International Civil Aviation Organization

Communication Navigation and Surveillance Sub-Group (CNS SG)

Fourth Meeting
(Cairo, Egypt, 25 - 27 September 2011)

Agenda Item 3:   **Review ATN/IPS Working Group Reports**

REVIEW ATN/IPS WORKING GROUP REPORT

(Presented by the Secretariat)

SUMMARY
This paper presents the outcome of the third meeting of the ATN/IPS Working Group also provide progress made in MID IP Network.   Action by the meeting is at paragraph 3.
REFERENCE
- ATN/IPS WG/3 Report   **-** MIDANPIRG/12 Report

1.   INTRODUCTION

1.1   The first and second IPS working Group Meetings (IPS WG1/2) were held at the ICAO MID Regional Office in Cairo in 12-14 May 2009 and 11-12 October 2009 respectively. The second meeting was held back to back with the MID AMC training.

1.2   The third meeting of the ATN/IPS Working Group (ATN/IPS WG/3) was held at the ICAO MID Regional Office in Cairo 17 - 19 July 2011 and was attended by 13 participants from six States (Bahrain, Egypt, Jordan, Lebanon, Saudi Arabia and Sudan). The meeting developed 4 Conclusions and one Decision.

2.   DISCUSSION

2.1   The third meeting of the ATN/IPS WG noted the outcome of the thirteenth meeting of Aeronautical Communication Panel (ACP) Working Group I – Internet Protocol Suite (ACP-WG-I 13), and the Seventeenth Meeting ACP Working Group on Maintenance of Air - Ground and Ground - Ground Communication (ACP-WG-M 17) held in Bangkok from 27 to 28 January and 31 January to 1 February 2011 respectively.

2.2   The meeting may wish to note that the ACP-WG-I 13 discussed the Voice over IP (VoIP) and noted the updates to EUROCAE Documents on VoIP in ATM. The ACP-WG-I 13 agreed to update the reference to ED 137A in Edition 2 of ICAO Doc 9896, for future publications.

2.3   The meeting may further wish to note that the ICAO Manual on ATN using Internet Protocol Suite (IPS) Standards and Protocol (Doc 9896) and the Manual on Detailed Technical Specifications for ATN using ISO/OSI Standards and Protocols (Doc 9880) were officially published in the second half 2010 and that the Manual of Technical Provisions for the Aeronautical Telecommunication Network (ATN) (Doc 9705) and the Comprehensive ATN Manual (Doc 9739) were withdrawn.

2.4   The ACP-WG-M 17 had decided to allow ICAO GIS Portal to be used as a means to timely capture information on bilateral AMHS connections and other CNS developments. This included the possibility of integrating some of the existing EUROCONTROL/ICAO EUR Region on-line database with the ICAO GIS Portal. Furthermore, the EUROCONTROL AMC could be used as an alternative to the GIS Portal for the purpose of indicating implementation status.

2.5   Further the ACP-WG-M 17 discussed VoIP Standards Development Status and issues related to maintenance of ICAO documents which make reference to industry standards and identified two different processes depending on whether changes were being supported by the States or by the industry. Following significant issues were noted related to the processing of changes:

   a)   the industry bodies today do not have an established Configuration Control Board or similar process. This is necessary as their committees are disbanded once their deliverables have been completed;
   b)   there is no forum for Industry Standards bodies and ICAO to coordinate their work. This is being worked on by the "Standards Roundtable" group however work is still in progress"; and
   c)   most industry bodies are driven by industry however RTCA is driven by the FAA.

2.6   The meeting may wish to note that the ATN/IPS WG/3 meeting recalled that the ATN activities have been on going in the MID Region for some years and the ATN application for ground messaging i.e. the AMHS has ben implemented largely in the MID Region. In this regard, the ATN/IPS WG/3 meeting revised the "MID REGIONAL ATN PLANNING AND IMPLEMENTATION DOCUMENT" as at **Appendix A** to this working paper.

2.7   The ATN/IPS WG/3 meeting was of the view that the development of a complete MID Regional document will be very extensive although IPS WG/1 and 2 has started the work, based on the other Regions' documents and experience gained from the current ATN implementation. The ATN-IPS WG agreed that mature plan and guidance material concerning the AMHS implementation is to be extracted from the MID REGIONAL ATN PLANNING AND IMPLEMENTATION DOCUMENT and updated in order to be a usable document for the MID Region. Accordingly, the ATN/IPS WG/3 meeting developed the AMHS part as at **Appendix B** to this working paper.

2.8   The meeting may wish to note that since 2008 the Jordanian integrated AFTN/AMHS system started its operation, and an international AMHS link between Jordan and the United Arab Emirates (UAE) using VPN has been operational efficiently since 3 March 2010. AMHS Interoperability and Pre-Operational Tests were successfully carried out with Egypt as well as with Saudi Arabia in June 2010. These links were put into operation in September and November 2010.

2.9   The meeting may further wish to note that the Bilateral AMHS Interoperability Tests based on ICAO EUR Doc 020 – EUR AMHS Manual - Version 4.0, Appendix E were performed on 21 and 22 February 2010 for Jordan and UAE systems, which were configured according to an agreed configuration document specifying all address and connection parameters necessary for the tests. The results of the Interoperability Tests encouraged both States to start AMHS Pre-Operational Tests according to Appendix F of the EUR AMHS Manual on 23 February 2010. As a consequence of the

error free Pre-Operational Tests, the cutover to operational use of the new AMHS link was done on 3 March 2010. It is also the first international AMHS via VPN implementation worldwide. Both Jordan and UAE reported that the connection has been very stable and reliable.

2.10   The ATN/IPS WG/3 meeting noted that the Trilateral Tests that have been performed between Amman, Cairo, and Jeddah in November 2010 according to appendix E of ICAO EUR Doc 020, which contains test cases for message submission, transfer, delivery and relay operation in addition to Alternative MTA routing and loop detection. As a result of the successful tests, the AMHS triangle was put into operational use, being the first AMHS triangle world-wide that uses static routing with pre-defined routing tables.

2.11   The ATN/IPS WG/3 was of the view that conducting a timely and thorough post-implementation review (PIR) helps in identifying lessons learned which will assist in planning, managing, and meeting the objectives of future AMHS projects. In this regard, it is important to note that Asymmetric routing may cause loss of messages due to the fact that a gateway cannot map a Non-Delivery Report to a subject message. Furthermore, Singular AMHS diversion for an area representing several PRMDs is substantial and cannot be performed by one letter as used in AFTN, to facilitate a diversion from AFTN to AMHS and vice versa.

2.12   Based on the above, the ATN/IPS WG/3 meeting urged MID AMHS COM Centres to review the current routing tables and make sure of deploying symmetric routes where possible, also encouraged MID States to make use of the corresponding PRMDs table to facilitate diversion from AFTN to AMHS and vice versa. Furthermore the meeting was of the opinion that States start the PRMD with the first two letters for their location indicator. Jordan had volunteered to keep the link website   http://carc.gov.jo/images/filemanager/061808AMC92%20corresponding%20PRMDs.pdf containing the PRMD file updated on their website for easy use by all MID States.

2.13   The meeting may wish to note that the developments within the global ICAO framework mainly Amendment 83 which introduced, among other issues, the Internet Protocol Suite (IPS) technology to the Aeronautical Telecommunication Network (ATN), and the Manual for the ATN using IPS Standards Protocols (Doc 9896).

2.14   The ATN/IPS WG/3 meeting recalled that the Internet Engineering Task Force (IETF) activities and noted that IETF, established 2 working groups: Address Lifetime Expectations (ALE) and IPng (IP next generation) to make recommendations for the IP Next Generation Protocol. The IETF produced specifications for Internet Protocol, Version 6 (IPv6) under RFC 2460. The specification has much larger address space (2128), and also supports additional features like mechanism for auto-configuration of network interfaces, encapsulation of itself and other protocols, built in authentication and encryption etc.

2.15   Based on the above, MIDANPIRG/12 meeting agreed with the global view, that the complete implementation of IPv6 will take time and consequently, there will be a long period until the co-exist of both protocols, IPv4 and IPv6.

2.16   MIDANPIRG/12 also agreed that careful attention is required to the current implementation of AFTN, CIDIN and ISO/OSI based ATN, and the Provisions for continuation of CIDIN, AFTN and ISO/OSI should continue to be developed to secure these implementations. Accordingly MIDANPIRG/12 meeting agreed that the MID ATN implementation should take place on the basis of regionally agreed requirements, taking into consideration, the System Wide Information Management concept and new developments.

2.17   The meeting may wish to recall that Europe's Pan European Network (PEN) is based on IPv6, has been initiated by EUROCONTROL. PEN will be implemented in Europe to meet the ATM requirements for a cost-effective, international communications network with the ability to support existing as well as future services. In its initial form, PEN is planned as a ground-ground IP network serving data communications between ANSPs and between ANSPs and EUROCONTROL.

2.18   Based on the above, MIDANPIRG/12 agreed for the development of the MID IP Network that should benefit the MID Region. In this regard the MIDANPIRG/12 agreed that an IP Network survey be conducted to obtain first hand information from MID States, and had accordingly agreed to Conclusion 12/39 MID IP NETWORK SURVEY.

2.19   As a follow-up to the above conclusion, ICAO MID Regional Office sent State Letter AN 7/5.1 – 11/016 dated 20 January 2011, requesting MID States to complete the survey and provide any information about existing IP infrastructure and IP Networks implemented within their State.

2.20   The ATN/IPS WG/3 meeting noted that only 5 States (Bahrain, Egypt, Iran, Jordan and Saudi Arabia) provided the replies, the ATN/IPS WG/3 meeting performed analysis on the replies as at **Appendix C** to this working paper.

2.21   The ATN/IPS WG/3 meeting reiterated MIDANPIRG/12 Conclusion 12/39 and urged MID State to submit their replies before the CNS SG/4 Meeting which was tentatively planned for 25-27 September 2011, since further action on the establishment of MID IP Network is dependent on the analysis of the survey. Accordingly, the ATN/IPS WG/3 meeting revised the IP Network survey and agreed to the following Draft Conclusion:

> *DRAFT CONCLUSION 3/3:   MID IP NETWORK SURVEY*
>
> *That, MID States complete the MID IP Network survey as at Appendix 3F (***Appendix D*** to this WP) to the Report on Agenda Item 3 and send to ICAO MID Regional Office by 01 September 2011.*

2.22   The meeting may wish to note that no survey replies were received until the writing of this working paper. Accordingly no analysis could be performed.

2.23   The ATN/IPS WG/3 meeting noted that some MID States had already developed domestic networks based on IP network, while other States are in the process of developing IP network. Consequently, the ATN/IPS WG/3 meeting was of the view that for harmonization and compatibility issues these networks be based according to ICAO standards as outlined in Doc 9896. Accordingly, the ATN/IPS WG/3 meeting agreed to the following Draft Conclusion:

> *DRAFT CONCLUSION 3/4:   DEVELOPMENT OF IP BASED MID NETWORKS*
>
> *That, MID States be urged to:*
>
> a)   *develop national plans, in line with the ICAO Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocols (Doc 9896), for migration to IPv6 taking the existing IPv4 based aeronautical systems into account;*
> b)   *consider the use of IPv4/IPv6 protocol translation devices only as a provisional solution during the migration; and*
> c)   *include a requirement for both IPv4 and IPv6 in their ongoing Air Traffic Services (ATS) Message Handling System (AMHS) implementation programmes in order toensure seamless transition and interoperability.*

2.24   The meeting may wish to note that the ATN/IPS WG/3 discussed an Agenda item Review of public internet usage in the MID Region, and agreed to consider the task concerning the use of public Internet is complete, since the public internet usage and guidance material and the survey for inventory have been approved by MIDANPIRG/12 and the develop document to be posted under the documentation in the new ICAO MID Forum site.

2.25   Furthermore, the ATN/IPS WG/3 meeting based on its discussion developed task list as at **Appendix E** to this working paper. The ATN/IPS WG/3 also reviewed the TOR and work programme of the Group and developed an updated version as at **Appendix F** to this working paper and agreed to the following Draft Decision:

> *DRAFT DECISION 3/5:   REVISED TOR OF THE ATN-IPS WORKING GROUP*
>
> *That, the Terms of Reference and Work Programme of the ATN-IPS Working-Group be updated as at Appendix 5B (**Appendix F** to this WP) to the Report on Agenda Item 5.*

3.   ACTION BY THE MEETING

3.1   The meeting is invited to:

a)   note the progress of ATN/IPS WG programme;
b)   endorse ATN/IPS WG/3 meeting conclusion in para 2.21, 2.23 and decisions in para 2.24 ; and
c)   propose any improvement for the ATN/IPS WG work programme.

APPENDIX A

MID REGIONAL ATN PLANNING AND IMPLEMENTATION DOCUMENT

Document Reference:	MIDANPIRG IPS/ WG
Author:	ATN Planning and IPS WG
Revision Number:	Draft Version 01 / 2009
Date:	Oct ober 2009

EXECUTIVE SUMMARY

This transition plan provides technical guidance on the transition from the ground infrastructure support of the Aeronautical Fixed Telecommunication Network (AFTN) and the Common ICAO Data Interchange Network (CIDIN) services to the Aeronautical Telecommunication Network (ATN) for the Middle East Region.

The Middle East ATN Ground Transition Plan outlines the requirements to increase bandwidth and upgrade protocols for those trunks that will support the main data flow of traffic through the Middle East Region. The plan also provides target dates in which these trunks and implementation of BBISs and BISs will need to occur to ensure a smooth transition of the ATN within the region, taking into account proper interface with adjacent regions.

This document explain the plan on the ATN ground transition activities applicable to the Middle East Region. The ATN Transition Plan includes information about the implementation of Regional ATN Routing Architecture as presented in this document and development of naming and addressing plan.

This document is also updated with other ATN related material useful for the ATN implementation such as
-   MID ATN IP based Strategy
-   MID AMHS implementation
-   MID AMHS testing
-

This document is live document which will keep developing and other parts will be added to the document also will be amended as and when deemed necessary as appropiate upon approval of the appropiate MIDANPIRG subsidiary bodies. In that respect comments from States will be appreciated and could be addressed through the appropiate MIDANPIRG subsidiary body.

Any references to this manual should be interpreted as also referring to Annex 10 and misinterpretation Annex 10 and the relevant ICAO documents will supersede this documents .

