TENTH WORKING GROUP MEETING OF AERONAUTICAL TELECOMMUNICATION NETWORK IMPLEMENTATION CO-ORDINATION GROUP (ATNICG WG/10)

Jaipur, India, 26 - 29 September 2011

Agenda Item 6: Development of ATN/AMHS Applications

OUTCOME OF ACP WORKING OF THE WHOLE MEETING ON SWIM AND DIRECTORY SERVICE

(Presented by the Secretariat)

SUMMARY

Working Papers were presented on SWIM and Directory Service to the Fourth Meeting of ACP Working Group of the Whole meeting held in Montreal. This paper invites the meeting to review the information provided in the two papers and comment on that. Paper also invites the meeting to assess if the information provided in the paper can be utilized in the region for the enhancement of ATN/AMHS.

This paper relates to:

Strategic Objective:
C – Environmental Protection and Sustainable Development of Air Transport

Global Plan Initiatives
GPI - 22 – Communication Infrastructure

1. Introduction

1.1 AENA (Air Traffic Service Provider, Spain), through its Working Paper presented to the Fourth Meeting of the Aeronautical Communication Panel (ACP) Working Group Of the Whole held in Montreal from 14 to 16 September, 2011 provided an update of the definition, architecture and strategy to deploy SWIM within Europe. A copy of the paper is placed at **Attachment A** to this paper for review by the meeting.

1.2 Progress of working within Aeronautical Communication Panel (ACP) Working Group I (IPS) was presented to the ACP Working Group of the Whole (WG W) held in Montreal. Paper presented briefed the meeting on the ongoing European activities on Directory Services. A copy of the Working Paper presented to the meeting is placed at **Attachment B** to this paper.

2. Discussion

2.1 ACP Working Group of the whole was informed that System Wide Information Management (SWIM) will allow exchange of ATM data and ATM services across the whole European ATM System. It is expected to be an enabler for ATM data sharing between end-user applications (that is ATM data provider and ATM data consumer) that are need in the ATM world. The goal of SWIM is to allow advanced interoperability between stakeholders across whole European ATN system including Civil and Military, Ground-Ground and Air-Ground segments.

2.2 The paper presented on SWIM to the ACP Working Group of the Whole meeting included architecture of the envisaged system at various levels, underlying IP networks (PENS project in Europe), various formats and models etc.

2.3 ACP WG W was also reminded that ICAO Doc 9880 Part IV specifies ATN Directory Service based on ISO/IEC 9594 also known as X.500 Directory Service. Basic directory service specified in X.500 has been modified to suite the requirements of ATN-specific object class. Paper presented to ACP WG W discussed additional operational requirements with regards to the use of directory services, that have so far not been taken into account.

2.4 Meeting is invited to review information provided in the two Working Papers presented to the ACP WG W meeting on SWIM and on Directory Service and provide comments. Meeting is also invited to assess if the information provided in the paper can be adopted in the region for the enhancement of ATN/AMHS operations.

3. Action Required by the Meeting

3.1 Meeting is invited to review the papers attached and provide comments. Meeting is also invited to assess if the information provided in the papers can be adopted in the region to enhance the level of ATN/AMHS operations.

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International Civil Aviation Organization

WORKING PAPER

ACP- WGW04/WP-26
14/09/11

AERONAUTICAL COMMUNICATIONS PANEL (ACP)
MEETING OF THE WORKING GROUP OF THE WHOLE

FOURTH MEETING

Montréal, 14 to 16 September 2011

Agenda Item 4: Future evolution of ground-ground messaging systems, including SWIM

SWIM DEPLOYMENT WITHIN EUROPE AND COEXISTENCE WITH AMHS

(Presented by Aena)

SUMMARY

This WP provides an update of the definitions, architecture and strategy to deploy SWIM within Europe. In addition to this, it also aims to identify the most important topics that ICAO will have to take into account regarding this new concept and its coexistence with AMHS.

