



**Single European Sky –  
Provision of Aeronautical Information  
for the European Upper Flight  
Information Region (EUIR)**

**Phase Three Report**

**Detailed Description of the  
Preferred and Alternative Solutions**



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# 1 INTRODUCTION

## 1.1 General

Under European Commission (EC) Single European Sky (SES) Community Law, in force since 20 April 2004, a single European Upper Flight Information Region (EUIR), covering airspace above Flight Level 285, has to be established, to overcome the fragmentation of airspace. The EUIR has an implementation date of January 2005. A consequence of this is the need to provide consolidated Aeronautical Information relating to the EUIR, including the publication of a single Aeronautical Information Publication (AIP) relating to the EUIR.

A study, which is being undertaken by STASYS, supported by Letové prevádzkové služby Slovenskej republiky, štátny podnik (LPS), has been commissioned that defines and analyses alternative options for the publication of Aeronautical Information for the EUIR. The study evaluates the feasibility of the provision of Aeronautical Information including the institutional, legal, technical and operational implications.

The results of the study have been used to assist in identification of the optimum solution for the implementation of a single AIP relating to the EUIR and form the basis for implementation planning. As it has not been possible to gain full acceptance of the optimum solution, alternative solutions are also detailed..

## 1.2 Purpose of Document

This document provides the findings of Phase 3 of the study. This phase has further developed the recommended (Solution 4) and alternative solutions (Solutions 1, 2 and 3) identified in Phase 2 of the study for the provision of Aeronautical Information for the upper airspace of the SES region. Furthermore it addresses those political, technical and institutional issues identified which were independent of any solution selected.

## 1.3 Scope

This document has been developed to address the need for the provision of Aeronautical Information for the EUIR.

Throughout its development, consideration has been given to the future wishes of the EC to extend the solution for the EUIR AIP to also address the lower airspace and possibly the terminal control area and airports.

The SES is currently foreseen to include the European Union (EU) Member States and Associated States<sup>1</sup> (those, who although not EU members, wish to be included within the SES).

Nevertheless, the content of this report is not specifically limited to these States. It is envisaged that, in the future, other States may wish to join the

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<sup>1</sup> Two States, Norway and Switzerland have agreed a legal position with the EC regarding membership of the Single European Sky.

SES, either through gaining membership of the EU or by inclusion as further Associated States.

The following list identifies the current States who are included within the SES (referred to as the SES States):

Members of the European Union:

Austria	Greece	Poland
Belgium	Hungary	Portugal
Cyprus	Ireland	Slovak Republic
Czech Republic	Italy	Slovenia
Denmark	Latvia*	Spain
Estonia*	Lithuania*	Sweden
Finland	Luxembourg	United Kingdom
France	Malta	
Germany	The Netherlands	

Associated States, in particular:

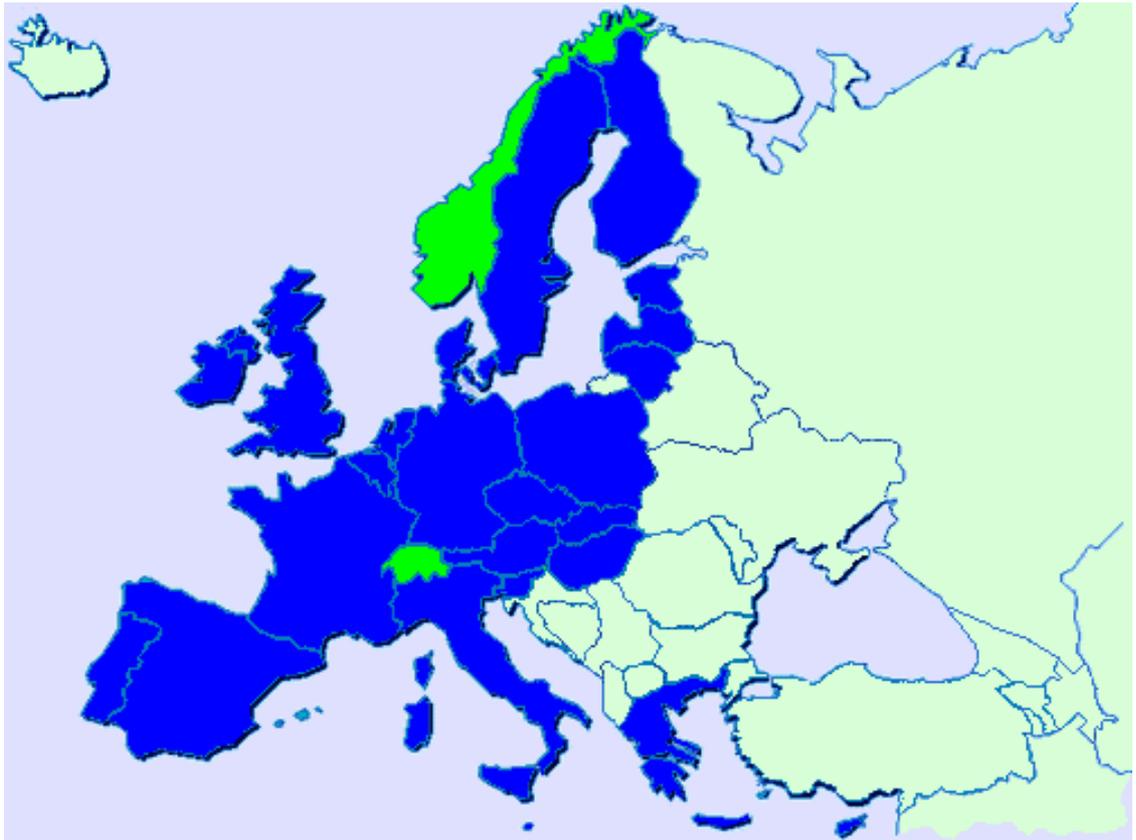
Norway	Switzerland
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This provides a total SES coverage as shown in Figure 1.

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\* Presently not members of EUROCONTROL.

\* Presently not members of EUROCONTROL.



**Figure 1: Single European Sky Coverage**

The study team have considered a wide range of possible solutions striving for compliance with the following key aims:

- a) The solution may be open to market competition;
- b) That the solution has a minimal impact on the working practises of States today;
- c) The solution should offer a low-cost route to achieving the aims of the EC;
- d) The timeliness of the provision of Aeronautical Information is paramount and therefore the provisions of the Aeronautical Information Control and Regulation (AIRAC) Cycle must be adhered to;

In formulating and assessing possible solutions, consideration was given to the use of commercial products, such as those offered for AIP and Chart production as part of the EAD Solution. These were, however, discounted as their recommendation was seen as going against the principles of open competition. Should a potential Service Provider for the EUIR AIP wish to use them as part of a proposal there would be no barrier to this.

## 1.4 Terms of Reference

During the study candidate solutions were identified but some aspects of the Terms of Reference within the Call For Tender (CFT) require further clarification. The two main reasons for this are:

- 1) To date there has not been full acceptance of any of the solutions provided within the Phase 2 report. Whilst it appears that there is a broad acceptance of the recommended solution (Solution 4), this is by no means unanimous;
- 2) Secondly, a number of comments received have expressed alternative solutions, each of which has typically been based upon a named body acting as the Service Provider. Such a solution is in opposition to the fundamental principles of the EC which insist that any Service Provision contract be let as a result of open competition.

The following points need further clarification:

- a) As there has been no general acceptance of the preferred solution presented within the Phase 2 report, this report has provided a means by which any of the presented solutions may be progressed. Where the issues discussed are independent of the solution selected they are fully developed to a point where they may form the basis of the implementation phase. However, many aspects are dependent upon a selected solution; here the recommended solution (Solution 4) is detailed. An allowance for the onward development of Solutions 1-3, should one of these prove more cost effective, is provided for in the implementation phase. Due to the lack of acceptance of a single solution, all four solutions have been looked at during phase 3 of the study. Therefore less detail is provided on these solutions than would have been the case with only one agreed solution;
- a) As, to date, the study team has been unable to obtain high-level cost estimates for the implementation of Solution 2, no Cost Benefit Analysis (CBA) can be performed. Figures have been formally requested to allow a CBA to be performed but no response has been provided from any of the parties involved, making it impossible for the CBA that is of such importance at this stage of the project, to be performed;
- b) As the costs for implementation are not available, the provision of a detailed cost model is not possible. It is considered that the potentially wide variance in implementation and operating costs may have a significant impact on the methodology used to recover these costs;
- c) No implementation legislation is provided; rather the study has proposed the text of a mandate for further use by the EC.

All information that was available during the timeframe of the study has been drawn on by the study team. Due to the complexity of some issues, further work is required that should be performed during follow-up investigations to this study.

## 1.5 Stakeholder Observations

Some feedback was provided by Stakeholders following the Phase 3 Workshop held in Brussels on September 14<sup>th</sup>. Some of this feedback would not affect the content of the report but warrants mentioning.

- a) Opposition to the expansion of the EAD, in any way, has been expressed by a number of Stakeholders.
- b) Concern has been expressed that opposition to the EAD by some Stakeholders stems from fears that staff levels at National Aeronautical Information Services (AIS) units would be cut when EAD is used at its full potential and this has in turn affected this report through consultation with those Stakeholders.
- c) Some Stakeholders believe that EAD should be used to its full potential and do not foresee any technical barriers to its expansion. The cost of expanding EAD should be weighed against building another system and the overheads that accompany this.
- d) States already using Commercial Off-The-Shelf (COTS) products for their AIPs and for input to the EAD should continue to do so for the EAIP.
- e) The report has been described as falling short of the terms of the study but as has been emphasised before, without the acceptance by all actors and the consequential agreement on a solution, there is little more that can be done by the authors of the report.
- f) It has been suggested that a full CBA and risk assessment for all four solutions should be carried out by an independent party and that the institutional issues are resolved. The issue of payment to perform the CBAs and risk assessments needs to be resolved.

## 1.6 Military

Throughout the study careful consideration was given to ensure that the Military domain was considered and included where appropriate. However, it was established that, on the whole, the Military behave as any another Data Originator providing data to a National AIS.

The amount of data passed to the Civil AIS for publication and the manner in which this action is performed varies significantly. In some cases a State's Military does not originate any information for publication in a Civil AIP but in other cases they provide a significant amount. In a few cases the Data Origination for Military information is performed in very close co-operation with the Civil AIS.

Despite these different operating practices, very few tangible differences were found when comparing the Military provision of information to the origination of data within the civil arena. This is possibly a clear demonstration of today's transition towards Civil / Military unity, working practices, integration and harmonisation.

## **2 BACKGROUND**

### **2.1 The Single European Sky**

The Single European Sky will be a harmonised and integrated Air Traffic Management (ATM) network, providing for safe, orderly and efficient air transport. As such, it will facilitate the movement of people and goods across the Community and between the Member States and third countries. Since air traffic is anticipated to grow considerably over the longer term it shall also contribute to a reduction in the environmentally damaging effects of air transport.

Member States have recognised that an important part in achieving these overall aims is that air navigation services should make optimum use of the limited resource which is airspace. The development of the SES presents an opportunity to improve the efficiency of the overall aviation infrastructure and to contribute to the reduction in the level of delays experienced by passengers and freight customers in recent years. Although in many cases delays may be attributable to airport or airline factors, a significant proportion of delays have been generated through a lack of capacity in airspace or through inefficient application of that capacity.

It is recognised that the introduction of Reduced Vertical Separation Minimum (RVSM) in 2002 has contributed significantly to the provision of additional airspace capacity. Nevertheless, such is the forecast increase in air traffic that it is considered that airspace capacity issues will return to the forefront in the medium term.

A more efficient ATM system will assist in reducing the workload of pilots and controllers, and therefore contribute to the safety of air travel by its very existence. Indeed the SES proposals are designed to combine to support safety.

The vital safety element inherent in the provision of air navigation services, together with its social and economic importance, means that a simple facilitation of harmonised standards in Europe is insufficient to address the issues. Instead, a legislative and regulatory framework is required to detail requirements that are more aligned to meet the goals of the SES.

### **2.2 Background to Study**

In order for a flight to take place, all information necessary must be made available to all parties or actors involved. These may include, amongst others, the Pilots, Airport Operators (AO) and Air Navigation Service Providers (ANSP).

Primarily there are two types of information, firstly about the environment in which the flight takes place and secondly about the flight itself. These two information types are normally referred to as Aeronautical Information and Flight Planning Information respectively.

Aeronautical Information is published by way of the Integrated Aeronautical Information Package (IAIP), in accordance with International Civil Aviation Organisation (ICAO) Annex 15 (Reference 3), which is published typically on a per State basis<sup>2</sup>. This leads to two significant issues:

- 1) For a flight across Europe the airspace of several States may be crossed and therefore reference to several IAIPs is required;
- 2) As the airspace is typically organised by a State within its own geographical borders, the organisation of this airspace, in relation to the airspace structure of its neighbouring States, may be inefficient.

As part of the SES, the EC will introduce a single EUIR. Through the introduction of such an airspace structure, the issues raised above will be addressed through a more unified approach to airspace planning and the publication of a single IAIP<sup>3</sup> for the EUIR.

## 2.3 Objective of Study

The main objective of this study was to investigate and assess if the concept of an AIP for the EUIR was feasible. By referring to general business models, this study can be paralleled to the first stage, the concept definition and feasibility stage which forms the basis for the next stage, implementation and initiation phase.

As will be seen, the study has concluded that the EUIR AIP is technically feasible although a number of institutional and political areas require clarification. This study has identified a number of possible solutions for the provision of Aeronautical Information for the EUIR. It takes into account ICAO Standards, and Recommended Practices (SARPs), and makes recommendations as to the approach(es) to be taken.

Furthermore, the study builds on these recommendations to provide high-level guidance as to how these approaches may be implemented.

## 2.4 Approach

The study was divided into three phases, each of which builds upon its predecessor. The phases are:

### 2.4.1 Phase One

Research of the present situation in terms of the current legislation, regulation and documentation related to and which may affect the implementation of the EUIR and the publication of its AIP.

### 2.4.2 Phase Two

The identification and description of possible means by which the EUIR AIP may be developed, published and maintained and a recommendation of the most suitable way forward.

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<sup>2</sup> It should be noted that some States delegate the publication of their Aeronautical Information to another State.

<sup>3</sup> Excluding Pre-Flight Information Bulletins.

### **2.4.3 Phase Three**

The recommended and alternative methods for implementation of the EUIR AIP are elaborated from which further steps will be prepared to implement the EUIR AIP.

## 3 THE FOUR CANDIDATE SOLUTIONS

### 3.1 The Challenges

The main institutional challenge was to identify a simple, low risk, low cost solution that would impose minimum change to the way AIS is provided by member States.

The main technical challenge of the creation and implementation of the EAIP is the reconciliation of the textual descriptions contained within the AIPs of the 27 SES States, rather than the marrying and matching of the geo-spatial data. This is a prime consideration in the selection of a proposed solution for the EAIP.

As would be expected in a study of this nature the non-technical issues such as institutional and political differences have made the selection of an optimised solution a challenging task.

Note: All four solutions require the use of tools to allow the construction of the resultant EUIR AIP by the European AIP Service Provider (EASP). For all four solutions these tools are seen as being relatively straight forward and not requiring the creation of new large systems.

### 3.2 The Assessment Criteria

During the investigation process the following essential criteria were used as benchmarks against which the possible solutions for the EAIP were assessed:

Criteria	Notes
Pan-European	Can the solution be applied through the SES region and furthermore take into account the likely expansion of the SES?
Practical	Does the solution offer a practical way of operating? The solution must present a way of working which provides a realistic working environment for the States, the EASP and the Users.
Flexible	Can the proposed solution adapt to changes to the main requirements for the EUIR AIP in an easy and cost effective manner? These changes may be, for example, with respect to scope of membership and data.
Minimal risk	Does the solution offer a low-risk route to implementation of the EUIR AIP and for the ongoing service provision?

Criteria	Notes
Scaleable to allow for future expansion	Does the solution allow for the simple extension of the EUIR AIP into lower airspace, the TMA and possibly the Aerodrome?
Minimal cost during implementation	Does the solution offer low cost Service Implementation? <sup>4</sup>  It is assumed that all SES States have migrated to the EAD and that they prepare an eAIP.
Minimal cost for Service Provision	Does the solution offer low cost Service Provision?  Once again, it is assumed that all SES States have migrated to the EAD and that they prepare an eAIP.
Minimal impact on current / planned State working practices	Does the solution have a minimal impact on the working practices of the States participating in the SES?
Make maximum use of existing investments	Does the solution make maximum re-use of, or allow for, the investments made throughout the AIM community? This includes bodies such ICAO, EUROCONTROL and the SES States.  Examples of investments include State systems, the AIXM, EAD, the eAIP and Extensible Mark-up Language (XML) Notice To Airmen (xNOTAM).
Platform independent	Can both the EASP and the States providing information develop their systems without the need to use specific hardware platforms?
Open architecture	Does the solution allow the implementation of the Service Provision to be developed through the use of standard interfaces etc. without any reference to specific systems?
Open to market competition	Are both the Service Implementation and Service Provision open to market competition though the issuing of CFTs?

**Table 1: Assessment Criteria**

<sup>4</sup> As formal estimates have not been received for all solutions, this assessment has been performed against costs considered realistic by the study team.

### 3.3 Solution 1

Solution 1 presents a possible means of implementing the EUIR AIP based upon the use of the EAD.

Its process flow is described as follows:

- 1) Each State or State Grouping prepares its Aeronautical Information; this will be achieved through National collection, collation and co-ordination.
- 2) The processed Aeronautical Information is entered, either by way of an EAD Client Interface Terminal (ECIT) or through a system-to-system connection using the EAD System Interface (ESI), into the EAD Static Data Operations (SDO) database;
- 3) The State or State Grouping also prepares a paper AIP which is entered, in the form of a Portable Document Format (PDF) version, into the EAD Published AIP Management System (PAMS) functionality. This again is undertaken either by way of an ECIT or using the ESI;
- 4) The EASP extracts the necessary geo-spatial data from the EAD SDO database, using an ESI interface. The necessary supporting text is identified and manually extracted from the National AIPs. This manual process will require that both sets of data are combined with agreed EUIR specific text (see 12.2.6) to produce the EUIR AIP;
- 5) The EUIR AIP is then created, published as both an eAIP for distribution directly to clients, and as a PDF version which may be stored within the EAD PAMS functionality for user access.

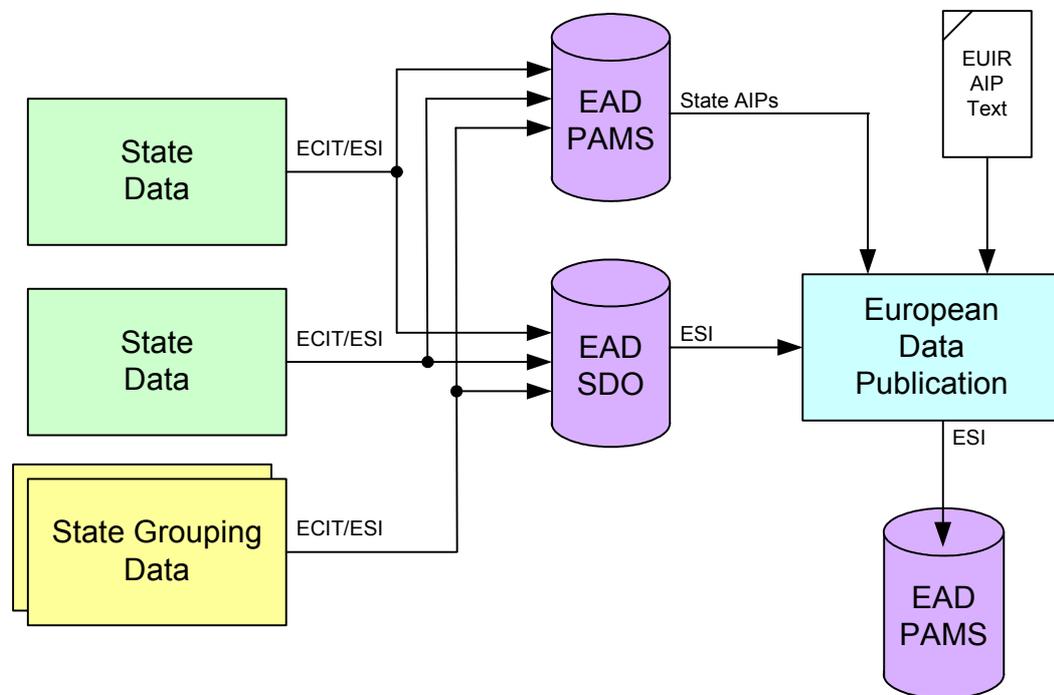


Figure 2: Possible Solution 1

### 3.3.1 Assessment Criteria Performance

<u>Criteria</u>	<u>Criteria Met?</u>	<u>Notes</u>
Pan-European	<b>Yes</b>	Makes use of the existing working practices in use, or planned, throughout the SES region.
Practical	<b>No</b>	The manual task of AIP text extraction makes this solution very impractical as it is labour intensive.
Flexible	<b>No</b>	This solution is dependent upon human action for the merging of AIPs. Those undertaking the merge must therefore fully understand the content and structure of all constituent AIPs. Any changes to these will have an effect and introduce risk, for the merge process.
Minimal risk	<b>No</b>	The manual process of national AIP text extraction may lead to human errors being introduced and a consequential loss of integrity.
Scaleable to allow for future expansion	<b>Yes</b>	The resulting EUIR AIP in eAIP format allows for the easy expansion of the single European AIP to lower airspace and terminal areas.
Minimal cost during implementation	<b>Yes</b>	No modifications or new tools are required in addition to those already planned for the States. A tool is required by the EASP to extract the geo-spatial data from EAD – this is envisaged as having a low implementation cost.
Minimal cost for Service Provision	<b>No</b>	The extraction of the AIP text from the national AIPs is a manual and labour intensive task and it is regarded as being of high cost. The risk of a loss of integrity through the manual processes will require that the processes adopted ensures that adequate quality checks are performed, furthermore, double / triple entry of data may be needed to ensure that the ICAO integrity requirements may be achieved.
Minimal impact on current / planned State	<b>Yes</b>	No excess work will be required by the State AIS over and above that carried out today or already planned for the future.

<u>Criteria</u>	<u>Criteria Met?</u>	<u>Notes</u>
working practices		
Make maximum use of existing investments	<b>Partly</b>	This solution does make use of the EAD as it stands today and the investment made by States in interfacing to it. No regard is paid however to other investments made such as the eAIP and xNOTAM.
Platform independent	<b>Yes</b>	The use of ESI which is Java and XML based means that the States' AIS may use any platform for the provision of the information. Likewise the EASP may use any platform to extract and compile information into the EUIR AIP.
Open architecture	<b>Partly</b>	This solution makes use of the EAD as a source of each State's data. The actual generation of the EUIR AIP is, however, open to any platform and architecture. An ESI will be required to provide the EUIR AIP.
Open to market competition	<b>Yes</b>	All elements of the service implementation and provision are open for market competition.

Table 2: Assessment Criteria Performance - Solution 1

### 3.4 Solution 2

Solution 2 is based upon the use of the EAD.

Its process flow is:

- 1) Each State or State Grouping prepares its Aeronautical Information; this will be achieved through National collection, collation and co-ordination.
- 2) The processed Aeronautical Information is entered, either by way of an ECIT or through a system-to-system connection using the ESI, into the EAD SDO database;
- 3) The State or State Grouping also prepares its AIP Text which is entered into a new EAD function. This again is undertaken either by way of an ECIT or using the ESI;
- 4) The EASP extracts the necessary geo-spatial data from the EAD SDO database and necessary AIP text from the new repository, using an ESI interface and combines the geo-spatial data with the agreed text to produce the EUIR AIP;
- 5) The EUIR AIP is then created, published as both an eAIP for distribution directly to clients, and as a PDF version which may be stored within the EAD PAMS functionality.