CHAPTER ONE

ATN Transition Plan

Table of Contents

1. INTRODUCTION

This chapter presents a plan on the ATN ground activities applicable to the ICAO MID Region. It provides also information on the ground infrastructures required to support the ATN and to take into consideration progressively the ATN air-to-ground requirements of the Region.

1.1 Objective

1.2 Scope

The scope of the chapter one includes:

- A brief description of the current ground infrastructure and upgrade plans based on AFTN/CIDIN;
- The types of ATN applications that will be used over the ground infrastructure;
- The types of trunks that will need to be upgraded to cater for ATN traffic; and
- A proposed implementation schedule on how the ATN should be transitioned within the region.

1.3 References

Reference 1   Annex 10
Reference 2   Manual of Technical Provisions for the ATN (Doc 9705-AN/956) Second Edition 1999 (in process to be withdrawn and material to move to 9880)
Reference 3   Comprehensive Aeronautical Telecommunication Network (ATN) Manual (Doc 9739-AN/961) First Edition 2000
Reference 4   Manual on the ATN using IPS standards and protocols (Doc 9896 AN/469)
Reference 5   Middle East AFTN/CIDIN Routing Directory
Reference 6   ICAO Location Indicators – Document 7910
Reference 7   MID Air Navigation Plan and Facilities and Services Implementation Document (ANP- FASID – Doc. 9708)
Reference 8   ASIA/PAC Regional Aeronautical Telecommunication Network (ATN) Planning Documents
Reference 9   EUR AMHS Manual - 4th Edition - April 2009

2. CURRENT GROUND INFRASTRUCTURE AND UPGRADE PLANS

2.1   The present ground-ground data communications system in the Middle Region comprises AFTN circuits and centers (tributary and main) that allow the exchange of ATS and other operational messages.

2.2   Five States of the Region already implemented the Common ICAO Data Interchange Network (CIDIN) as an upgrade of the low speed AFTN circuits to improve the efficiency and reliability of message exchange. These CIDIN circuits are operating at 9600Bps and the remaining circuits at 50 Bps to 300 Bps, using asynchronous protocols.

2.3   The detail of international circuits operating within the Region and between neighboring regions. is documented in Table CNS 1A of the ICAO MID CNS Facilities and Services Implementation Document (FASID).

2.4   The current AFTN topology in the Region shows that the majority of circuits will not be suitable to be used for the ATN without some form of upgrade. In later stage, it will be necessary to identify those circuits that need to be upgraded in both bandwidth and protocols.

2.5   With regard to bandwidth requirements, it is assumed that 64Kbps or higher shall

be used for Intra-regional connections while 64Kbps (based on agreement with other regions) or higher speed could be preferred for Inter-Regional connections when full ATN is implemented.

2.6   It is important to note that some States have already started the establishment of a communication infrastructure that would serve the ATN. There have been implementations of high speed point-to-point digital links operating at 64KBPS and carrying voice and data traffic.

2.7   In respect to the upgrade of protocols, it is expected that they will be implemented on a bilateral arrangements between States according to the preferred protocols: prefaraberly TCP/IP V.6. **Frame Relay or Asynchronous Transfer Mode (ATM) or any other protocol that will be included in the ICAO Standards in future.**

2.8   It can happen that due to different planning activities, by States, not all States within the MID Region will be migrating to the ATN at the same time. Therefore, there will be a need to maintain the existing AFTN circuits to operate in parallel with any new implementation of high-speed links to meet ATN requirements and could migrate the AFTN.

3.   ATN END SYSTEM APPLICATIONS

3.1   According to the Manual of Technical Provisions for ATN (Doc. 9705- AN/956) and Comprehensive Aeronautical Telecommunication Network (ATN) Manual (Doc 9739-AN/961), it is to be taken into consideration that 9739 will be with drawn also ATSMHS part is obsolete in doc 9705 and Superseded by Doc 9880. There are currently six end system applications. The table below lists these applications and provides a brief summary of their functions:

Applications	Functions
Context Management (CM)	An ATN application that provides a logon service allowing initial aircraft introduction into the ATN and provides also a directory of all other data link applications on the aircraft.
Automatic Dependent Surveillance (ADS)	An ATN application that provides data from the aircraft to the ATS unit(s) for surveillance purpose.
Controller Pilot Data Link Communication (CPDLC)	An ATN application that provides a means of ATC data communication between controlling, receiving or downstream ATS units and the aircraft, using air-ground and ground-ground sub-networks.
Flight Information Service (FIS)	An ATN application that provides to aircraft information and advice those are useful for the safe and efficient conduct of flight.
ATS Message Handling Service (ATSMHS)	**A set of computing and communication resources that are implemented by ATS organizations to provide the ATS message service.**
ATS Inter-facility Data Communication (AIDC) and On-Line Date Interchange (OLDI)	**An ATN application dedicated to exchanges between ATS units of ATC information in support of flight notification, flight coordination, transfer of control, transfer of communication, transfer of surveillance data and transfer of general data.** OLDI is seen as a subset of AIDC

4.   ATN TRAFFIC

4.1   **Ground-Ground Traffic**

4.1.1   ATS Message Handling System (AMHS)

4.1.1.1   With the introduction of AMHS as the replacement for AFTN/CIDIN, a number of AFTN circuit links between centers will need to be upgraded to cater for the increase of traffic load generated by AMHS overheads. Analysis carried out in other Regions showed that there will be significant overheads generated by AMHS for a typical message of about 250 bytes. As the message size increases the amount of overheads generated becomes less significant to the size of the body of the message. In transitioning from AFTN/CIDIN to AMHS, States will have to anticipate this increase in bandwidth to accommodate AMHS traffic so as to maintain current or better performance of traffic delivery.

4.1.2   ATS Interfacility Data Communication (AIDC)

4.1.2.1   It is also important to note that there will also be an increase in other forms of data traffic due to implementation of other ATN applications such as the ATS Inter-facility Data Communication (AIDC) application. AIDC will generally be used by Flight Data Processors (FDP) to communicate between each other, which are normally established in each Fight Information Region (FIR). It can therefore be expected that data generated by this application will increase bandwidth requirements on those links that are required to pass this information between FIRs.

4.1.2.2   States will need to ensure that not only are the links that are established between States are capable of transferring data in a timely manner but also for those links that provide an alternate path for the applications to use in times of disruption to the primary links.

4.2   **Air-Ground Traffic**

4.2.1   With the implementation of the air-ground applications it is important to ensure that transit response times are kept to a minimum level so as not to affect the overall response time that it takes for traffic such as ADS reports and CPDLC messages to be delivered to their final destination. This again reflects the need to ensure that critical ground links within the Region are capable of handling this information efficiently.

4.2.2   Another important factor with air-ground traffic is the generation of routing information that is caused by aircraft that will move between various ATN routing domains. To maintain this information in a defined area requires a minimum number of backbone routers to be implemented which protects the majority of all other ATN routers from being flooded with routing information.

5.   ATN ROUTING ARCHITECTURE

5.1   The ATN infrastructure can be divided into two main areas to support both the air-ground and ground-ground applications that will operate over the ATN.

5.2   For air-ground support the ATN needs to support an ATN Routing Backbone network so that routing information about where an aircraft is can be maintained by this backbone. As aircraft move through various coverage media and FIR boundaries the ATN Routing Backbone will be notified of the changing routing data for each mobile aircraft in the region. The type of ATN Routing Backbone architecture for the Middle East Region is documented in the Middle East ATN Routing Architecture Plan (Reference 4 Manual on the ATN using IPS standards and protocols (Doc 9896 AN/469)

5.3   Reference) and is summarized in Figure 5-1 of this document.

5.4   It is anticipated that the trunks used for the ATN Routing Backbone will also be used to carry ground-ground application data such as the AMHS. This of course depends upon the routing policies set up between each router, which determine which links are to be used for the different classes of traffic that can be expected to transverse the network.

5.5

5.6   **Figure 5-1** shows the proposed ATN Routing Backbone for ICAO MID Region.

The ATN Router Backbone tries to use existing trunks that have already been established between the nominated States who will operate the backbone that is currently used for the AFTN. Virtually these trunks will need to be upgraded to cater for the increase in traffic load that will be handled by the ATN. Further details about these trunks are documented in Section 6.

5.7   To improve the resilience and redundancy aspects of the ATN routing backbone, it is proposed that additional trunks be incorporated to ensure minimal disruption to the air-ground applications. This effectively ensures that the Middle East Region can function on its own without support from other regions relaying information on behalf of a failed router or trunk service within the ICAO MID Region. These additional trunks have been shown as dashed lines in Figure 5-1. Also shown are the inter-regional connections between the Middle Region and its neighboring Regions. Additional inter-regional connections are also proposed and are further documented in Section 6.

5.8 It is important to note that costs will may increase due to implementing higher bandwidth links (In some States only high bandwidth are avialable and cost less than the TTY circuits due to new technologies). Therefore the region should review its requirements in having to use point to point circuits every where when a number of strategically placed links may suffice with alternate dial up or IP VPN over secured channels on demand capabilities being deployed between key sites. This may help to offset the costs and still provide for an efficient ground-ground network for the ATN.
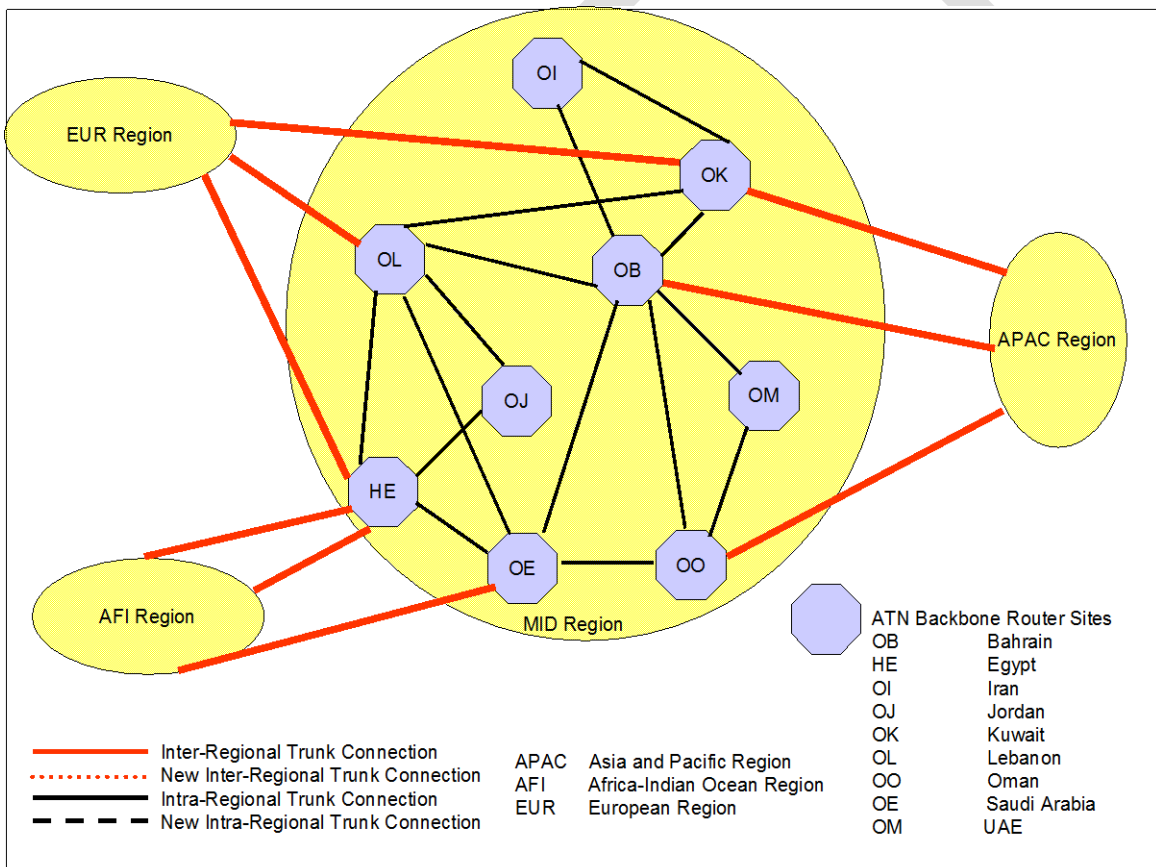

Figure 5-1 MID ATN Backbone Routing Architecture

6.   ATN BACKBONE TRUNKS

6.1 Table 6-1 provides a list of existing or proposed upgrading of AFTN/CIDIN circuits that have been selected for the transition to the ATN routing backbone. Also provided in the table are proposed additional new trunks that should be considered to provide the necessary redundancy and backup services for the ATN for the region.

6.2 As part of the transition from AFTN to the ATN, the existing link capacity, especially those using CIDIN Protocol must be able to handle both AFTN and ATN for those States who do not intent to migrate to AMHS straight away. It is assumed that States that have been nominated to provide the ATN backbone routing environment will do so in a timely manner so as to allow those States who are ready to start their implementation programs can do so without too much restriction within the region. Where a nominated State cannot provide the ATN backbone then an alternative arrangement should be put in place for another State, who is willing to provide the service (e.g Jordan UAE IP VPN connection).

