible extension to ECAC Member States

Recommendation 2

Identify mechanisms to ensure international co-ordination of airspace design and management.

11.3 Operational Rules

Recommendation 3

Identify which principles, rules and procedures for the conduct of military (OAT) operations and for OAT/GAT compatibility need to be commonly applied within EUROCONTROL* Member States.

* with a possible extension to ECAC Member States

11.4 Pre-Tactical and Real-time Airspace Management

Recommendation 4

Investigate methods to improve the usage of Conditional Routes.

Recommendation 5

Investigate a more effective method for the notification and dissemination of airspace status during pre-tactical (ASM Level 2) and real-time (ASM Level 3) phases.

11.5 Provision of Air Traffic Services

Recommendation 6

Investigate a common content, format and methods for automatic exchange of GAT and OAT flight data, both nationally and internationally, to be adopted by all EUROCONTROL * Member States.

* with a possible extension to ECAC Member States

Recommendation 7

Identify the most efficient civil/military en-route ATS operational arrangements in the high density airspace of EUROCONTROL Member States.

11.6 Safety

Recommendation 8

Investigate the need to address formally safety issues within ATM civil-military co-ordination at European level.

11.7 FUA Review

Recommendation 9

Develop both national and international review processes to ensure the most effective use and evolution of the FUA concept.

ANNEX 1: PROJECT OBJECTIVES

In October 2000, EUROCONTROL launched the Civil-Military Co-ordination Project to identify the most effective (best practice) model for civil-military ATS integration, and the constraints/impediments to universal European application of that model. This project has been set up in response to a request from EUROCONTROL's Provisional Council in July 2000[26]. It will also examine the implementation status of the Flexible Use of Airspace and identify where improvements to exchange of real-time information between civil and military authorities may be required. Its successful completion will help EUROCONTROL and its stakeholders to improve ATC capacity, enhance ATM performance and improve civil-military co-ordination

The project is being handled jointly by the EUROCONTROL Agency (Military Expert and Airspace Management & Navigation Units) and the independent Performance Review Unit (PRU).

The project consists of two phases – Fact-Finding and Improving Civil-Military Performance.

The first phase was a review of existing documentation and projects, including a number of regional initiatives aimed at improving ATC capacity in specific areas; setting out the evolving institutional framework; and conducting interviews with civil and military partners in Member States, several airlines and a number of EUROCONTROL services. A preliminary report on the fact finding phase was delivered in late 2000, followed by an intermediate report in Spring 2001 for peer review, and a final report for public presentation in Summer 2001.

The second phase will translate the conclusions on best practices into proposals to improve civil-military co-ordination in Europe, and will develop correlative methods to monitor, measure and report on progress. Phase 2 is expected to start upon completion of Phase 1, and will be planned in detail during Phase 1.

[26] At its 8th Session, on 13 July 2000 the Provisional Council of EUROCONTROL requested the Director General to examine the implementation status of Flexible Use of Airspace (FUA) in European States, and to put in place a programme to ensure best practice and to foster integration of civil/military air traffic services, making real-time information readily available to civil and military authorities to enable them to maximise the use of airspace and existing ATC capacity.

ANNEX 2: ASM/ATFM/Flight Planning Time-Synchronisation

If the information is not presented on time to the following downstream process, then this information is useless regardless of its relevance and quality. Thus the time-synchronisation of the information flow is the most critical issue. Figure 7 below[27] describes the "ideal" information flow during the pre-tactical phase (see also Section 6 of the ASM Handbook).