1. Introduction

1.1 SWIM, System Wide Information Management, will allow the exchange of ATM data and ATM services across the whole European ATM System.

1.2 It is important to notice that SWIM is not an ATM end-user application itself. Moreover, it is an enabler for ATM data sharing between end-user applications (i.e., ATM data provider or ATM data consumer) that are needed in the ATM world.

1.3 SWIM concept will make the information be available to the end-user applications and will not constrain the implementation of end-user applications.

1.4 SWIM shall ensure a fully consistent, modern, efficient, safe, secure and interoperable solution supporting the ATM information sharing and exchange between the diverse ATM stakeholders.

2. SWIM overview

2.1 The goal of SWIM is to allow advanced interoperability between Stakeholders. SWIM enables data sharing between ATM services across the whole European ATM system (Civil and Military, Ground-Ground and Air-Ground) segments.

2.2 The goal is to improve collaborative decision making and common situational awareness through the provision of quality information to the right entity at the right time using mainstream Information Technology.

2.3 SWIM technical infrastructure is a set of software components distributed over a network infrastructure that allows interoperability between ATM systems (civil and military) including aircraft. It provides connected systems with the technical means to support application services invocation, information services and non-functional services. All these services are made interoperable by the use, whenever possible, of standard technologies and clear defined interfaces...

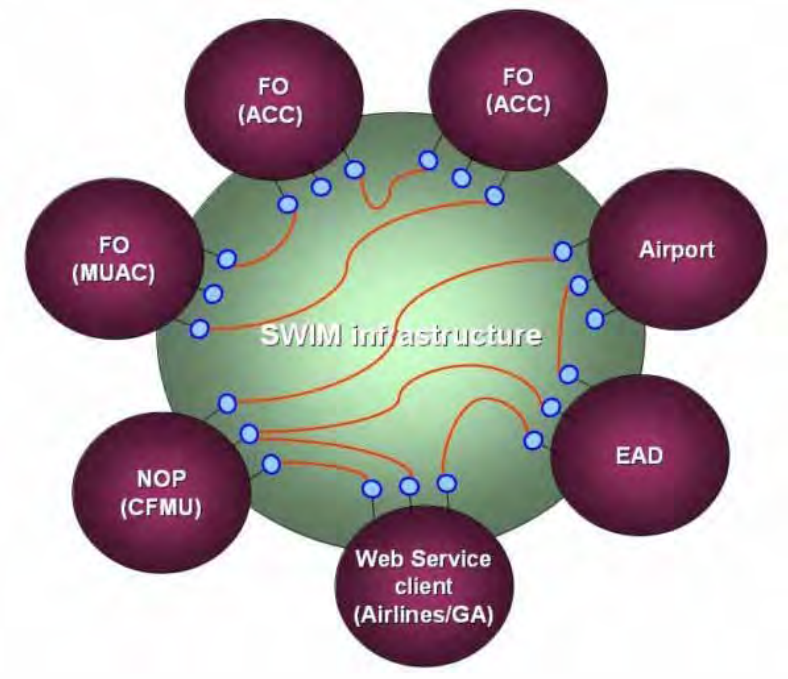

Figure 1.- SWIM technical Infrastructure.

2.4 SWIM consists of different layers. The layers that have been identified so far within the framework of SESAR are:

2.4.1 Networks layer- physical pan-European wide area network along with the essential technical IT building blocks (e.g. transport protocols, firewalls, routers). PENS and Internet will likely be used.

2.4.2 SWIM Technical Infrastructure layer containing technical (middleware) capabilities that a SWIM infrastructure will provide to all connected systems or that will be identified on those systems already providing such capabilities.

2.4.3 ATM Applications layer containing the ATM application functionality that is SWIM-enabled. This encompasses both provider-side applications that furnish ATM service implementations, and consumer-side applications that make use of these remote services (through the infrastructure). These applications are provided typically by system WPs.