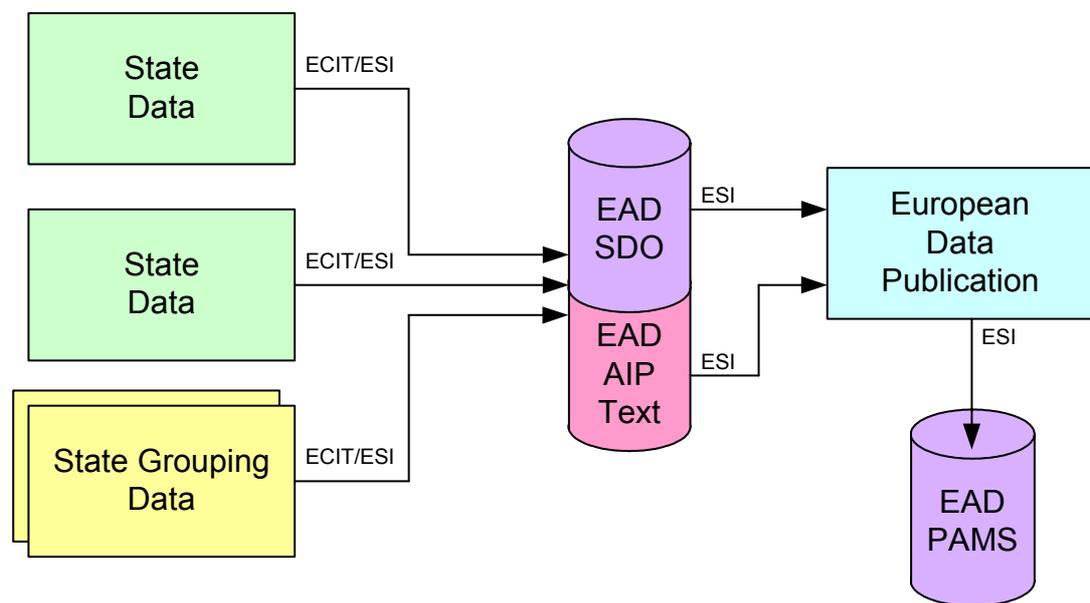


Figure 3: Possible Solution 2

### 3.4.1 Assessment Criteria Performance

<u>Criteria</u>	<u>Criteria Met?</u>	<u>Notes</u>
Pan-European	Yes	Makes use of the existing working practices in use, or planned, throughout the SES region.
Practical	No	The large impact on current working practices, the significant changes required to existing technology and the impact of change to the EAD (and the subsequent expansion of AIXM and potential risk of acceptance of the AIXM) makes this solution rather impractical.
Flexible	No	Any change to the EAD may require a change to a client's ESI or ECIT and will require further staff retraining. It has been expressed by a number of States that EAD should stabilise before additional functionality is implemented.  Due to the significant impact on Clients of changes made to the EAD, any modifications required to the EAD may not be implemented promptly as changes will have to be made to connected systems before the EAD modifications can be issued.
Minimal risk	No	The large impact of any change to the EAD on SES Members makes Solution 2 a high risk solution.  Should the EAD be unavailable this would have a serious impact on the availability of the EUIR AIP Service as no easy fall-back position is seen.
Scaleable to allow for future expansion	Yes	The resulting EUIR AIP in eAIP format allows for the easy expansion of the single European AIP to lower airspace and terminal areas.
Minimal cost during implementation	No	Large change required to EAD to hold textual information in a computer literate form. This will have a major impact on all ESI Clients.  This may also have a potentially negative impact on the adoption of the AIXM as a

<u>Criteria</u>	<u>Criteria Met?</u>	<u>Notes</u>
		world-wide format if this solution is implemented through an extension to the AIXM.
Minimal cost for Service Provision	<b>No</b>	Significant increase in the working practices and therefore costs of State AIS required. Any change to the EAD may require a change to a client's ESI or ECIT and may even require staff retraining. This may introduce unplanned work for States not planning to use the EUIR AIP.
Minimal impact on current / planned State working practices	<b>No</b>	States would be required to enter their AIP textual information into the EAD in a computer literate form (i.e., not in PDF format as is currently the case).
Make maximum use of existing investments	<b>Yes</b>	The investments made in the development of the EAD and the eAIP specification are both used. Re-use of the States' own eAIPs is not however made.
Platform independent	<b>Yes</b>	The use of ESI which is Java and XML based means that the States' AIS may use any platform for the provision of the information. Likewise the EASP may use any platform to extract and compile information into the EUIR AIP.
Open architecture	<b>Partly</b>	This solution is primarily based upon the use of standards and therefore allows the implementation to be performed in any way. The use of EAD for obtaining the State information and publishing the resultant eAIP limits the architecture in some ways.
Open to market competition	<b>Partly</b>	Whilst Service Provision could go to open tender, it requires an ECIT connection to the EAD. The development of the necessary EAD functionality to implement this solution will remain the remit of the system provider as only one company is in a position to bid for this enhancement.

**Table 3: Assessment Criteria Performance - Solution 2**

### 3.5 Solution 3

Solution 3 is not based upon any system architecture but does make use of EUROCONTROL's eAIP specification.

Its process flow is:

- 1) Each State or State Grouping prepares its Aeronautical Information in the form of an eAIP;
- 2) The processed Aeronautical Information is passed to the EASP. This transmission may be by way of the Internet, e-mail or through use of a private network;
- 3) The EUIR AIP Provider uses tools and processes to merge the various National eAIP documents into a single EUIR AIP, again in the form of an eAIP;
- 4) The EUIR eAIP is distributed to the end users. This distribution may be carried out through use of a paper document or through use of the Internet or e-mail.

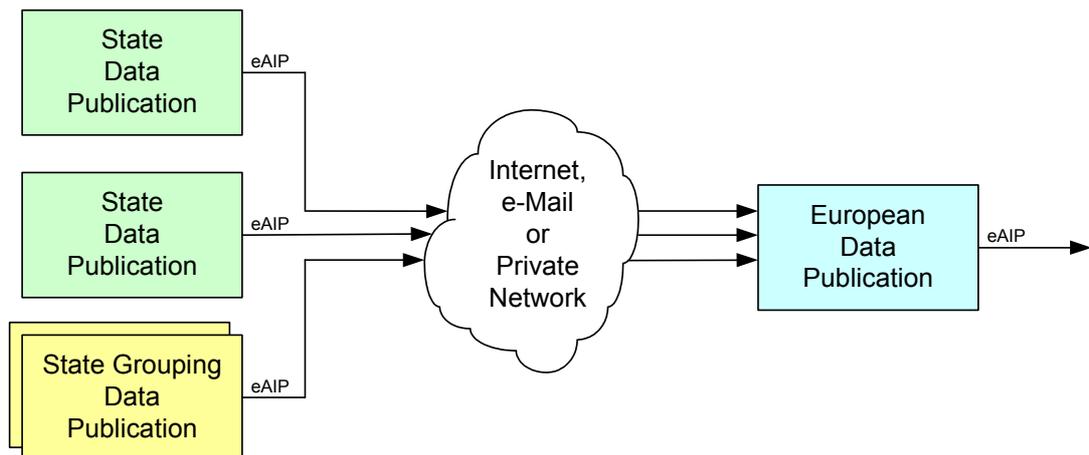


Figure 4: Possible Solution 3

### 3.5.1 Assessment Criteria Performance

<u>Criteria</u>	<u>Criteria Met?</u>	<u>Notes</u>
Pan-European	<b>Yes</b>	Makes use of the existing working practices in use, or planned, throughout the SES region.
Practical	<b>Yes</b>	This solution requires little additional effort from the States and is a relatively straight forward process, which may be highly automated, for the EASP.
Flexible	<b>Yes</b>	<p>As the eAIP specification may be adopted as an ICAO standard, this solution would allow additional States to join the SES without the need to migrate to EAD. For Solution 3, therefore, validation against the EAD SDO database would not be available nor would use of the NOTAM functionality.</p> <p>The development of an eAIP is a low cost option for States – some States have selected this as their preferred option for creation of a national AIP rather than the traditional paper based product.</p> <p>The eAIP can be manually produced if so wished so alternative products may be used.</p>
Minimal risk	<b>Partly</b>	<p>The undefined / unregulated communications for the provision of eAIPs to the EASP introduces risk. As long as CRC type validation is normally used to ensure the correct receipt, this risk may be mitigated through processes employed by the EASP in the light of non-receipt of a States eAIP.</p> <p>Tools may be required to cope with EUIR AIP production should a State electronic AIP not be available in the timeframe.</p>
Scaleable to allow for future expansion	<b>Yes</b>	The resulting EUIR AIP in eAIP format allows for the easy expansion of the single European AIP to lower airspace and terminal areas.

Minimal cost during implementation	<b>Yes</b>	Tools are required to merge the national eAIPs and validate the data in the EUIR AIP – these have been assessed as having a low cost for implementation. An email/Internet connection is required to provide the eAIP to the EASP but this is foreseen as being of low cost. Facilitation and support for States to migrate to the eAIP is already planned.
Minimal cost for Service Provision	<b>Yes</b>	The process of extracting data from the State eAIPs, checking for consistency and merging it into a single EUIR AIP is foreseen as a mainly automated process and inexpensive. Some human interaction will be required during this process and any inconsistencies found would require effort to resolve them. This solution is therefore seen as having a low service provision cost.
Minimal impact on current / planned State working practices	<b>Partly</b>	At the point at which the EUIR AIP is provided, the constituent States are likely to already be preparing an eAIP. The additional impact will be the distribution of the eAIP, at an early point, to the EASP and the Internet link and back-up or private network used to do this.
Make maximum use of existing investments	<b>Partly</b>	Use of the eAIP is made without the need for modification however no use is made of the EAD and hence States investments in interfacing to it.
Platform independent	<b>Yes</b>	The use of the eAIP specification which is XML based means that the States' AIS may use any platform for the provision of the information. Likewise, the EASP may use any platform to extract and compile information into the EUIR AIP. No dependence on any current system is required by Solution 3.
Open architecture	<b>Yes</b>	This solution is based solely upon the use of standards and therefore allows the implementation to be performed in any way. No constraints exist on its implementation with respect to architecture.
Open to market competition	<b>Yes</b>	All elements of the service implementation and provision are open for market competition.

Table 4: Assessment Criteria Performance - Solution 3

### 3.6 Solution 4

Solution 4 is based upon the eAIP but makes use of the EAD PAMS functionality for the extraction and storage of eAIPs and the use of the EAD SDO data to validate the EUIR eAIP.

The process flow for the recommended solution is:

- 1) Each State or State Grouping prepares its Aeronautical Information in the form of an eAIP;
- 2) The eAIP is entered, either by way of an ECIT or through a system to system connection using the ESI, into the EAD PAMS database;
- 3) The EASP uses tools and processes to merge the various National eAIP documents into a single EUIR AIP, again in the form of an eAIP;
- 4) The EUIR eAIP is then validated against the content of the EAD SDO. This will again be through the use of tools and the ESI to access the EAD data;

Whilst, in all likelihood the National eAIPs will be prepared from the EAD SDO data, this validation is seen as a vital step in verifying the content of the EUIR eAIP. The EAD will act in its role as a reference source of quality assured Aeronautical Information;

- 5) The EUIR eAIP is stored, using an ESI link, within the EAD PAMS database, making it available through the EAD distribution channels.

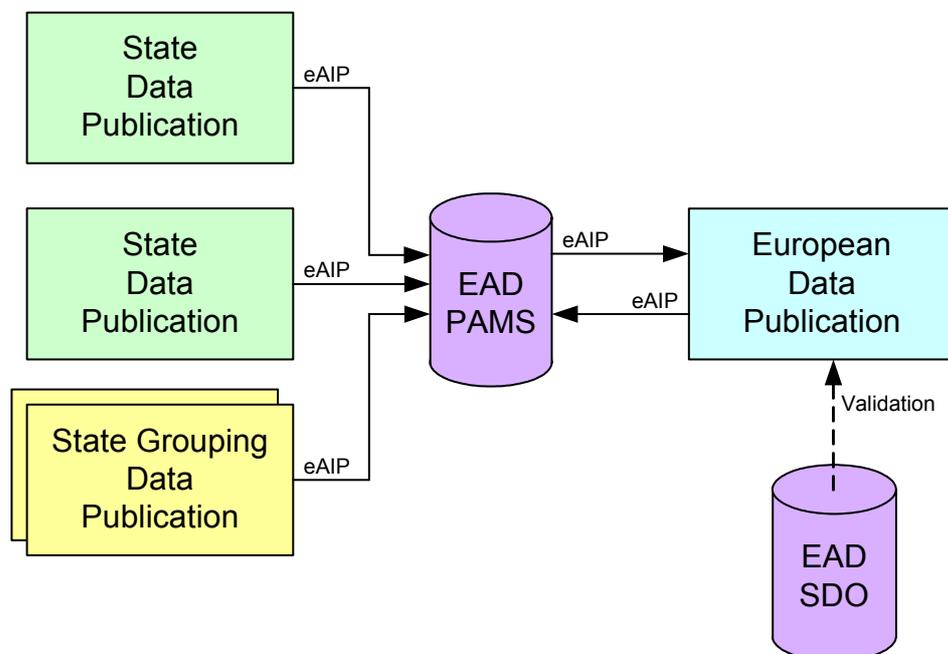


Figure 5: Possible Solution 4

**3.6.1 Assessment Criteria Performance**

<u>Criteria</u>	<u>Criteria Met?</u>	<u>Notes</u>
Pan-European	Yes	Makes use of the existing working practices in use, or planned, throughout the SES region.
Practical	Yes	This solution requires no additional effort from the States and is a relatively straight forward process, which may be highly automated, for the EASP.
Flexible	Yes	<p>As the eAIP specification may be adopted as an ICAO standard, this solution would allow additional States to join the SES without the need to migrate to EAD. In this instance validation against the SDO database would not be available.</p> <p>The development of an eAIP is a low cost option for States – some States have selected this as their preferred option for creation of a national AIP rather than the traditional paper based product.</p> <p>The eAIP can be manually produced if so wished so alternative products may be used.</p>
Minimal risk	Yes	<p>Reliance on standards and limited use of systems makes this solution desirable. The ability to validate the data in the EUIR AIP against the EAD SDO database minimises the risk of incorrect data being published.</p> <p>Fallback planning is available in the event of the non-availability of the EAD as standard internet / e-mail distribution of information to and from the EASP may be used. The ability to validate the resultant EUIR AIP would however be lost in this instance.</p> <p>Tools may be required to cope with EUIR AIP production should a State electronic AIP not be available in the timeframe.</p>
Scaleable to allow for future expansion	Yes	The resulting EUIR AIP in eAIP format allows for the easy expansion of the single European AIP to lower airspace and terminal areas.

<u>Criteria</u>	<u>Criteria Met?</u>	<u>Notes</u>
Minimal cost during implementation	<b>Yes</b>	Tools are required to merge the national eAIPs and validate the data in the EUIR AIP – these have been assessed as having a low cost for implementation.  Facilitation and support for States to migrate to the eAIP and EAD are already planned.
Minimal cost for Service Provision	<b>Yes</b>	The process of extracting data from the State eAIPs and checking for consistency, merging it into a single EUIR AIP and validating this against the EAD is foreseen as a mainly automated process and inexpensive. Some human interaction will be required during this process and any inconsistencies found would require effort to resolve them.  This solution is therefore seen as having a low service provision cost.
Minimal impact on current / planned State working practices	<b>Yes</b>	At the point at which the EUIR AIP is provided, the constituent States are likely to be preparing an eAIP and storing this within the EAD. No amendment to current working practices is therefore foreseen.
Make maximum use of existing investments	<b>Yes</b>	Use of the EAD and the eAIP are made without the need for modification.
Platform independent	<b>Yes</b>	The use of ESI which is Java and XML based means that the States' AIS may use any platform for the provision of the information. Likewise the EASP may use any platform to extract and compile information into the EUIR AIP.  No dependence on any current system is required.
Open architecture	<b>Partly</b>	This solution is primarily based upon the use of standards and therefore allows the implementation to be performed in any way. The use of EAD for obtaining the State information and publishing the resultant eAIP limits the architecture in some ways.

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<u>Criteria</u>	<u>Criteria Met?</u>	<u>Notes</u>
Open to market competition	Yes	All elements of the service implementation and provision are open for market competition.

**Table 5: Assessment Criteria Performance - Solution 4**

### 3.7 The Recommended and Alternative Solutions

The solutions have been summarised against the assessment criteria in Table 6.

<b>Criteria</b>	<b>Solution 1</b>	<b>Solution 2</b>	<b>Solution 3</b>	<b>Solution 4</b>
Pan-European	Yes	Yes	Yes	Yes
Practical	No	No	Yes	Yes
Flexible	No	No	Yes	Yes
Minimal risk	No	No	Partly	Yes
Scaleable to allow for future expansion	Yes	Yes	Yes	Yes
Minimal cost during implementation	Yes	No	Yes	Yes
Minimal cost for Service Provision	No	No	Yes	Yes
Minimal impact on current / planned State working practices	Yes	No	Partly	Yes
Make maximum use of existing investments	Partly	Yes	Partly	Yes
Platform independent	Yes	Yes	Yes	Yes
Open architecture	Partly	Partly	Yes	Partly
Open to market competition	Yes	Partly	Yes	Yes

**Table 6: Assessment Criteria Performance – All Solutions**

A comparison of each candidate solution clearly shows that Solution 4 meets most of the assessment criteria – one criteria only being partially met. The other proposed solutions fail to fully meet three or more of the assessment criteria.

With Solution 4 the impact on current working practices is kept to a minimum and it is foreseen that cost to Stakeholders will also be kept to a minimum (subject to a full CBA being performed) and the impact of change is less than the other solutions. Lastly, it was felt that the Solution 4 provided the best opportunity for other States who are not currently participating in the SES to join without the need for a significant investment, including the need to

become a fully migrated participant in the EAD<sup>5</sup>. Nevertheless, it was felt that the EAD would benefit from the availability of such States' data in electronic format to the replace the manual entry of such data which is the present norm.

Another important consideration was that strong resistance to any suggestion that the EAD be expanded beyond its current functionality was experienced with at least one State communicating its strong opposition to expansion. It was stated by a number of Heads of AIS that the EAD should be permitted to stabilise against its current functionality, and that States should be able to migrate against this, as they have committed to do so, without an increase in functionality and a subsequent shift in the goal-posts for migration.

As addressed earlier, a minority opinion has expressed a view that the final solution should be based upon the sole use of the EAD and that its functionality should be extended to permit this.

Whilst such views remain it has not been possible to select a single solution. Various stakeholders and stakeholder groups have expressed opinion supporting all four solutions and as such the other three solutions have also been developed.

Whilst solutions 1 – 3 meet the key requirements of a select few Stakeholders and are technically feasible, **in the opinion of the study team** none of these solutions offer the optimum solution when consideration is given to the impact across the whole AIS community.

The following chapters provide detailed description of each of the four solutions.

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<sup>5</sup> Whilst it is appreciated that all ECAC States have stated an intention to migrate to the EAD, the possible scope of the SES extends beyond the current ECAC member States and, indeed, outside Europe. Here migration to the EAD is less likely.

## 4 OPERATIONAL AND TECHNICAL CONCEPT – RECOMMENDED SOLUTION – SOLUTION 4

### 4.1 Overview

#### 4.1.1 Data Flow

The data flow for the recommended solution is represented in Figure 6.

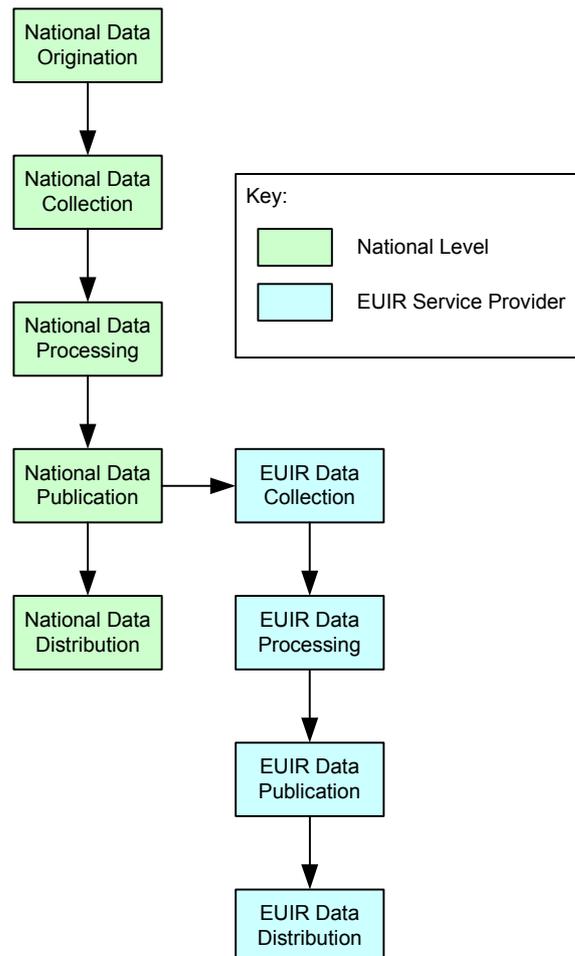


Figure 6: Data Flow – Solution 4

#### 4.1.2 Data Collection

The collection of data is made up of two distinct and separated phases: Local collection and European collection. The term Local has been used here as it is not necessary that this action be performed only at a National level. Indeed, a State may select to undertake this action on a per Flight Information Region (FIR) basis (where they have more than a single FIR) or, more likely, through joint working practices with other States.

The selected solution allows data collection by the provider of the EUIR AIP to be performed in many ways so making maximum benefit of the investments made in their own systems, the EAD system and through EUROCONTROL programmes which make use of XML, such as the eAIP and xNOTAM.

The process of combining eAIPs into a single publication therefore allows a very flexible means of data collection. It has been suggested in some comments raised on the Phase 1 and Phase 2 reports that the harmonised text required for the EUIR AIP should be provided by a single European body. Whilst the creation of such a body is beyond the scope of this study, and is being addressed by other work packages associated with the SES, the solution proposed would support such a way of working.

The Data Collection activities are described in more detail as follows:

#### **4.1.2.1 National Data Collection**

The origination of data by States would remain unchanged. The State Data Originator(s) would continue to pass data to the responsible AIS. The scope of Aeronautical Information for which an AIS is responsible may be defined to any extent providing that it is notified to the EASP. Consequently, for every piece of information to be published as part of the EUIR AIP, the AIS responsible for publishing that information, at a National Level, is known.

Once a National or State Grouping AIS has collected all the data necessary for publication it will progress to the Data Processing step.

#### **4.1.2.2 EUIR AIP Service Provider**

The task of Data Collection for the EASP is a simple one. Once each National AIS has produced its eAIP and entered it into EAD PAMS, the EASP will simply collect the data by extracting them all.

The task of the EASP will be to ensure that all the National eAIPs are made available to it at the appropriate time and to pursue any which are not present.

#### **4.1.3 Data Processing**

The Data Processing performed by States today, or planned in order to comply with the European Convergence and Implementation Plans (ECIPs), should continue, unaffected by the proposed solution if so desired. Some areas of possible improvement are, however, in need of assessment. These improvements do not affect the production of the EUIR AIP but do impinge on its quality.

The research performed during development of the Static Data Procedures (SDP) found that many different detailed processes apply today and that the quality of the provided end data varies significantly between States. Furthermore, research undertaken by EUROCONTROL as part of its Data Integrity initiative has found that the ICAO requirements for the traceability and integrity assurance of data are not met.

There is a need for the EASP to receive data of the required quality and that the traceability of this data is guaranteed. Such records are not widely

available today and studies have shown that integrity levels do not comply with ICAO.

For these reasons it is recommended that, as part of the implementation phase of the EUIR AIP, the requirements for greater harmonisation of operating procedures are assessed.

The processing required by the EASP may be detailed as follows:

- a) The collected eAIPs are parsed to ensure compliance with the defined XML Schemas;
- b) Any invalid eAIPs or parts of eAIPs are referred back to the originating body for validation and correction;
- c) Ensure that any text included within National eAIPs which it has been agreed will be harmonised<sup>6</sup> is compliant with agreements;
- d) Refer back to the originating authority any eAIPs whose text is not compliant with the harmonised text agreements;
- e) The eAIPs are merged to provide a single European AIP covering the required information. This will involve the filtering of the information merged to include only those elements applicable to Upper Airspace. If and when the AIP is required to include lower airspace, terminal area or Aerodrome information, this filter can be revised to include the increased scope of the new content. In this way the solution meets the requirements of the SES that it must be suitable for possible extension, without the need to rework or amend the basic operating principles;
- f) Any inconsistencies within the combined eAIP are raised to the EASP for manual processing. This would likely involve discussion with the relevant States, EUROCONTROL and the EAD Service Provider;
- g) The content of the combined eAIP is verified against the content of the EAD SDO database;
- h) Any inconsistencies found between the combined eAIP and the content of the EAD are raised to the operator for manual processing. Again, this would likely involve discussion with the relevant States, EUROCONTROL and the EAD Service Provider.

This processing is covered further in section 4.2.2.1.

#### **4.1.4 Cartography**

Initially the EUIR AIP must only cover upper airspace, for which the requirement for charts is very limited. It is foreseen that an overall Upper-Airspace chart is required (possible broken down into several sheets) and that, in the future, when Functional Airspace Blocks (FABs) are created, a single sheet could be provided for each block.

Today EUROCONTROL prepares the Automated System for the Management of Aeronautical Information Charting (ASMAC) Charts which

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<sup>6</sup> Any harmonisation of text will be as a result of other studies and mandates whose remit is the improved harmonisation and utilisation of European airspace.

are available for both Upper and Lower airspace. It is recommended that use be made of these charts for publication of the SES Upper-Airspace chart, again taking maximum benefits of investments already made.

Furthermore the SkyView product also produced by EUROCONTROL provides interactive, digital access to the required information.

Where any additional charts are required (e.g. PDRG Chart), the level of detail needed means it unlikely that an overall chart would suffice. In this instance consideration should be given to the use of charts initially at a National level and later, upon their creation, at an FAB level. The responsibility for production of these charts resting at a National or FAB level respectively.

#### 4.1.5 Data Publication

Having processed its information, a State may continue to publish the information as it currently does today. A paper AIP may be provided or, as is being seen increasingly in practice, the eAIP may act as the primary means of publication. This generally involves the production of a suitable style sheet to allow the eAIP information to be viewed in a format compliant with ICAO Annex 15 (Reference 3).

One advantage of the eAIP is the ability to apply different style sheets to the same core information to present it in differing user formats. Figure 7 illustrates this capability.

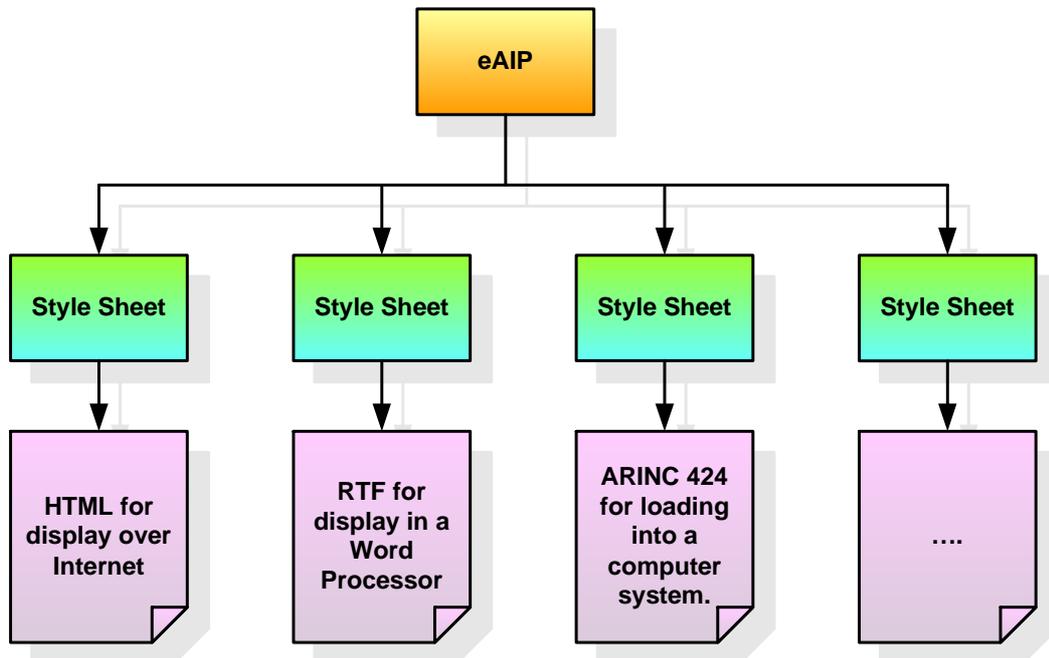


Figure 7: Style Sheet Application

Whilst the preparation of style sheets for the use of the National AIPs is a State task, those which are required for the EUIR AIP should be specified to the EASP.