Table 6.1 AFTN Circuit Upgrade and Backbone BIS Implementation

Nominated State	ATN Backbone Connection		Target Date Of Implementation		Trunk Type	Comments
	Speed	Protocol	Circuit	BBIS		
Bahrain				2009		
Singapore	19200 bps		2009		Inter-Regional	Upgrade of circuit
Egypt				2009		
Greece	64000bps	TBD	2009		Inter-Regional	Upgrade of circuit
Kenya	19200 bps	TBD	2009		Inter-Regional	Upgrade of circuit
Tunisia	19200 bps	TBD	2009		Inter-Regional	Upgrade of circuit
Kuwait				2009	Inter-Regional	
Italy (check EUR)	19200 bps	TBD	2009			Upgrade of circuit
Pakistan (check ASIA/PAC)	64000bps	TBD	2009		Inter-Regional	Upgrade of circuit
Lebanon				2009	Inter-Regional	
Cyprus	64000bps	TBD	2009			Upgrade of circuit
Oman				2009	Inter-Regional	
Mumbai	64000bps	X.25	2009			Upgrade of circuit
Saudi Arabia				2009	Inter-Regional	
Ethiopia	64000bps	xxxx				Circuit is upgraded

7. INTERCONNECTION OF ATN ROUTERS

7.1 This section describes the interconnection requirements for ATN routers for the Middle East Region. Table 7-1 shows a pictorial view of the interconnection between various States in the Region.
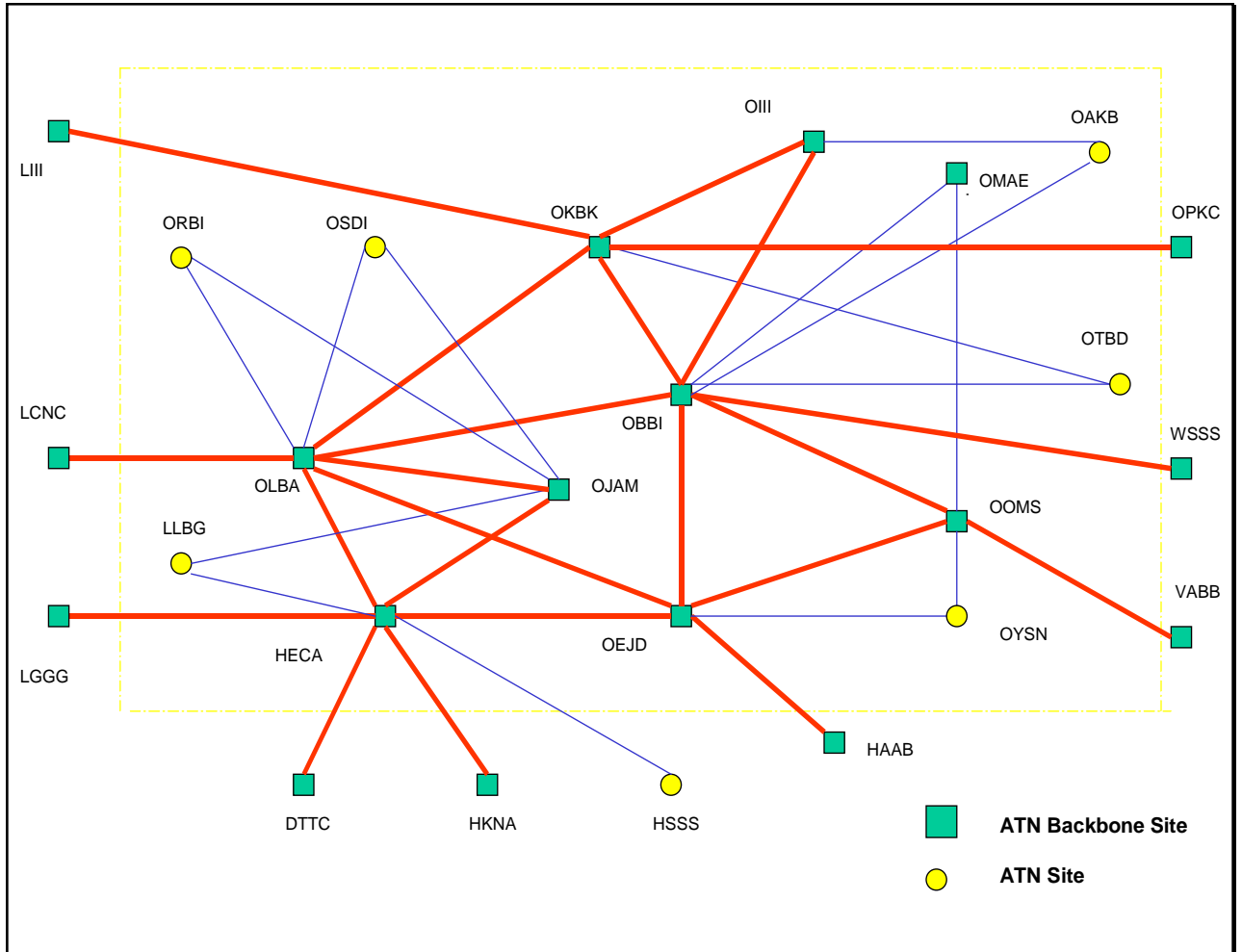
Libya to be added as ATN site (HECA – HLLL)

Figure 7-1 MID ATN Router Interconnection
(This needs to be updated based on the proposed additional intra-regional trunk)

7.2 It is proposed that all existing AFTN circuits are upgraded as soon as practicable to CIDIN or other modern protocols that are compatible with the ATN Lower Layers. In doing so, these links would be sized to cater for both AFTN and ATN. This would allow the region to set-up a sub-network that could support current operational requirements for AFTN and to allow trials and operation services of the ATN to be implemented at minimal cost to the region.

7.3 Further details have been provided in Table 7-1, which lists all international connections between countries and their proposed bandwidth requirements and implementation dates.

MID Region BIS Routing Interconnections

Backbone State	ATN Interconnection		Target Date Of Implementation		Connection Type	Comments
	Speed	Protocol	Circuit	BIS		
Bahrain				2010		
Abu Dhabi	64Kbps	TBD	2003	2010	Intra-Regional	Circuit upgraded
Beirut	9600bps	TBD	2000	2010	Intra-Regional	Circuit upgraded
Doha	64Kbps	TBD	2003	2010	Intra-Regional	Circuit upgraded
Jeddah	64Kbps	TBD	2004	2010	Intra-Regional	Circuit upgraded
Kabul	9600bps	TBD	2005	2010	Intra-Regional	Upgrade of circuit required Upgrade of BIS required
Kuwait	64Kbps	TBD	2004	2010	Intra-Regional	Circuit upgraded
Muscat	9600bps	TBD	2005	2010	Intra-Regional	Upgrade of circuit required Upgrade of BIS required
Tehran	9600bps	TBD	2005	2010	Intra-Regional	Upgrade of circuit required Upgrade of BIS required
Egypt				2007		
Amman	64Kbps	TBD	2005	2007	Intra-Regional	Egype to update
Ben Gurion	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Beirut	9600bps	TBD	2000	2007	Intra-Regional	Circuit upgraded
Jeddah	9600bps	TBD	2003	2007	Intra-Regional	Circuit upgraded
Iran				2007		
Bahrain	9600bps	TBD	2004	2007	Intra-Regional	Upgrade of circuit required
Kuwait	9600bps	TBD	2005	2007	Intra-Regional	Circuit upgraded
Jordan				2007		
Baghdad	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Ben Gurion	9600bps	TBD	2003	2007	Intra-Regional	Circuit upgraded
Beirut	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Cairo	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Damascus	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Kuwait				2007		
Baghdad	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Bahrain	64Kbps	TBD	2005	2007	Intra-Regional	Circuit upgraded
Beirut	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Tehran	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Lebanon				2007		
Amman	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Baghdad	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Bahrain	9600bps	TBD	2000	2007	Intra-Regional	Circuit upgraded
Cairo	9600bps	TBD	2000	2007	Intra-Regional	Circuit upgraded

Backbone State	ATN Interconnection		Target Date Of Implementation		Connection Type	Comments
	Speed	Protocol	Circuit	BIS		
Damascus	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Kuwait	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Jeddah	9600bps	TBD	2004	2007	Intra-Regional	Upgrade of circuit required
Oman				2007		
Abu Dhabi	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Bahrain	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Jeddah	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Sana'a	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Saudi Arabia				2007		
Bahrain	64Kbps	TBD	2007	2007	Intra-Regional	Circuit upgraded
Beirut	9600bps	TBD	2004	2007	Intra-Regional	Upgrade of circuit required
Cairo	9600bps	TBD	2003	2007	Intra-Regional	Circuit upgraded
Muscat	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
Sana'a	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required
UAE				2007		
Bahrain	9600bps	TBD	2003	2007	Intra-Regional	Circuit upgraded
Muscat	9600bps	TBD	2005	2007	Intra-Regional	Upgrade of circuit required

Table 7 - 1 – MID Region BIS Routing Interconnections

Note: Speed requirements are an indication only and may vary between sites to meet different performance requirements for the type of ATN services and applications that are operating over each link.

8. TRANSITION ACTIVITIES

It is recommended that there will be three phases in the implementation of the ATN infrastructure.

- Phase 1, Upgrade of existing sub network infrastructures to support the Backbone BISs (BBISs);
- Phase 2, Implementation of the ATN Regional BBISs; and
- Phase 3, Implementation of supporting ATN BISs.

8.1 Phase 1

8.1.1 This phase consists of upgrading existing AFTN circuits where possible that will support the introduction of the ATN Backbone BISs. Table 6-1 identifies those circuits that will need to be upgraded in both bandwidth and protocols.

8.1.2 In regards to bandwidth requirements, Table 6-1 proposes a preferred speed that will be required when full ATN is implemented. However, lower speeds may be introduced in the initial implementation phases between some locations by bilateral arrangements between States. States will be expected to monitor the performance of these links and increase bandwidth requirements as traffic load increases.

8.1.3   Where new circuits have been identified these will only need to be introduced on a case-by-case basis as BBISs are implemented.

8.1.4   In respect to the upgrade of protocols between States, it is recommend that any efficient Wide Area Network protocols is implemented in ATN routers such as TCP/IP, Frame Relay and Asynchronous Transfer Mode (ATM). This implementation of these protocols will be done on a bilateral arrangement between States.

8.2   **Phase 2**

8.2.1   Phase 2 consists of implementing the Backbone BISs (BBISs) that will support the MID Region. The BBISs are important to the success of the ATN implementation program for the region and will need to be reviewed regularly to determine if contingency arrangements should be put in place where nominated States fail to provide the infrastructure in a timely manner.

Note: Implementation of Inter-Regional BBIS connections between MID Region and neighboring regions will also need to be determined and encouraged during this phase.

8.3   **Phase 3**

8.3.1   Phase 3 is the implementation of all other BISs that will connect to the Backbone BISs.
Further information including initial target dates for the upgrade of the sub-network links and protocols and implementation of the BISs for each State can be found in the table CNS 1B – ATN Router Plan of the FASID. Refinement of the target dates will continue to be updated as States start to develop their implementation programs and can provide feedback to the ICAO MID Regional Office.

CHAPTER TWO

Routing Architecture Plan

Table of Contents

EXECUTIVE SUMMARY

This document provides technical guidance on the Planning and Implementation of the transition to the Aeronautical Telecommunication Network (ATN) for the ground data communications of the ICAO MID Region.

The material presented here is technical in nature. The ATN Transition Plan includes information about the implementation of Regional ATN Routing Architecture as presented in this document.

The routing architecture is based upon the need for a ground-ground infrastructure to eventually replace the existing AFTN/CIDIN infrastructure. For this reason, the routing architecture uses the existing AFTN/CIDIN infrastructure as a guideline for the positioning of ATN equipment.

The routing architecture is designed primarily for the ground-ground environment. It is intended that this architecture will also be suitable as the routing architecture for the introduction of the air-ground communication requirements.

1. INTRODUCTION

This initial plan provides technical guidance on the routing architecture for the Middle East Region.

1.1   Terms used

1.1.1   ***Aeronautical Fixed Telecommunication Network (AFTN)***: a low-speed network providing the majority of ground-ground data communication services within the ICAO realm. This term is defined in ICAO Annex 10.

1.1.2   ***Boundary Intermediate Systems (BIS)***: a router that supports IDRP and routes PDUs to more than one routing domain. This term is defined in ICAO Doc. 9705-AN/956 and 9739-AN/961.

1.1.3   ***Backbone Boundary Intermediate Systems (BBIS***): a router that primarily routes PDUs between routing domains and does not support End Systems.

Note: This definition is similar to that found in ICAO Doc. 9705 and is meant to be consistent with that definition.   This definition is made on the assumption that this version of the routing architecture is limited to the ground-ground infrastructure.

1.1.4   ***Common ICAO Data Interchange Network (CIDIN)***: a part of the aeronautical fixed service which uses bit-oriented procedures and packet switching techniques.

1.1.5   ***End Boundary Intermediate Systems (EBIS)***: a router that primarily routes PDUs between routing domains and connected End Systems.

1.1.6   ***End Systems (ES)***: an ATN system that supports one or more applications and that is a source and/or destination for PDUs.

1.1.7   ***Inter Regional Boundary Intermediate Systems (IRBIS):*** a router that routes PDUs between systems (both End Systems and Boundary Intermediate Systems) within the Region with routers outside of the Region. These routers are the entry points into the Region and exit points from the Region for PDUs.

1.1.8   ***Network Service Access Point (NSAP)*** address: a 20-octet value that uniquely identifies an interface between the Transport Layer and the Network Layer. In the ATN it provides the address of transport entity providing ATN Internet services.

1.2 Acronyms used

AFTN	-	Aeronautical Fixed Telecommunication Network
BIS	-	Boundary Intermediate Systems
BBIS	-	Backbone Boundary Intermediate Systems
CIDIN	-	Common ICAO Data Interchange Network
CLNP	-	Connectionless Network Protocol
EBIS	-	End Boundary Intermediate Systems
ES	-	End System
IDRP	-	Inter-Domain Routing Protocol
IS	-	Intermediate System
PDU	-	Protocol Data Unit

2. ROUTING DOMAIN FUNDZAMENTALS

The ATN consists of a set of End-Systems (ESs) and a set of Intermediate Systems (ISs). ESs are the source and destination of all data and are where the applications reside. ISs are better known as routers and relay PDUs from one system to another.

The ISs and ESs are organized into *Routing Domains*. Routing Domains are used to define sets of systems (that typically operate together) into clusters. These clusters have two major properties:

- they are controlled by a single organization, and
- a significant amount of the traffic is internal to the cluster.

The single most important characteristic is that they are controlled by a single organization. This characteristic is manifested in technical terms by mutual trust between all routers in a routing domain. Routing protocols are based on the fact that the information exchanged between *intra*-domain routers can be trusted. No special reliability or trust is required to accept information about advertised routes.

The second characteristic, most traffic is internal to a routing domain, is more an artifact of proper network engineering. Routing domains are established through the NSAP addressing conventions established for the ATN in Doc. 9705, Sub-Volume 5. All systems with NSAP addresses defined with the same address prefix are by definition in the same routing domain.

2.1   Intra-Domain Routing

2.1.1   Intra-domain routing is the routing of PDUs from the source to destination where both are in the same domain. Intra-domain routing implies one or more ISs capable of routing PDUs across the domain. Examples of intra-domain routing would be CLNP-capable routers exchanging PDUs between two Local Area Networks.