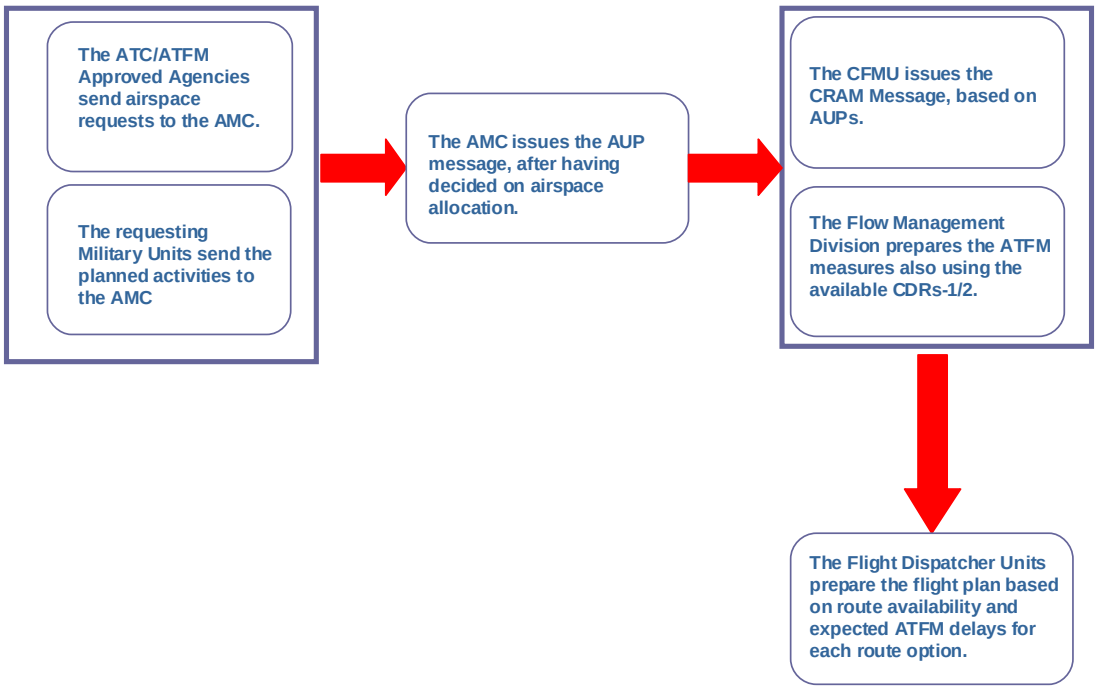

Figure 7: The "Ideal" Information Flow during the Pre-tactical Phase

The AMC is the only unit that can properly filter and evaluate conflicting requests originated by military scheduling units and ATC/ATFM units (based on priority rules and negotiation procedures defined at State level). It is clear that the management of airspace must be always upstream to any process. The ATFM units should then consider the route opportunities and ATC capacity increases made available by the ASM units for preparing ATFM routing scenario and ATFM regulations. The preparation of the flight plan is the last downstream process. Only when the availability of airspace (ASM) and the ATFM measures have been decided can the flight dispatcher have a clear view of the opportunities available (i.e. route options and associated flight time, impact of delay for each route option on the airline schedule, etc.).

In fact, the actual timing of ASM and ATFM pre-tactical does not allow the use of available airspace and ATC capacity increases in the preparation of ATFM plans. The CDRs-1/2 availability is notified through CRAM at 1500UTC the day before the operations. The CFMU Flow Management Division performs the ATFM pre-tactical 1 day

[27] The figure also refers to Annex 2 in ASM Handbook in (Common ASM/ATC/ATFM Timetable).

in advance and issues the ATFM notification message between 1400UTC –1600UTC the day before operations. As a consequence the flow optimisation is done using the permanent route structure and the ATC declared capacity not improved by CDR openings.

Moving the actual timing of ASM/ATFM/Flight Planning activities will be a major undertaking. On the one hand, several AOs[28] declared that it would be useful if the CRAM could be received earlier, to allow more processing during office hours where staff resources were better suited to deal with it. On the other hand many military authorities have reported difficulties in complying with the actual deadlines: *"Although the wings can respect this very tight deadlines, the constraints to take into consideration are numerous (i.e. time restrictions due to noise, weather, aircraft maintenance, many pilots use the same aircraft for training, etc.). Issuing the AUP the day before operations at 1400 is already a very challenging deadline, which cannot be removed earlier without reducing the accuracy of the schedule for military training operations."*

[28] Source: University of Westminster report

ANNEX 3: Short-term Improvements to the ATS Route Network[29]

The Annual Rolling Process for Short-term Improvements to the ATS Route Network is conducted by the ANT/RNDSG group. This is the right forum for discussing the effectiveness of Conditional Routes in providing flight time and ATFM delay reduction. Although the process provides effective ATC capacity increases in solving ATC bottlenecks, the benefits of designing specific route segments is not often shown in terms of ATC capacity increase, delay or flying time reduction.