This study recommends that only two style sheets are made available by the EASP. These being the provision of Style sheets to allow the EUIR AIP to be

viewed using HTML and in the form of a RTF document. The selection of RTF allows a user to electronically annotate the document if required.

Many users will have individual needs which will require the data to be manipulated into other formats, for example ARINC 424. Whilst these additional style sheets could also be provided by the EASP they are more client specific and should not be provided under the cost of the basic service provision. Permitting the EASP to provide additional style sheets may not be in accordance with the requirements of open competition as this will, in effect, create a monopoly position for the EASP in the supply of style sheets.

Careful monitoring and Oversight Management of the EASP will be necessary to ensure that the information provided is accurate, appropriate to its use and that both the information itself, and all necessary meta-information pertaining to it, are made available to all who wish to use it in both an open and timely way. See section 4.1.6, below.

#### **4.1.6 Data Access and Distribution**

Each State maintains a distribution list of organisations and people who have subscribed to receive its AIP. Some of these clients pay for receipt whilst others receive it free of charge, often through reciprocal agreements between the issuing State and the receiving State.

Some States that have migrated to the EAD are using the EAD subscription functionality as a means of distributing electronic copies of their publications. Furthermore, some States have made their AIP freely available by way of State AIS internet sites.

As the EUIR AIP will not replace the National AIPs it is not foreseen that these current means of distribution will be changed. The States will still be required to distribute the information which they publish, whether it is for all airspace or only that necessary for flight in lower-airspace, to their client bases.

It is however intended that the EAD is used as the primary means of making the EUIR AIP available to its users and that the EAD System be used to manage the subscription list for its distribution (a client who wishes to receive the eAIP will be able to subscribe for it using the EAD functionality).

In consequence the following would apply:

- a) The EASP enters the EUIR AIP into the EAD PAMS<sup>7</sup> database through use of an ESI connection;
- b) The EUIR AIP is, as a consequence, made available to any user through use of the EAD Public User interface available through an internet connection;
- c) The EAD system will transmit the EUIR AIP to any client who has subscribed to receive it;
- d) The management of previous and future versions is performed by the EAD system without additional burden.

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<sup>7</sup> EAD PAMS will be able to hold eAIPs from November 2004.

A more detailed description of the means of access and distribution is provided in 4.3.

#### **4.1.7 NOTAM**

The vast majority of NOTAM issued are initiated as a result of changes to infrastructure. Whilst these may affect upper airspace (for example the outage of an en-route Navigation Aid (Navaid)), it is not the case that these would fall under the responsibility of the provider of the EUIR AIP.

Each year it has been estimated that a small number (less than ten) of NOTAM will be required which will solely affect the upper airspace and therefore require creation by the EASP. Despite this low number, it is considered essential that a H24 NOTAM facility must exist as part of the service provision. Furthermore, ***it is the opinion of the study team*** that the EAD functionality should be used as the means of both creating, storing and distributing these NOTAM if its EASP is not already equipped to do so.

Although it is for those organisations who tender for supply of the EUIR AIP Service Provision to propose how an H24 NOTAM service will be provided, it is the recommendation of this study that, for a Service Provider who does not already have in place a H24 NOTAM facility, this effort would be more cost-effectively provided through sub-contract to another organisation already offering such a service.

## **4.2 Implementation**

### **4.2.1 Existing Technology**

#### **4.2.1.1 eAIP**

The eAIP, as developed by EUROCONTROL, forms the underlying technology through which the EUIR AIP will be implemented as it will be used to both source the information and will be the medium by which the information is published. The eAIP is a recent development, enabled mainly through the emergence of XML technology.

It should be noted that the implementation of the eAIP is already an ECIP objective. Should the recommendation of this report be accepted, then the ECIP will need to be raised to Pan-European status. In consequence, and though there is a steady migration by European States to the publication of the AIP in eAIP form, additional support, facilitation, training and awareness will be required to ensure the revised ECIP objective is met within the required timeframe. These requirements should be captured in the implementation definition phase.

The implementation of the eAIP by States is not considered further in the report.

States will need to make available a sub-set of their State eAIP, in effect a second eAIP, for the EUIR AIP. This will be needed because the EUIR AIP will not contain all the information required for an entire State AIP.

Two means of providing this are considered:

- 1) Firstly, an eAIP which only holds the upper airspace information;
- 2) Secondly, a version which permits either, upper airspace only; upper and lower airspace; upper, lower and terminal airspace; or all information to be contained.

Whilst the former meets the immediate needs of the EUIR AIP, it would need enhancement should the EUIR AIP be extended to include additional airspace. The latter option would not require such enhancement and would therefore meet more closely the likely future needs. It is recommended that, as part of the implementation phase, these options be considered more fully.

#### **4.2.1.2 EAD**

The EAD as operational today does not provide all the facilities needed for implementation of the preferred solution. However, the additional functions needed, the storage and access to eAIP versions of a State's publication are currently planned and should therefore be available within the timeframe necessary. It is therefore considered that no further implementation of the EAD is necessary.

It should be noted that where this report makes mention of the EAD this is with reference to the functionality which is provided and is in no way a reference to the Service Provision aspect.

Use of the following EAD functionality is planned:

- a) The PAMS functionality for the storage of National eAIPs by the States;
- b) The PAMS functionality for the retrieval of National eAIPs by the EASP;
- c) The SDO database for validation of the content of the EUIR AIP;
- d) The PAMS functionality for the storage of the EUIR AIP;
- e) The PAMS functionality for distribution of the EUIR AIP;
- f) The International NOTAM Operations (INO) functionality for the creation and storage of EUIR NOTAM messages;
- g) The INO functionality for the distribution of EUIR NOTAM messages;
- h) The legal recording functionality for maintaining the audit trail of actions undertaken by both users of the EUIR AIP and the EASP with reference to the above functions.

#### **4.2.1.3 NOTAM**

There is no necessity for any modification to the ICAO standard NOTAM message or processing as specified within ICAO Annex 15 (Reference 3) and EUROCONTROL's Operating Procedures for AIS Dynamic Data (OPADD) (Reference 12) respectively. As such, the implementation of the NOTAM requirements for the EUIR IAIP may be considered a simple task. Section 4.1.7, above, outlined the basic requirements for NOTAM within the scope of the EUIR.

In the future it may become operationally advantageous for use to be made of the new xNOTAM being developed by EUROCONTROL. This is covered further in section 4.2.2.2.

## **4.2.2 New Technology Required**

### **4.2.2.1 eAIP Merge and Validation Tool**

A new tool to allow the eAIPs prepared by National Agencies to be validated and merged as the Single European AIP is the single tool to be developed during the implementation phase. Initially the data will cover only upper airspace but later, if required, it may cover lower and terminal airspace. It is considered that the development of the tool will not be a difficult or onerous task. The use of the eAIP Specification brings the benefit of a fully computer literate source of information which may be read, manipulated compared and ordered by an automated tool with the minimum of human interference.

Figure 8 is a process flow diagram of the actions which the eAIP Merge & Validation Tool (EMVT) would be required to undertake. For the sake of clarity, reporting points to the operator are not shown.

The major activities are:

- a) The tool will interface to the EAD PAMS database using an ESI to automatically extract the Nationally issued eAIPs. This will be initiated as an operator action and will report progress as the eAIPs are received. This requirement will mean that the EMVT must be created as an EAD ESI Client;
- b) Once the National eAIPs have been extracted from the EAD they will be validated against the eAIP Schema definition as issued by EUROCONTROL;
- c) If an error in the validation of the eAIPs against the issued schema definition is detected this will be reported to the operator. This must then be raised to the body responsible for issuing the eAIP for clarification and rectification;
- d) Once all the eAIPs which constitute the SES region have been validated, the tool will automatically perform the merge, comparing textual data to ensure compliance against any agreed, harmonised text;
- e) If any text does not comply with that agreed for use within the SES airspace by way of harmonisation, this will be reported to the operator for clarification and correction by the responsible National body;
- f) Once a coherent and compliant EUIR eAIP has been prepared, the geo-spatial information which it contains will be validated against the SDO database using an ESI connection. This check will be used to validate both that the source eAIPs were consistent with the SDO database and that the process of merging the EUIR eAIP<sup>8</sup> has not introduced any errors;

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<sup>8</sup> Validation of the processes and tools used to populate the EAD and to produce the National and EUIR eAIPs should be such that this validation should not identify any differences. It is, however, considered an important step from in assisting with the constant aim of improving the integrity of aeronautical information.

- g) If any differences are identified between the EUIR eAIP and the EAD SDO data, these will be investigated. If the applicable National eAIP and EAD SDO data differ, it will be reported to both the National body responsible and the EAD Service Provider;
- h) The EUIR eAIP will be stored within the EAD PAMS database through use of an ESI connection. This will ensure that it is both distributed to the clients who have subscribed to receive it and that it is made generally available through use of the EAD Public User Interface.

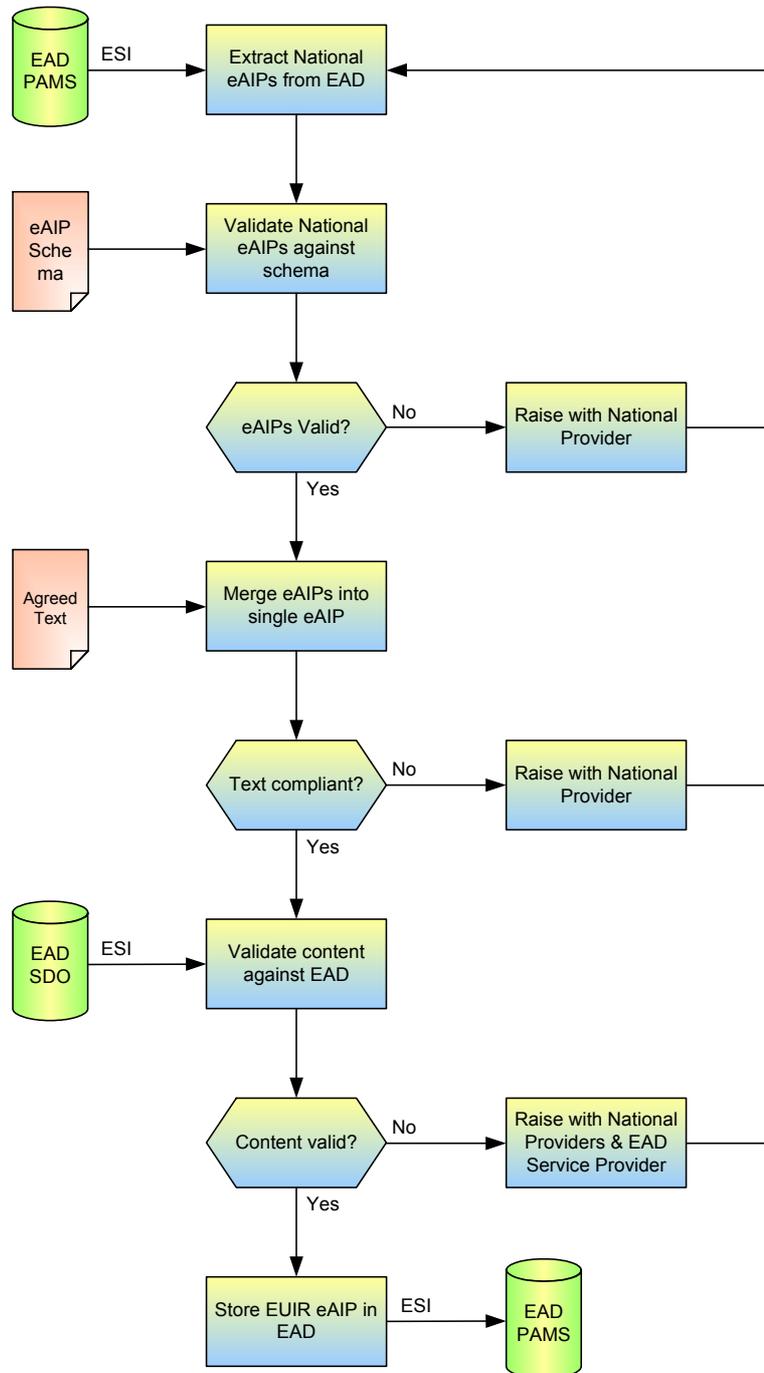


Figure 8: eAIP Merge & Validation Tool (Solution 4)

#### 4.2.2.2 **xNOTAM**

The xNOTAM is a current project being undertaken by EUROCONTROL. The project is determining the feasibility of updating Aeronautical Information to create an accurate and dynamic database, through a computer literate NOTAM enabled by XML.

The objectives set for the project will ensure a significant improvement in the provision of dynamic data as compared with today. The main benefit for the EUIR is the ability for a computer to fully decode and understand received NOTAM messages. The availability of such data will be a key component of the dynamic management of airspace.

There are three areas in which possible future use should be considered:

- 1) The use of the xNOTAM for the receipt of information, issued by the SES States;
- 2) The use of the xNOTAM for the transmission of NOTAM information by the EASP;
- 3) The real-time update of EUIR information using xNOTAM.

**The study team has noted** that the project is in the feasibility stage and as a consequence, feel that they cannot recommend its use at the time of writing.

Nonetheless, should the xNOTAM achieve its aims, and early indications for this are very favourable, the use of the xNOTAM should be researched further during the implementation phase of this project. If, as it appears, the xNOTAM will offer significantly enhanced European NOTAM capabilities, with the ability to automatically convert messages to standard ICAO format, and the ECAC States adopt this as the primary means of transmission and receipt of information which qualifies for NOTAM, it would be irrational for the provision of EUIR information not to follow suit.

#### 4.2.3 **Time Implications**

To facilitate EAD operations, a two week period has been introduced into the AIRAC Cycle to allow the EAD Service Provider to ensure the co-ordination of State data prior to publication. Once this co-ordination has been achieved, the States are given a further two weeks to prepare their AIPs<sup>9</sup>. This second two week period provides:

- a) A period to produce the publications;
- b) A period to print master copies and obtain approval for release;
- c) A period to reproduce, collate and package the publications for distribution.

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<sup>9</sup> It is highly likely that States will in actuality prepare their AIP during the two weeks in which the EAD Service Provider performs consistency checks and co-ordinates the data. This will be done knowing that there is a risk that a problem is identified with their data. As the processes based around the use of the EAD become more practised this risk will be lessened.

The third activity is often the most time-consuming and it is in this period that **the study team recommends** that the EUIR eAIP be prepared. This recommendation is based on the following assumptions:

- The co-ordination activities that the EAD Service Provider performs will help ensure that geo-spatial inconsistencies are unlikely to be found in the EUIR eAIP;
- Once the EUIR AIP has been established, textual changes, and hence the possibility of inconsistencies in the EUIR eAIP, will be infrequent;
- Given footnote 9, the eAIPs may well become available earlier than envisaged.

Figure 9 provides an illustration of the proposed AIP production time-line in relation to the AIRAC cycle.

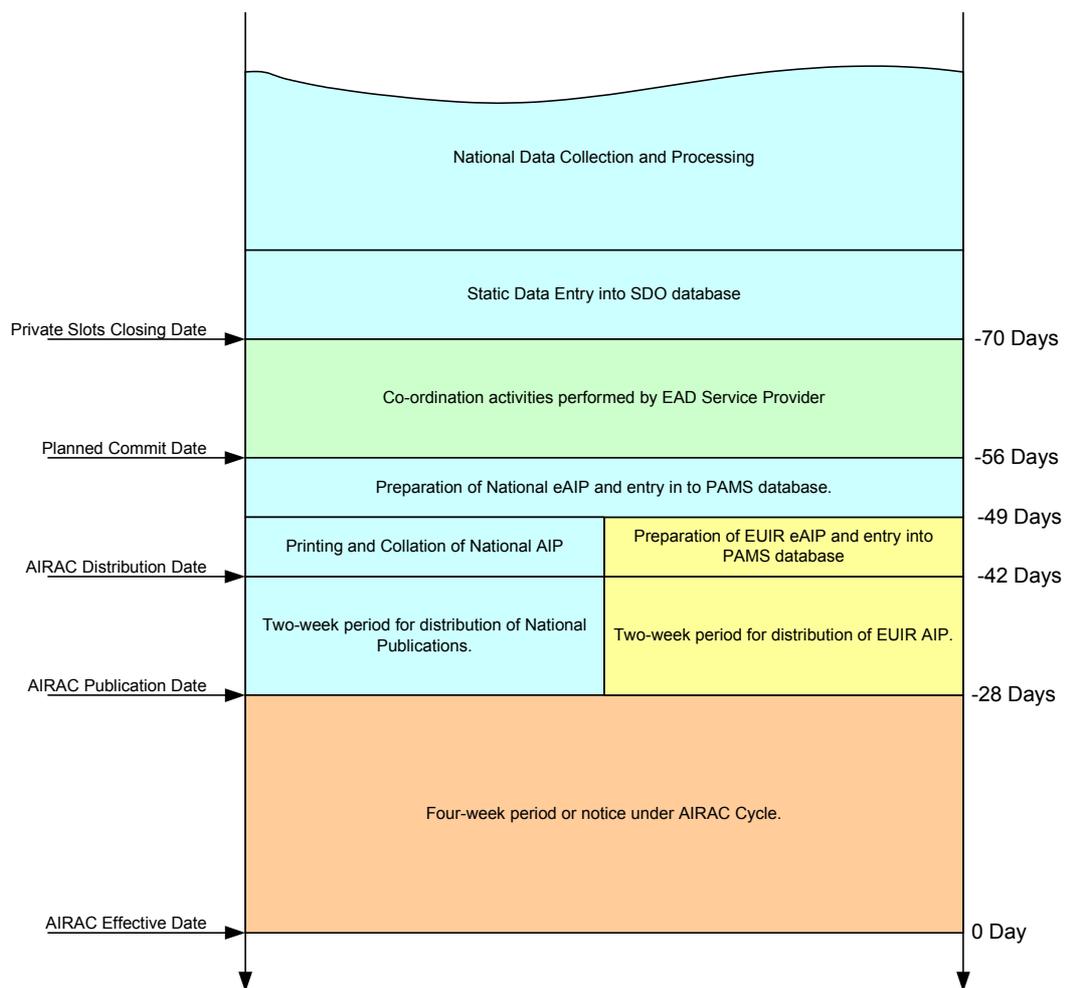


Figure 9: Proposed EUIR AIP Time-line for Solution 4

### 4.3 EUIR AIP - Means of Access

The EUIR AIP will potentially have a world-wide client-base. Six means of access are envisaged:

- 1) Using an ECIT to access the documents stored in PAMS;
- 2) Using the ESI to access the documents stored in PAMS;
- 3) Using the ESI to subscribe to automatically receive the documents;
- 4) Using the EAD Public User interface to access the publications using the EAD web-site;
- 5) By placing the documents on an EASP managed web-site;
- 6) Through a non-EAD means of subscription managed by the EASP.

The guidance of ICAO is that the production costs of a master AIP should be met by route charges, the users of the AIP only paying the reproduction and distribution costs. It is therefore reasonable to assume that only the last case should incur additional user costs. It is therefore recommended that either no charge or only a modest handling charge should be made for receipt of a web-based electronic EUIR AIP.

The first four cases are fully detailed within the EAD documentation available via EUROCONTROL's website (see <http://www.eurocontrol.int/ead/library>). Furthermore, the first three are governed through the application of Service Level Agreements (SLA) which are developed and signed when clients migrate to use of the EAD.

Although the need for the EASP to provide a website is not mandatory it is considered highly desirable as this provides another independent means by which the EUIR AIP may be obtained.

Typically an AIS provides a subscription service for the AIP, used as a means of recording what documents should be provided to whom, in what format and by what means. This also often includes information such as payment status. Nevertheless, issues associated with copyright and liability will need to be addressed during the implementation planning phase.

It is recommended that the CFT issued for the Service Provision should include, as an option, the need to propose a subscription service. Although it is likely that other means of access will predominately be used, and hence that the subscription list will be quite small, it is an essential component of the service.

The subscription service should provide for:

- a) Paper distribution;
- b) Electronic distribution via a secure network;

- c) Delivery via e-mail<sup>10</sup> or CD-ROM (postal);
- d) Delivery in the form of an eAIP or HTML pages (the later achieved through use of a XML style sheet).

It should be noted that only in the form of a Paper AIP would the amendment service be required. In all other cases an entire, up-to-date, AIP can be provided.

## 4.4 Maintenance

The proposed solution provides for a highly maintainable service as the impact of change is minimised through the recommended simple interface and distributed architecture.

For example:

- a) A change to the eAIP specification should have no impact on the EAD and on consequent ESI connections and State database functionalities as the PAMS database is used solely to hold a data file;
- b) A change to the EAD which does not affect ESI will have no impact on the EUIR AIP data extraction / entry to EAD;
- c) A new release of the AIXM will impact the EAD and potentially ESI communications but should have minimal effect on the EMVT software.

The limitation of impact was a key factor in **the study team recommending** this solution.

## 4.5 Availability

### 4.5.1 Access

It is foreseen that the EUIR AIP will be available in the EAD PAMS database, available through the EAD Public User Interface accessed using an Internet connection. It is also envisaged that clients may subscribe to the EUIR AIP through the EAD service. The EUIR AIP will also be available on the EASP's website, ensuring that a copy of the EUIR AIP is always available to the end-user.

#### 4.5.1.1 EAD PAMS

EAD PAMS where the EUIR AIP will be stored is a 24-hour service providing continuous support. It has a parallel (contingency) service so availability is not a prime concern.

#### 4.5.1.2 NOTAM

The provision of EUIR Aeronautical Information will include the publication of NOTAM. **It is the recommendation of the study team** that the EAD

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<sup>10</sup> The use of e-mail may have size implications as an SES EUIR eAIP is likely to be of a significant size. This may have a bearing on the way the eAIP files are structured, created and stored.

functionality should be used to validate, store and distribute these NOTAM. As with the service offered in 4.5.1.1 above, availability is not an issue as the EAD provides a contingency service.

#### 4.5.2 **Safety and Security**

Much of the information in this section comes from EUROCONTROL's Electronic AIP Specification (Reference 15). The integrity of the EUIR AIP is directly related to the use of an eAIP for operational needs. Therefore, data integrity must be maintained by a secure transmission path between the EUIR AIP editor and the EUIR AIP user. One distribution method for the EUIR AIP is the Internet, which as a public network, is currently not a secure path. To help maintain data integrity in an insecure environment, a protection layer must be added to the data. This can be provided by technologies such as electronic signature and authentication, with non-repudiation (the user cannot deny sending the information) as an additional benefit.

The electronic signature scheme is currently the most likely means of ensuring eAIP data integrity and authenticity of information. It provides three levels of protection:

- 1) EUIR AIP Data Integrity – protection against modification on the path from originator to the user;
- 2) EUIR AIP Data Authentication – certification of the data originator;
- 3) EUIR AIP Data Non-repudiation – Originator cannot deny having signed the data.

The process the EASP may follow with the electronic signature scheme is as follows:

- b) The EASP sets up a signing environment;
- c) The EASP provides each end-user with the signing certificate or public key using a different channel to that transmitting the EUIR AIP;
- d) The end-user checks with the EASP for authenticity;
- e) The end-user acquires appropriate software to verify the signature;
- f) For each distribution, the EASP signs the published EUIR AIP package. If there are several packages, each should be individually signed;
- g) The EUIR AIP packages are distributed with their signatures;
- h) The end-user receives the eAIP package and checks the signature.

There are a number of issues which may affect the authentication and integrity of the data supplied by the EASP and these can be avoided by creating as secure an environment as possible with tight security procedures.

<u>Issue</u>	<u>Procedures/Action Required</u>
Key theft	Ensure that a secure environment has been provided where key theft can be detected and have procedures

	in place to revoke and change incriminated keys and associated certificates.
Look-alike certificates	The end-user needs to validate the certificate with the EASP and trusted contact information must be used for this.
Email Impersonation	The use of the electronic signature will ensure that data integrity and authenticity are not jeopardised.
Data Corruption – accidental or intentional	The use of electronic signature will ensure that no data corruption has occurred on the path from EASP to the end-user.

Table 7: Integrity Issues

## 4.6 Continuity of Service and Contingency Planning

The current EC draft regulation on common requirements for provision of air navigation services states that “*A provider of air navigation services shall adopt contingency plans to detail the steps to be followed towards the continuity of services in the case of events which result in significant degradation or interruption of its services. These plans shall cover events resulting from accidents, technical failure, intentional acts, unscheduled breakdown or force majeure*”.

Contingency planning to mitigate a service failure is of high importance for the service provided by the EASP. It is not envisaged as being a serious problem if the eAIP for the EUIR is not available for up to a few hours. Furthermore, by the EUIR AIP being made available through both the EAD and an EASP web-site, this risk is significantly reduced.

The availability of live NOTAM links is, however, considered critical. To mitigate the risk of EUIR eAIP unavailability, it may be advisable for the end user to always store and make available on the client side computer or network, a local copy of the EUIR AIP.

Software and procedures should be in place to ensure continuity of service and to avoid server outage in the first place.