2.1.2   Since the ATN is specified across State boundaries, there are no SARPs developed for intra-domain routing. The choice and configuration of internal routers is a local matter.

2.2   Inter-Domain Routing

2.2.1   The central definition of routing in the ATN is concerned with inter-domain routing. This is a particularly difficult problem since by the very nature of inter-domain routing; the information received cannot be fully trusted.

2.2.2   Inter-domain routing is based upon the mutual distrust of the received routing information. First, reliability mechanisms must be built-in to ensure the reliable transfer of the information. Second, the received information must be filtered to ensure that it meets the suitability constraints of the received system (in other words, can it be believed).

2.2.3   After receiving the routing information, the inter-domain router must build routing tables based upon its internal policy about routing its data.

2.3   Types of Routing Domains

2.3.1   There are two basic types of routing domains: end routing domains, and transit routing domains. An end routing domain routes PDUs to and from end-systems within its routing domain. Figure 1 shows an end routing domain.
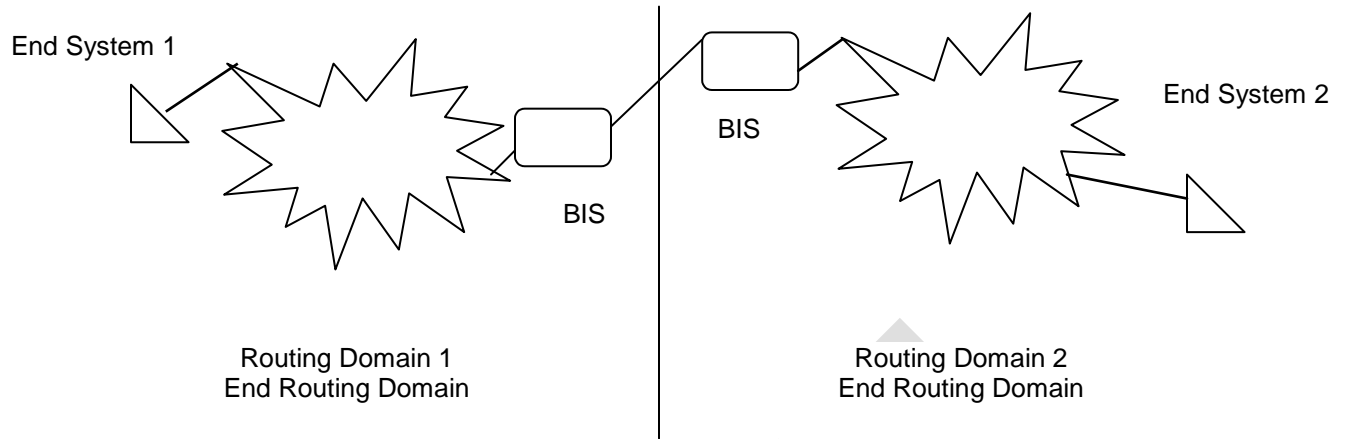
Figure 1 – End Routing Domains

A transit routing domain routes PDUs between two or more routing domains, and may as an option also act as an end routing domain. An example of a transit domain is where a set of backbone routers is configured in their own routing domain with all of the end systems in end routing domains attached to the backbone.
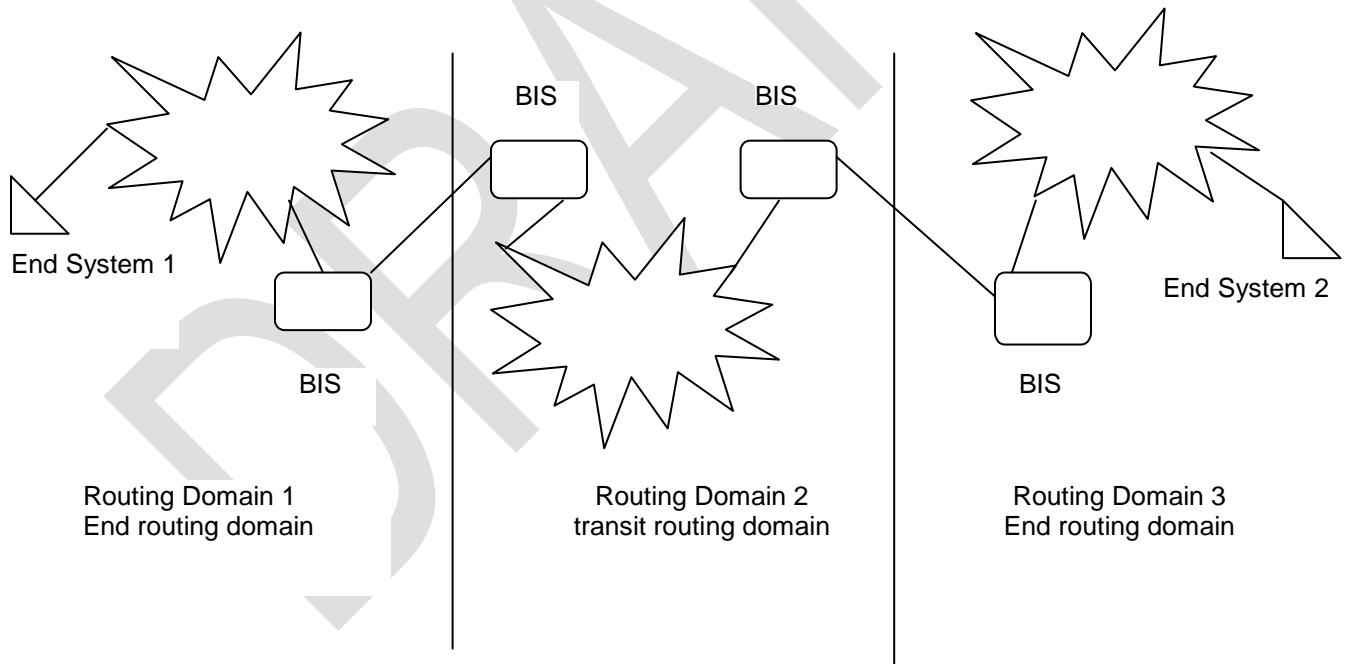
Figure 2 – Transit Routing Domains

Note: A transit routing domain may or may not be part of the backbone. A transit routing domain may consist of BISs none of which are backbone routers.

2.4   Routing Domain Construction

2.4.1   Based on the above, a routing domain consists of at least one inter-domain router.

Note: There must be at least one BIS. There is no requirement for any other equipment.
Routing domains are elements of the physical structure of the ATN.

3.   ROUTER FUNDAMENTALS

All routers discussed within this document are ICAO Doc. 9705 and 9739 compliant Boundary Intermediate Systems (BISs).

NOTE: INDIVIDUAL STATES MAY ELECT TO USE OTHER ROUTERS THAT DO NOT COMPLY WITH THE ATN IDRP REQUIREMENTS AS FOUND IN ICAO DOC. 9705 WITHIN THE LIMITS OF THEIR OWN STATES. THESE ROUTER ARE INTERNAL STATE ISSUES AND OUTSIDE THE SCOPE OF THIS DOCUMENT.

3.1   Boundary Intermediate System Overview

3.1.1   Boundary Intermediate Systems comprise the interfaces between networks, and in particular, between different routing domains. The term "Boundary Intermediate System" can often be replaced with the more common term "router".

3.1.2   An important consideration in developing the routing architecture is the different roles that routers take within the ATN environment.

3.2   Router Types

There will be two primary types of BISs employed within the Region:
- Backbone BISs (BBISs), and
- End BISs (EBISs).

Note: A third type of BIS is supported within this routing architecture but since its use is subject primarily to bi-lateral agreements between States and Organizations, it is not fully described here. This third type of BIS is non-BBIS that acts as a transit router between two RDs but is not part of the Regional backbone.

3.2.1   Backbone BISs

3.2.1.1   A BBIS is a router that primarily routes PDUs between routing domains. These routers are typically higher performance routers that aid in the efficient flow of data between domains. BBISs may have End-Systems connected to them, but often are limited to only router-to-router connections.

3.2.1.2   Within the context of the MID Region, BBISs can be further subdivided into Regional BBISs, and Inter-Regional BBISs. Regional BBISs are backbone routers that only connect to routers within the Region. Inter-regional Backbone BBISs are those backbone routers that connect to BBISs in other Regions.

Note: A single, high-performance router may act as both a Regional BBIS and an Inter-Regional BBIS based upon meeting the requirements for performance and reliability.
Note: For completeness of the routing architecture, it must be mentioned that the routers out-side of the Region to which Inter-Regional Backbone BISs attach are, in fact, Inter-Regional Backbone BISs in the other Region.

Note: The interconnections of backbone BISs typically require higher capacity communication lines based on the consolidation of traffic through those backbone routers. Even though the architecture takes into account existing AFTN infrastructure facilities, the need to upgrade the communication facilities as traffic through the backbone increases may be necessary.

Note: It is possible for some States to provide transit routing from its routing domain(s) to the routing domains of other States using BISs that are not backbone routers. For the purposes of this routing architecture, it is not possible to distinguish between these transit routing domain routers and BBISs.

3.2.2   END BISs

3.2.2.1   End BISs are connected to one or more BBISs and provide routing services to a single routing domain. Further, End BISs do not act as a transit router for passing PDUs between other routing domains.

4.   MID REGION ROUTING ARCHITECTURE

The MID Region routing architecture is based upon several concepts:

1.   From a routing domain point of view, the Region can be considered an "autonomous" area, that is, there is a difference between routers located within the Region and outside the Region.
2.   Routing domains and confederations of routing domains may be applied to areas within the Region.
3.   States will make their own implementation and transition decisions.

The routing architecture can be divided into several distinct parts:

- the definition of the backbone routing structure for passing information between routing domains within the Region;
- the definition of the routing structure between routing domains not on the backbone;
- the definition of the routing structure for use in end-routing domains; and
- the definition of the routing structure for passing information from this Region to other Regions.

The first component is the definition of the backbone routing structure that supports the exchange of data within the Region. This part defines the interconnection of the major communication facilities in the Region and how they cooperate to link all of the systems in the Region.

The second component is the definition of the structure that allows end routing domains to exchange data across the backbone to another end routing domain. This part defines how the end routing domains connect through the backbone.

The third component defines the routing structure that is used within an end routing domain. This part defines how the individual routing domains may be used to pass data.

The fourth part is needed to define how data will be routed between the systems within the Region with those systems outside the Region. More importantly, the structure describes how all-global ATN systems are accessible from systems in the Region.

4.1   MID Region Backbone

4.1.1   Regional Backbone

4.1.1.1   The definition of a Regional Backbone is based upon the efficiencies that may be realized by concentrating ATN traffic at major communication centers and using the economy of scale in passing this information between major communication centers.

4.1.1.2   The rationale for defining Regional Backbone sites is based upon existing major AFTN center sites and on the flow of both AFTN traffic and possible future air-ground ATN traffic.

4.1.1.3   Within the Region there do exist main AFTN communication centers that can be used to simplify the definition of backbone architecture.

4.1.1.4   However, it must be understood that the expected growth in communication traffic over the ATN could quickly exceed the capabilities of the existing communication infrastructure.

Planning for the increased traffic loads will be needed as soon as ATN traffic begins to flow.

4.1.1.5 The architecture and communication requirements define a routing plan that incorporates alternate routing and communication paths so that no single router or communication failure can isolate major parts of the Region.

4.1.1.6 The nine (9) BBIS sites defined in Table 4.1-1 are based on the expected traffic flows. A current AFTN center site identified as a potential backbone router site. This site is listed first and in bold text as follows:

ATN Backbone router site	State
1	**BAHRAIN (Bahrain)**
2	**EGYPT (Cairo)**
3	**IRAN (Tehran)**
4	**JORDAN (Amman)**
5	**KUWAIT (Kuwait)**
6	**LEBANON (Beirut)**
7	**OMAN (Muscat**)
8	**SAUDI ARABIA (Jeddah)**
9	**UAE (Abu Dhabi)**

Table 4.1-1 – Definition of MID Region Backbone Sites

4.1.1.7 At each ATN Backbone router site, there should be at least one BBIS. States committing to operate backbone routers are presented in the table above.

4.1.1.8 Summarizing the information presented above, the MID Region Backbone network will consist of at least one BBIS router at each of the backbone sites identified above. The actual location of the routers will be based upon implementation schedules and the choices of States.

4.1.2 Backbone Router Requirements

The definition of BBIS and the location of these routers may be affected by the requirements for backbone routers. A backbone router must meet several performance and reliability requirements:

- Availability,
- Reliability,
- Capacity, and
- Alternative routing

4.1.2.1 Availability

A backbone router must provide a high-level of availability (24 hours a day, 7 days a week).

4.1.2.2 Reliability

A backbone router must be a very reliable system that may require either redundant hardware or more than one router per site.

4.1.2.3 Capacity

As a communication concentrator site, backbone routers must be capable of supporting significantly more traffic than other ATN routers.

4.1.2.4 Alternative Routing

Based upon the need for continuity of service, backbone routers will require multiple communication links with a minimum of two and preferably three or more other backbone routers to guarantee alternate routing paths in case of link or router failure.

4.1.3   Routing Policies

4.1.3.1   States providing Regional BBISs must be capable of supporting routing policies that allow for Regional transit traffic and for dynamic re-routing of traffic based upon loading or link/router failures.

4.2   Inter-Regional Backbone

The second component of the MID Region Routing Architecture is the definition and potential location of Inter-Regional Backbone Routers.   The manner in which this architecture was developed was to ensure that the use of the existing communication infrastructure is possible to the greatest degree.   The use of the existing communication infrastructure should reduce the overall cost of transitioning to the ATN.

As already indicated, the Inter-Regional BBISs provide communication from routers within the MID Region to routers in other regions.   These Inter-Regional BBISs provide vital communications across regions and therefore need to have redundant communication paths and high availability. (Note: This can be accomplished through multiple routers at different locations.)

Based upon the current AFTN circuit environment, the following States have been identified as potential sites for Inter-Regional BBISs. The States currently have circuits with States outside of the MID Region are found in Table 4.2-1 below.