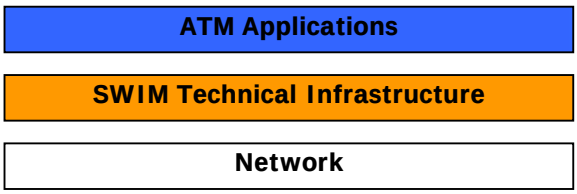

Figure 2.- Architecture model of SWIM layers.

2.5 The following items described here gather all the messaging requirements being analyzed for SWIM:

2.5.1 Messaging is the fundamental capability that permits decoupled communication between distributed systems. It includes functions for the efficient and reliable communication between service providers and service consumers.

2.5.2 It should support different relationships between providers and consumers, including one-to-one, one-to-many and many-to-many. It should include the capability to route messages, including routing based on message content, as well as functions for efficient and reliable delivery across SWIM in a secure way.

3. IP underlying networks (PENS Project in Europe)

3.1 Current data communications in the air traffic management domain heavily rely on X.25, a technology that is obsolete and phased out (OLDI, ASTERIX, AFTN/X.25 and CIDIN), being IP as the network protocol to be used for future aeronautical communications.

3.2 States are promoting the decommissioning of X.25 systems because the technology is difficult to maintain, expertise is hard to find, and, at the end of the day, it is expensive according to those that have this technology widely deployed.

3.3 PENS provides a common IP based managed network service across the European Region.

3.4 PENS is a common facility that allows ANSPs two different IP interconnection possibilities. In those cases where the ANSPs have their own IP networks, they can connect their national IP networks to PENS. In those others where the ANSPs don’t have their own IP network, the PENS project can install an access point,

consisting of a PENS router, at each location where an IP connection needs to be implemented, in order to provide connectivity with the PENS network.

3.5 PENS provides an efficient support to operational data and potentially voice communications: existing services and new requirements from future Air Traffic Management (ATM) concepts including SWIM.

3.6 The objective of PENS is to provide the required infrastructure to guarantee end-to-end IP connectivity for a variety of aeronautical users and applications. In this sense, PENS has been deployed to support existing and future services. Currently three categories of users/services have been defined - CFMU, EAD and ANSPs - and their migration to PENS is ongoing.