Failures to the EUIR AIP Service may occur for a number of different reasons which will affect the service and dictate the procedures required to avoid the situation and to maintain continuity of service. Some of the potential causes of failure are listed below (Table 8).

<u>Type of failure</u>	<u>Affect on Service</u>	<u>Procedures Required</u>	<u>Contingency Planning</u>
Download server tampering	May affect availability and data integrity.	Server should be secure with latest patches applied. The operating system should be secure. Electronic signature should be used.	Offer redundant service.

<u>Type of failure</u>	<u>Affect on Service</u>	<u>Procedures Required</u>	<u>Contingency Planning</u>
Download server denial of service	The EUIR eAIP is not available.	Maintain proper security practices as detailed above. Policy of not relying solely on remote service.	Offer redundant service.
Download Server Hijacking	May affect availability and data integrity.	Maintain proper security practices as detailed above to secure all computers and devices which are crossed by Web requests from the end-user's side to the server's side. Use Secure Socket Layer to ensure that the end-user is connected to the expected web server and not to the attackers. Use electronic signature.	Offer redundant service.

**Table 8: Service Failures**

## 5 OPERATIONAL AND TECHNICAL CONCEPT – ALTERNATIVE SOLUTION – SOLUTION 1

### 5.1 Overview

#### 5.1.1 Data Flow

The data flow for Solution 1 is represented in Figure 10.

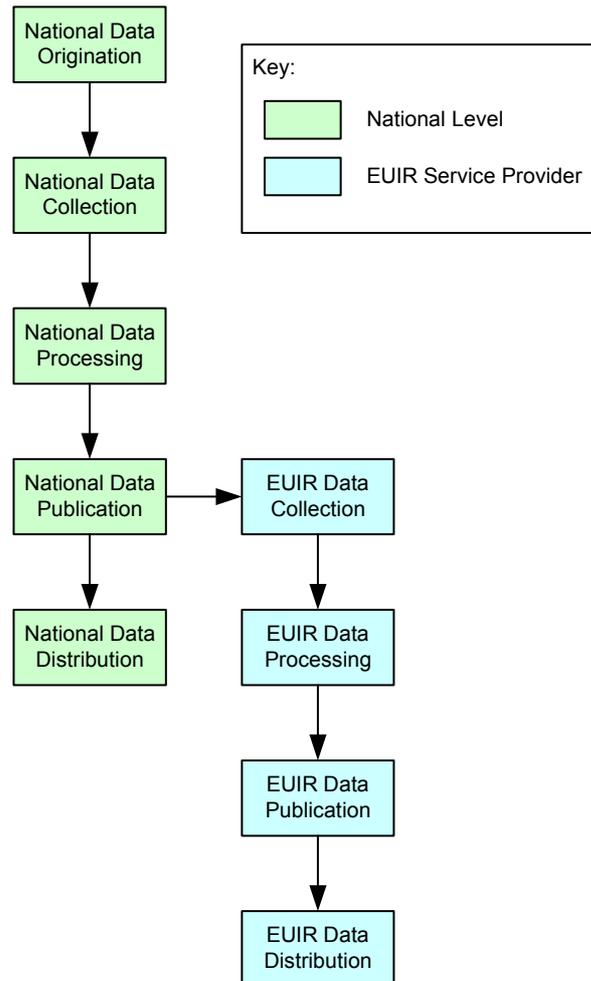


Figure 10: Data Flow – Solution 1

#### 5.1.2 Data Collection

The collection of data is made up of two distinct and separated phases: Local collection and European collection. The term Local has been used here as it is not necessary that this action be performed only at a National level. Indeed, a State may select to undertake this action on a per FIR basis (where they have more than a single FIR) or, more likely, through joint working practices with other States.

Solution 1 allows partial data collection by the provider of the EUIR AIP to be performed through the EAD and their systems linked to this using ESI

connections and xNOTAM. An element of manual extraction is involved for the supporting AIP text. The remainder of the EUIR specific text is manually collected also.

It has been suggested in some comments raised on the Phase 1 and Phase 2 reports that the harmonised text required for the EUIR AIP should be provided by a single European body. Whilst the creation of such a body is beyond the scope of this study, and is being addressed by other work packages associated with the SES, the solution proposed would support such a way of working.

The Data Collection activities may be described in more detail as follows:

#### **5.1.2.1 National Data Collection**

The National Data Collection will be the same as Solution 4. See 4.1.2.1 for further details.

#### **5.1.2.2 EUIR AIP Service Provider**

The task of Data Collection for the EASP is a reasonably complex one when compared with the other proposed solutions. Once the National AIS have entered their geo-spatial data into the EAD SDO database and their AIPs in PDF format into the EAD PAMS database, the EASP will extract the geo-spatial data and the AIPs.

The task of the EASP will be to ensure that all national geo-spatial and text data is made available to it at the appropriate time and to pursue any which are not present.

#### **5.1.3 Data Processing**

The Data Processing performed by States today, or planned in order to comply with the ECIPs, should continue unaffected by Solution 1, if so desired.

Some areas of possible improvement to current working procedures are also in need of assessment. These improvements do not affect the production of the EUIR AIP but do impinge on its quality.

The research performed during development of the SDP found that many different detailed processes apply today and that the quality of the provided end data varies significantly between States. Furthermore, research undertaken by EUROCONTROL as part of its Data Integrity initiative has found that the ICAO requirements for the traceability and integrity assurance of data are not met.

There is a need for the EASP to receive data of the required quality and that the traceability of this data is guaranteed. Such records are not widely available today and as mentioned above, integrity levels do not comply with ICAO.

For these reasons it is recommended that, as part of the implementation phase of the EUIR AIP, the requirements for greater harmonisation of operating procedures are assessed.

The processing required by the EASP may be detailed as follows:

- a) Ensure that any State text data entered in the AIPs which it has been agreed will be harmonised<sup>11</sup>, is compliant with agreements. This will be a manual process;
- b) Refer to the originating authority any text which is not compliant with the harmonised text agreements;
- c) The geo-spatial data is extracted from the EAD SDO and the AIP text data is manually extracted from the AIPs retrieved from EAD PAMS. This data will be merged with additional, EUIR specific, text to provide a single European AIP covering the required information.

Whereas there is a relatively small amount of text data for the EUIR and the solution meets the requirements of the SES that it must be suitable for possible extension, without the need to rework or amend the basic operating principles, it must be stressed that if the European AIP is expanded to cover lower and terminal airspace, the amount of text data that will need to be extracted from each AIP makes this solution impracticable and high risk due to the elevated level of user intervention required in the process;

- d) Any inconsistencies within the combined EUIR AIP are raised to the EASP for manual processing. This would likely involve discussion with the relevant States, EUROCONTROL and the EAD Service Provider;

This processing is covered further in section 5.2.2.1.

#### **5.1.4 Cartography**

It is recommended that the generation of charts should be as recommended for Solution 4. See 4.1.4 for further details.

#### **5.1.5 Data Publication**

Data Publication is the same as for Solution 4. See 4.1.5 for further details.

#### **5.1.6 Data Access and Distribution**

Data Access and Distribution is the same as for Solution 4. See section 4.1.6 for further details.

#### **5.1.7 NOTAM**

The distribution of NOTAM is the same as for Solution 4. See section 4.1.7 for further details.

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<sup>11</sup> Any harmonisation of text will be as a result of other studies and mandates whose remit is the improved harmonisation and utilisation of European airspace.

## 5.2 Implementation

### 5.2.1 Existing Technology

#### 5.2.1.1 eAIP

An EUIR AIP will be a large and cumbersome document if used in its paper form. The use of electronic media is therefore considered essential as this will allow the EUIR AIP to be searched and filtered to reduce its scope to that needed.

The eAIP, as developed by EUROCONTROL, will be the medium by which the information is published. The eAIP is a recent development, enabled mainly through the emergence of XML technology.

#### 5.2.1.2 EAD

The EAD as operational today provides all the facilities needed for the implementation of Solution 1.

As previously mentioned, it should be noted that where this report refers to the EAD it is with reference to the functionality which is provided and is in no way a reference to the Service Provision aspect.

Solution 1 would make use of the following EAD functionality:

- a) The PAMS functionality for the storage of National AIPs in PDF format by the States;
- b) The SDO functionality for the storage of geo-spatial data by the States;
- c) The PAMS functionality for the retrieval of National AIPs in PDF format by the EASP;
- d) The SDO functionality for the retrieval of geo-spatial data by the EASP;
- e) The PAMS functionality for the storage of the EUIR AIP;
- f) The PAMS functionality for the distribution of the EUIR AIP;
- g) The INO functionality for the creation and storage of EUIR NOTAM messages;
- h) The legal recording functionality for maintaining the audit trail of actions undertaken by both users of the EUIR AIP and the EASP with reference to the above functions.

#### 5.2.1.3 NOTAM

The use of NOTAM is the same as for Solution 4. See section 4.2.1.3 for further details.

## 5.2.2 ***New Technology Required***

### 5.2.2.1 ***Data Extraction Tool***

A tool would be required to allow the geo-spatial data entered in the EAD to be extracted. Initially the data will cover only upper airspace but later, if required, it may cover lower and terminal airspace. It is considered that development of the tool will not be a difficult or onerous task.

The main activity is:

- 1) The tool will interface to the EAD SDO database using an ESI connection to automatically extract the State geo-spatial data. This will be initiated as an operator action and will report progress as the data is received.
- 2) The tool will interface to the EAD PAMS database using an ESI connection to extract the State AIPs. This will again be initiated as an operator action and will report progress as the data is received.

These requirements will mean that the tool must be created as an EAD ESI Client.

### 5.2.2.2 ***xNOTAM***

The approach to xNOTAM is the same as for Solution 4. See section 4.2.2.2 for further details.

## 5.2.3 ***Time Implications***

To facilitate EAD operations, a two week period has been introduced into the AIRAC Cycle to allow the EAD Service Provider to ensure the co-ordination of State data prior to publication. Once this co-ordination has been achieved the States are given a further two weeks to prepare their AIPs<sup>12</sup>. This second two week period provides:

- a) A period to produce the publications;
- b) A period to print master copies and obtain approval for release;
- c) A period to reproduce, collate and package the publications for distribution.

The third activity is often the most time-consuming and it is in this period that ***the study team recommends*** that the EUIR eAIP be prepared. This recommendation is based on the following assumptions:

- a) The co-ordination activities that the EAD Service Provider performs will help ensure that geo-spatial inconsistencies are unlikely to be found in the EUIR eAIP;
- b) Once the EUIR AIP has been established, textual changes, and hence the possibility of inconsistencies in the EUIR eAIP, will be infrequent.

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<sup>12</sup> It is highly likely that States will in actuality prepare their AIP during the two weeks in which the EAD Service Provider performs consistency checks and co-ordinates the data. This will be done knowing that there is a risk that a problem is identified with their data. As the processes based around the use of the EAD become more practised this risk will be lessened.

Figure 11 provides an illustration of the proposed AIP production time-line in relation to the AIRAC cycle.

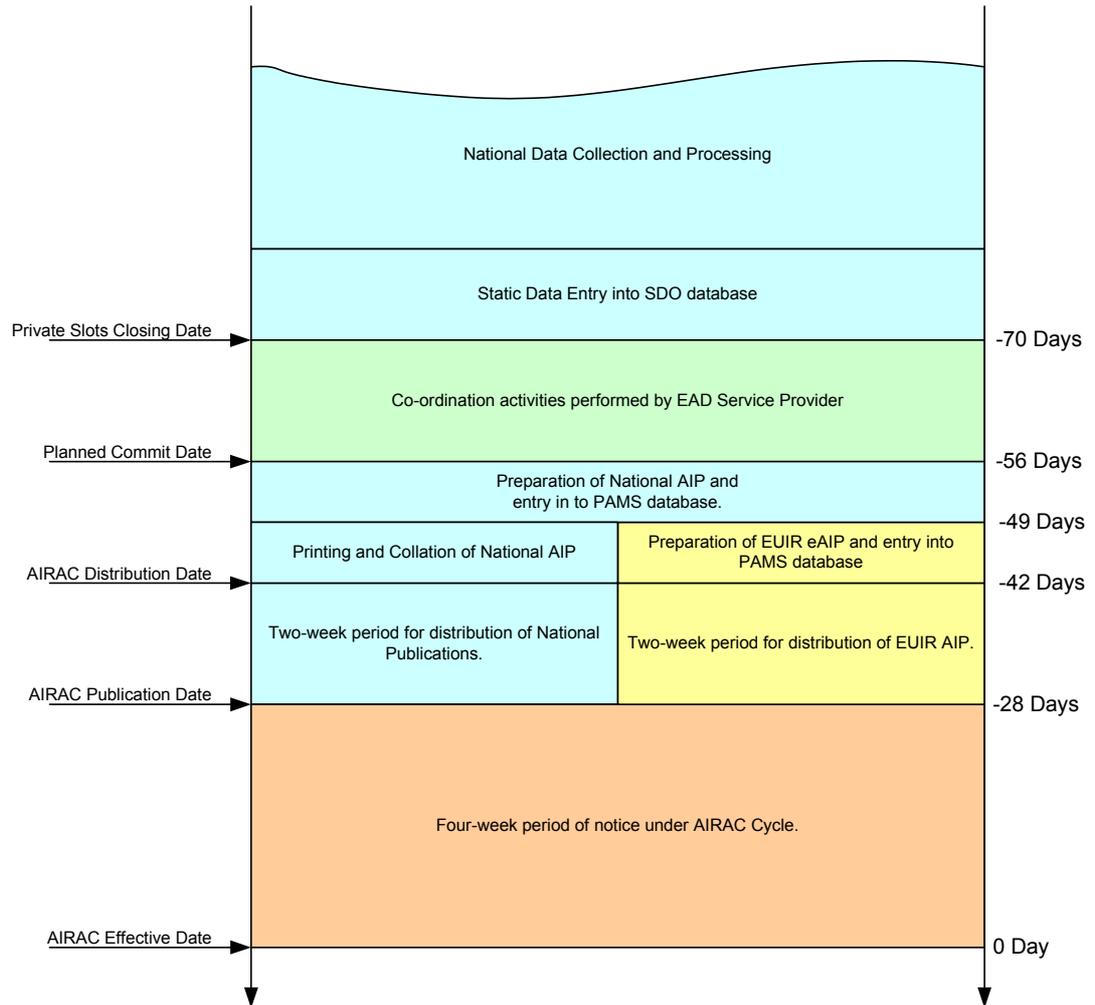


Figure 11: Proposed EUIR AIP Time-line for Solution 1

### **5.3 EUIR AIP - Means of Access**

The means of access for the EUIR AIP are the same as for Solution 4. See section 4.3 for further details.

### **5.4 Maintenance**

Solution 1 provides a maintainable service as the impact of change is minimised through the simple interface and distributed architecture.

For example:

- a) A change to the eAIP specification should have little impact as this is only used as the means for publishing the EUIR AIP;
- b) A change to the EAD which does not affect the ESI will have no impact on the EUIR AIP data extraction / entry to EAD.

### **5.5 Availability**

All issues associated with availability are the same as for Solution 4. See section 4.5 for further details.

### **5.6 Continuity of Service and Contingency Planning**

Continuity of service and contingency planning is the same as for Solution 4. See section 4.6 for further details.

## 6 OPERATIONAL AND TECHNICAL CONCEPT – ALTERNATIVE SOLUTION – SOLUTION 2

### 6.1 Overview

#### 6.1.1 Data Flow

The data flow for Solution 2 is represented in Figure 12.

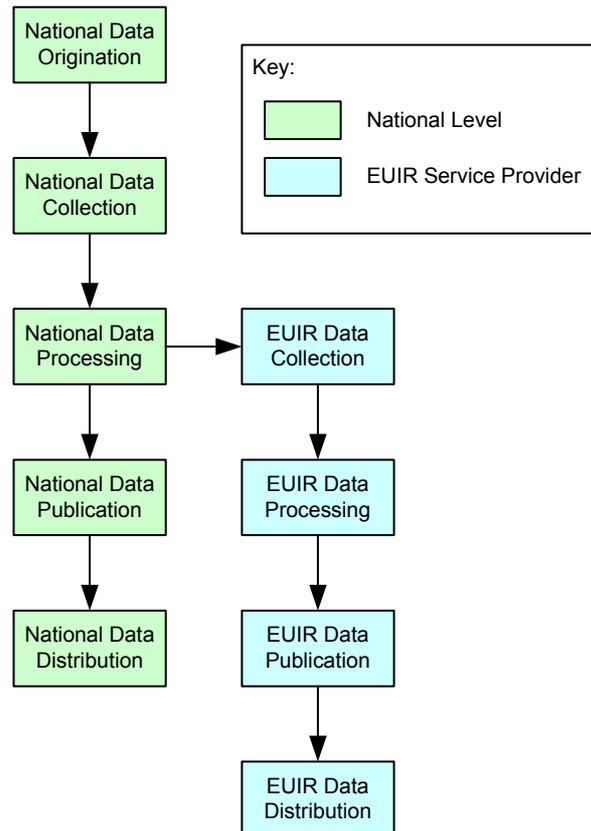


Figure 12: Data Flow – Solution 2

#### 6.1.2 Data Collection

The collection of data is made up of two distinct and separated phases: Local collection and European collection. The term Local has been used here as it is not necessary that this action be performed only at a National level. Indeed, a State may select to undertake this action on a per FIR basis (where they have more than a single FIR) or, more likely, through joint working practices with other States.

Solution 2 allows data collection by the provider of the EUIR AIP to be performed through the EAD and their systems linked to this using ESI connections and xNOTAM.

It has been suggested in some comments raised on the Phase 1 and Phase 2 reports that the harmonised text required for the EUIR AIP should be provided by a single European body. Whilst the creation of such a body is beyond the scope of this study, and is being addressed by other work packages associated with the SES, the solution proposed would support such a way of working.

The Data Collection activities may be described in more detail as follows:

#### **6.1.2.1 National Data Collection**

The National Data Collection will be the same as Solution 4. See 4.1.2.1 for further details.

#### **6.1.2.2 EUIR AIP Service Provider**

The task of Data Collection for the EASP is a simple one. Once the National AIS have entered their geo-spatial data into the EAD SDO database and their AIP text into the new EAD Text repository, the EASP will extract all the data.

The task of the EASP will be to ensure that all national geo-spatial and text data is made available to it at the appropriate time and to pursue any that are not present.

#### **6.1.3 Data Processing**

The Data Processing performed by States today, or planned in order to comply with the ECIPs, will be affected by Solution 2. States would also have to enter its AIP text data into a new EAD Text repository. There are significant omissions in the data (mainly textual) currently held by the EAD when compared with that required for preparation of the EUIR AIP. It is thought that the entry of this additional data by the States would have a significant impact on current working practices and changes would also have to be made to existing ESI connections and maybe ECITs to accommodate the changes to the EAD. The extension of the EUIR AIP to lower and terminal areas will again impact State working practices as additional data entry into the EAD will be required. This additional data could be entered before the EUIR AIP is extended although this may bring opposition from States as the additional workload will not serve an immediate purpose and will be an unfunded exercise.

Some areas of possible improvement to current working procedures are also in need of assessment. These improvements do not affect the production of the EUIR AIP but do impinge on its quality.

The research performed during development of the SDP found that many different detailed processes apply today and that the quality of the provided end data varies significantly between States. Furthermore, research undertaken by EUROCONTROL as part of its Data Integrity initiative has found that the ICAO requirements for the traceability and integrity assurance of data are not met.

There is a need for the EASP to receive data of the required quality and that the traceability of this data is guaranteed. Such records are not widely

available today and as mentioned above, integrity levels do not comply with ICAO.

For these reasons it is recommended that, as part of the implementation phase of the EUIR AIP, the requirements for greater harmonisation of operating procedures are assessed.

The processing required by the EASP may be detailed as follows:

- a) Ensure that any State text data entered in the EAD Text Repository which it has been agreed will be harmonised<sup>13</sup> is compliant with agreements;
- b) Refer to the originating authority any text which is not compliant with the harmonised text agreements;
- c) The geo-spatial data and text data are extracted from the appropriate EAD sub-systems and merged to provide a single European AIP covering the required information. If it is decided that States will enter all AIP Text data into the EAD then this step will involve the filtering of the information merged to include only those elements applicable to Upper Airspace. If and when the AIP is required to include lower airspace, terminal area or Aerodrome information, this filter can be revised to include the increased scope of the new content. In this way the solution may meet the requirements of the SES that it must be suitable for possible extension, without the need to rework or amend the basic operating principles;
- d) Any inconsistencies within the combined eAIP are raised to the EASP for manual processing. This would likely involve discussion with the relevant States, EUROCONTROL and the EAD Service Provider;

This processing is covered further in section 6.2.2.1.

#### **6.1.4 Cartography**

It is recommended that the generation of charts should be as recommended for Solution 4. See 4.1.4 for further details.

#### **6.1.5 Data Publication**

Data Publication is the same as for Solution 4. See 4.1.5 for further details.

#### **6.1.6 Data Access and Distribution**

Data Access and Distribution is the same as for Solution 4. See section 4.1.6 for further details.

#### **6.1.7 NOTAM**

The distribution of NOTAM is the same as for Solution 4. See section 4.1.7 for further details.

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<sup>13</sup> Any harmonisation of text will be as a result of other studies and mandates whose remit is the improved harmonisation and utilisation of European airspace.

## 6.2 Implementation

### 6.2.1 *Existing Technology*

#### 6.2.1.1 *eAIP*

An EUIR AIP will be a large and cumbersome document if used in its paper form. The use of electronic media is therefore considered essential as this will allow the AIP to be searched and filtered to reduce its scope to that needed.

The eAIP, as developed by EUROCONTROL, will be the medium by which the information is published. The eAIP is a recent development, enabled mainly through the emergence of XML technology.

#### 6.2.1.2 *EAD*

The EAD of today does not provide all the facilities needed for implementation of Solution 2. An additional function needed, to store and access the EUIR AIP, is currently planned and should be available within the timeframe necessary. In addition, a new EAD AIP Text Repository is required. This may impact the timeframe for the EUIR AIP.

As previously mentioned, it should be noted that where this report refers to the EAD it is with reference to the functionality which is provided and is in no way a reference to the Service Provision aspect.

Use of the following EAD functionality is planned:

- a) The SDO database for the storage of State geo-spatial data;
- b) The new AIP Text repository for the storage of State AIP textual data;
- c) The PAMS functionality for the storage of the EUIR AIP;
- d) The PAMS functionality for distribution of the EUIR AIP;
- e) The International NOTAM Operations (INO) functionality for the creation and storage of EUIR NOTAM messages;
- f) The INO functionality for the distribution of EUIR NOTAM messages;
- g) The legal recording functionality for maintaining the audit trail of actions undertaken by both users of the EUIR AIP and the EASP with reference to the above functions.

#### 6.2.1.3 *NOTAM*

The use of NOTAM is the same as for Solution 4. See section 4.2.1.3 for further details.

## **6.2.2 New Technology Required**

### **6.2.2.1 EUIR Data Extraction and Merge Tool**

The development of a new tool to allow the geo-spatial and text data entered in the EAD to be extracted and merged as the Single European AIP is the single implementation task required. Initially the data will cover only upper airspace but later, if required, it may cover lower and terminal airspace. It is considered that the development of the tool will not be a difficult or onerous task.

Figure 13, below, presents a process flow diagram of the actions which the EUIR Data Extraction and Merge Tool (EDEM-T) would be required to undertake. For the sake of clarity, reporting points to the operator are not shown.

The major activities are:

- a) The tool will interface to the EAD PAMS database using an ESI to automatically extract State geo-spatial data. This will be initiated as an operator action and will report progress as the data is received. This requirement will mean that the EDEM-T must be created as an EAD ESI Client;
- b) The tool will interface to the EAD AIP Text Repository using an ESI to automatically extract State AIP text data. This will be initiated as an operator action and will report progress as they are received. This requirement will mean that the EDEM-T must be created as an EAD ESI Client;
- c) Once all the data has been successfully extracted for the SES region, the tool will automatically perform the merge, comparing textual data to ensure compliance against any agreed, harmonised text;
- d) If any text does not comply with that agreed for use within the SES airspace by way of harmonisation, this will be reported to the operator for clarification and correction by the responsible National body;
- e) An EUIR eAIP will be produced and stored within the EAD PAMS database through use of an ESI connection. This will ensure that it is both distributed to the clients who have subscribed to receive it and that it is made generally available through use of the EAD Public User Interface.

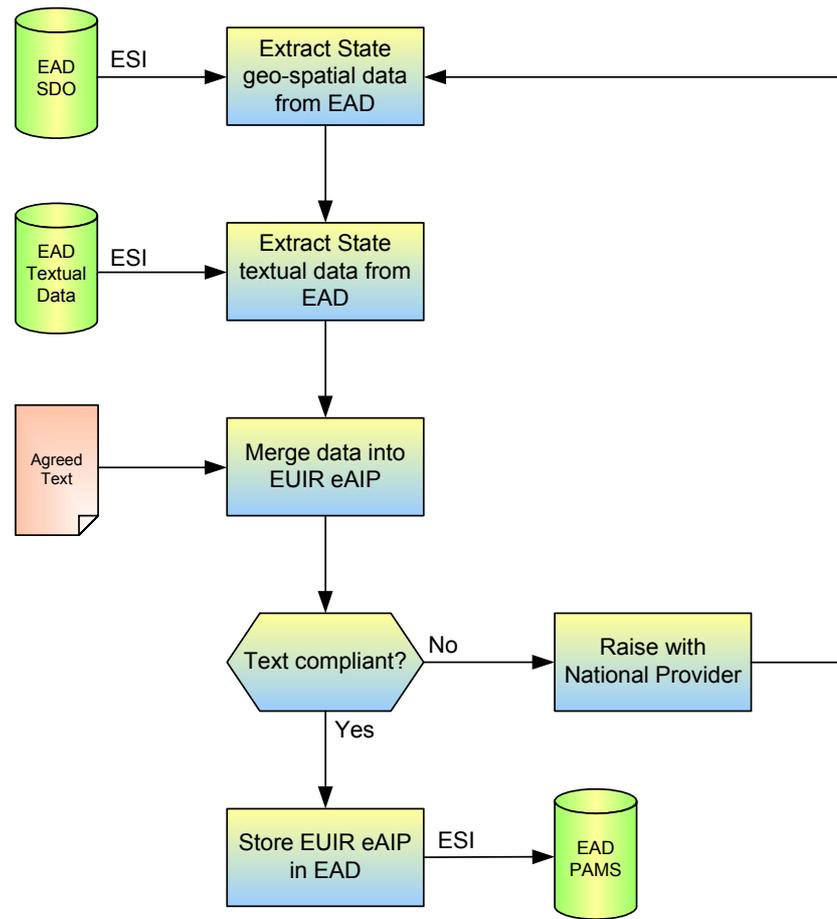


Figure 13: EUIR Data Extraction and Merge Tool (Solution 2)

### 6.2.2.2 xNOTAM

The approach to xNOTAM is the same as for Solution 4. See section 4.2.2.2 for further details.