State	Neighboring Region	Current circuit
Bahrain	Asia-Pac	upgraded
Egypt	Africa Europe	To be upgraded Circuit upgraded
Kuwait	Asia-Pac Europe	to be upgraded No updated information
Lebanon	Europe	Circuit upgraded
Oman	Asia-Pac	No updated information
Saudi Arabia	Africa	Asmara Circuit upgraded Adis ababa upgraded

Table 4.2-1   Table of Circuits with other ICAO Regions

For the transition to the ATN, connectivity to the other Regions should be a priority. This is especially important as other Regions begin the transition to the ATN and begin deploying ATN BISs.

4.2.1   Long Term Implementation

4.2.1.1   The transition to a fully implemented ATN requires that connectivity amongst the IACO Regions be robust.   That is, there is the need to ensure alternate paths and reliable communication.   Table 4.2-1 presents a minimal Inter-Regional Backbone that provides a minimum of 2 circuits to other ICAO Regions that communicate directly with the MID Region. For the long-term implementation of ATN, it would be advisable to have 3 circuits to each Region. The addition of circuits to Africa should be considered.
Note: Information is needed on States Plan in implementing ATN.
4.2.2   Initial Implementation

4.2.2.1   The initial implementation of the ATN, outside of the MID Region, will most likely be in ASIA/PAC and Europe. Therefore, initial transition planning may focus on those locations. Note: Information is needed on States Plan in implementing ATN.

4.2.2.2   For connecting to other Regions, there should be a minimum of two (2) Inter-Regional BBISs. The location of these Inter-Regional BBISs may be located at the centers where the AFTN/CIDIN centers already exist.

Note: The locations presented above are examples of possible router sites. The selection of actual locations will be based on implementation schedules and circuit availabilities.

Note: For additional reliability, a third Inter-Regional BBIS would be preferred.

4.2.2.3   For connecting to Africa, an Inter-Regional BBISs may be located at the location of the existing AFTN centers: Cairo or Jeddah. However, this router would not be needed until such time as ATN traffic is destined for that Region and the location of the router would be determined at that time.

Note: Future work is still required for the definition of policy descriptions for the backbone architecture.
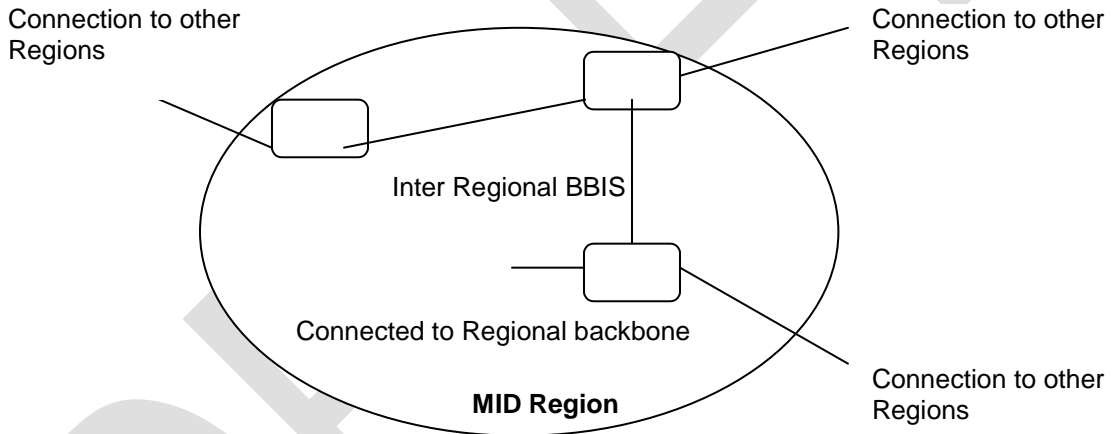

Figure 3 – Inter-Regional Backbone Routers

4.2.3   Transition Issues

4.2.3.1   The transition issues relating to the regional routing architecture is described in the ATN Transition Plan.

4.3   End BISs

4.3.1   It is assumed that naming and addressing (and routing domain definition) will be done on a Regional basis. Further, that for areas within the Region that may utilize an End BIS serving more than one State, the naming structure will be based on the Regional NSAP format defined in Doc. 9880 9705. Further, States may choose to either implement the Regional (or Sub-Regional) NSAP format or the State NSAP format based on whether it installs a BIS.

5.   ROUTING DOMAINS

5.1   Each State is expected to have one or more routing domains. Where a State

chooses not to implement an ATN BIS, it may choose to incorporate its systems into a routing domain of another State.

5.2   The MID Regional ATN Backbone will consist of routers from the selected States. Each of these routers will be part of its State's routing domain.

Note: This means that the backbone will not be configured with its own routing domain. Routing to the backbone and between backbone routers will be controlled through IDRP routing policies.

5.3   Each State will be responsible for the designation of routing policies for its End Systems and End BISs. Individual States will also be responsible for establishing routing policies for routing to its designated BBIS.
The use of routing confederations is for further study.

6.   ATN TRANSITION

Based upon the previous sections, the implementation of the ATN within the MID Region may require considerable planning for the transition of the AFTN/CIDIN.

6.1   Initial Regional Implementations

6.1.1   The very beginning of ATN implementation will be bilateral testing between States. for this scenario, each State will need at a minimum:

- an ATN router,
- a means for managing the router,
- an ATN application, and
- a circuit connecting the States.

6.1.2   States involved in bilateral ATN trials should consider the use of the trial infrastructure in expanding the ATN throughout the Region.

6.1.3   The below should provide the creterias required for testing:

Rashid and Mahmood Ramadan to provide the full testing creteria.
Mohamed Ali to provide the OLDI testing creteria

6.2   Regional ATN Implementation

6.2.1   At a certain time, sufficient bilateral trials will be underway to permit a Region-wide ATN network based upon the plan presented above. As each State implements the ATN applications and network infrastructure, it will be added to the Regional infrastructure according to this plan.

CHAPTER THREE

AMHS

Table of Contents

Executive Summary

This document provides technical guidance on the naming convention for the transition of ground Aeronautical Fixed Telecommunication Network (AFTN) services to the ATS Message Handling System (AMHS) within the MID region.

Based upon the ATN SARPs as published in ICAO Annex 10 and ICAO Doc. 9880, Manual of technical provisions for the ATN (Doc 9705) ATSMHS part is obsolete Superseded by Doc 9880, the Regions are advised to develop naming and addressing plans. These Regional Plans may be used to guide States in the assignment and registration of addresses and names to be used for the Aeronautical Telecommunication Network (ATN).

An extract of the AMHS Register from the main ICAO register for the MID States is provided in this part for planning and implementation

This document presents the draft from other region which the IPS Working Group shall update.

1. Introduction

This document presents the naming assignment conventions for allocating Originator/Recipient (O/R) names to be used for the ATS Message Handling System (AMHS) in the MID Region.

The information contained in this document is drawn from a number of developments and will be continued to be updated by the IPS Working group members

1.1 Objectives

The objective of the document is to provide guidance in the naming convention to be used for the AMHS in the MID Region.

1.2 Scope

The scope of the document includes:
- ☐Describing the attributes of the AMHS address format, and
- ☐Recommending the values for the relevant attributes that are to be used in the AMHS address.

The MID Regional ATN AMHS naming convention presented here will comply with the relevant formats as specified in ICAO Doc. 9705 (Reference 1). The MID Regional ATN AMHS Naming Plan defines the method for assigning values to each of the relevant attributes of the AMHS address. States within the Region may choose to assign their AMHS addresses based upon the recommendations found here.

1.3 References

Reference 1   Manual of Technical Provisions for the ATN (Doc 9880 9705-AN/956) First Edition 1998.

Reference 2   ICAO Location Indicators – Document 7910/94

1.4 Abbreviations

The following abbreviations are used in this document:

ADMD	Administration Management Domain
AFTN	Aeronautical Fixed Telecommunication Network
AMHS	ATS Message Handling System
MIDANPIRG	Middle East Air Navigation Planning and Implementation Regional Group
ATN	Aeronautical Telecommunication Network
ATNTTF	ICAO ATN Transition Task Force
ATS	Air Traffic Service
ATSO	Air Traffic Service Organizations
ICAO	International Civil Aviation Organization
ITU-T	International Telecommunication Union Telecommunication Standardization Sector
MHS	Message Handling Service
MTA	Message Transfer Agent
O/R	Originator/Recipient
PRMD	Private Management Domain
SARP	Standards and Recommended Practices

2. AMHS NAMING CONVENTION

To ensure continuity and compatibility with other AMHS naming conventions developed by other regions, it is proposed that the MID Region's AMHS naming convention should be based upon coordnation using the Europe ATS message Management Center AMC as recommended by the ICAO State letter AN 7/49.1-09/34, .

2.1 MF-Addressing Format

ICAO Document 9705 (Reference 1) states that the AMHS shall be composed of AMHS Management Domains. These AMHS Management Domains may elect to operate as either an Administration Management Domain (ADMD) or a Private Management domain (PRMD), depending on the national telecommunications regulation in force in the country where it operates and on its relationships with other Management Domains. Each AMHS user within an AMHS Management Domain is assigned an Originator/Recipient (O/R) name, which is also referred to as a MF-address. The attributes of a MF-address are described in the table below.

Table 2.1-1 MF-Address Attributes

Attribute	Notation	Comment
Country-name	C	
AFMD	A	
PRMD	P	
Organization-name	O	
Organizational Unit name	OUN	n = 1 -4
Common name		
Personal name	S G I GQ	Surname Given name Initials Generation Qualifier
Domain-defined-attributes	DDA	(DDA type) = (DDA Value), up to 4 attributes

It is recommended that States who are about to start their AMHS implementation programs should use the MF-Address format structure.

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[1] SPACE (Study and Planning of AMHS Communications in Europe) is a project supported by the European Commission and is the combined efforts of the participating countries and organizations from EUROCONTROL, France, Germany, Spain and the United Kingdom.

2.2 XF-Addressing Scheme

In addition to the MF-address, the ATN SARPs have defined an XF-address format. ICAO Document 9705 (Reference 1) stipulates that the XF-address of a direct or indirect AMHS user shall be composed exclusively of the following:

2.2.1   An AMHS Management Domain,

2.2.2   An organization-name attribute set to the 4-character value "AFTN" and encoded as a Printable String,

2.2.3   An organizational-unit-names attribute, which comprises the 8-character alphabetical value of the AFTN address indicator of the user, encoded as a Printable String.

It is recommended that States who have already started implementing the XF-Address format can do so but should consider migrating to the MF-Address format as soon as is practical.

2.3 Naming Convention For MF-Address Format

At the third ATN Panel meeting it was recommended that ICAO register with the ITU-T the ADMD name "ICAO" as an international ADMD under the "XX" country code. It was also recommended that ICAO establishes and maintains a register of PRMDs allocated by air traffic service providers according to the "XX" + "ICAO" address structure. The management of this register would be established and maintained in the same way as the Location Indicators (Doc 7910) and Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services (Doc 8585).

The Air Navigation Commission on the 1st of June 2000 approved these recommendations. It is therefore recommended that the MID region accept the format for the allocation of the first two attributes used in the O/R name.

It has been proposed in the ATN Panel working groups that a common naming convention be used worldwide to help stream line the addressing scheme and to ensure compatibility and consistency with other neighboring regions. This scheme would be based on the work that has been ongoing in Europe. It was also stressed that if States have not already started their implementation programs for AMHS that when planning to do so that they should adopt the MF-Address format over the XF-Address format.

It is therefore recommended for the MID region to adopt the proposed worldwide MF-Address format, which uses the following attributes to define the O/R name during the transition phase from AFTN to AMHS:

1. Country-name;
2. ADMD;
3. PRMD;
4. Organization-name;
5. Organizational-unit-name 1; and
6. Common Name.

2.3.1 Country Name

The country name is a mandatory requirement and shall consist of the two alphanumeric ISO 3166 Country Code "XX" encoded as a Printable String. ICAO has been requested by the ATN Panel to use the country code "XX" as this is a special code registered by the ITU-T for the purpose of allocation to international organizations, which do not reside within any particular country.

2.3.2 ADMD

The administrative domain is a mandatory requirement and shall consist of the Printable String "ICAO". ICAO has registered "ICAO" as the ADMD with the ITU-T. By providing the "ICAO" ADMD will allow the addressing schemes to be independent of any constraints that may be imposed by management domains in the global MHS or national regulations that may vary from region to region.

2.3.3 PRMD

The private management domain is an optional requirement but recommended to be implemented by States in the MID Region as part of the worldwide MF-Address format scheme.

The contents of this field can contain the ICAO Country Indicator specified by ICAO Document 9710 [Reference 2] or the name of the Air Traffic Service Organization (ATSO) that has been registered with ICAO. Where an ATSO has not yet assigned their PRMD then a default value will be allocated, which will use either one, two or three letters of the ICAO Country Indicator specified in ICAO Document 9710 [Reference 2]. This has been chosen for its simplistic and non-ambiguous format, which is already managed by ICAO. Hence providing an easier management role for ICAO who will be responsible for maintaining the register of all PRMDs allocated under the ADMD of "ICAO".

2.3.4 Organization Name

The organization name is used for defining the local or national geographical routing information. This information is to be assigned by the ATSO and for example can be based on the ICAO location indicator as specified in ICAO Document 9710 or some other value determined by an ATSO and published with ICAO. Figure 2.3.4-1 provides a pictorial view of how the organization name can be used in relation with the lower attribute structure.
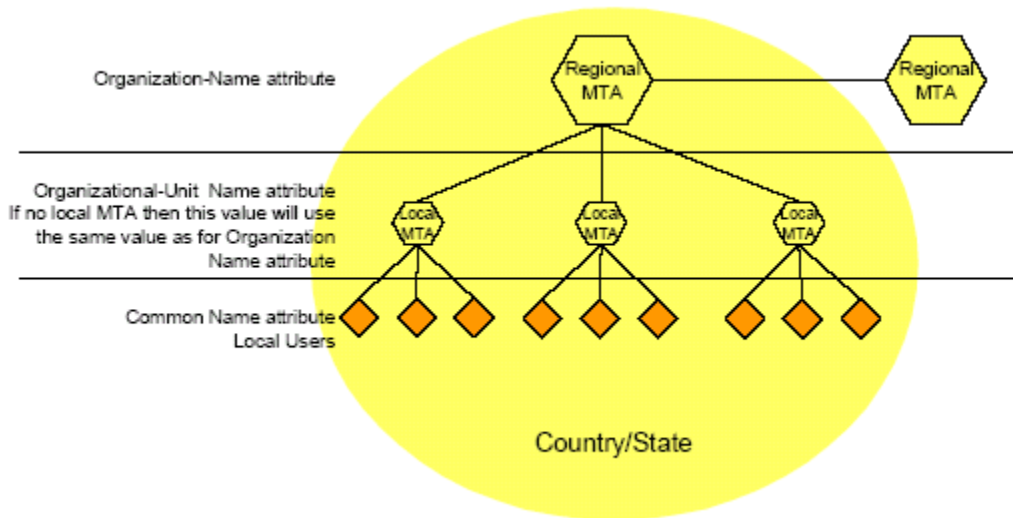
Figure 2.3.4-1 Lower Attribute Structure

2.3.5 Organizational Unit Name OU1

Each State or organization is allocated a unique ATS message organizational name. As all States are familiar with the ICAO four character location indicator defined in ICAO document 7910 (Reference 2), it is proposed that the organization unit name 1 use the location indicator to identify the Message Transfer Agent (MTA) site, encoded as a Printable String.