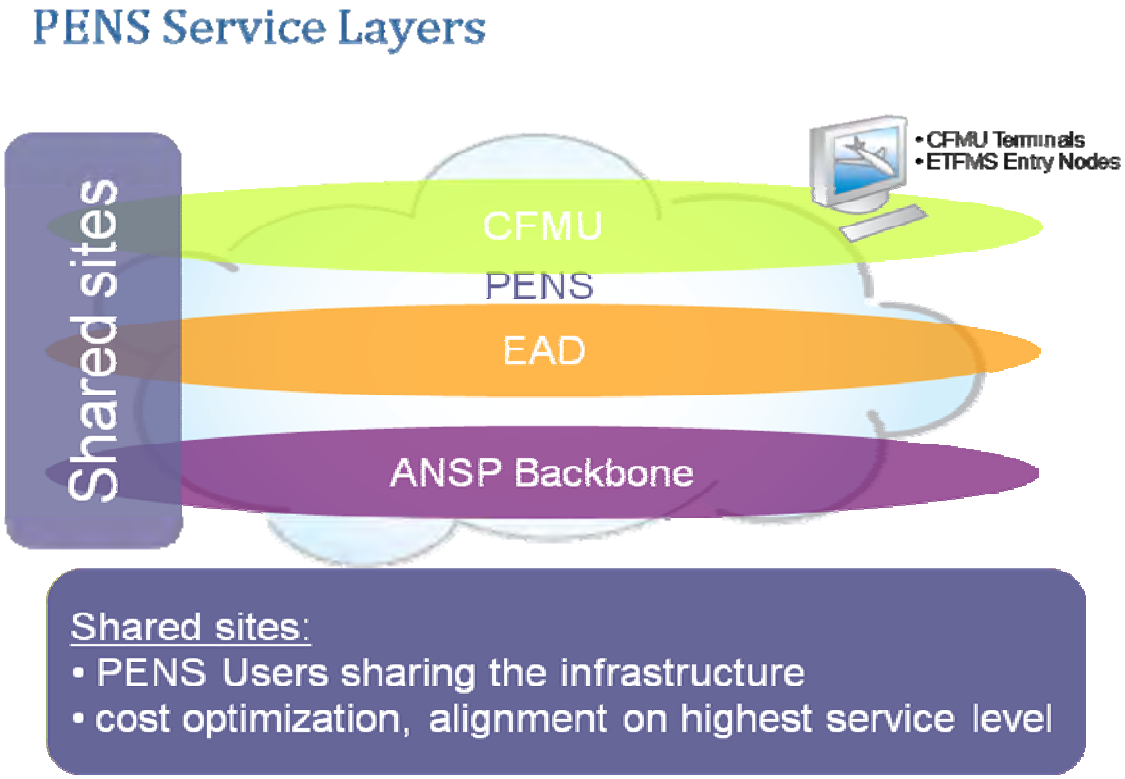

Figure 3.- PENS Services layers with different VPNs: CFMU, EAD and ANSP Backbones.

3.7 The ANSP Backbone service supports among others the AMHS, RADAR and FMTP applications. It is also planned to use the PENS for SESAR validation and testing. Due to the different needs of the various services and users, several VPNs have been defined over PENS. According to the requirements (real time or not) and the purposes (operational or test) demanded by the ANSPs, different classes of service have been implemented.