There are also significant implications in designing conditional routes across many military areas and States. We should start from the basic consideration that Flight Dispatchers examine options based on integral routes, instead of viewing isolated segments of conditional routes. When an intra-European city-pair is under consideration, the CDR-2s national segments should not be seen separately, but in the context of the whole city-pair flight plan.

The FUA response was the introduction of the "Lead AMC concept"[30] whose application should ensure the co-ordination of the opening periods of each national segment of the same CDR-2. However this co-ordination often results in a minimal opening period, which is unsatisfactory for the city pair served. The factors causing this are the different priority rules and negotiation procedures applied in neighbouring States (e.g. in Belgium and Germany) and the lack of synchronisation of military training activities throughout neighbouring States. These factors cannot be easily overcome.

Designing Conditional Routes that pass through many military areas and States may generate false expectations for the city pair served. Assessing the minimum useful length and the average availability of the segment is a crucial consideration before designing and publishing a conditional route.

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29 Annex 1, ASM Handbook

30 Following a proposal by The Netherlands to the Flexible Use of Airspace Sub-Group (FUSG) in September 1997, five States (Belgium, Denmark, Germany, The Netherlands and Norway) proposed the Lead AMC Concept in order to streamline the existing procedure for dealing with cross-border CDRs. Under the Concept, the responsibility for co-ordination and publication of certain cross-border CDRs could be devolved in each particular case to a single ("Lead") AMC. The Lead AMC does not have to be the AMC at the origin of the flight and assignment of responsibility is decided on a case-by-case basis. The Lead AMC function was established by the 5 States AMC Co-ordination Group in 1998 and underwent a trial period which ended in January 1999. After the successful trial, the five States continued its use in an extended trial period while awaiting a formal decision from the FUSG.

ANNEX 4: Acronyms

Aas	national Approved Agencies
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
AFSBw	Military Airspace Authority of Germany
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Service
AMC	Airspace Management Cells
ANSP	Air Navigation Services Provider
ANT	EUROCONTROL Airspace and Navigation Team
AO	Aircraft Operator
APW	Area Proximity Warning
ASM	Airspace Management
ATC	Air Traffic Control
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATS	Air Traffic Services
AUP	Airspace Use Plan
CAA	Civil Aviation Authority
CBA	Cross Border Area
CDR	Conditional Route(s)
CFMU	EUROCONTROL – Central Flow Management Unit
CHIEF	Switzerland (CH), Italy (I), Spain (E) and France (F)
CMIC	Civil-Military Standing Interface Committee
CRAM	Conditional Route Availability Message
DAP	Directorate of Airspace Policy, United Kingdom
DFS	Deutsche Flugsicherung GmbH
DIRCAM	Military Airspace Authority of France
DNA	Air Navigation Directorate of CAA, France
EAD	European AIS Database
EATMP	European Air Traffic Management Programme
EC	European Commission
ECAC	European Civil Aviation Conference
EMEU	EUROCONTROL Military Expert Unit
ENAV	Ente Nazionale di Assistenza al Volo
ESARR	Safety Regulation Requirements
ETFMS	Enhanced Traffic Flow Management System
EU	European Union
FDPS	Flight Data Processing System
FMP	Flow Management Position
FUA	Flexible Use of Airspace
GAT	General Air Traffic
GeMA	German Joint Committee
ICAO	International Civil Aviation Organization
IPR	Intellectual Property Right
LoA	Local Operational Agreement
MoD	Ministry of Defence
MoT	Ministry of Transport

NATO	North Atlantic Treaty Organisation
NOTAM	Notice to Airmen
OAT	Operational Air Traffic
PRC	Performance Review Commission
PRU	Performance Review Unit
RNDSG	Route Network Development Sub-Group
RVSM	Reduced Vertical Separation Minima
SRC	Safety Regulation Commission
SSR	Secondary Surveillance Radar
TCAS	Traffic Collision Avoidance System
TSA	Temporary Segregated Area
UUP	Updated Airspace Use Plan