### 6.2.3 Time Implications

To facilitate EAD operations, a two week period has been introduced into the AIRAC Cycle to allow the EAD Service Provider to ensure the co-ordination of State data prior to publication. Once this co-ordination has been achieved the States are given a further two weeks to prepare their AIPs<sup>14</sup>. This second two week period provides:

- A period to produce the publications;
- A period to print master copies and obtain approval for release;
- A period to reproduce, collate and package the publications for distribution.

<sup>14</sup> It is highly likely that States will in actuality prepare their AIP during the two weeks in which the EAD Service Provider performs consistency checks and co-ordinates the data. This will be done knowing that there is a risk that a problem is identified with their data. As the processes based around the use of the EAD become more practised this risk will be lessened.

The third activity is often the most time-consuming and it is in this period that **the study team recommends** that the EUIR eAIP be prepared. This recommendation is based on the following assumptions:

- a) The co-ordination activities that the EAD Service Provider performs will help ensure that geo-spatial inconsistencies are unlikely to be found in the EUIR eAIP;
- b) Once the EUIR AIP has been established, textual changes, and hence the possibility of inconsistencies in the EUIR eAIP, will be infrequent;

Figure 14 provides an illustration of the proposed AIP production time-line in relation to the AIRAC cycle.

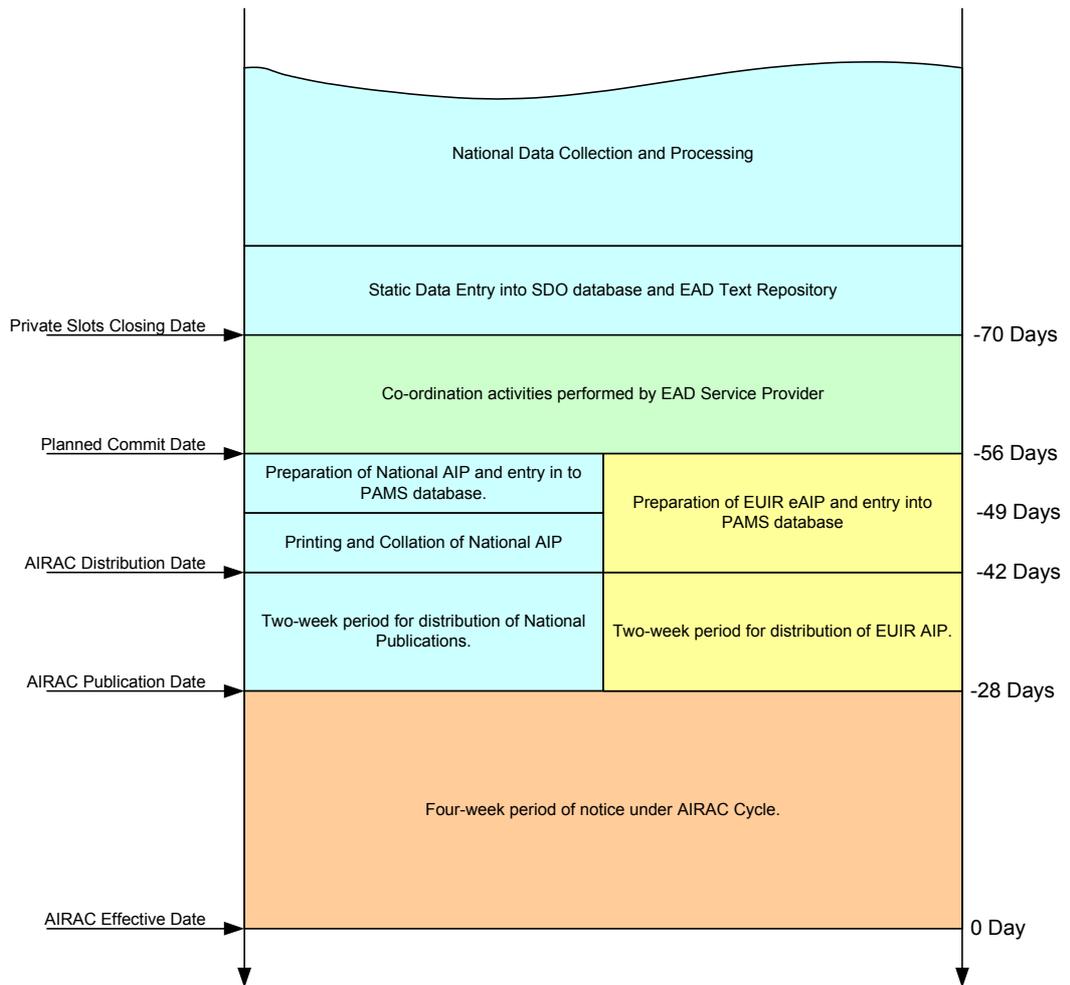


Figure 14: Proposed EUIR AIP Time-line for Solution 2.

### **6.3 EUIR AIP - Means of Access**

The means of access for the EUIR AIP are the same as for Solution 4. See section 4.3 for further details.

### **6.4 Maintenance**

Solution 2 has some risk associated with its maintainability.

For example:

- a) Changes to one EAD sub-system may have an impact on other sub-systems and may require a change to any client's ESI or ECIT;
- b) A new release of the AIXM will impact the EAD and potentially ESI communications and will have an impact on the EDEMT;
- c) A change to the eAIP specification should have no impact on the EAD and on consequent ESI connections and State database functionalities as the EAD PAMS database is used solely to hold a data file.

### **6.5 Availability**

All issues associated with availability are the same as for Solution 4. See section 4.5 for further details.

### **6.6 Continuity of Service and Contingency Planning**

Continuity of service and contingency planning is the same as for Solution 4. See section 4.6 for further details.

## 7 OPERATIONAL AND TECHNICAL CONCEPT – ALTERNATIVE SOLUTION - SOLUTION 3

### 7.1 Overview

#### 7.1.1 Data Flow

The data flow for Solution 3 is represented in Figure 15.

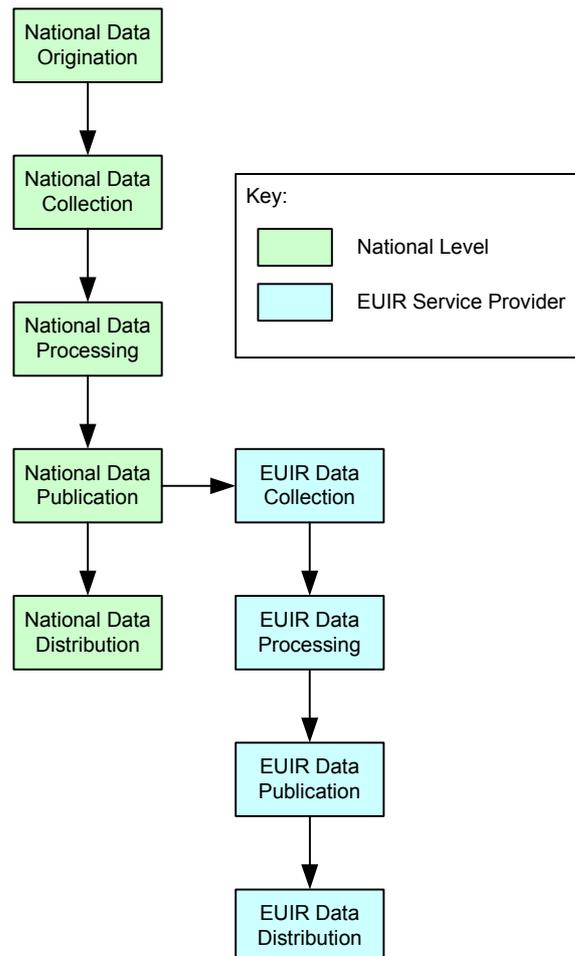


Figure 15: Data Flow – Solution 3

#### 7.1.2 Data Collection

The collection of data is made up of two distinct and separated phases: Local collection and European collection. The term Local has been used here as it is not necessary that this action be performed only at a National level. Indeed, a State may select to undertake this action on a per FIR basis (where they have more than a single FIR) or, more likely, through joint working practices with other States.

Solution 3 allows data collection by the provider of the EUIR AIP to be performed in many ways so making maximum benefit of the investments made in their own systems and through EUROCONTROL programmes which make use of XML, such as the eAIP and xNOTAM.

The process of combining eAIPs into a single publication therefore allows a very flexible means of data collection. It has been suggested in some comments raised on the Phase 1 and Phase 2 reports that the harmonised text required for the EUIR AIP should be provided by a single European body. Whilst the creation of such a body is beyond the scope of this study, and is being addressed by other work packages associated with the SES, the solution proposed would support such a way of working.

The Data Collection activities are described in more detail as follows:

#### **7.1.2.1 National Data Collection**

National Data Collection remains the same as for Solution 4. See 4.1.2.1.

#### **7.1.2.2 EUIR AIP Service Provider**

The task of Data Collection for the EASP is a simple one. Once each National AIS has produced its eAIP and made it available on the Internet or on a private network, the EASP will collect the eAIPs. Alternatively the National AIS may e-mail their eAIP directly to the EASP.

The task of the EASP will be to ensure that all the National eAIPs are made available to it at the appropriate time and to pursue any which are not present.

#### **7.1.3 Data Processing**

The Data Processing performed by States today, or planned in order to comply with the European Convergence and Implementation Plans (ECIPs), should continue, unaffected by the proposed solution if so desired. Some areas of possible improvement are, however, in need of assessment. These improvements do not affect the production of the EUIR AIP but do impinge on its quality.

The research performed during development of the SDP found that many different detailed processes apply today and that the quality of the provided end data varies significantly between States. Furthermore, research undertaken by EUROCONTROL as part of its Data Integrity initiative has found that the ICAO requirements for the traceability and integrity assurance of data are not met.

There is a need for the EASP to receive data of the required quality and that the traceability of this data is guaranteed. Such records are not widely available today and studies have shown that integrity levels do not comply with ICAO.

For these reasons it is recommended that, as part of the implementation phase of the EUIR AIP, the requirements for greater harmonisation of operating procedures is assessed.

The processing required by the EASP may be detailed as follows:

- a) The collected eAIPs are parsed to ensure compliance with the defined XML Schemas;
- b) Any invalid eAIPs or parts of eAIPs are referred back to the originating body for validation and correction;
- c) Ensure that any text included within National eAIPs which it has been agreed will be harmonised<sup>15</sup> is compliant with agreements;
- d) Refer back to the originating authority any eAIPs whose text is not compliant with the harmonised text agreements;
- e) The eAIPs are merged to provide a single European AIP covering the required information. This will involve the filtering of the information merged to include only those elements applicable to Upper Airspace. If and when the AIP is required to include lower airspace, terminal area or Aerodrome information, this filter can be revised to include the increased scope of the new content. In this way the solution meets the requirements of the SES that it must be suitable for possible extension, without the need to rework or amend the basic operating principles;
- f) Any inconsistencies within the combined eAIP are raised to the EASP for manual processing. This would likely involve discussion with the relevant States, EUROCONTROL and the EAD Service Provider;
- g) Any inconsistencies found between the combined eAIP and the content of the EAD are raised to the operator for manual processing. Again, this would likely involve discussion with the relevant States, EUROCONTROL and the EAD Service Provider.

This processing is covered further in section 7.2.2.1.

#### **7.1.4 Cartography**

It is recommended that the generation of charts should be as recommended for Solution 4. See 4.1.4 for further details.

#### **7.1.5 Data Publication**

Data Publication is the same as for Solution 4. See section 4.1.5.

#### **7.1.6 Data Access and Distribution**

Each State maintains a distribution list of organisations and people who have subscribed to receive its AIP. Some of these clients pay for receipt whilst others receive it free of charge, often through reciprocal agreements between the issuing State and the receiving State.

Some States that have migrated to the EAD are using the EAD subscription functionality as a means of distributing electronic copies of their publications. Furthermore, some States have made their AIP freely available by way of State AIS internet sites.

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<sup>15</sup> Any harmonisation of text will be as a result of other studies and mandates whose remit is the improved harmonisation and utilisation of European airspace.

As the EUIR AIP will not replace the National AIPs it is not foreseen that these current means of distribution will be changed. The States will still be required to distribute the information which they publish, whether it is for all airspace or only that necessary for flight in lower airspace, to their client bases.

The following distribution methods are proposed for the EUIR AIP:

- a) By post;
- b) By email;
- c) Via the Internet;

### **7.1.7 NOTAM**

The issue of NOTAM is the same as for Solution 4. See Section 4.1.7.

## **7.2 Implementation**

### **7.2.1 Existing Technology**

#### **7.2.1.1 eAIP**

The eAIP, as developed by EUROCONTROL, forms the underlying technology through which the EUIR AIP will be implemented as it will be used to both source the information and will be the medium by which the information is published. The eAIP is a recent development, enabled mainly through the emergence of XML technology.

It should be noted that the implementation of the eAIP is already an ECIP objective. Should the recommendation of this report be accepted, then the ECIP will need to be raised to Pan-European status. In consequence, and though there is a steady migration by European States to the publication of the AIP in eAIP form, additional support, facilitation, training and awareness will be required to ensure the revised ECIP objective is met within the required timeframe. These requirements should be captured in the implementation definition phase.

The implementation of the eAIP by States is not considered further in the report.

States will need to make available a sub-set of their State eAIP, in effect a second eAIP, for the EUIR AIP. This will be needed because the EUIR AIP will not contain all the information required for an entire State AIP.

Two means of providing this are considered:

- 1) Firstly, an eAIP which only holds the upper airspace information;
- 2) Secondly, a version which permits either, upper airspace only; upper and lower airspace; upper, lower and terminal airspace; or all information to be contained.

Whilst the former meets the immediate needs of the EUIR AIP, it would need enhancement should the EUIR AIP be extended to include additional airspace. The latter option would not require such enhancement and would

therefore meet more closely the likely future needs. It is recommended that, as part of the implementation phase, these options be considered more fully.

### **7.2.1.2 NOTAM**

The use of NOTAM is the same as for Solution 4. See Section 4.2.1.3 for further details.

## **7.2.2 New Technology Required**

### **7.2.2.1 eAIP Merge Tool**

A new tool to allow the eAIPs prepared by National Agencies to be merged as the Single European AIP is the single tool to be developed during the implementation phase. Initially the data will cover only upper airspace but later, if required, it may cover lower and terminal airspace. It is considered that the development of the tool will not be a difficult or onerous task. The use of the eAIP Specification brings the benefit of a fully computer literate source of information which may be read, manipulated, compared and ordered by an automated tool with the minimum of human interference.

Figure 16 is a process flow diagram of the actions which the eAIP Merge Tool (EMT) would be required to undertake. For the sake of clarity reporting points to the operator are not shown.

The major activities are:

- a) The national eAIPs will be validated against the eAIP Schema definition as issued by EUROCONTROL;
- b) If an error in the validation of the eAIPs against the issued schema definition is detected this will be reported to the operator. This must then be raised to the body responsible for issuing the eAIP for clarification and rectification;
- c) Once all the eAIPs which constitute the SES region have been validated, the tool will automatically perform the merge, comparing textual data to ensure compliance against any agreed, harmonised text;
- d) If any text does not comply with that agreed for use within the SES airspace by way of harmonisation, this will be reported to the operator for clarification and correction by the responsible National body;
- e) The EUIR eAIP will be ready for distribution.

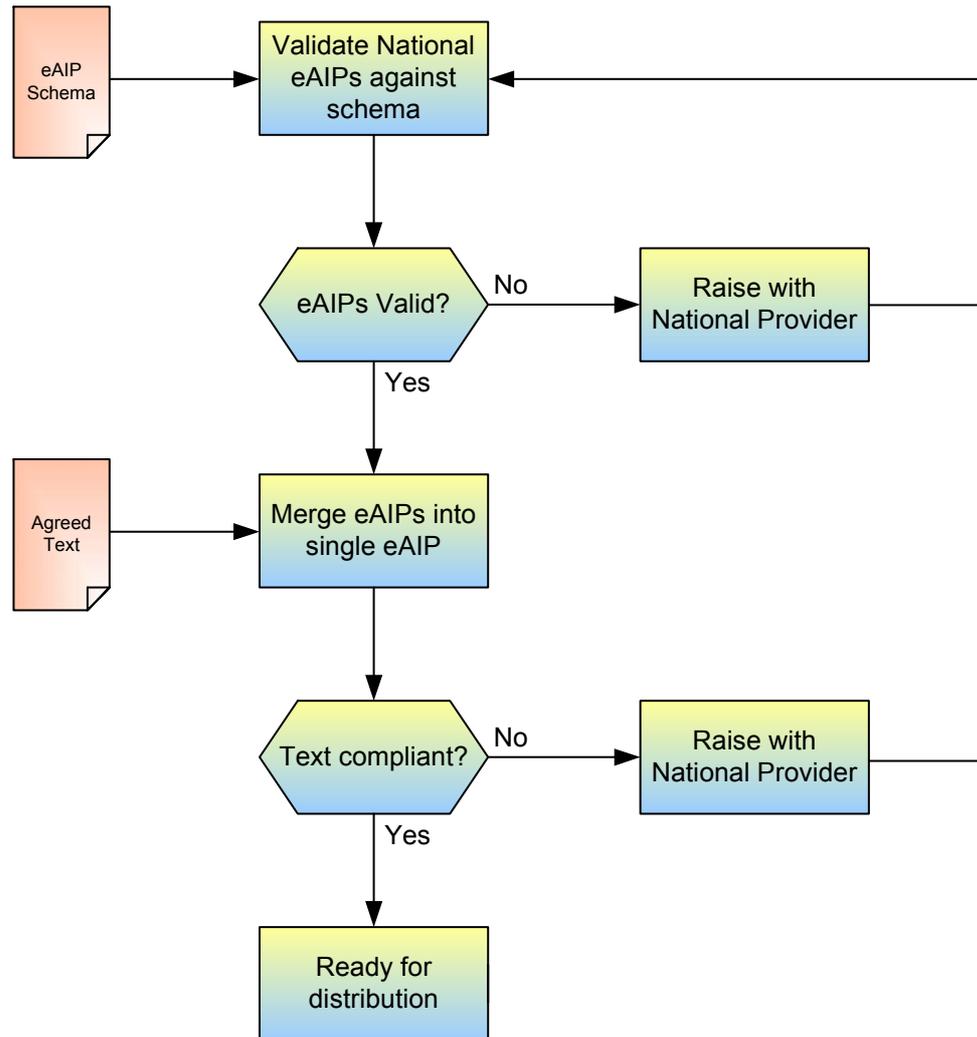


Figure 16: eAIP Merge Tool (Solution 3)

### 7.2.2.2 xNOTAM

The approach to xNOTAM is the same as for Solution 4. See section 4.2.2.2 for further details.

### 7.2.3 Time Implications

States typically prepare their AIPs in three distinct phases:

- A period to collate information and prepare the publications;
- A period to print master copies and obtain approval for release;
- A period to reproduce, collate and package the publications for distribution.

**The study team recommends** that the EUIR eAIP be prepared during this second phase and that it be distributed during the third phase. This recommendation is based on the assumptions that the States make their eAIPs available to the EASP at the same time as they start the printing and collation of their amendments.

Figure 17 provides an illustration of the proposed AIP production time-line in relation to the AIRAC cycle.

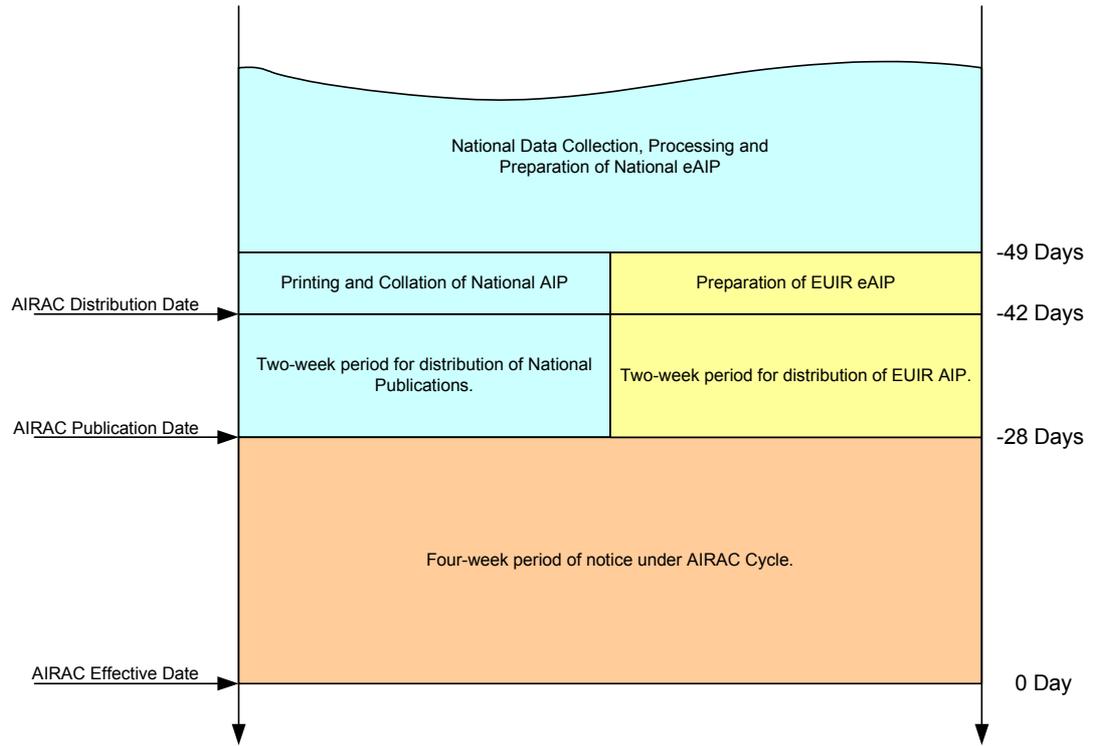


Figure 17: Proposed EUIR AIP Time-line – Solution 3

### 7.3 EUIR AIP - Means of Access

The EUIR AIP will potentially have a world-wide client-base. Two means of access are envisaged:

- 1) By placing the documents on an EASP managed web-site;
- 2) Through a non-EAD means of subscription managed by the EASP (email or post).

The guidance of ICAO is that the production costs of a master AIP should be met by route charges, the users of the AIP only paying the reproduction and distribution costs. It is therefore reasonable to assume that only the last case should incur additional user costs. It is therefore recommended that either no charge or only modest handling charge should be made for receipt of a web-based electronic EUIR AIP.

The provision of a website by the EASP is considered essential as this provides an independent means by which the EUIR AIP may be obtained.

Typically an AIS provides a subscription service for the AIP, used as a means of recording what documents should be provided to whom and in what format and by what means. This also often includes information such as payment status. Nevertheless, issues associated with copyright and liability will need to be addressed during the implementation planning phase.

It is recommended that the CFT issued for the Service Provision should include, as an option, the need to propose a subscription service. Although it is likely that other means of access will predominately be used, and hence the subscription list will be quite small, it is an essential component of the service.

The subscription service should provide for:

- a) Paper distribution;
- b) Electronic distribution via a secure network;
- c) Delivery via e-mail<sup>16</sup> or CD-ROM (postal);
- d) Delivery in the form of an eAIP or HTML pages (the later achieved through use of a XML style sheet).

It should be noted that only in the form of a Paper AIP would the amendment service be required. In all other cases an entire, up-to-date, AIP can be provided.

### 7.4 Maintenance

The proposed solution provides for a highly maintainable service as the impact of change is minimised through the recommended simple interface and distributed architecture.

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<sup>16</sup> The use of e-mail may have size implications as an SES EUIR eAIP is likely to be of a significant size. This may have a bearing on the way the eAIP files are structured, created and stored.

For example, a change to the eAIP specification should have a minimal impact on the EMT software.

## **7.5 Availability**

### **7.5.1 Access**

The EUIR AIP will be available on the EASP's website, ensuring that a copy of the EUIR AIP is always available to the end-user.

#### **7.5.1.1 NOTAM**

The provision of EUIR Aeronautical Information will include the publication of NOTAM. The EASP should provide a H24 NOTAM Service. A full contingency service must also be provided.

### **7.5.2 Safety and Security**

The safety and security issues are the same as those raised for Solution 4. See section 4.5.2 for further details.

## **7.6 Continuity of Service and Contingency Planning**

Continuity and contingency planning is the same as for Solution 4. See Section 4.6 for further details.

## 8 DATA ISSUES

### 8.1 ICAO and the Duplication of Data

The duplication of data is the largest area of uncertainty regarding the publication of a EUIR AIP that has been identified.

Under the SES regulations a State may continue to publish its own data by way of a National AIP. This will inevitably lead to a certain amount of duplication of data between these National publications and the EUIR AIP.

ICAO Annex 15 (Reference 3) specifically mandates against this, stating “*Each AIP shall not duplicate information within itself or from other sources.*”.