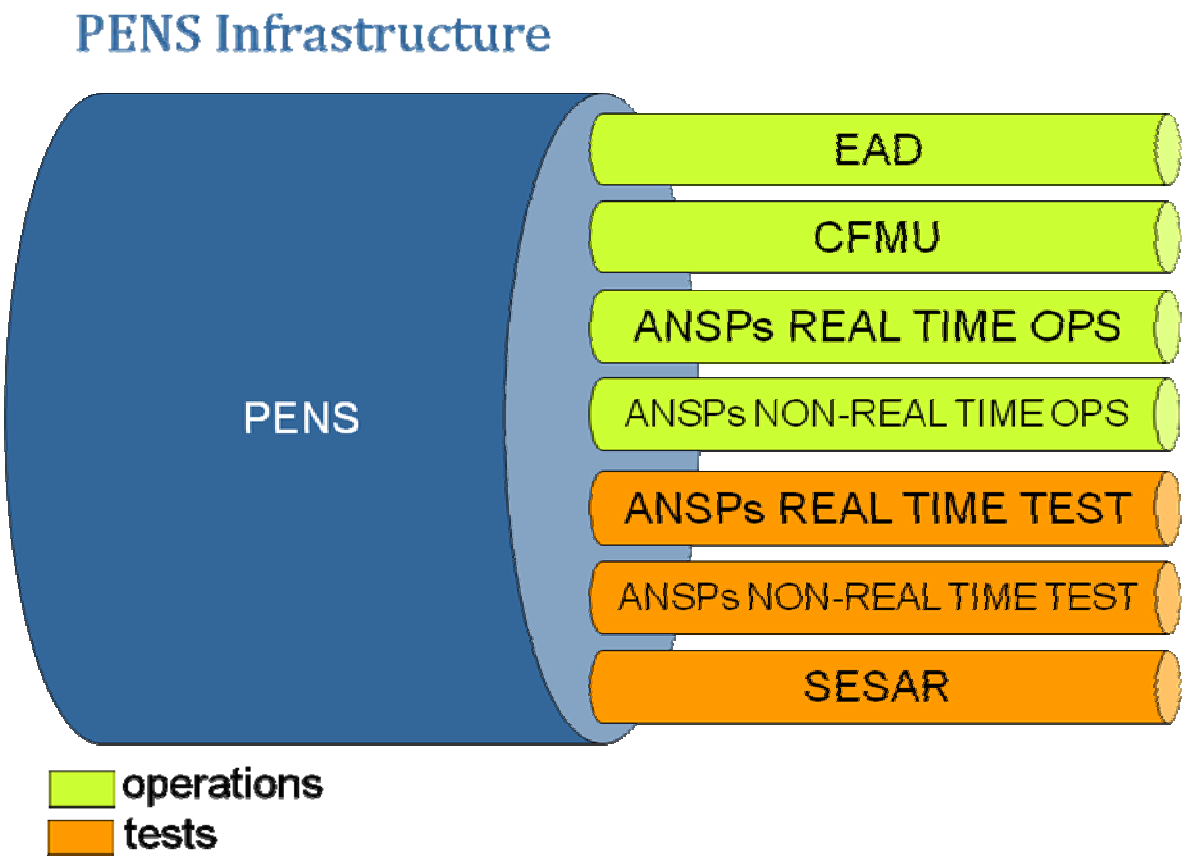

Figure 4 - VPNs foreseen within PENS framework.

3.8 Even though it is in the first implementation stages, the future of the PENS seems to be very promising. Already there are requests for the project to expand so as to accommodate ANSPs in the entire EUR Region and beyond. Airlines have also expressed a strong interest to get connected to PENS. In this sense, SITA and ARINC support the idea of the connection with PENS through the specific network devices. This way, ANSPs and airlines would get connected to exchange valuable information strengthening the concept of CDM.

4. AMHS Concept

4.1 ATS Message Handling System is a message oriented technology designed to support ICAO-based message exchange in line with particular formats and handling requirements as defined by ICAO.

4.2 The exchanged messages include:

- Flight regularity messages, including those exchanged for ATFM purposes;
- Aeronautical information service (AIS) messages, e.g. NOTAMs, SNOWTAMs, ASHTAMS;
- Meteorological messages concerning reports and forecasts (such as TAF, METAR, SPECI);

- Flight safety messages, e.g. movement and control messages, messages originated by an aircraft operating agency concerning an aircraft in flight or about to depart, specific meteorological messages (e.g. SIGMET, AIRMET, etc.);
- Distress messages (including SAR related traffic);
- Urgency messages;
- Aeronautical administrative messages, and;
- Service messages.

4.3 ATSMHS defines a store and forward messaging service used to exchange ATS messages between users over the ATN network.

4.4 The ATS Message Handling System (AMHS) technical specifications are compliant with mature message handling systems standards such as ISO/IEC 10021 and ITU-T X.400.

4.5 Additionally, AMHS is able to support the exchange of binary data – a need already identified in the AIS and MET environment.

4.6 AMHS is the logical evolution of CIDIN in the EUR Region and of the AFTN worldwide. In the case of Europe, the implementation of AMHS will be fostered by the existence of PENS.

4.7 The message switches forming the nodes of the ATS Messaging infrastructure are currently deployed in international COM Centres and operated by the staff of these COM Centres.

4.8 The precise role of international COM Centres in the future information exchange environment (SWIM after 2020) will probably need to be re-examined, however it would be safe to assume that the services provided by store and forward messaging and AMHS in particular will be required for the foreseeable future.

5. ATS Messaging and transition to SWIM

5.1 This chapter highlights the topics expected to be addressed in the framework of transition from the current ATS Messaging concept towards a communication architecture based on SWIM.

5.2 Functional areas:

5.2.1 The ATS network currently conveys messages mostly related to flights before they are active, but also some messages related to active flights.

5.2.2 In the framework of SESAR, the requirements for ATS/ATFM, AIS and MET related information exchange will be taken into account in the SWIM architecture.

5.2.3 Considering that ATS Messaging is generic by nature and can be used to exchange any kind of message, service continuity for the exchange of other messages, including distress messages, urgency messages, administrative and service messages is expected to be addressed as part of the transition to SWIM.