Note: The MTA site may be the MTA name of the server. However there are security issues that need to be addressed to ensure that this arrangement does not cause any unnecessary concerns with service providers that allow the MTA name to be broadcast in this fashion.

2.3.6 Common Name

It is proposed that during the AFTN transition to AMHS that the common name attribute be used to contain the 8-character alphabetical value of the AFTN address indicator of the user, encoded as a Printable String.

Possible example of an O/R address is shown in Table 2.3.6-1.

Table 2.3.6-1 Example of a MF-Address AMHS Naming Convention

Attribute	Assign By	Value	Comment
Country-name (C)	ITU-T	XX	International Organization
ADMD (A)	ICAO	ICAO	ICAO Responsibility to register
PRMD (P)	ATSO		ATSO registered private domain
Organization name (O)	ATSO		Local/national geographical information, which can be based on ICAO Location Indictors (Doc 7910)
Organizational-Unit name (OU1)	ATSO		ICAO Location Indicator (Doc 7910)
Common Name (CN)	ATSO		AFTN indicator address

MID Region AMHS addresses

State	AMHS Address Specification							
State Name	Nationality Letters or Designator	Country-name attribute	ADMD-name attribute	PRMD-name attribute	Addressing scheme	ATN Directory naming-context	Organization-name (for CAAS only) single value or reference to the CAAS Table	Comments
Bahrain	OB	XX	ICAO	OB	CAAS		see Table OB	confirmed by SL
Egypt	HE	XX	ICAO	HE	CAAS		HECA	confirmed by SL
Iran (Islamic Republic of)	OI	XX	ICAO	OI	XF			confirmed by SL
Iraq	OR	XX	ICAO	OR	XF			
Israel	LL	XX	ICAO	LL	XF			

Jordan	OJ	XX	ICAO	OJ	CAAS		OJAC	confirmed by SL
Kuwait	OK	XX	ICAO	OK	XF			
Lebanon	OL	XX	ICAO	OL	XF			
Oman	OO	XX	ICAO	OO	XF			
Qatar	OT	XX	ICAO	OT	XF			
Saudi Arabia	OE	XX	ICAO	OE	XF			confirmed by SL
Syrian Arab Republic	OS	XX	ICAO	OS	XF			
UAE	OM	XX	ICAO	OM	XF			confirmed by SL
Yemen	OY	XX	ICAO	OY	XF			

2.4.5 Organizational Unit Name OU1

The organizational unit name 1 attribute is used to contain the 8-character alphabetical value of the AFTN address indicator of the user, encoded as a Printable String.

Possible example of an O/R address is shown in Table 2.4-1.

Table 2.4.5-1 Example of a XF-Address AMHS Naming Convention

Attribute	Assigned By	Value	Comment
Country-name (C)	ITU-T	XX	International Organization
ADMD (P)	ICAO	ICAO	ICAO Responsibility to register
PRMD (P)	ATSO	e.g. Australia	ICAO Country Indicator or ATSO registered private domain with ICAO.
Organization-name	ATSO	**AFTN**	AFTN name
Organization-Unit Name (OUI)	ATSO	e.g. YBBBYFYX	AFTN indicator address

2.5 General Use of X.400 O/R Addresses

Note: The address format of X.400 O/R address attributes for sending general nonoperational AMHS traffic is a local matter for States to implement if they wish to do so and no further advice is given in this plan.

3. Conclusions

The MID Region ATN AMHS Naming Plan aligns itself with the global AMHS naming scheme as proposed by the ATN Panel working groups. Also to maintain compatibility with in the region it is proposed that the MF-Address format should be adopted where a State has not yet started its

AMHS implementation program. This will ensure compatibility with the proposed global AMHS naming scheme.

4. MID AHMS Implementation

Com Center	Installation	Operation	MTA Name	AFTN/AMHS Gateway	ATS Message UA	ATS service level	Protocol (IPS, ATN)	Remarks
Bahrain		-	MTA-OB-1	Y	Y	Extended	Dual Stack	Support IPv4 only
Egypt	2008	-	MTA-HE-1	Y	N	Extended	Dual Stack	Support IPv4 only
Iran	-	-	-	-	-	-	-	-
Iraq	-	-	-	-	-	-	-	-
Israel	-	-	-	-	-	-	-	-
Jordan	2008	2010	MTA-OJ-1	Y	Y	Extended	Dual Stack	Support IPv4 only
Kuwait		-	MTA-OK-1	Y	Y	Extended		Support IPv4 only
Lebanon	-	-	-	-	-	-	-	-
Oman	2008	2009	MTA-OO-1	Y	Y	Extended		Support IPv4 only
Qatar		-	MTA-OT-1	Y	Y			Support IPv4 only
Saudi	2008	-	MTA-OE-1	Y	Y	Extended	Dual Stack	Support IPv4 only
Syria	-	-	-	-	-	-	-	-
UAE	2006	2009	MTA-OM-1	Y	Y	Basic		Support IPv4 only
Yemen	-	-	-	-	-	-	-	-

The MID Region shall use the Europe EUR AMHS Manual EUR Doc 020 and all its Appendices for the implementation of AMHS

CHAPTER FOUR

NSAP Addressing Plan

1. NSAP Addressing Plan

Introduction

The MID Regional ATN Addressing Plan provides guidance to the States within the Region in assigning NSAP addresses to their ATN systems. The Plan addresses the need for consistency within the Region for address assignment.

To find a suitable ATN addressing convention that would be acceptable for use in the MID region requires a routing architecture that minimizes routing updates and over heads within the ground ATN infrastructure for both ground-ground and air-ground services and applications.

The ATN addressing convention must allow for an addressing scheme that is:

- Practical - to provide autonomous administration of ATN addresses for States and Organizations, and
- Flexible - to allow for future expansion and/or routing re-configuration of the ground ATN infrastructure with minimal re-assigning of ATN addresses.

The recommendations proposed in the MID Regional ATN Addressing Plan take advantage of the work performed by the European ACCESS1 Project (Reference 3).

1 ACCESS (ATN Compliant Communications European Strategy Study) is a project funded by the European Commission and jointly produced by the following companies and administrations: National Air Traffic Services (NATS), Deutsche Flugsicherung (DFS) and Service Technique de la Navigation Aerienne (STNA).

2. NSAP Address Format

The NSAP address format is defined in ICAO Doc. 9705 (Reference 1), Sub-Volume 5. The format is based upon the requirements specified in the base standard (ISO/IEC 8348) and incorporates the specific ATN requirements for addressing both ground and mobile systems.

The structure of the Network Service Access Point (NSAP) address is depicted in Figure 5.
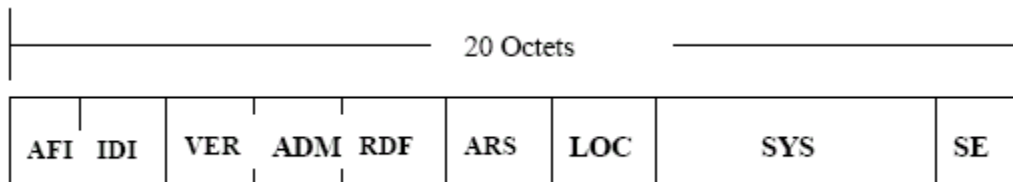

Figure 5 NSAP Address Format

The NSAP address structure contains 9 fields, which are described in Table 4.2-1.

Field Name	Field Description	Size	Syntax	Number of Characters/ Digits	Field Encoding
AFI	Authority and format Identifier	1 Octet	Decimal	2 Digits	BDC
IDI	Initial domain Identifier	2 Octets	Decimal	4 Digits	BCD
VER	Version	1 Octet	Hex	2 Digits	Binary
ADM	Administration Identifier	3 Octets	Alpha or Hex/Alpha	3 Characters 2 Digits/ 2 Characters	IA-5 Binary/ IA-5
RDF	Routing Domain Format	1 Octet	Hex	2 Digits	Binary
ARS	Administration Region Selector	3 Octets	Hex	6 Digits	Binary
LOC	Location	2 Octets	Hex	4 Digits	Binary
SYS	System Identifier	6 Octets	Hex	12 Digits	Binary
SEL	NSAP Selector	1 Octet	Hex	2 Digits	Binary

Table 4.2-1 - Encoding Rules for the ATN NSAP

3 Recommendations For NSAP Address Fields Assignments

3.1 The AFI and IDI Fields

The ATN Internet SARPs (Reference 1) require allocation of the following values:
- Decimal for the AFI field to indicate the type of NSAP being used. This value has been assigned the character sequence "47".

- Decimal for the IDI field to designate ICAO. This value has been assigned the character sequence "0027".

As recommended in Reference 1, ATN NSAP addresses and NETs will be written as the character sequence "470027+" where the "+" is used to separate the Binary Coded Decimal (BCD) fields from subsequent Hexadecimal fields.

Hence the AFI and IDI fields will be set to 470027 for fixed ATSC systems/domains and for mobile ATSC systems/domains.

3.2 The VER Field

The VER field is used to partition the ATN Network Addressing domain into a number of sub-ordinate Addressing Domains.

The values currently specified in Reference 1 for the VER field are summarized in Table 3.2-1.

VER Field Value	Network Addressing Domain	Common NSAP Address Prefix for Domain	Value to be used by States of MID region
[0000 0001]	Fixed AINSC	470027+01	
[0100 0001]	Mobile AINSC	470027+41	
[1000 0001]	Fixed ATSC	470027+81	470027+81 (ATSO Iss and Ess)
[1100 0001]	Mobile ATSC	470027+C1	470027+C1 (General Aviation)

Table 3.2-1 - Defined Values for the VER Field

3.3 The ADM Field

The ADM field is used to further partition the ATN Network Addressing Domain. The field designates a single State or Organization. Depending on what the VER field is set to will determine what values should be used in the ADM field.

When the VER field is set to "81" (Fixed ATSC), the ATN SARPs permits two possible ways for encoding the ADM field.

The first method recommends that the State's three character alphanumeric ISO country code is used, as defined in ISO 3166. States may choose this method, however it will provide less flexibility than the second method for the addressing of regional entities (e.g. regional RDCs or regional organizations that are not country specific).

The second method that is recommended for use in the MID region is to use the first octet of the field to define the ICAO region. This would permit the reduction of the routing information that would otherwise be generated. It is recommended that the remaining two octets of the field will further identify the country, RDCs and the regional organizations that are not country specific as follows:

- For the identification of a country, it is recommended that States use the ICAO two letter location indicator (Reference 4) instead of the two character alphanumeric ISO 3166 country code. The structure of the ICAO two letter location indicator allows for a more efficient identification of a location. For example, indicators starting with the same letter "V" designate several countries in the same local region (e.g. Thailand, Sri Lanka, India, Cambodia etc.). The second letter will actually define the specific country within this local region (e.g. "VT" for Thailand, "VC" for Sri Lanka etc.). Where a country has several ICAO two letter location indicators allocated to it, the assigning authority of the ADM field will be responsible in determining the preferred location indicator to represent that country. For example, the indicators "VA", "VI", "VO", "VE" are assigned to India and one of these indicators will be selected to represent India. The encoding of the ICAO two letter location indicators will be upper case alphanumeric values.

- For regional organizations that are not country specific, it is recommended to allocate a lower case alphanumeric value so as there will be no conflict with the ICAO two letter location indicators.

- For the addressing of RDCs (e.g. Island RDCs, Backbone RDCs), in particular for those that are not country specific, it is recommended to allocate codes with the most significant bit set to 1 in the second octet. Valid values would be in the hexadecimal range [8000 – FFFF].

ICAO MID Regional group would be the allocation authority of the ADM field.

In summary, the values allocated for the ADM field is indicated in Table 3.3-1.

VER Field Network Addressing Domain	ADM Field Values
Fixed AINSC	Derived from the set of three-character alphanumeric characters representing an IATA airline or an Aeronautical Stakeholder Designator.
Mobile AINSC	Derived from the set of three-character alphanumeric characters representing an IATA airline or an Aeronautical Stakeholder Designator.
Fixed ATSC	To allow for efficient routing information to be exchanged, it is proposed that the ICAO Regional code be used in the first octet of the ADM field followed by the ICAO two-letter location indicator for countries. The Regional codes are shown below. Regional Codes: [1000 0000] Africa [1000 0001] Asia [1000 0010] Caribbean [1000 0011] Europe [1000 0100] Middle East [1000 0101] North America [1000 0110] North Atlantic [1000 0111] Pacific [1000 1000] South America For example Thailand would be represented by the following hexadecimal sequence: 815654. Table 4.3.3-2 provides further examples for a selected number of countries. Where a two letter country code is not applicable, the following rules would apply: ICAO would assign lower case alphanumeric characters using a two letter value to organizations that wish to be based in a particular region. For example, if an organization is to be based in the Pacific region and wanted to be represented by the characters 'sa', this would be represented by the following hexadecimal sequence: 877361 ICAO would assign regional codes for RDCs where a country

	code or organization code is not applicable. Values would be assigned with the most significant bit set to 1 in the second octet. For example a RDC established in the Pacific region would be represented by the following hexadecimal sequence: 878100.
Mobile ATSC	As for Fixed ATSC

Table 3.3-1 - Defined Values for the ADM Field

Fixed or Mobile MID ATSC Addressing Domain	Hexadecimal Code of the ADM Field	Comment
Australia	875942	Pacific Region + 'YB'
China	815A42	Asia Region + 'ZB'
India	815649	Asia region + 'VI'
Fiji	874E46	Pacific Region + 'NF'
Japan	81524A	Asia Region + 'RJ'
New Zealand	874E5A	Pacific Region + 'NZ'
Singapore	815753	Asia Region + 'WS'
Thailand	815654	Asia Region + 'VT'
Viet Nam	815656	Asia Region + 'VV'

Table 3.3-2 – Example of Proposed ADM Value Assignment for Selected Asia/Pacific Entities

3.4 The RDF Field

The RDF field is historical and is not used. Therefore the RDF field shall be set to [0000 0000].