This has been further reinforced by a letter from ICAO sent to EUROCONTROL. Given this apparent impasse, it appears that the EUIR AIP and ICAO regulations cannot co-exist.

However, there is duplication in an AIP as it stands today and for good operational reasons. For example, a Navaid used for en-route and approach will appear in both the ENR and AD sections of the AIP. Furthermore, a Navaid near a State border may appear in another State’s AIP if it used for navigation within that State’s territory. A procedure is often represented twice, once textually and another graphically which is another form of duplication.

There is good reason why such a non-duplication requirement exists. If information is published in two places and a difference is identified, which takes precedence? It is generally considered that there is only one legal source. Indeed, it would appear that given the current ICAO requirements and SES Legislation, only one of the AIPs, either the National or the European, would have a legal standing.

This risk may be mitigated to an extent by the proposed solutions:

Solutions 3 and 4 is based upon the amalgamation of information from each States’ eAIP. Clearly a key element of this will be the harmonisation of text with the EUIR AIP and State eAIPs.

Solution 2 is the extraction of data from a database which is used in the construction of an eAIP. Solution 1 partially uses this method.

All processes will be reliant upon software. It is **the recommendation of the study team** that any software be subject to suitable verification and validation to ensure that the risk of information being published in both a National publication and the EUIR AIP with different values is acceptable. Furthermore, it may well be argued that such a tool may also be used to ensure the consistency between all SES States and hence lead to an overall improvement in safety.

It is recommended that as part of any EUIR AIP implementation, this conflict be addressed further with ICAO.

## 8.2 Standards and Formats

The recommended solution (Solution 4) and Solution 3 have minimal impact on the standards and formats in place today, requiring only minor amendment to handle the additional concepts introduced by the EUIR.

Solution 2 would have a significant impact on the AIXM as this would require extension to include all textual information contained within an AIP. Such major revisions must be considered with extreme caution as this may have an impact on the ability to gain ICAO acceptance of the AIXM as the world-wide standard for the digital transfer of Aeronautical Information. The loss of such an acceptance would have a major impact on the AIS community as a whole, the EAD and industry who offer products which meet this standard.

Solution 1 would have no impact on the standards and formats in place today.

The standards and formats to which the EUIR AIP preparation will adhere are identified in sections 8.2.1 to 8.2.4.

### 8.2.1 AIXM

The AIXM is an XML based exchange format, currently at version 3.3. It has been produced by EUROCONTROL and is generally accepted as the industry standard means of sharing geo-spatial Aeronautical Information in Europe and has been adopted by the Federal Aviation Administration.

The AIXM has been derived from the Aeronautical Information Conceptual Model (AICM), which provides a formal description of the information / data managed by the AIS. The AICM was developed with consideration given to the following:

- a) The content of ICAO Annex 15;
- b) The content of AIPs;
- c) Harmonization with models of significant Stakeholders;
- d) Industry standards.

AIXM is implemented and used by an increasing number of stakeholders, which include the EAD, the environment database of the Central Flow Management Unit (CFMU) and a number of National AIS database systems (Slovakia, Switzerland, Norway, France, Czech Republic, etc.). Both the eAIP and EAD, which the solutions make full or partial use of for the EUIR AIP make full use of, are based on the AIXM. EUROCONTROL is promoting the AIXM as a world-wide standard for the exchange of Aeronautical Information for adoption by ICAO. This would facilitate participation in the SES by States outside the EC at minimum cost.

### 8.2.2 eAIP

The eAIP specification has been developed by EUROCONTROL as part of the move towards a paperless AIS.

The eAIP specification is fully compliant with the ICAO requirements for AIP content and structure, as laid down in ICAO Annex 15 (Reference 3). In addition, the eAIP Specification enforces a strict application of the ICAO requirements concerning the AIP structure. It provides a standard way to:

- a) Publish the content of an AIP (including Amendments, Supplements and Aeronautical Information Circular (AIC)) in a structured electronic format;
- b) Visualise the content of an AIP on a computer screen, using Web technology.

EUROCONTROL has published ECIP INF03 for the implementation and provision of the eAIP. A number of States are already issuing an eAIP (for example, Belgium, Slovenia, Moldavia and Armenia). By November 2004, the eAIP Specification will also be supported by Release 2 of EAD.

The aim of EUROCONTROL is for the eAIP Specification to be adopted as a global standard, firstly on a regional basis and then through its adoption by ICAO.

The publication of a State's AIP solely in electronic form is now accepted by ICAO. This was confirmed at AIS Team Meeting 20 where it is recorded in the minutes that ICAO confirmed "*.....the sole electronic publication, currently Annex 15 effectively recognises equal value between electronic and paper publication. However, should a recipient require a paper version, it is the State AIS obligation to provide this paper version.*".

This statement was further clarified at AIS Team Meeting 21 where ICAO reiterated that, should a user wish to receive a paper copy, the obligation on a State to so provide it remains.

Solutions 3 and 4 for the provision of an EUIR AIP makes maximum use of the eAIP specification. This will allow States outside Europe to easily participate in the SES without major investment other than that specified as part of global standardisation and will also provide data in digital media for electronic incorporation into the EAD.

Solutions 1 and 2 and also makes use of the eAIP specification but only as a means of publishing the end product (the EUIR AIP).

### 8.2.3 **EAD**

The rationale behind the development of the EAD system and a centralised EAD service was to enhance operational safety of air navigation by ensuring the quality of Aeronautical Information and by facilitating its timely and efficient (electronic) distribution. The primary beneficiary of the EAD will be the ANSP organisations and the airspace users' community from the ECAC Member States. The EAD will also be used by airlines that are based outside the ECAC area and by commercial organisations that use the Aeronautical Information to provide value-added services and products. Implementation of the EAD introduces automation and centralisation in the provision, processing and distribution of Aeronautical Information.

For Solution 4, the EAD will provide the EASP with a means of validating the geo-spatial data contained in the EUIR AIP against a database of validated geo-spatial data. It will also be a central repository for the eAIPs of all ECAC Member States and the EUIR AIP.

For Solution 1, the EAD will be the source of all geo-spatial data and the repository for the State AIPs and the EUIR AIP.

For Solution 2, the EAD will be the source of all geo-spatial and textual data and the repository for the EUIR AIP.

Solution 3 will make no use of the EAD.

However, it should be noted that the EAD at the current time is a repository of geo-spatial data only. It does not contain the textual information in a computer literate format which constitutes approximately 80% of the content of an AIP in an electronic, useable form.

### **8.2.3.1 ESI**

The ESI provides a standard for data exchange in order to ensure harmonisation and interoperability between the EAD and the end user systems.

For Solution 4, EAD clients and the EASP shall use the ESI standard when entering and extracting eAIPs and during the validation stage of the EUIR AIP production.

For Solution 1, the EAD clients and the EASP shall use the ESI standard when entering and extracting geo-spatial data and AIPs. The EAD clients and EASP will use the ESI standard to enter and extract the EUIR AIP.

For Solution 2, the EAD clients and the EASP shall use the ESI standard when entering and extracting geo-spatial and textual data. The EAD clients and EASP will use the ESI standard to enter and extract the EUIR AIP.

Solution 3 will make no use of the ESI standard.

### **8.2.4 ICAO AIP Content and Format**

The contents of the AIP are specified in ICAO Annex 15 (Reference 3). The AIS Manual (Reference 4) provides guidance as to the format of an AIP through inclusion of a specimen AIP. This is of course aimed at the provision of a complete AIP, namely the General, En-route and Aerodrome sections.

One of the known limitations with the ICAO specification of the AIP format is that it provides for much freedom in the presentation of the required information. The recommended solution (Solution 4) and Solution 3 does however overcome this issue as a result of States being required to adopt the EUROCONTROL eAIP Specification. All solutions would also gain some benefit from the use of the eAIP for publication of the EUIR AIP but Solution 2 would have to address the standardisation of text entered into the EAD database.

Much of the work undertaken by EUROCONTROL in the development of the eAIP Specification has been to identify:

- a) Areas in which States' AIP differ in publication and provide a prescriptive description of how these areas should be provided;
- b) Information requiring publication within an AIP but not included within ICAO specimen AIP.

Not all the information specified by ICAO for inclusion within the AIP is required for the EUIR AIP as much of it relates to lower airspace and aerodrome elements only. A suggested list of those features and attributes of an AIP which will be provided within the EUIR AIP are provided in Annexe A.

The format of an AIP, as specified by ICAO, requires that a statement of explanation as to why certain information has been excluded is made. As only a limited subset of the ICAO AIP content is presently required, many sections will be empty. This will lead to a document which is not useable as required information will be lost in amongst sections repeatedly stating “*not applicable as the information is not required for upper airspace AIP*” or some similar phrase.

***It is the opinion of the study team*** that all data required for a European AIP, including Upper, Lower, Terminal Airspace and Aerodromes for the whole of Europe be brought together by the EASP and that filters be used to produce an EUIR AIP. In this way, expansion to include Lower, Terminal Area and Aerodromes would be easily accomplished.

Currently all ICAO Member States file “differences” if their national regulations and practices are not in accordance with the requirements of Annex 15 (Reference 3). The issue of the filing of differences for regulations and practices directly related to the EUIR and its AIP needs to be addressed during future work. It should be noted that as the EU is not a sovereign State, has not signed up to the Chicago Convention and is not therefore a member of ICAO, one option would be for each SES State to file a difference, although this may be seen as an inappropriate way of operating.

#### **8.2.4.1 Charts**

It is envisaged that none of the charts as specified in Annex 15 (Reference 3) paragraph 4.1.3 will be required for the EUIR AIP. The following en-route charts are required:

- a) Upper Airspace Chart;
- b) Prohibited, Restricted and Danger Areas (PDRG) Chart;
- c) Military Exercise and Training Areas Index Chart;
- d) Military Exercise and Training Areas and Air Defence Identification Zone (ADIZ) Index Chart;
- e) Temporary Segregated Area (TSA) Chart;
- f) Other Activities of a Dangerous Nature Index Chart;
- g) Radio Facility Index Chart.

It is envisaged that the charts for the EUIR will be made available electronically but that they must also be available in paper form. The cost associated with printing charts is high. It is therefore likely that some States will not have the budget needed to print charts locally.

### **8.3 Extendibility to Further Data Types**

Further data types are unlikely to be added to the EUIR AIP unless they are either:

- a) A requirement of ICAO through Annex 15 (Reference 3);
- b) Needed for inclusion at a European level.

In both cases, it is highly probable that the AICM / AIXM and eAIP Specifications would be updated to include the required information.

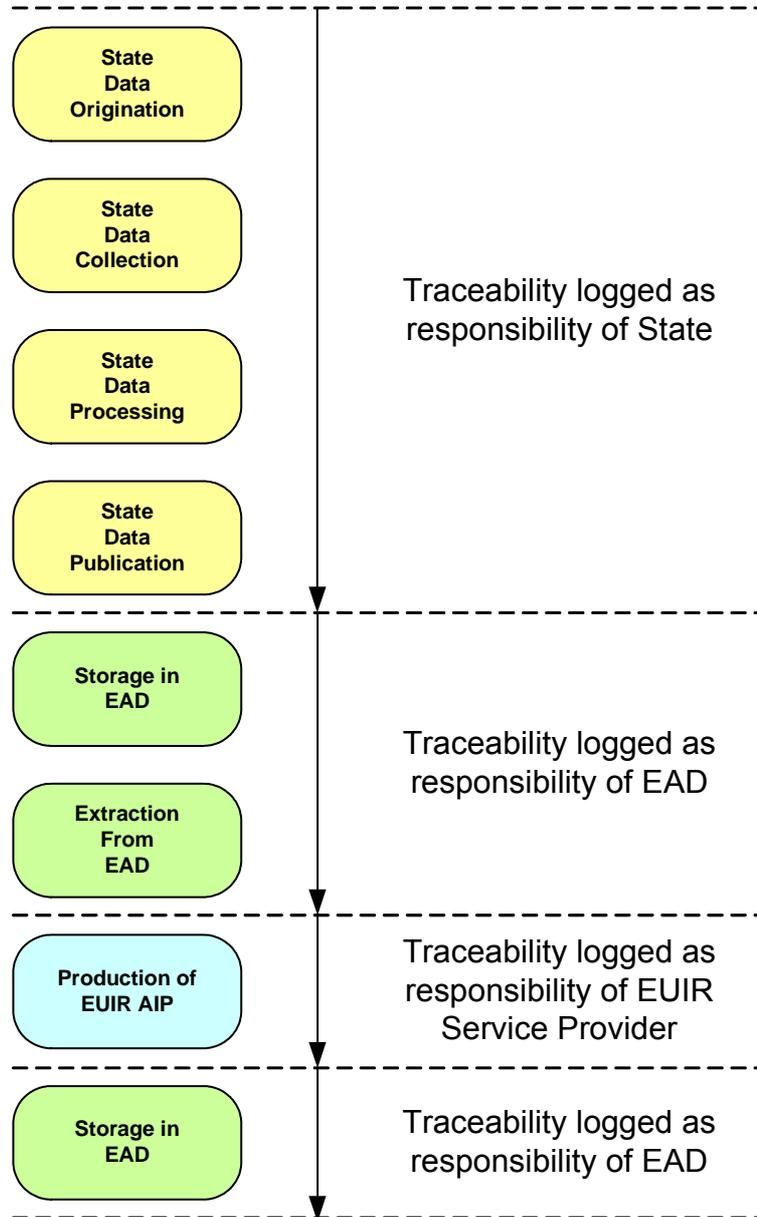
If the single AIP were to be extended from Upper Airspace to include Lower Airspace and possibly even Terminal Area and Aerodrome information, the proposed methodology remains entirely applicable. All information required will be present within a State's eAIP and therefore may be merged to form an AIP with any scope, required for the contributing States airspace.

The manner in which the AICM / AIXM are controlled in terms of maintenance of the standard and therefore how additional data types will be added is covered in section 9.7.3.

## 8.4 Traceability of Data

Solutions 1, 2 and 4 make full use of the traceability of the data processing nodes through use of the EAD recording and logs kept.

The main audit points and the responsibility of logging are:



**Figure 18: Responsibility for Traceability**

As can be seen, the missing traceability over and above the current requirements are constrained to one, very small, element of the data process (shown in blue above).

For all solutions, new tools must be developed to perform a number of different transactions associated with the extraction, merge, validation and storage of data to differing extents.

The technical specifications developed against which these tools will be produced shall include the requirements for the traceability of data and the recording of the meta-data which supports it to provide a full audit trail.

## **8.5 Presentation of Data**

### **8.5.1 Style Sheets**

Much of the information in this section and section 8.5.2 comes from EUROCONTROL's Electronic AIP Specification (Reference 15). Style Sheets were developed as part of the eAIP specification to enable the simple conversion of XML into different formats from the same source, meeting the varying requirements of the end-users. The eAIP specification allows the XML files which the eAIP comprises to be converted to HTML format, and hence enable on-screen browsing, and to PDF format for printing. Currently eXtensible Stylesheet Language Formatting Objects (XSL-FO) is used to format an eAIP in order to print it on paper. In the future software will be available to directly print an XSL-FO document. In the mean time, software is used to convert XSL-FO to PDF or PostScript format to then print those files.

### **8.5.2 SVG**

The current recommendation of the EUROCONTROL eAIP Project is for all eAIP graphics to be made available in Scalable Vector Graphics (SVG) format. SVG is an XML-based language to express 2-dimensional drawings whilst offering high quality presentation and printing. SVG allows the user to zoom into a small portion of an SVG image and still see a very precise definition of the image. SVG images can also be interactive. Another advantage is that file sizes are typically smaller than for an equivalent graphic in raster format. In addition, it is possible to add "script functions" into the SVG file, which allows for enhancements to be incorporated. For example, it is possible to show the differences between the current and the previous version of a chart.

Being written in XML, SVG charts can quite easily be linked to other XML information.

### **8.5.3 Filtering of Information**

The amount of information contained within the EUIR AIP is large and, if prepared as a paper document, would run to several volumes. It is therefore desirable that a means of filtering the information be provided such that a user is able to view and, if required, print only that information of relevance.

Filtering could be provided against a number of criteria such as:

- a) By one or more States;
- b) Through a geographically defined area, e.g. a specified rectangular or circular area;
- c) Against a defined route as can be carried out today in generating Pre-flight Information Bulletins (PIBs);
- d) By a specific AIP section, e.g. Air Navigation Services Charges.

Whilst basic filtering could be provided by way of style sheets, more complex filtering would require tools to be applied to the eAIP. These should therefore be developed by users to suit their own needs. It is possible that industry will see a need to supply such tools and as a consequence, COTS products to provide such capability may become available.

## 8.6 Compatibility and Interaction with Other Data Sources

The recommendation to provide the EUIR AIP in an eAIP format provides an opportunity for its content to be shared with other systems. Nevertheless, given that the majority of requirements for the access to consolidated and consistent data are for geo-spatial data, **the study team recommends** that the EAD remains the primary source of such data.

However, where a system needs to access textual data, the EUIR eAIP provides an ideal mechanism. For example, should an Air Traffic Control (ATC) system wish to provide the textual data associated with a Navaid, this is not contained in a computer literate form within the EAD. It is therefore recommended that the geo-spatial data be obtained from the EAD and the supplementary textual data extracted from the EUIR eAIP.

## 9 REGULATORY, INSTITUTIONAL AND CONTRACTUAL ISSUES

### 9.1 ICAO

The services provided by a State Authority are generally provided in accordance with the ICAO SARPs. The ICAO website (<http://www.icao.int>) defines SARPs as:

*“A Standard is defined as any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognised as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38 of the Convention.*

*A Recommended Practice is any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognised as desirable in the interest of safety, regularity or efficiency of international air navigation, and to which Contracting States will endeavour to conform in accordance with the Convention. States are invited to inform the Council of non-compliance.*

*SARPs are formulated in broad terms and restricted to essential requirements. For complex systems such as communications equipment, SARPs material is constructed in two sections: core SARPs — material of a fundamental regulatory nature contained within the main body of the Annexes, and detailed technical specifications placed either in Appendices to Annexes or in manuals.”*

The differences to SARPs notified by States are published in Supplements to Annexes and within the relevant National AIP. However, States are often reluctant to operate in a manner which contravenes ICAO; of the 27 SES States only 7 have currently notified ICAO of differences.

It should be noted that the ECAC States consider that they provide the IAIP in conformity with the requirements of ICAO Annex 15 (Reference 3). Nevertheless, significant differences of interpretation of the SARPs were identified. In consequence, EUROCONTROL has established projects to define more detailed descriptions – often under the remit of a harmonisation activity. The AIS Data Process (ADP), SDP and OPADD were developed to establish one such common understanding.

The significance of the ICAO SARPs is acknowledged within the SES Legislation. For example, the Airspace Regulation states *“Without prejudice to the publication by Member States of aeronautical information and in a manner consistent with this publication, the Commission, in close cooperation with EUROCONTROL, shall coordinate the development of a single aeronautical information publication relating to the EUIR, taking account of relevant ICAO requirements.”*

Such acknowledgement and acceptance of the ICAO requirements is a fundamental necessity in achieving the implementation of the EUIR AIP. Any proposal which failed to pay due regard to the ICAO SARPs would be unlikely to gain the support and acceptance of the Stakeholders required to implement it.

## 9.2 Single European Sky

The SES is enacted through a number of regulations which have been established and accepted by both the European Parliament and Council.

These regulations provide the framework within which the SES is created – mainly through the development of mandates for implementation by EUROCONTROL. These mandates in turn may lead to the development of rules which provide mandatory actions for the States to perform.

Whilst the SES Regulations, in the main, are able to co-exist and in many cases reinforce the position of ICAO one fundamental difference, as noted in 8.1, has been found with regards to the duplication of data, although in essence the ICAO requirements appear to be in contradiction with regards to the duplication of data within an AIP.

## 9.3 Safety

The creation of the EUIR AIP must in no way compromise the safety of flight. As addressed later in the document (see 12.2.8) a safety case must be undertaken to assess the impact of both the creation of the EUIR AIP and the processes used to achieve it.

The EUIR AIP will involve many actors from the Data Originators in each State, through the States air navigation and AIS providers and through to the EASP. Each of these must be fully cognisant of the requirements placed upon them for ensuring the safety of both the data which they source and the processes which they apply to it.

The following section details the main actors and their responsibilities with respect the service. Rather than address safety within these sections the following overall statements should be applied:

- a) Each actor must declare the safety processes which they apply to ensure that the data they provide to the next actor complies with the minimum safety standards associated with it;
- b) Each actor must demonstrate compliance with the required safety standards be it international, national or industry. For examples, compliance with the Eurocontrol Safety Regulatory Requirement (ESARRs);
- c) Each actor should fully support any request that their operation be subjected to a safety audit.

## 9.4 Actors, Responsibilities and Liabilities

### 9.4.1 General

A number of actors appear in the overall process for the provision of Aeronautical Information for the EUIR. Each of these carries their own responsibilities and hence liabilities.

Where a delegation of service has been made, the delegating authority still retains the responsibility for the actions delegated. The allocation of liability however may be the subject of a contractual agreement.

The following sections outline the main actor groups involved, the responsibilities that they carry and their liabilities.

### 9.4.2 Data Originators

Data Originators are any organisation that requires Aeronautical Information to be made publicly available. This includes, for example, Aerodrome Authorities, ANSPs and Military Organisations.

A Data Originator is responsible for the provision of information to the AIS for publication either directly or through a third-party such as a Civil Aviation Authority (CAA):

- a) In a timely manner to allow publication to take place in accordance with prescribed schedules (e.g. AIRAC Cycle);
- b) Of sufficient quality to meet the needs of the user and as laid down within ICAO and National regulation;
- c) With the required assurance of integrity and accuracy as specified by ICAO.

Furthermore, in many cases a Data Originator may be asked to approve the AIP Amendment used to publish the information prior to publication.

An AIS will take reasonable steps to ensure that the data it receives meets the criteria as required under ICAO Annex 15 (Reference 3) which states "*Aeronautical information obtained ... shall, if possible, be verified before distribution and if not verified shall, when distributed, be clearly identified as such.*".

In reality an AIS today is only able to perform reasonableness checks and, hence, it is the Data Originator who is ultimately held accountable and therefore liable for any errors or omissions in the data which they provide for publication.

### 9.4.3 National AIS

A National AIS is responsible for publishing the data which it receives from Data Originators. Its responsibilities include:

- a) The application of process checks to ensure that amended data is received from the appropriate source;

- b) The accurate reflection of received data within the IAIP products;
- c) The timely release of Aeronautical Information in accordance with prescribed schedules (e.g. AIRAC Cycle);
- d) The distribution of the required Aeronautical Information to those users who have subscribed to receive it.

In the event of information being incorrectly published, e.g. as a result of a transcription error, preparation of the IAIP product, or in the case of information being published despite being received from an incorrect authority, the State shall be responsible. The liability however will rest according to the contractual / regulative position of the State and its AIS provider.

#### **9.4.4 EUROCONTROL and the EAD**

The responsibilities and liabilities of the EAD and its Data Providers have been clearly defined by EUROCONTROL in References 13 and 14 as follows:

EUROCONTROL shall be responsible for the successful and effective provision of the EAD Service.

- a) EUROCONTROL shall be liable in accordance with the provisions of Article 25 of the amended Convention. Its contractual liability is governed by the law applicable to the contract concerned. With regard to non-contractual liability, the Organisation shall make reparation for damage caused by the negligence of its organs, or of its servants in the scope of their employment, in so far as damage can be attributed to them;
- b) A participating State shall continue to remain responsible for providing an AIS in accordance with Article 28 of the Convention on International Civil Aviation (Chicago Convention) and Annex 15 (Reference 3) to this Convention;
- c) A participating State shall be responsible for the accuracy and timely provision to the EAD of the Aeronautical Information it is responsible for;
- d) A participating State shall be liable and maintain Intellectual Property Rights (IPR) for the information provided to the EAD;
- e) A participating State shall grant EUROCONTROL the right to process, collate and distribute the information provided by the participating State to the EAD;
- f) All client SLA shall be between EUROCONTROL and the client.
- g) The EAD Service Provider (ESP) shall contract directly with EUROCONTROL and shall be paid only by EUROCONTROL for the execution and provision of the Service;
- h) The service shall at all times be a EUROCONTROL and EUROCONTROL-owned service. The Service Provider shall ensure the service is at all times perceived and recognised as being a EUROCONTROL provided service.

In the framework of the service contract concluded between EUROCONTROL and the ESP, a Service Level Specification (SLS), detailing

the services to be delivered by the ESP and the roles and responsibilities of each involved party, will also be established. The service contract, together with the SLS, will represent the tool through which the EUROCONTROL will implement and ensure compliance with any applicable regulation, and the provision of the Service in particular. The EUROCONTROL will thus be responsible for the oversight management of the outsourcing service contract in order to ensure that the ESP meets its contractual obligations.

The operation of the EAD, and thus the formal provision of the Service, will be performed under contract by the ESP on behalf of EUROCONTROL. Therefore, EUROCONTROL, owner and sponsor of the Service, will be responsible to its member States for the Service being rendered satisfactorily, in accordance with appropriate and agreed service levels and performance requirements.

#### **9.4.5 SES States and the EASP**

The SES States are the body with overall responsibility for the creation of the SES and subsequently the EUIR and its associated AIP. The SES States do not, however, intend to jointly provide any service associated with the EUIR AIP, and will contract a service provider (the EASP) to provide this on its behalf.

For the recommended solution (Solution 4), the EASP will be responsible for:

- a) The collection of all SES States eAIPs;
- b) The collation of the SES States eAIPs into a single EUIR AIP;
- c) The resolution of any information which is in conflict with either a neighbouring State's data or with agreed Pan-European information;
- d) The distribution of the eAIP through incorporation into the EAD PAMS database, a website and directly to subscribed clients.