5.3 Geographical coverage

5.3.1 ATS Messaging based on AFTN/CIDIN/AMHS is a globally adopted standard for ICAO Member States and ANSPs. It provides a common and single interface to all users, hiding the potential heterogeneity of lower layers to the service users. The Regional networks linked by means of inter-Regional connections, provide a global seamless messaging infrastructure.

5.3.2 There is no indication at present that SWIM would be implemented outside the EUR SES and US FAA environment. Furthermore, ICAO is assessing a global solution taking into consideration the outputs from FAA/NEXTGEN and SESAR.

5.3.3 The implementation of a seamless IP infrastructure, such as PENS, to serve as an ICAO global network backbone, would be desirable but not easily achievable within the 2020 SESAR timeframe.

5.3.4 However, the types of message identified in section above and included in SWIM are also utilised outside the EUR/US geographical area (e.g. flight plans, NOTAMs, MET etc.). This means that the systems in Europe communicating via SWIM will also need to communicate directly or indirectly with systems in other Regions which are not "SWIM-capable", but are presumably still exchanging messages/data using ATS Messaging. Inter-working will be required between the European SWIM environment and the ATS Messaging environment in other Regions.

5.4 Communication model:

5.4.1 ATS Messaging operates with several major characteristics:

5.4.2 A store-and-forward messaging model from one source to multiple recipients;

a) Each message is sent independently of other messages. The system does not provide any "request/response mechanism";

b) Distribution is based on collective addresses / distribution lists (DLs) which can be operated in a recursive manner: a collective address may contain individual addresses which themselves are collective. This allows collective addresses to operate at various levels, typically one international level for "wide distribution" and one national level for "local distribution". Pertaining to one of these DLs may be seen as the subscription to a service.

c) No need for "synchronous exchanges" (messages are held in case of recipient system being not available).

5.4.3 In the framework of SWIM transition, the major differences in scope and nature between the communication models of ATS Messaging and of SWIM are expected to be analysed. The current information distribution mechanism based on DLs (collective addresses) may form a starting point for the SWIM subscription mechanism.

5.5 Message formats

5.5.1 ATS Messaging being a flexible, multi-purpose communication system, it can convey practically any kind of message format and syntax. In the considered scope, this includes:

a) for character-oriented formats:

i) Structured syntaxes and formats specified in ICAO or other applicable (e.g. WMO) Documents (Doc 4444, Annex 15, etc.) for flight plans, MET, AIS, etc.

ii) Regional or national structured syntaxes and formats (ADEXP, etc.);

iii) Unstructured or free text;

iv) Syntaxes such as XML can be included in a message body, subject to a few constraints (e.g. supported character set);

b) Message body containing binary data:

i) The support of binary data, combined with the absence of restriction on message size or length, makes it possible to convey any kind of data message. The only limit is related to network/system design in terms of capacity and performance.

5.5.2 As part of a transition strategy, it should be possible, if needed, to exchange AIS and MET data in their XML format using ATS Messaging. Although technically possible, such a solution is not expected to be optimal. The co-existence and/or conversion between the formats identified above are expected to be addressed as part of SWIM transition.

5.6 Interworking and coordination between ATS Messaging and SWIM

5.6.1 This paper has shown that Messaging is a core capability that SWIM must implement.

5.6.2 A transitional strategy should be studied and assessed in close coordination with SESAR WPs which are already defining the architecture and the services that SWIM will provide:

a) Transition approaches for communication systems, when needed, often include conversion gateways, encapsulation techniques and/or dual/multiple stack implementations (co-existence approach). It is obviously too early at this time to identify the most appropriate approach to be adopted during the transition to SWIM period.

b) However the answers to the following questions should be included in the SWIM transitional work:

i) Assuming that ATS Messaging is still required for communication with other Regions, to what extend will it need to be maintained within the Region in parallel or as part of the SWIM environment?

ii) Does it make sense to consider multi-stack architecture so that there must be some kind of “conversion gateways” between ATS Messaging environment and SWIM environment? How and where should these gateways be implemented?

iii) If “conversion gateways” are not chosen as transitional systems, this may mean that there is some geographical and functional overlapping between the residual ATS Messaging environment and the SWIM environment. This implies that connected end systems (FDPS, etc.) would be required to maintain dual connectivity. Could this be adopted as a general solution?

iv) How SWIM should be protected in terms of legacy when it comes to protocols and messages?