3.5 The ARS Field

The ARS field is used to:

- Distinguish Routing Domains operated by the same State or Organization (in Fixed Network Addressing domains); and

- Identify the aircraft on which the addressed system is located (in Mobile Network Addressing Domains).

Each State or Organization identified in the ADM field will be responsible for assigning the values for the ARS field.

In accordance with the SARPs, for a Mobile Network Addressing Domain, the 24-bit ICAO Aircraft Identifier is inserted in the ARS field. However, no specific values have been specified for Fixed Network Addressing Domains.

The ARS field shall be assigned in a manner that simplifies the routing of data and makes provision for any potential lower level organizational units that could, in the future, operate an ATN Routing Domain.

The MID Regional ATN Addressing Plan recommends the ARS field be decomposed into three subfields as shown in Figure 4.3.5-1: Network ID, Network Group ID and Domain ID.
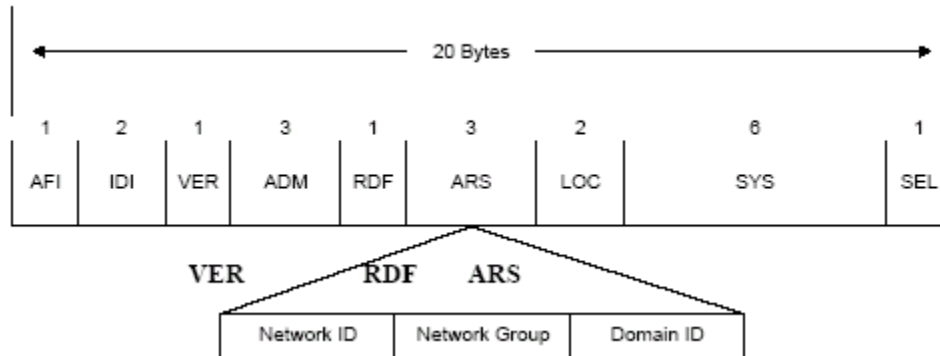

Figure 4.3.5-1 Proposed ARS Field Format

3.5.1 Network ID

Potential future operators of an ATN Routing Domain could be:
- A national Air Traffic Service Organization(s) (ATSO);
- A national military organization;
- A national meteorological organization; and
- An airport operator.

At present it is assumed that military organizations and meteorological organizations will not start up their own ATN Routing Domains and will be located within a national ATSO ATN Routing Domain. The same may apply to airport operators.

However in planning for the long term it is deemed necessary that provision is made available for these future possibilities.

In allowing for this possible expansion, it is recommended that the different ranges of values for the Network ID subfield be allocated to the different national organizations as follows:

- Hexadecimal values [00 – 1F] of the first octet of the ARS field be reserved for the addressing of domains and systems operated by the national ATSO.
- Hexadecimal values [20 – 3F] of the first octet of the ARS field be reserved for the addressing of domains and systems operated by the national military organization.
- Hexadecimal values [40 – 5F] of the first octet of the ARS field be reserved for the addressing of domains and systems operated by the national airport operators. (Note: this range matches the ASCII range of alphabetical upper case characters).
- Hexadecimal values [60 – 7F] of the first octet of the ARS field is reserved for the addressing of domains and systems operated by the national meteorological organization.
- Hexadecimal values [80 – FF] are reserved.

A national organization would then be able to register one or several values for the Network ID subfield within the range that has been reserved for its organization category.

In addition to the Network ID subfield being used for distinguishing the different national organizations, it is proposed that this subfield also be used for the identification of the particular role of the addressed domain. For example, setting the Network ID subfield to the hexadecimal value "01" would represent the set of operational Routing Domains of the national ATSO. Setting

the Network ID subfield to hexadecimal "11" would represent the set of non-operational Routing Domains of the national ATSO. In using the Network ID subfield in this manner, allows national ATSOs to provide for a duplicate non-operational network to be used for trials and pre-operational testing. Similar arrangements could be used for the other national organizations.

3.5.2 Network Group ID

This subfield can be used to subdivide a ground ATN network into smaller groups. This field is unique within a particular network. This may be useful for future expansion by allowing regions to be formed within a particular network as defined by the Network ID. The formation of regions may be useful in helping contain the routing traffic exchanged within the network.

This subfield is also used to designate an RDC. RDCs can also be used to assist in the formation of regions within an Administrative Domain and they offer an additional level of flexibility when used to combine RDs into a confederation. RDCs are designated by setting the uppermost bit of this subfield to "1".

3.5.3 Domain ID

This subfield is a unique identifier assigned to each Routing Domain in the Network Group.

Table 3.5.3-1 shows possible examples on how the ARS field could be used. In the table two Network Groups "01" and "02" are defined. These two Network Groups can for example represent two FIRs in a country. One of the two Network Group contains two RDs and the other one contains three RDs. These two Network Groups can also address the initial RDs in a country (i.e. two RDs) with a planned expansion towards five RDs.

Network ID	Network Group ID	Domain ID	Comment
01	**01**	01	Network ID "01" indicates an ATSO operational network that contain two Network Groups "01" and "02". Network Group "01" contains two RDs "01" and "02". Network Group "02" contains three RDs "01", "02" and "03".
		02	
	02	01	
		02	
		03	

Table 3.5.3-1 – Example of ARS Value Assignment

3.5.4 Addressing RDCs in the ARS field

The Network Group ID subfield is used to segregate the addressing space of actual RDs and RDCs. When the uppermost bit of the Network Group ID subfield is set to "1" the second and third octets of the ARS field are assigned from the RDC addressing space (i.e., 8000-FFFF) and must be unique within that addressing domain. Otherwise, the subfields are assigned from the NSAP Address Space as described above for the Network Group ID and Domain ID subfields.

Similar principles as explained in sections 3.5.2 and 3.5.3 for the addressing of RDs can be applied to the addressing of RDCs, as required:

- The second octet of the ARD field may identify a group of RDCs.
- The third octet of the ARS field identifies RDCs.

3.6 The LOC Field

The LOC field is used to:
- Distinguish Routing Areas within Fixed Routing Domains, identified by the ARS field; and
- Distinguish Routing Areas and Routing domains within aircraft identified by the ARS field.

The assignment of the LOC field value is the responsibility of the State or organization that is the addressing authority for the routing domain in which the identified routing area is contained.

To assist States or organizations, it is recommended that the LOC field be decomposed into two subfields as shown in Figure 3.6-1: Subdomain Group ID and Subdomain ID.
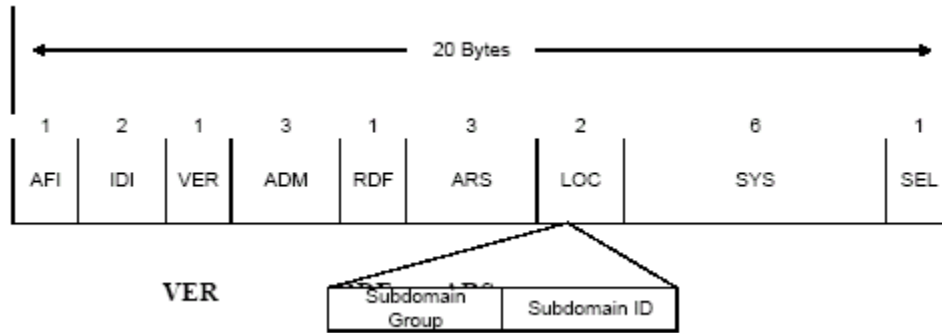
Figure 3.6-1 Proposed LOC Field Format

3.6.1 Subdomain Group ID

This subfield can be used to subdivide a domain into separate groups. For example, each control centre could defined as a routing domain. A control centre may contain an EnRoute facility, Terminal facilities, and Tower facilities. Each of these facilities can be classified as a different Subdomain Group allowing addressing to be delegated to each facility, if desired. For this example, this subfield can be assigned as shown in the Table 3.6.1-1.

Value (hex)	Description
00	Reserved
01	No specific group. Used for RDs that do not require subdivision
02	EnRoute Subdomain
03 - FF	Assigned as required

Table 3.6.1-1 – Example of Subdomain Group ID Value Assignment

3.6.2 Subdomain ID

This subfield is a unique identifier assigned to each routing area within a Subdomain Group. This subfield allows multiple areas to exist within a subdomain group and must be unique within the subdomain. This subfield could be assigned as shown in the Table 4.3.6.2-1.

Value (hex)	Description
00	Reserved
01	No specific area. Used for Subdomains that do not require subdivision
02 - FF	Assigned as required by the Subdomain Group Addressing Authority

Table 3.6.2-1 – Example of Subdomain ID Value Assignment

3.7 The SYS Field

The SYS field is used to uniquely identify an End-System or Intermediate-System. The allocation of the SYS field value is the responsibility of the organization that is the addressing authority for the routing area that contains the identified ATN End-System or Intermediate-System.

The type of values or structure for the SYS field is for individual authorities to choose, as appropriate.

It has been suggested that the 48-bit LAN address of a device attached to an IEEE 802 local area network that is being used as an ATN ES or IS, could be used in this field. However, this may have ramification if the SYS field is tied to a subnetwork dependent information such as the physical network address (e.g. 48-bit LAN address) that is associated with a particular device. The problem will occur when the device is replaced by another device which will use a different 48-bit LAN address, requiring the NSAP address of the ATN ES or IS to be changed.

It is therefore recommended that the SYS field be used to identify the system without any dependency on physical information. Possible examples of this is to define whether the system is an IS or an ES, the type of function or role the system is used for (e.g. primary system, hot standby system, cold standby system, etc.), or the type of applications that are running on the system (e.g. AMHS, AIDC, ADS, CPDLC, Network Management, etc.). A requirement found in Section 7.1.4.b.1 of ISO 10589 IS-IS states that all Level 2 ISs within a Routing Domain must have a unique SYS field value. In order to enforce this requirement related to IS-IS Level 2 addressing, it is recommended that the values assigned to the LOC subfields also be assigned to the upper two octets of the SYS field. Using this approach enables the addressing authority for each Subdomain Group the flexibility to assign addresses without conflicting with addresses of other groups within the same Routing Domain.

3.8 The SEL Field

The SEL field is used to identify the End-System or Intermediate-System network entity or network service user process responsible for originating or receiving Network Service Data Units (NSDUs).

Table 3.8-1 identifies the defined values that shall be used in this field in accordance with Reference 1.

SEL Field Value	Used
[0000 0000]	Used for an IS network entity except in the case of an airborne IS implementing the procedures for the optional non-use of IDRP.
[0000 0001]	Used for the ISO 8073 COTP protocol in the Ground or Airborne End-Systems.
[0000 0010]	Used for the ISO 8602 CLTP protocol in the Ground or Airborne End-Systems.
[1111 1110]	Used for an IS network entity belonging to an airborne IS implementing the procedures for the optional non-use of IDRP.
[1111 1111]	Reserved

Table 3.8-1 - Defined Values for the SEL Field

4. Conclusions

The MID Regional ATN Addressing Plan consists of a set of recommendations for each State to assign regional NSAP addresses in a consistent manner. Using these recommendations, it should be possible to develop efficient routing policies that limit the amount of information exchange while providing comprehensive ATN services. Further, the application of this plan will permit simplified ATN service growth with a minimum of router re-configuration.

5. Recommendations

The members of the IPS Working group to review and comment on the MID Regional ATN Addressing Plan as presented above.

CHAPTER FIVE

ATN using IPS standard:

ATN using IPS standard:

The Internet Protocol suite (IPS) is made of four layers: media access,

network, transport and application. There are three major physical components of the ATN/IPS: IPS host, IPS router and interconnecting sub networks.

IPV6 internetworking

The Internet Protocol (IP) is an unreliable and connectionless protocol that is performed across various technologies of subnetworks. ATN/IPS makes use of IP version 6 (IPv6) (RFC 2640). In comparison with the preceding IPv4, the IP address space has been expanded and more flexibility is provided with additional features.

Mobile (airborne) nodes in the ATN/IPS shall implement Mobile IPv6 (RFC 3775) that allows IPS host to move in the internet from one network to another. Mobile host has two IP addresses , its original address, called home address and a temporary address, called the care-of address.