For Solution 1 the EASP will be responsible for:

- a) The collection of all SES States geo-spatial and AIPs;
- b) The collation of all SES States geo-spatial data and textual data extracted from the national AIPs;
- c) The resolution of any information which is in conflict with either a neighbouring State's data or with agreed Pan-European information;
- d) The distribution of the eAIP through incorporation into the EAD PAMS database, a website and directly to subscribed clients

For Solution 2 the EASP will be responsible for:

- a) The collection of all SES States geo-spatial and textual data;
- b) The collation of all SES States geo-spatial and textual data;
- c) The resolution of any information which is in conflict with either a neighbouring State's data or with agreed Pan-European information;
- d) The distribution of the eAIP through incorporation into the EAD PAMS database, a website and directly to subscribed clients.

For Solution 3 the EASP will be responsible for:

- a) The collection of all SES States eAIPs;
- b) The collation of the SES States eAIPs into a single EUIR AIP;
- c) The resolution of any information which is in conflict with either a neighbouring State's data or with agreed Pan-European information;
- d) The distribution of the eAIP through a subscription service or via a website.

The model of liability and responsibility used for the EASP service should comply with that used for the EAD as, fundamentally, the two processes bear much the same operating principles.

#### **9.4.6 Liability – SES Requirements**

The draft regulation from the EC regarding common requirements for the provision of air navigation services, states that *“Air navigation service providers should have in place arrangements to cover losses for damage arising from liabilities. The method employed should follow national law requirements. Member States which allow the provision of air navigation services in all or part of the airspace under their responsibility without certification in cases where the provider of such services offer them primarily to aircraft movements other than general air traffic under article 7(5) of the Service Provision Regulation, should be held liable for any losses or damages suffered as a result of any safety-related act or omission by any such air navigation service provider.”*

### **9.5 Sovereignty**

Under the SES Legislation a State retains full sovereignty for the airspace above its territory, delegating, as permitted under ICAO regulations, the service provision element for publication of part of that territory.

It has been confirmed by ICAO that delegation of publication to the EC for some aspects of a State's Aeronautical Information, if required, is fully permissible under the Annex 15 (Reference 3) regulations.

### **9.6 Service Certification**

#### **9.6.1 General**

There is a growing trend today for the certification of service organisations, the provision of AIS being no different. As the EUIR AIP will contain the information for many States and will act as a reference document with implications on the safety of flight, should errors be included, there are many valid reasons for the Service Providers involved to be certified against defined standards.

Within the provision of the EUIR AIP there are Service Providers involved in two stages of the process, National Providers who provide AIS publications on a State or State grouping basis and the EASP who issues the EUIR AIP.

***It is the recommendation of the study team*** that the certification of these bodies should be identical, the quality of the final products being dependent upon the entire process chain, not just one element.

Three types of certification have been ***identified by the study team***, these are:

- 1) Certification of Quality Management System (QMS);
- 2) Certification required through the SES Legislation;
- 3) Certification of Operational Staff.

Each if these is addressed in more detail below.

### **9.6.2 QMS Certification**

As discussed in 10.3.1, AIS Service Providers are now mandated by ICAO to implement a QMS, ISO 9000 being recommended. Whilst States may well implement a perfectly acceptable QMS without seeking external certification, instead relying on self assessment and audits, this should not be seen as the preferred way forward.

It is therefore proposed that both the National AIS Service Providers and the EASP implement a QMS compliant with ISO 9001:2000 and that this be certified by an approved ISO assessment agency.

Whilst the certification of each individual State's QMS will help to ensure a consistent approach to quality at a higher level, this should not be seen as a replacement to the work undertaken by EUROCONTROL in the development of harmonisation standards. Programmes such as the development of the OPADD, CASP and SDP have been undertaken to ensure a consistent approach to quality across ECAC States as a whole.

### **9.6.3 SES Certification**

The SES Legislation states<sup>17</sup> that "*The provision of all air navigation services within the Community shall be subject to certification by Member States.*" and that "*Applications for certification shall be submitted to the national supervisory authority of the Member State where the applicant has its principal place of operation and, if any, its registered office.*"

This legislation applies to the provision of AIS services through the Framework Regulation<sup>18</sup> stating "*air navigation services' means air traffic services; communication, navigation and surveillance services; meteorological services for air navigation; and aeronautical information services*".

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<sup>17</sup> Regulation of the European Parliament and of the Council on the provision of air navigation services in the Single European Sky ("The Service Provision Regulation"), Article 7 – Certification of Air Navigation Service Providers.

<sup>18</sup> Regulation (EC) No 549/2004 Of The European Parliament And Of The Council laying down the framework for the creation of the single European sky (the framework Regulation)

For the National AIS Service Providers it is clear that this certification process should be governed by, and issued by, the National Supervisory Authority of that State (typically the CAA).

***It is the recommendation of the study team*** that the SES Members nominate a single body to oversee the EASP acting, in effect, as a “*European Supervisory Body*”. Through nomination of such a body, the EC may be assured that the service offered will be consistently provided wherever the EASP is based and that should the Service Provision contract be transferred from one organisation to another, for example through a re-tendering process, that users of the service do not see a degradation of service.

The appropriate body to certify the EASP needs to be established as part of the implementation phase.

#### **9.6.4 Staff Certification**

The requirements for the licensing of personnel are provided within ICAO Annex 1 (Reference 1). This Annex details the method in which a license shall be granted and the manner in which it shall be presented.

The current ICAO requirements have no provision for the licensing of AIS personnel, providing they are not also acting in another role which does require a qualification. In such a case the licensing requirements for this second role would apply, but only for those secondary functions.

Some European States already have a National licensing arrangement for AIS staff, other States license their AIS personnel as Air Traffic Control Assistants (ATCA), and many do not license their AIS Staff at all.

The SES Legislation potentially introduces<sup>19</sup> the need for AIS personnel to be licensed and hence a standard against which to license them is required. ICAO Annex 1 (Reference 1) does not prohibit the introduction of licensing for AIS; the only restriction placed would be on the colour of an issued license which should not be any of those already specified.

EUROCONTROL has already developed the CASP (Reference 10) which has provided:

- a) A reference framework of competencies for AIS personnel;
- b) A series of Human Resource Management guidelines by State AIS.

One of the purposes of the CASP (Reference 10) was to provide a useful basis for States if licensing of AIS personnel were to be considered. Clearly further work will be required in the area of CASP if licensing is required.

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<sup>19</sup> The SES Legislation covering Air Navigation Service Provision introduces the concept of certification of Providers. This may lead to a requirement for a Service Providers staff to achieve key basic requirements.

## 9.7 Stakeholder Management and Change Control

### 9.7.1 *General*

The control of change is one key element to the continuous management of the Service and Products offered for the EUIR AIP. This may be affected by change requests to the:

- a) Requirements for the AIP itself;
- b) AIXM;
- c) eAIP;
- d) EAD.

It is essential that the control mechanisms for each of these are adequately defined such that impact on the EUIR Service is understood and planned for.

### 9.7.2 *EUIR AIP*

Changes to the requirements for the EUIR AIP itself must be managed. The sources of change foreseen include amendments to:

- a) ICAO Annex 15 (Reference 3);
- b) Single European Sky Legislation;
- c) User Requirements;
- d) Process Improvement.

A change control board should be established to manage and control such changes. Two possibilities exist, that the EASP itself is asked to provide such a board as part of any service provision contract, or a regulative body is nominated either by the EC or by the Member States to establish and run this board.

In order to ensure that the Stakeholders of the EUIR AIP are involved in its change process and therefore included in an active role in its future development, the following list of participants are foreseen for the EUIR AIP Change Control Board (EACCB):

- a) The European Commission;
- b) EUROCONTROL:
  - 1) Aeronautical Information Management (AIM) Domain;
  - 2) EUIR AIP Oversight Management;
- c) ICAO;
- d) Representatives of the SES States AIS;
- e) The EUIR AIP Service Provider;
- f) Representatives of user groups (IATA etc.).

The terms of reference of the EACCB should be defined as part of the implementation phase.

### 9.7.3 **AIXM Configuration Control Board**

The AIXM Configuration Control Board (ACCB) has been established to provide a controlled and managed means by which the AIXM may be developed. The AIXM is already accepted as the defacto European standard for the exchange of Aeronautical Information and is likely to be accepted by ICAO as a world-wide standard.

Any changes to this standard have the potential to be far-reaching with any system which makes use of it possibly requiring modification. Consequently, any changes to the standard must be made after due consideration and debate, the advantages and disadvantages of each proposal being considered. The mission of the ACCB has been established as *“to control the evolution of the Aeronautical Information Exchange Model (AIXM) and of related specifications, in order to satisfy the needs of the largest possible number of stakeholders.”*.

The ACCB consists of representatives from:

- a) States (ECAC States, US, Japan, Russia, Australia etc.);
- b) Agency Units (EAD, CFMU, etc.);
- c) Other AIXM stakeholders (mainly industry).

The tasks of the ACCB are defined as:

- a) To collect, record and analyse facts and opinions from users, both direct and indirect, of the current effective version(s) of AIXM;
- b) To issue proposals for changes to AIXM;
- c) To approve changes to the AIXM;
- d) To schedule new AIXM versions and decide on the changes to be incorporated;
- e) To establish a working procedure;
- f) To develop requirements for and decide on the use of software tools in support of its activities.

It is considered essential that the EASP participate in the ACCB to gain an understanding of future changes which may impact their service.

### 9.7.4 **eAIP**

At the time of the study the eAIP is still in its infancy and consequently the EUROCONTROL Agency is maintaining the eAIP Specification directly. For each intended change, a consultation exercise is made with a 'stakeholder group', which comprises:

- a) States having implemented an eAIP;
- b) Representatives from commercial companies that have explicitly requested to be informed about changes, as they claim to develop an eAIP related product.

In due course, the intention is to set up a configuration control board for the eAIP, similar to the ACCB addressed above. This will be hosted by the AIS Technical Sub-group and attended by those who have a proven interest.

### 9.7.5 EAD

The main function in controlling the operation and enhancement of the EAD is the EAD Service Steering Group (EAD SSG). This body has been established to “*ensure that the interests of all users are taken into account in the operation and enhancement of the EAD.*”.

The participants of the EAD SSG are:

- a) Personnel nominated by the organisations of EUROCONTROL member States, including CAAs, Military Organisations and ANSPs;
- b) Observers from other organisations may attend the meetings of the EAD SSG subject to agreement by SSG members.

It is recommended that the EASP be permitted, by EUROCONTROL, to attend the EAD SSG as a representative of the SES States and hence participate fully rather than act as an observer.

## 9.8 Service and Product Development

This study has predominately addressed the requirements of the EUIR AIP in its initial form; however, some consideration has also been given to potential future needs.

It is envisaged that the EUIR AIP may be extended to cover Lower Airspace, this may be addressed from a legislative perspective in late 2006. Further extension to include Terminal Movement Area (TMA) and Aerodrome information seems a distinct possibility. Comments raised by Stakeholders during this study have shown that many believe the full benefits of an AIP covering all SES territory will only be achieved when all of airspace is included.

It is also likely that, over time, the requirements of ICAO for data to be included within the IAIP will be amended in line with the recommendations of the Air Navigation Council. The EUIR products would therefore require adaptation / enhancement to comply, amendment 33 to ICAO Annex 15 (Reference 3) has already introduced an increased requirement for data which will need to be addressed by the States for their National products.

The EUIR AIP will be developed, implemented and maintained in accordance with the eAIP specification and the geo-spatial elements in it will be validated against the content of the EAD. The EAD itself may evolve and new technologies may be employed to provide the service. Therefore, it must be ensured that means to provide for the EUIR AIP are planned and that a controlled migration to improved technology / services is provided for.

**It is also the recommendation of the study team** that the EAIP Service Provider should not, under the terms of a contract with the SES States, be permitted to provide other commercial (value-added) products based upon the content of the EUIR AIP. The organisation who successfully tenders for the right to operate the EUIR AIP Service will be placed in a privileged position, having easy and, more importantly, early access to the information to be published. Such an advantage may not be in accordance with the principles of the EC that open market conditions should prevail for the

provision of services and products. This recommendation has been included at the request of some Stakeholders who, though they may not wish to or be able to perform the service, see any advantage gained by the EASP, as being potentially damaging to their core business objectives.

## 9.9 Intellectual Property Rights and Copyright

Annex 15 (Reference 3) states that “*In order to protect the investment of the products of a State’s AIS as well as to ensure better control of their use, States may wish to apply copyright to those products in accordance with their national laws.*”. Furthermore, the statement is then made that “*Any product of a State’s AIS which has been granted copyright protection by the State ...shall only be made available to a third party on the condition that the third party is made aware that the product is copyright protected and it should be appropriately annotated that the product is subject to copyright by the originating State.*”.

This raises the potential situation where some of the information contained within the EUIR AIP is the subject of copyright as decreed by the originating State whilst other information is made freely available in an unrestricted manner.

Furthermore, if the EUIR AIP is distributed in an electronic form, how is any copyright statement “*appropriately annotated*”?

During the development of the EAD, much research was carried out regarding the situation regarding IPR and Copyright with relation to Aeronautical Information. The outcome of this research led to the current position regarding ownership and copyright of data within the EAD.

Currently the AIS community is monitoring a legal action between Air Services Australia and Jeppesen regarding the ownership and copyright of Aeronautical Information and the ability of an issuing State to constrain the use, manipulation and commercialisation of said data.

The outcome of this case may have far reaching implications for the Aeronautical Information community as a whole. It appears unlikely that the status quo will remain. Whatever the outcome, a precedent is likely to be set for the future access and use of data. As such, this case has the ability to significantly affect the implementation of IPR and Copyright although this will have to be tested in States other than Australia.

The implementation phase of the EUIR AIP must address this issue in more detail to ensure that a suitable, legally binding, position is established which satisfies the needs of the originating authorities.

## 9.10 Language

It is a requirement of ICAO that all AIPs are published in at least the English language. It is therefore essential that the EUIR AIP is provided in this form. **The study team has, in other phases of the study, suggested** that as the only common language for Upper Airspace information for the SES today is English, there is no need to provide the EUIR AIP in any other language.

In the comments raised to the study team by Stakeholders, not one objection to this statement has been voiced. Consequently, it is the **recommendation**

**of the study team** that the EUIR AIP be provided by the EASP in English only.

Should a State wish to translate the document into their National language or languages then that would be permitted but, in doing so, the State must accept liability for any errors introduced in the process of translation.

It should be noted that should the EUIR AIP be extended below upper airspace, its publication in only the English language may not be acceptable.

## 10 SERVICE PERFORMANCE

### 10.1 Service Level Agreements

A SLA provides a means of capturing and agreeing the service which a customer expects to receive from a supplier. In the case of the EUIR AIP a number of different agreements may be needed to cover the various transaction points in the process chain.

If Solutions 1, 2 and 4 are adopted the main transactions will be:

- a) National AIS → EAD;
- b) EAD → EASP;
- c) EASP → EAD;
- d) EASP → SES States.

If Solution 3 is adopted the main transaction points will be:

- a) National AIS → EASP;
- b) EASP → SES States.

For each of these transactions a SLA is required which will form the basis of an agreement as to what the service will be, what should be delivered, the Key Performance Indicators (KPIs) by which it shall be measured and what actions will be taken should the service fail to meet its requirements.

Furthermore, the EASP is providing a service on behalf of the SES States and, therefore, a SLA should be developed as part of the contract between these two bodies.

Though outside the scope of this study, **the study team would recommend** that consideration be given to whether a series of SLAs are required between the National Data Originators and the State AIS. Whilst this is an element of the process which remains unaffected by the implementation of the EUIR AIP, failures at this point may have a severe impact on the validity of the EUIR AIP.

#### 10.1.1 ***National Data Originators → National AIS***

Some States have already begun to address the need for SLAs between the AIS and its data originators and its users. This is especially true of AIS provided by commercial organisations.

During the implementation phase, consideration should be given to the need to expand the use of SLAs between National Data Originators and National AIS. Although the process proposed by any of the solutions does not impact this work, it is essential that the data is originated at an appropriate time and format so as not to delay or jeopardise the latter stages of the process.

**The study team recommends** that, in the implementation phase, a generic SLA is developed which may be used by State AIS as the basis for individual agreements with each Data Originator.

### **10.1.2 National AIS → EUROCONTROL (EAD)**

Under the ECIP INF01 and INF01-MIL01<sup>20</sup>, all SES States will migrate to use of the EAD. This will require them to:

- a) Enter their Static Data into the SDO database;
- b) Provide their AIP for storage within the PAMS database.

As such, each SES Member State becomes an EAD Client and in particular an EAD Data Provider. One of the actions which must be undertaken as part of this migration is the development and agreement of a SLA between the National AIS and EUROCONTROL's EAD programme.

These SLA may therefore be considered as being extant and therefore no further action should be necessary.

### **10.1.3 EUROCONTROL (EAD) → EASP**

Under Solutions 1, 2 and 4, EAD will be the reference source of Static Data to the EASP.

Solution 1 would see the EAD as the source of the national eAIPs. Whilst Solution 2 would see EAD act as the source of textual and geo-spatial data by way of its structured databases. Solution 1 would see the EAD as the source of geo-spatial data and AIPs in PDF format.

In Solutions 1, 2 and 4 the EASP will therefore act as an EAD Data User for these functions and will be required to negotiate, and agree, a SLA with EUROCONTROL's EAD Oversight Management function.

Given the likely timeframe for implementation of the EUIR AIP, this SLA is likely to be a standardised document and as such forms one action of the implementation phase.

### **10.1.4 EASP → EUROCONTROL (EAD)**

Chapter 10.1.2 covers the agreement necessary for a National AIS to provide its AIP to the EAD for inclusion within the PAMS database. The EASP will also act as an EAD Data Provider, supplying the EUIR AIP for storage within PAMS for Solutions 1, 2 and 4.

As with the EASP Data User agreement, it is envisaged that this will be a standard document which must be agreed as one action of the implementation phase.

### **10.1.5 EASP → SES States**

The Service Provision contract for the EUIR AIP will be placed by the SES States and should be supported by a SLA. This should clearly identify the expectations of the SES States for the service in terms of:

- a) The services to be delivered;

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<sup>20</sup> Civil AIS are obliged to migrate to the EAD by December 2006, Military Authorities by December 2008.

- b) How performance should be tracked and reported;
- c) How problems will be managed;
- d) What fees and expenses will be made (bonus / malus payments);
- e) The customer's (SES States) duties and responsibilities.

If, as is thought, the Service Provision is implemented by SES States contract, careful consideration should be given to the inclusion of bonus/malus clauses, based upon established and agreed KPIs, which allow the performance of the EASP to be reflected in the payments made.

EUROCONTROL's EAD programme has developed a SLA for the contract with GroupEAD for provision of service. It is thought that, although different in some respects, much of the service specification included within this document will be of relevance to and able to be incorporated in the EASP SLA.

Furthermore, as discussed in 10.4, it is believed that the EAD Oversight Management function is ideally placed and suited to oversee the performance of the EASP on behalf of the SES States for all solutions. It would therefore be desirable for much of the service specification to be broadly similar to allow for consistency and ease of management.

### **10.1.6 National AIS → EASP**

With Solution 3, an agreement must be established for each SES Member State to provide an eAIP to the EASP.

It is envisaged that this will be a standard document which must be agreed as one action of the implementation phase.

## **10.2 Key Performance Indicators for Service**

The performance of the EUIR Service must be assessed as part of the QMS of the EASP. The first requirement for the assessment of the performance of the EAIP service is to identify the KPI against which the service will be measured, monitored and analysed<sup>21</sup>.

The main objectives of KPI analysis are:

- a) To identify opportunities and problems;
- b) To determine priorities;
- c) To take action to improve;
- d) To make decisions to re-locate resources;
- e) To change or adjust strategy;
- f) To provide feedback to change behaviour;
- g) To recognise and reward accomplishments.

The KPI Deployment Process can be summarised as:

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<sup>21</sup> Much of the information on Key Performance Indicators was taken from EUROCONTROL's work on Top-12 KPIs for AIS.

- a) KPI Definition;
- b) Identification of Production Process;
- c) Development of Data Collection Plan;
- d) Monitoring of KPI Compliance by Event-Drive Measurement, Sampling Based Measurement and Simulation;
- e) Gather and Analyse Data;
- f) Make Improvements based on Analysis.

Paragraphs 10.2.1 to 10.2.5.1 provide a non-exhaustive list, derived by the study team by way of illustration, of some of the most significant KPIs that may be applied to the EUIR Service. As with the discussion regarding the SLA, a set of KPIs has been developed for EAD, reuse of which, where applicable, would ensure consistency.

### **10.2.1 Traceability**

Traceability is a requirement of both ICAO and the International Organisation for Standardisation (ISO) 9001 and from the AIS perspective is one of the most important user requirements. The aim of the Traceability KPI is to enable the investigation of data anomalies in order to take preventative measures and corrective action, the recording of all data and its processing from source to the end-user and to support an archive system and the frequency of archiving. Traceability may be measured by the time to trace assessment method, averaging the elapsed time required to trace data back to origination.

### **10.2.2 Security**

As security violations, such as unauthorised accesses to resources, may negatively affect the safety of navigation, the Security KPI is regarded as an important one for the EUIR Service. The aim of the Security KPI is to evaluate system security and to check each component of the production process against unauthorised access. Security may be assessed on the number of unauthorised accesses or attempts to access resources illegally for a given period of time. Data collection can be categorised into the number of detected incidents related to unreliable input data, number of incidents in the physical environment, number of unauthorised accesses to critical computer components and the number of illegal attempts to access critical computer components.

### **10.2.3 Availability**

The availability of service is specified in ICAO's AIS Manual. The aim of the Availability KPI is to measure and monitor product and service availability, monitor the availability of each component of the production process and to diagnose the parameters of components which originate the degradation in availability. Availability may be assessed by calculating the ratio of down time to total time in operation.

### **10.2.4 Timeliness**

The adherence to the AIRAC cycle is specified by ICAO. In particular, Aeronautical Information concerning significant changes in facilities, services or procedures should be provided in accordance with the effective dates of the AIRAC system. The aim of the Timeliness KPI is to check the reception and provision of Aeronautical Information in accordance with the effective dates of the AIRAC cycle. Timeliness may be assessed by the number of occasions where the reception and effective dates of the AIRAC are not respected in a given period.

### **10.2.5 Personnel Capability**

As part of the QMS defined in Annex 15 (Reference 3), personnel shall possess the skills and competencies required to perform those functions assigned to them. The aim of the Personnel Capability KPI is to evaluate the capability of personnel involved in the production process, as a team. This can be assessed by analysing the gap between the required and the actual staff and competence gap analysis.

#### **10.2.5.1 User Enquiries**

As part of the QMS specified in Annex 15 (Reference 3), users shall be provided with assurance and confidence that distributed Aeronautical Information/Data satisfies the data quality requirements. ICAO's AIS Manual also states that any inadequacy observed by the operator in the course of operations of facilities essential to the safety of those operations, is reported to the authority responsible for them. The aim of the User Enquiries KPI is to increase confidence, to minimise the problem related to data quality and to take action in problematic areas. This can be assessed by calculating the number of user enquiries to the total number of products, publications and services.

## **10.3 Quality Management System**

### **10.3.1 ICAO**

ICAO's Annex 15 (Reference 3) states that a State shall introduce a properly organised quality system containing procedures, processes and resources necessary to implement quality management at each function stage: receipt and/or origination, collation and assembly, editing, formatting, publication/storage and distribution. ICAO has specified the implementation of ISO 9000 QMS in AIS and the achievement of ISO 9001:2000.

Commonly a State's ANSP will elect to gain a separate certification for each service that it offers. However, some functions, such as training or accounts, provide a common service across the business and these are often certified together and referenced from an individual service's QMS.

### **10.3.2 EC**

The EC draft regulation on Common Requirements for the Provision of Air Navigation Services, also states that an ANSP shall introduce a Quality

Management System, and that this may be ISO 9001 certification, for all air navigation services it provides by the end of 2006.

The QMS recommended by the EC shall define:

- a) The authority, duties and responsibilities of the nominated post holders, in particular the management personnel in charge of safety, quality, security and human resources related functions;
- b) The relationship between different parts of the organisation, including where relevant how different divisions and departments relate to the individual services provided;
- c) The subordination and reporting lines of, for example, all divisions and departments.

An ANSP shall be organised in such way that it can accommodate relevant operational and technology changes resulting from plans developed throughout the Community.

The ANSP shall specify:

- a) The quality of services and the level of service delivery that the service provider intends to meet;
- b) The methodology and inputs employed in the calculation of the planned level of service delivery;
- c) Indicators of performance against which the quality of service may be reasonably assessed.

### **10.3.3 EUROCONTROL**

EUROCONTROL has issued an ECIP INF02, for the implementation and certification of the ISO 9001:2000 Standard for AIS covering the totality of IAIP for all ECAC States. This also applies, but is not mandatory, to military AIS where the role is similar or equivalent to that of civil AIS. Certification by the appropriate ISO bodies had a target date of the end of 2003. Currently not all ECAC States have achieved certification.

### **10.3.4 ISO 9000:2001 - Human Resources**

With the emphasis of Human Resources in ISO 9000:2001, organisations must ensure that their personnel that have a defined responsibility within the QMS, are competent and that the appropriate levels of training, skills and experience are well defined. The training must meet the competency levels required of personnel performed activities that affect quality. Organisations must determine and provide resources necessary to implement and improve the QMS processes and to address customer satisfaction. Organisations must identify, provide and maintain the facilities necessary to achieve the conformity of their products. Organisations must identify and manage human and physical factors in relation to the work environment. Organisations must keep training records including education, experience, training and qualifications. Employees must understand the relevance and importance of what they do and how this contributes to the achievement of the quality

objectives. Organisations must evaluate the effectiveness of the training they provide. Initial and periodic assessments shall be established that require personnel to demonstrate the required skills and competencies.

#### 10.3.4.1 CASP

Common AIS Staff Profiling (CASP, Reference 10) has been created by EUROCONTROL to map AIS/MAP functions to required standard knowledge, skills and abilities. The CASP group is composed of ECAC State AIS/MAP experts and EUROCONTROL Human Factors and Training specialists.