5.7 The role of international COM Centres

5.7.1 The role of international COM centres as foreseen by ICAO and implemented globally will most probably be impacted during the transition to SWIM. It is difficult to assess the magnitude of this impact at this time. The operational and technical role of the COM Centres and of their staff should be analyzed when implementing the future SWIM environment, taking into account the need for service continuity, seamless interoperability, inter-regional traffic exchange, requirements at the national level and volume and criticality of residual traffic.

5.7.2 Furthermore, the role of a COM Centre is likely to vary depending on its actual position within the network, and the level of integration to SWIM of the ATS units, airports, originators of ATS, AIS and MET data and other entities it directly serves, as well as the level of integration of its neighboring environment..

5.7.3 However, if this transition is implemented through the “conversion gateways”, the potential impact mentioned above should not be so critical. Indeed, these “conversion gateways” should remove this complexity from the COM Centres.

6. Action by the Meeting

6.1 The ACP WGW is invited to

a) notice the content of the paper;

b) provide feedback and comments

– END –

International Civil Aviation Organization

ACP-WGW/04 IP-?
12/09/11

INFORMATION PAPER

AERONAUTICAL COMMUNICATIONS PANEL (ACP)

FOURTH MEETING OF THE WORKING GROUP OF THE WHOLE

Montréal, Canada 14 – 16 September 2011

Agenda Item 1: Progress of work within ACP WGs F(Frequency), I (IPS) and M (Maintenance)

Progress of work within WG-I

Presented by Luc Deneufchatel

Prepared by Jean-Yves Piram (AFSG / IRCT Chairman)

SUMMARY

This paper presents the ongoing European activities on directory

ACTION

The ACP / WGW04 is invited to note the information presented in this paper.

1. INTRODUCTION

ICAO Doc 9880 AN/466 Part IV specifies besides others the ATN directory service (ATN DIR). The 1st edition of this manual published in 2010 superseded the 3rd edition of ICAO Doc 9705 AN/956 Sub-Volume VII published in 2002.

The ATN DIR implements directory services based on the international standards series ISO/IEC 9594 which are known as the X.500 Directory service. The X.500 Directory could be considered a generic, database-like data storage acting as a global, distributed application with a high level of automation. The X.500 Directory is specified in an open way allowing for further extensions as necessary.

ICAO Doc 9880 amends the X.500 base standards with technical details introducing an ATN directory schema, ATN-specific attribute types and ATN-specific objects classes.

Reference to well-defined, international standards enables the deployment of commercial off-the-shelf (COTS) products supporting cost efficiency, compatibility and inter-working.

The ATN DIR allows users of the ATN to obtain information stored in the ATN directory. The information in the ATN directory composes of, but is not limited to information on ATN users,

applications and services participating in the ATN. The ATN DIR provides multi-purpose directory services over the ATN and is open to support further applications and new environments such as NextGen and SWIM.

The ATS Message Handling Services (ATSMHS) are one of the supported ATN applications specified in ICAO Doc 9880. The ATSMHS provides two levels of service. The use of the ATN DIR is specified for the more sophisticated Extended ATS Message Handling Service.

2. OPERATIONAL ASPECTS

Ongoing deployment of the ATSMHS yielded further operational requirements with regard to the use of directory services, that have so far not been taken into account and that prevented up to now from the introduction of the ATN DIR.