CASP (Reference 10) has come from the need to define the tasks, qualifications, training and assessments which are a result of the ISO 9000:2001 requirements to address human resource activities in a rapidly changing ATM environment, as detailed above. The results of this work by CASP are job descriptions and person specifications and a set of AIS Staff Profiling guidelines and generic tools for use by ECAC AIS staff and organisations, to aid the implementation of harmonised management processes across Europe.

#### 10.3.4.2 EUIR AIP Service Provider

As the EASP shall be providing a similar service for the SES region as national ANSPs provide to individual States, it is foreseen that it shall also be certified to ISO 9001:2000 in line with the ICAO requirements, making full use of the work of CASP as described in 10.3.4.1 above. This shall be verified by audit. Currently provision of air navigation services within the Community shall be subject to certification by its Member States. It is recommended that the EASP is certified by a European Supervisory Body.

### 10.4 External Monitoring & Service Oversight

Once the EUIR AIP Service has been established, it is essential that its performance is independently monitored to ensure that the standards necessary are achieved and maintained.

Whilst the requirements for a QMS bring about a certain, and necessary, degree of assurance that the defined processes are being applied, this does not remove the need for external oversight.

Firstly, certification of a QMS, such as ISO 9001:2000, is an internally initiated action. It is the EASP itself who will organise and fund the external assessment needed to gain certification.

Secondly, an ISO assessment tends to concentrate on adherence to the quality processes in place and their refinement, rather than on the service or product which is produced as a consequence.

It is therefore recommended that an oversight body be established to monitor and assess the performance of the EASP. This should ensure that the Service specified within the SLA (see 10.1) is being met and that the requirements to maintain performance against KPIs is achieved (see 10.2).

One requirement of the study was to ensure that maximum benefit was gained from the existing investments. Whilst this was intended to refer to systems and standards etc., ***the study team recommends*** that this should

be broadened to include management organisations. The EAD programme has established the EAD Oversight Management to ensure that, amongst other requirements, the EAD Service Provision is executed in an acceptable manner. It is, therefore, **recommended that** consideration be given to expanding the terms of reference of this organisation to include the oversight management of the EASP Service also. It is hoped that through such an expansion, benefits to both services may be gained and a spirit of joint working and co-operation fostered.

## 11 FINANCING

### 11.1 General

A number of key assumptions have been made in addressing the financial aspects of the EUIR AIP and the service required to provide it. These are that:

- a) The cost of the EAD Service Provision is already met through existing cost recovery mechanisms established by EUROCONTROL;
- b) The overhead costs of each State preparing a National eAIP is met by the existing cost recovery mechanisms funding the State AIS;
- c) That all States have migrated to the EAD and are making their eAIP available through the PAMS functionality and their Static Data available through the SDO functionality.

### 11.2 Costs for EUIR AIS Provision

ICAO recommends that the overhead costs of offering an AIS should be funded through airport and air navigation charges, stating "*The overhead cost of collecting and compiling aeronautical information / data should be included in the cost basis for airport and air navigation service charges, as appropriate, in accordance with the principles contained within ICAO's Policies on Charges for Airports and Air Navigation Services.*"

Furthermore, where the overhead costs of the AIS are met in such a manner, copies of the IAIP should be provided at a cost which covers the reproduction and distribution costs only, the guidance stating "*When costs of collection and compilation of aeronautical information / data are recovered through airports and air navigation service charges, the charge for to an individual customer for the supply of a particular AIS product, either in paper or electronic form, may be based on the costs of printing paper copies or production of electronic media, and distribution costs.*"

States will still be required to prepare National publications, at the very least, to publish Lower and Terminal Airspace as well as Aerodrome information. It is also highly likely that they will also continue to publish Upper Airspace information, as permitted under SES Legislation, providing a single publication covering all State territory. It is therefore reasonable to assume that the current level of funding necessary within States will remain unaltered. In the future, if, as is thought likely, further States form collaborations to provide either joint AIS or joint working agreements where workload is shared, then cost savings may be seen. Such savings are, however, likely to be seen in the mid to longer terms and therefore should not form the basis of any initial costs calculations.

In consequence, any cost incurred in providing the EUIR AIS and the overhead costs of the products it offers must be seen as an additional cost.

One benefit of Solutions 3 and 4 is that it offers the ability to prepare an EUIR AIP with a very low requirement for human resources. This, therefore,

provides for a minimal increase in the overall cost of AIS provision throughout Europe.

If, as recommended, the EUIR eAIP is made available through the PAMS functionality of the EAD, or by way of an EASP web-site, then it may be reasonable to argue that the reproduction and distribution costs are zero. It is therefore considered that the EUIR eAIP, when provided in this way, should be free of charge.

Where the EUIR AIP is required by a client in either paper form or by way of an electronic media such as CD-ROM, then the ICAO guidance should be applied and the reproduction and distribution costs recovered.

## 11.3 Funding Methods

A number of options may be envisaged for funding the Service Provision for the EUIR AIP. It is beyond the remit of this study to select a method, but several possibilities are provided here for further consideration during the implementation phase of the EUIR AIP.

Where possible, suggestions have been made to take benefit of the existing cost collection methodologies in place today.

Stakeholders have stated during the progress of this study that there cannot be an increase in user charges. Nevertheless funding shall be required for service implementation (the development of the EUIR AIP) and for service provision. The costs associated with Solutions 3 and 4 are thought to be low, those associated with Solutions 1 and 2 being estimated to be much higher. The issue of funding must, therefore, be addressed and **the study team recommend that** this is included in the implementation initiation phase.

### 11.3.1 Airport and Air Navigation Service Charges

Whilst it has been stated by Stakeholders during the progress of this study that there cannot be an increase in user charges to fund what is seen as "*the same information packaged differently*" it must be considered as one possible option.

### 11.3.2 EAD

A cost mechanism already exists for the funding of the EAD, through cost collection from:

- a) The ECAC States who, through EUROCONTROL, established the system;
- b) From charges levied to users who make use of the data contained within the EAD to generate value-added, and therefore profit based, products and services.

EUROCONTROL manages and monitors the EAD as a Pan-European service which provides a means of access to Aeronautical Information as required for the EUIR AIP. It is therefore one possibility that the funding level for EAD be increased to cover an additional Service Provision contract,

placed as a result of an open tender, for the provision of the EUIR AIP service.

The increased funding levels would require careful calculation and assignment to ensure that those States currently funding EAD who are not participating in the SES are not financially penalised.

### 11.3.3 **EUROCONTROL Funding**

Within the context of the previous suggestion for funding, EUROCONTROL itself is funded by its member States through the route charges. These contributions could be increased to cover the additional costs incurred in establishing and overseeing the execution of the EUIR AIP Service.

### 11.3.4 **European Commission Funding**

Whilst the EUIR does bring some benefit to users it is questionable whether, until a European AIP also includes at least Lower Airspace, there is a sufficient benefit to bring about user cost-savings and hence offer encouragement for investment in higher priced products to obtain saving elsewhere.

During the study it has been expressed many times by users that they are not happy to see increased charges being levied to fund an AIP which they do not see as bringing benefit. As the States will be required to continue their current tasks it may be required for the EC to look to fund the additional costs until such time as the EUIR AIP offers costs savings elsewhere and hence its funding may be re-directed.

EC funds are derived, in the main, from the European Union States.

## 11.4 **Funding**

Wherever funding is derived, the budgeting issue will be a complex affair given the State groupings involved. Table 9 provides the relationships involved and includes all States which could make up the European airspace. Green shading highlights those States who are committed to the SES and red, those who are not currently foreseen to participate.

<u>State</u>	<u>EU</u>	<u>SES</u>	<u>CANSO</u>	<u>ECAC</u>	<u>EUROCONTROL</u>
Albania				✓	✓
Armenia				✓	
Austria	✓	✓	✓	✓	✓
Azerbaijan			✓	✓	

<u>State</u>	<u>EU</u>	<u>SES</u>	<u>CANSO</u>	<u>ECAC</u>	<u>EUROCONTROL</u>
Latvia	✓	✓	✓	✓	
Lithuania	✓	✓	✓	✓	
Luxembourg	✓	✓		✓	✓
Malta	✓	✓	✓	✓	✓

<u>State</u>	<u>EU</u>	<u>SES</u>	<u>CANSO</u>	<u>ECAC</u>	<u>EUROCONTROL</u>
Belarus					
Belgium	✓	✓	✓	✓	✓
Bosnia and Herzegovina				✓	✓
Bulgaria			✓	✓	✓
Croatia				✓	✓
Cyprus	✓	✓		✓	✓
Czech Republic	✓	✓	✓	✓	✓
Denmark	✓	✓	✓	✓	✓
Estonia	✓	✓	✓	✓	
Finland	✓	✓		✓	✓
FYROM <sup>22</sup>				✓	✓
France	✓	✓		✓	✓
Germany	✓	✓	✓	✓	✓
Greece	✓	✓		✓	✓
Hungary	✓	✓	✓	✓	✓
Iceland				✓	
Ireland	✓	✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓
Moldova			✓	✓	✓
Monaco				✓	✓
The Netherlands	✓	✓	✓	✓	✓
Norway		✓	✓	✓	✓
Poland	✓	✓	✓	✓	✓
Portugal	✓	✓	✓	✓	✓
Romania			✓	✓	✓
Russia					
Serbia and Montenegro				✓	
Slovak Republic	✓	✓	✓	✓	✓
Slovenia	✓	✓	✓	✓	✓
Spain	✓	✓	✓	✓	✓
Sweden	✓	✓	✓	✓	✓
Switzerland		✓	✓	✓	✓
Turkey				✓	✓
Ukraine			✓	✓	
United Kingdom	✓	✓	✓	✓	✓

**Table 9: Organisation Membership**

It can clearly be seen from this table that none of the current representative bodies fully encompasses those members of the SES. The EU has all but two of the members; EUROCONTROL has 24 of the 27 members but also includes 10 States who are not SES Members. ECAC includes all currently planned SES States and has 14 additional non-SES States. Two States (Russia and Belarus) are not members of any of these organisations.

<sup>22</sup> Former Yugoslav Republic of Macedonia

CANSO, whilst not a government established body, does provide a grouping of Service Providers whose voice is becoming increasingly established within Europe – CANSO represents 22 of the 27 SES States.

The situation could be further complicated in the future if, as is thought likely, other States outside Europe join the SES.

How, therefore, funding, provided through any of the mechanisms identified in 11.3 above, can be set must be fully addressed during the implementation phase.

## 12 CONCLUSIONS

### 12.1 General

**The study team has concluded** that the implementation of a Single EUIR AIP, covering all SES airspace is technically feasible. This conclusion may be drawn as a result of:

- a) The existence of the EAD as a reference database of geo-spatial data;
- b) The creation of the eAIP specification to allow the content of an AIP to be held in a computer literate form;
- c) The increasing movement towards the use of electronic means for AIP publication;
- d) The investments made by States in the development and adoption of AIS harmonised standards, specifications and systems;
- e) The commitments of SES States to migrate to the use of EAD and the eAIP.

Furthermore, **the study team has concluded** that the most beneficial way of implementing the EUIR AIP is through Solution 4. However, the team is also mindful of the fact that, whilst there has been a broad acceptance of this proposal, there are some key Stakeholders who would prefer to see the role of the EAD expanded and their preference is for Solution 2. Other Stakeholders have expressed a preference for Solutions 1 and 3.

In order to progress with the development of the EUIR AIP, it has been necessary to transfer some of the actions which it was initially intended to address within the scope of this study, to the implementation phase.

The implementation phase of the EUIR *may* be undertaken by EUROCONTROL under a mandate issued by the EC, the draft text of which is in Annexe B. It should be clearly understood that any mandate would require EUROCONTROL to act as the specifying and co-ordinating body, providing the facilitation and support to the SES States. It does not require the Agency to create tools and products.

The implementation of the EUIR AIP and the Aeronautical Information it shall contain, must meet three key requirements:

- 1) It must be made available at the appropriate time;
- 2) It must be of a quality level commensurate with the needs of the users;
- 3) It must be exchanged in a manner which ensures that its integrity is maintained.

The availability, quality and exchange of geo-spatial Aeronautical Information have already been addressed through the creation and operation of the EAD, the remaining elements must be addressed during implementation.

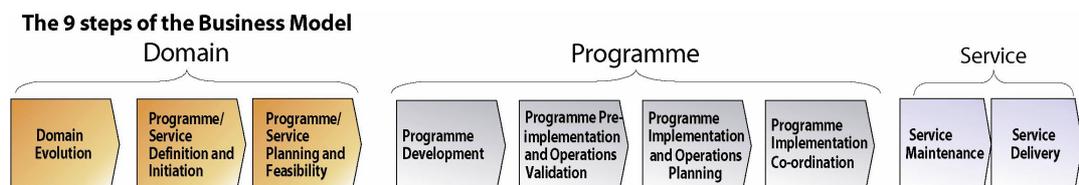
## 12.2 Recommendations for Future Action

As discussed earlier and raised a number of times within this document, the study has been unable to obtain sufficient information within the time available to adequately research, discuss and analyse all elements of this complex task.

Furthermore, as part of the study, additional areas, beyond the scope and remit of this phase, have been established which it is considered are in need of further analysis.

As the mandate for implementation could be issued to EUROCONTROL and would therefore, most likely, at least initially be assigned to the AIM Domain, it would be both probable and desirable for the Business Model applied to meet the practices of EUROCONTROL. Figure 19 provides a graphical representation of the steps involved.

This model provides high level guidance as to the steps to be undertaken in progressing an idea or concept from initial thoughts through to potential implementation.



**Figure 19: Business Model**

It may be considered that, as an assessment of the feasibility of the EUIR AIP, this study has performed the first step of this model 'Domain Evolution'. If a mandate is issued to EUROCONTROL the second step of the model shall be commenced.

This section provides details of recommended actions which it is foreseen will require resolution / analysis as part of the implementation phase of the SES EUIR and hence within the next step of the Business Model.

### 12.2.1 Content and Scope

This study has provided a high-level view of the data which would be required for publication within the EUIR AIP, sufficiently detailed to allow preliminary analysis of the solutions to be performed. The first element of the implementation phase should, however, address the topics of content and scope to a greater extent to ensure that all information required for the EUIR AIP is considered at a lower-level.

### 12.2.2 Cost Assessment

Although requested during the study, it has not been possible to obtain even budgetary estimates for all of the solutions proposed due to formally requested figures not being forthcoming. This was a critical element of the

study and one for which the information was requested by many stakeholders.

In the interest of obtaining unbiased and fair figures ***it has been the decision of the study team***, supported by the EC, not to release any of the estimates prior to them all being available.

It is therefore necessary that, as the second element of the implementation phase, an independent body be requested to complete the actions for a cost analysis, assessing the likely implementation costs of all solutions.

A further cost analysis must also be performed for the year-on-year running costs of each solution.

### **12.2.3 Implementation Plan**

A plan for implementation must be developed which shows the transition from the situation today to one whereby the EUIR AIP is published through the application of whichever solution is chosen.

The implementation plan should give consideration to the following issues:

- a) The phasing of the implementation, including the possible proof of concept through merging a small number of States' AIPs before introducing others, working towards the end goal;
- b) The impact of States migrating late to either the EAD or the eAIP;
- c) How, where and when training and facilitation support will be provided for the EAD and eAIP. Although these are currently planned by EUROCONTROL under the individual programmes/projects, some alignment between these and the SES EUIR project may be necessary;
- d) How and when the oversight functions are established;
- e) The CFT process for both Service Implementation and Provision.

### **12.2.4 Duplication**

As highlighted earlier, there is an issue regarding the ICAO requirement that AIP data shall not be duplicated conversely. This requirement cannot be satisfied whilst complying with the SES Legislation.

The hopes of the EC that future releases of an European AIP would extend to all airspace could possibly lead to the removal of the need, or a limitation in the scope of, National AIPs and hence mitigate this issue.

Five options currently appear possible:

- 1) The concept of an EUIR AIP is abandoned;
- 2) The SES Legislation is amended to specifically exclude the ability for SES States to publish upper airspace information within their National AIP;
- 3) That ICAO is requested to amend SARPs to remove the non-duplication requirement, and in doing so recognise its own requirements for the duplication of data in the en-route and airfield sections of the AIP;

- 4) National AIPs and an EUIR AIP both exist containing Upper Airspace information in conflict with the ICAO SARPs;
- 5) All SES States file a difference against paragraph 4.2.1.1 of ICAO Annex 15 (Reference 3).

None of these options appears to be ideal. As part of any implementation phase, ***it is recommended*** that this issue is addressed with the EC, ICAO, EUROCONTROL and SES States to bring about an agreement, acceptable to all parties, on the way forward.

### **12.2.5 Charging**

Having performed a cost analysis, established the preferred solution and detailed this further, one element of the mandate issued should be to ascertain more precise estimates for the cost of service implementation and provision.

Once this is known, the issue of charging and from where funding may be sourced must be addressed further.

### **12.2.6 Harmonised Text**

It is clear that an EUIR AIP will require text which is applicable throughout the SES region. Some of this will be agreed as a result of other work areas of the SES and in some cases through the development of the eAIP specification. It is however, likely that some harmonisation of text will still be required and that this must be agreed during the implementation phase.

### **12.2.7 Integrity**

The integrity of data is becoming an ever more important issue as the navigation methods used become increasingly reliant upon accurate data.

EUROCONTROL's AIM and NAV Domains initiated a Data Integrity project which undertook the first three activities of the EATM Business Model. These domain activities are now nearing completion and it is anticipated that EUROCONTROL's effort in addressing the improvement in the integrity of data will continue either as new programme or as part of an existing programme.

It is essential that in the implementation of the EUIR AIP the requirements and guidance of this programme are considered and integrated where appropriate.

### **12.2.8 Safety Case**

To support the implementation of the EUIR AIP, consideration must be given to the production of an overarching Safety Case that provides the safety argument and supporting evidence to demonstrate that the implementation of the EUIR AIP is acceptably safe, i.e. that the Air Traffic Services (ATS) environment is at least as safe and preferably safer as a result. The Safety Case can be used to assess the net safety benefit of the change and will include inter alia:

- a) The scope and boundary of the changes to the ATS environment brought about by the EUIR AIP implementation;
- b) Description of the changes;
- c) Compliance with the appropriate standards and regulations;
- d) Hazard identification and risk assessment of the changes to derive safety requirements;
- e) Evidence that the safety requirements have been met in the design and the implementation of the EUIR AIP;
- f) Requirements for ongoing Safety Monitoring to ensure that levels of safety are maintained in service.

### **12.2.9 Intellectual Property Rights and Copyright**

As addressed in 9.9, above, current litigation is taking place which may have an impact on any decision regarding the IPR and copyright of the information published by way of the EUIR AIP. **It is therefore the recommendation of the study team** that, during the implementation phase, a watching brief is maintained on this court case and, where appropriate, seek legal advice regarding these issues and the EUIR AIP. A position must be established which is legally binding and which satisfies the needs of the originating authorities.

### **12.2.10 Service Provider Licensing**

As part of the implementation phase, **it is recommended** that two areas of Service Provider licensing are addressed, namely National and European Providers.

Firstly, in order to build upon a sound basis of quality assured data with a satisfactory integrity level, it is thought beneficial that EUROCONTROL provide facilitation support to National Supervisory Authorities and State AIS in the development of standards against which AIS providers may be licensed in accordance with SES rules.

Secondly, given that the EASP will be providing a service for a world-wide client base and on behalf of National AIS, it is considered essential that this body be licensed against a standard which has been agreed as acceptable within a Europe-wide forum. EUROCONTROL is ideally placed to undertake this task and, as recommended earlier, to act as a European Supervisory Authority for this service.

### **12.2.11 Staff Qualifications**

The issue of Staff Qualification is broadly similar to Service Provider licensing and it is recommended that it be addressed in the same manner, namely at a National and European level.

It is therefore recommended that, should the EC wish to continue with the requirement to license AIS personnel that, as part of the implementation

phase, the CASP (Reference 10) be considered as a framework from which detailed licensing criteria could be developed.

### **12.2.12 *Regulative Issues***

Where appropriate, and decided through the process of defining the implementing programme for the EUIR AIP, it may become necessary for additional regulation to be established.

EUROCONTROL's Regulatory Unit (RU) would play a key and essential element in drafting any new rules necessary to ensure the successful operation of the EUIR and its associated Aeronautical Information Service Provision.

## **12.3 Mandate**

The draft text for a mandate which could be provided to EUROCONTROL for implementation of the EUIR AIP is provided in Annexe B.

## 13 THE LONGER-TERM FUTURE

Whilst the recommendations of this study have been based upon the need to implement the EUIR AIP against a requirement of low cost and minimum impact on the services as they exist today, it is clear that AIS within Europe may be provided in a very different manner in the future.

It is widely accepted that it is highly likely that the SES will be extended into, initially, lower airspace and subsequently into terminal airspace and possibly into the aerodrome itself. During this progression the benefits of the SES become greater and the true benefits of a single AIP are realised.

It is, therefore, highly probable that the final position will be one where a single AIP exists for all European Aeronautical Information, removing the necessity for States to publish their own information – this effectively being fully delegated to a European AIS. In this scenario, cost benefits, for example, through economy of scale will be possible, the end-user will be presented with a fully integrated and harmonised data source and many of the issues identified, such as duplication of data will be avoided.

The publication of a European AIP would therefore see a need to restructure the provision of data within Europe and consequently may see a different approach to the preparation and publication of the AIP.

The SES States would simply act as providers of geo-spatial data and a body acting as the European AIS would be responsible for the provision of the supporting text (much of which is foreseen to be harmonised to a high degree). Therefore, the solution which appears to be most suitable for this future scenario is solution 1.

Consequently, the recommendations made within this report may be seen as a step in the right direction, working towards a future European AIS. The final scenario is, however, many years away and a number of additional issues, beyond the scope of this study, would have to be addressed prior to such a service being implemented.

## 14 REFERENCED DOCUMENTS

The following documents have been referenced within this report.

<u>Ref.</u>	<u>Title</u>	<u>Date/Issue</u>
1.	ICAO Annex 1	Ninth Edition July 2001
2.	ICAO Annex 4	Tenth Edition, December 2001
3.	ICAO Annex 15	Eleventh Edition July 2003
4.	ICAO Doc 8126	Sixth Edition, 2003
5.	Regulation (EC) No 549/2004 - The Framework Regulation	10 March 2004
6.	Regulation (EC) No 550/2004 - The Service Provision Regulation	10 March 2004
7.	Regulation (EC) No 551/2004 - The Airspace Regulation	10 March 2004
8.	Regulation (EC) No 552/2004 - The Interoperability Regulation	10 March 2004
9.	Regulation (EC) No ---/-- - Draft common requirements for the provision of air navigation services	20/07/2004
10.	Common AIS Staff Profiling	Edition 0.3, February 2004
11.	EUROCONTROL AIS Data Process	Edition 1.0, December 2002
12.	Operating Procedures for AIS Dynamic Data (OPADD)	Edition 1.0, January 2000
13.	EAD Service Concept	Edition 1.0, 09 May 2000
14.	EAD Service Charter, AP/ACG/8/14	11 May 2000
15.	Electronic AIP Specification	Edition 1.0.3, 16 February 2004

**Table 10: Documents Referenced**

## 15 ABBREVIATIONS

<u>Acronym</u>	<u>Meaning</u>
ACCB	AIXM Configuration Control Board
ADIZ	Air Defence Identification Zone
ADP	AIS Data Process
ATCA	Air Traffic Control Assistants
AIC	Aeronautical Information Circular
AICM	Aeronautical Information Conceptual Model
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation And Control
AIS	Aeronautical Information Services
AIXM	Aeronautical Information Exchange Model
ANSP	Air Navigation Service Provider
AO	Airport Operator
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Services
CAA	Civil Aviation Authority
CASP	Common AIS Staff Profiling
CBA	Cost Benefit Analysis
CFMU	Central Flow Management Unit
CFT	Call for Tender
COTS	Commercial Off-The-Shelf
DGTREN	Directorate General Transport and Energy
EACCB	EUIR AIP Change Control Board
EAD	European AIS Database
EAD SSG	EAD Service Steering Group
eAIP	Electronic AIP
EASP	EUIR AIP Service Provider

<u>Acronym</u>	<u>Meaning</u>
EC	European Commission
ECAC	European Civil Aviation Conference
ECIP	European Convergence and Implementation Plan
ECIT	EAD Client Interface Terminal
EDEMT	EUIR Data Extraction and Merge Tool
EMVT	eAIP Merge and Validation Tool
ESARR	Eurocontrol Safety Regulatory Requirement
ESI	EAD System Interface
ESP	EAD Service Provider
EU	European Union
EUIR	European Upper Flight Information Region
FIR	Flight Information Region
IAIP	Integrated Aeronautical Information Package
ICAO	International Civil Aviation Organisation
INO	International NOTAM Operations
IPR	Intellectual Property Rights
ISO	International Organisation for Standardisation
LPS	Letové prevádzkové služby Slovenskej republiky, štátny podnik
Navaid	Navigation Aid
NOTAM	Notice to Airmen
OPADD	Operating Procedures for AIS Dynamic Data
PAMS	Published AIP Management System
PDF	Portable Document Format
PDRG	Prohibited, Restricted and Danger Areas
PIB	Pre-Flight Information Bulletin
QMS	Quality Management System
RU	EUROCONTROL's Regulatory Unit
RVSM	Reduced Vertical Separation Minimum
SARPs	Standards and Recommended Practices
SDO	Static Data Operations
SDP	Static Data Procedures
SES	Single European Sky

<u>Acronym</u>	<u>Meaning</u>
SLA	Service Level Agreement
SLS	Service Level Specification
SVG	Scalable Vector Graphics
TMA	Terminal Movement Area
TSA	Temporary Segregated Area
XML	Extensible Mark-up Language
xNOTAM	XML Notice To Airmen
XSL-FO	eXtensible Stylesheet Language Formatting Objects

**Table 11: Abbreviations Used**

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