During the coexistence of the AFTN and AMHS, consistency of AMHS address information at any time is crucial for the operation of the AMHS and especially of the AFTN/AMHS gateway. The AMHS address information is required for transparent conversion of AFTN into AMHS addresses and vice versa. Simultaneous availability and implementation of exactly identical AMHS address information on a global, world-wide basis is essential to ensure proper operation. Inconsistency of AMHS address information could lead to non-delivery of messages within the AFTN and AMHS.

For the Basic ATS Message Handling Service the ATS Messaging Management Centre (AMC) took over the role for management and coordination of AMHS address information. State Letter with reference AN 7/49.1-09/34 dated 14 April 2009 announced the use of the AMC in the short- to medium-term on a global basis. The AMC makes use of well-defined procedures in order to ensure synchronisation and consistency of AMHS address information.

For the long-term, the State Letter emphasises the need for a truly global method for establishment of management centres in the ICAO Regions and cooperation between such centres.

3. ONGOING STUDY PROPOSED BY EUROCONTROL TO AFSG / PLANNING GROUP

In October 2010 EUROCONTOL launched a call for tenders for '*Validation of Directory Service Operational Concept*'. EURCONTROL awarded in December 2010 the contract on the study to the German supplier COMSOFT GmbH. The study is ongoing and further referred to as European Directory Service (EDS) study.

The objective of the EDS study is the development and validation of an operational concept for directory services as a common facility taking into account existing specifications (ICAO manuals, European AMHS Community Specification, etc), systems (ATN DIR, AMHS), and infrastructure (AMC, networks, etc). The EDS study consists of the work packages analysis, development of concept, validation of concept, and final report.

EUROCONTROL reported the draft results of the EDS study several times to the AFSG Planning Group as well as to the AFSG/15 which took place in April 2011. The AFSG Planning Group in its 43rd meeting agreed with the basic EDS concept.

Finalisation of the analysis and EDS concept documents are expected in the near future, and to be followed by validation of the EDS concept and the final report.

Approach to solution

Currently the AMC (**A**mhs **M**anagement **C**entre) provides off-line means for management of AMHS address information. Within the Extended ATS Message Handling Service this function is intended to be implemented using on-line directory services.

In support of various systems, off- and on-line distributions of AMHS address information have to exist in parallel for a period of time. In order to ensure synchronisation and consistency between off- and online means, the EDS concept adopted the general procedures given by State Letter with reference AN 7/49.1-09/34 dated 14 April 2009 and implemented by the AMC. The EDS concept also plans for migration aids from off- to on-line services resulting in three transitional steps.

Instead of a fully meshed network between 250 or more communication partners, the solution proposed by EDS is based on a centralised topology within Europe in order to ensure correctness and consistency of information prior to distribution. The EDS concept is also prepared for the exchange of information with further States and other Regions. If adopted by other Regions, the EDS concept would allow for a hierarchical implementation of ATN directory services. The EDS study proposes to make essential information such as the AMHS address information locally available. Replication would be the preferred means for distribution of information as already defined by ICAO Doc 9880.

For the exchange of information between Directory Service Agents (DSAs), the EDS study retains the standard protocols already included in ICAO Doc 9880; however encourages the use of the Directory Information Shadowing Protocol (DISP) for replication of information.

Whereas the **D**irectory **A**ccess **P**rotocol (DAP) remains mandatory for access to the directory by management applications, the use of the **L**ightweight **D**irectory **A**ccess **P**rotocol (LDAP) as given by IETF RFC 4511 is considered as a cost-effective alternative to incorporate a **D**irectory **U**ser **A**gent (DUA) into applications with limited directory requirements.

In order to allow for management, synchronisation and version handling of information the EDS concept propose a minor extension to the DIT structure as specified by ICAO Doc 9880. The extension is defined in a way that prevents from conflicts with existing solutions and also provides backward compatibility. No additional attributes types and objects classes besides the ones specified in ICAO Doc 9880 have been used so far.

4. ACTION BY THE MEETING

The ACP WGW/04 is invited to note the information provided in this paper.