Interior and exterior routing

To provide sufficient flexibility for the establishment of routing policy in large TCP/IP environment, the Internet is divided into autonomous systems (AS), AS are uniquely identified by AS numbers in Doc 9896, Table 1-1 show the AS number of countries in MID region:

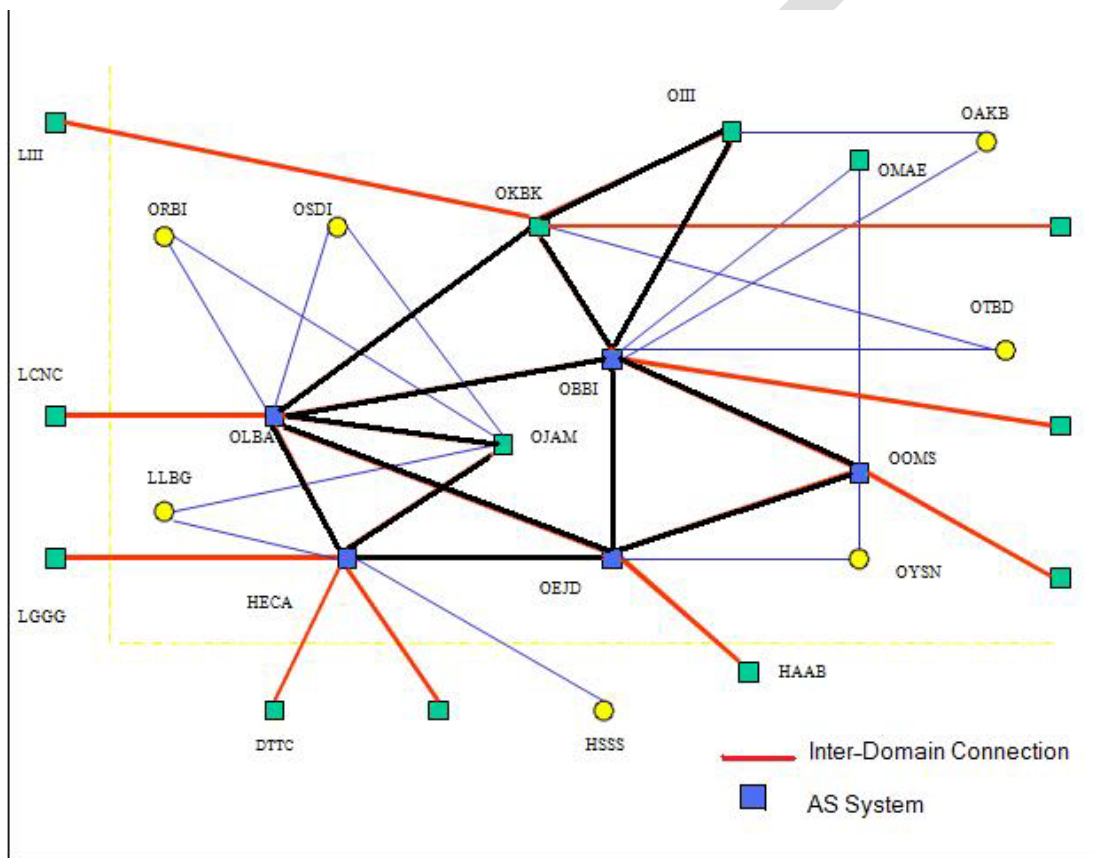| Country	AS Number	Country	AS Number
Bahrain	64590	Lebanon	64596
Egypt	64559	Oman	65256
Iran, Islamic Republic of	64582	Qatar	65269
Iraq	64583	Saudi Arabia	65278
Israel	64584	Syria	65290
Jordan	64588	United Arab Emirates	65299
Kuwait	64593	Yemen	65309

Table 1-1

Mid Region Main centers shall use dual stack IPS router which support IPv6 and IPv4 , IPS routers which support inter-domain dynamic routing shall implement the Border Gateway Protocol (BGP-4), and Static routes can be used with point-to-point Intra-domain connection or RIP routing protocol.

Border Gateway Protocol (BGP)

The border Gateway protocol is the de facto standard exterior routing protocol in Internet, which allows routers in different Ass to cooperate in the exchange of routing information by means of message which are sent over TCP connections.

The BGP-4 algorithm has been expanded to solve the "multi-homing" issue of an AS, that means an AS can have multiple network interfaces so that the connectivity between Ass becomes fault-tolerant incase of network failure.

Transport Protocols

IPS host shall implement the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP), Furthermore ATN/IPS hosts are required to supporting the following registered port numbers:
- tcp 102 for ATSMHS
- tcp 8500 for FMTP
- tcp/udp 5910 for CM
- tcp/udp 5911 for CPDLC
- tcp/udp 5912 for FIS
- tcp/udp 5913 for ADS

Transition Activities:
In addition to what is mentioned in 1.8
- Implementation of IPS Router that support IPv4 and IPv6 .
- Upgrade all systems to support IPv6.
- Implementation of Network Transition Mechanism.

Network Transition Mechanism

Three transitions mechanisms can assist countries to deploy the ATN IPS in a heterogeneous environment:

o Tunnelling: IPv6 has been specified to operate over a variety of lower layer interfaces such as Frame Relay, ATM, HDLC, PPP and LAN technologies. Tunnelling implies that a given protocol is encapsulated into another, meaning that IPv6 would be encapsulated into another functionally equivalent network protocol.

o Dual stack: The dual stack mechanism implies that an implementation handles more than one communications protocol for a given application or function by supporting both IPv4 and IPv6 protocols.

o Translation: Translation mechanisms imply the conversion from one protocol to another. Network Address Translation Protocol Translation (NAT-PT), have been developed in the context of the transition from IPv4 to IPv6 as both versions share a number of common features.

MID AMHS Implementation plan and guidance

EXECUTIVE SUMMARY

(To be developed)

Table of Contents

References

Reference 1	Annex 10
Reference 2	Manual of Detailed Technical Specifications for ATN using ISO/OSI standards and Protocols Doc 9880
Reference 4	Manual on the ATN using IPS standards and protocols (Doc 9896 AN/469)
Reference 5	Middle East AFTN/CIDIN Routing Directory
Reference 6	ICAO Location Indicators – Document 7910
Reference 7	MID Air Navigation Plan and Facilities and Services Implementation Document (ANP- FASID – Doc. 9708)
Reference 8	ASIA/PAC Regional Aeronautical Telecommunication Network (ATN) Planning Documents
Reference 9	EUR AMHS Manual DOC 020 - 4th Edition - April 2009

Abbreviations

The following abbreviations are used in this document:

ADMD	Administration Management Domain
AFTN	Aeronautical Fixed Telecommunication Network
AMHS	ATS Message Handling System
MIDANPIRG	Middle East Air Navigation Planning and Implementation Regional Group
ATN	Aeronautical Telecommunication Network
ATNTTF	ICAO ATN Transition Task Force
ATS	Air Traffic Service
ATSO	Air Traffic Service Organizations
ICAO	International Civil Aviation Organization
ITU-T	International Telecommunication Union Telecommunication Standardization Sector
MHS	Message Handling Service
MTA	Message Transfer Agent
MTCU	Message Transfer and Control Unit
MS	Message store
O/R	Originator/Recipient
PRMD	Private Management Domain
SARP	Standards and Recommended Practices
UA	ATS UserAgent

Chapter 1

Introduction

1.1 <u>AFS</u>

Annex 10 defines the aeronautical fixed service that shall comprise the following systems and applications that are used for ground ground (i.e. point-to-point and/or point-to-multipoint) communications in the international aeronautical telecommunication service:

a) ATS direct speech circuits and networks;

b) meteorological operational circuits, networks and broadcast systems;

c) the aeronautical fixed telecommunications network (AFTN);

d) the common ICAO data interchange network (CIDIN);

e) the air traffic services (ATS) message handling services;

f) the inter-centre communications (ICC).

1.1 <u>AFTN/ CIDIN</u>

1.1.1 The operational requirements for such an information exchange were met by the development of the Aeronautical Fixed Telecommunications Network. The AFTN provides a store-and-forward messaging service for the conveyance of text messages in ITA-2 or IA-5 format, using character-oriented procedures.

1.1.2 Although AFTN served its purpose well for many years, AFTN technology has become outdated due to the fact that is remains bound to its telex/telegraphic origins. One major step towards overcoming the limitations of the AFTN was taken with the introduction of the Common ICAO Data Interchange Network, which is based on packet switching techniques. The CIDIN provides a common transport service for the conveyance of binary or text application messages in an expeditious and reliable manner.

1.2 <u>ATSMHS Overview</u>

1.2.1 The ATN SARPs for the Air Traffic Services Message-Handling Service (ATSMHS) define the ICAO store and forward messaging service used to exchange ATS messages between users over the ATN internet.

1.2.2 The set of computing and communication resources implemented by Air Navigation Service Providers (ANSP) to provide the ATS Message Handling Service is commonly referred to as AMHS (ATS Message Handling System). The ATS Message Handling System SARPs are compliant with mature message handling systems standards such as ITU-T X.400.

1.2.3 ATSMHS End Systems:

Four End systems comprising ATSMHS system:

1. ATS Message User Agent: The component provides the user interface for message submission to the AMHS and message delivery from the AMHS. For the support of the extended ATSMHS, an ATS message user agent shall include a DUA.

2. ATS Message Server: The component accepts, relays and delivers messages in a store-and-forward fashion and serves attached ATS Message User Agents. An ATS message server shall include an MTA and optionally one or several MS, For the support of the extended ATSMHS, an ATS message server shall include a DUA.

3. AFTN/AMHS Gateway: The gateway serves as a bridge between the AFTN and AMHS by performing mutual conversions between AMHS and AFTN information objects.

1.2.4 Functional Objects

The systems comprising the AMHS shall themselves be comprised of the following functional objects**:**

   a) Message Transfer Agent(s) (MTA); which performs the function of the message switch.

b)   User Agent(s) (UA); which performs the user access to the MTA and provides an appropriate user interface.

c)   Message Store(s) (MS); which provides the intermediary storage between MTA and UA and is usually co-located with the MTA.

d) Access Unit(s) (AU); which provides for intercommunication with other Messaging Systems.

Chapter 2

Topology & Routing strategy

This chapter presents a plan on the ATN ground activities applicable to the ICAO MID Region. It provides also information on the ground infrastructures required to support the ATN and to take into consideration progressively the ATN air-to-ground requirements of the Region.

2.1 The current ground infrastructure

2.1.1   The present ground-ground data communications system in the Middle Region comprises AFTN circuits and centers (tributary and main) that allow the exchange of ATS and other operational messages.

2.1.2   Five States of the Region already implemented the Common ICAO Data Interchange Network (CIDIN) as an upgrade of the low speed AFTN circuits to improve the efficiency and reliability of message exchange. These CIDIN circuits are operating at 9600Bps and the remaining circuits at 50 Bps to 300 Bps, using asynchronous protocols.

2.1.3   The detail of international circuits operating within the Region and between neighboring regions. is documented in Table CNS 1A of the ICAO MID CNS Facilities and Services Implementation Document (FASID). And provided by AMC.

2.1.4   The current AFTN topology in the Region shows that the majority of circuits will not be suitable to be used for the ATN without some form of upgrade. In later stage, it will be necessary to identify those circuits that need to be upgraded in both bandwidth and protocols.

2.1.5   With regard to bandwidth requirements, it is assumed that 64Kbps or higher shall be used for Intra-regional connections while 64Kbps (based on agreement with other regions) or higher speed could be preferred for Inter-Regional connections when full ATN is implemented.

2.1.6   It is important to note that some States have already started the

establishment of a communication infrastructure that would serve the ATN. There have been implementations of high speed point-to-point digital links operating at 64KBPS and carrying voice and data traffic.

2.1.7   In respect to the upgrade of protocols, it is expected that they will be implemented on a bilateral arrangements between States according to the preferred protocols: prefaraberly TCP/IP V.6. Frame Relay or Asynchronous Transfer Mode (ATM) or any other protocol that will be included in the ICAO Standards in future.

2.1.8   It can happen that due to different planning activities, by States, not all States within the MID Region will be migrating to the ATN at the same time. Therefore, there will be a need to maintain the existing AFTN circuits as well as a provision for an AMHS/AFTN Gateway; to operate in parallel with any new implementation of high-speed links to meet ATN requirements and could migrate the AFTN.

2.1.9   With the introduction of AMHS as the replacement for AFTN/CIDIN, a number of AFTN circuit links between centers will need to be upgraded to cater for the increase of traffic load generated by AMHS overheads. Analysis carried out in other Regions showed that there will be significant overheads generated by AMHS for a typical message of about 250 bytes. As the message size increases the amount of overheads generated becomes less significant to the size of the body of the message. In transitioning from AFTN/CIDIN to AMHS, States will have to anticipate this increase in bandwidth to accommodate AMHS traffic so as to maintain current or better performance of traffic delivery.

2.1.10   States will need to ensure that not only are the links that are established between States are capable of transferring data in a timely manner but also for those links that provide an alternate path for the applications to use in times of disruption to the primary links.

2.2 Target AMHS Topology

There are many possibilities how to interconnect a given set of nodes, The fully meshed topology can fulfill the maximum performance, various network topologies can be implemented, ATN/IPS WG members tasked to study different solutions.

- To be developed -

2.3 AMHS Routing

Routing to a destination which is adjacent to the source is referred to as *direct routing*. Routing to a more distant destination is called *indirect routing* (in the above figure from A to B).

2.3.1 Static and dynamic routing

Static routing is based on fixed paths across a given topology; in the event of topology changes pre-defined, alternative paths may be used. In contrast, with *adaptive* or *dynamic* routing, routing paths are updated by means of an algorithm when the topology or traffic load distribution change. AMHS routing is considered as "static.

2.3.2 The nature of MHS (AMHS) routing

Message Handling Systems transfer messages between users (UAs) in a store-and-forward manner. A message submitted by the originator will be transferred through one or more MTAs and delivered to one or more recipients (UAs). The originator does not specify the route (i.e. the MTAs to be passed) but identifies a recipient by means of its OR-address (or directory name). It is the responsibility of each routing MTA to determine the next MTA to which the message should be transferred to progress its journey to its recipient(s).

The connections between MTAs are, from the MHS point of view, realised by pair-wise established application associations. We can also interpret such an association between a pair of MTAs as "logical link" as an established association is not of physical nature.

2.3.3 Interrelations with underlying network services

In implementations, logical links (or associations) make use of underlying network services offered by an appropriate network infrastructure.

1) A meshed *MHS network (topology)* allows alternate MHS routing paths between an originating UA and a recipient´s UA by passing alternate MTAs and logical links;

2) a meshed *Internet* allows alternate network paths between a pair of MTAs by using alternate routers and subnetworks; and

3) general-topology sub networks allow alternate sub network paths between given pairs of routers by using alternate switching nodes and physical links.

Chapter 3

Addressing and Naming Plan

3.1 Introduction

This chapter provides technical guidance on the addressing and naming convention for the transition of ground Aeronautical Fixed Telecommunication Network (AFTN) services to the ATS Message Handling System (AMHS) within the MID region.

An extract of the AMHS Register from the main ICAO register for the MID States is provided in this part for planning and implementation.

This document presents the naming assignment conventions for allocating Originator/Recipient (O/R) names to be used for the ATS Message Handling System (AMHS) in the MID Region.

The information contained in this document is drawn from a number of developments and will be continued to be updated by the IPS Working group members

The scope of this chapter includes:

- Describing the attributes of the AMHS address format, and
- Recommending the values for the relevant attributes that are to be used in the AMHS address.

The MID Regional ATN AMHS naming convention presented here will comply with the relevant formats as specified in ICAO Doc. 9880 (Reference 1). The MID Regional ATN AMHS Naming Plan defines the method for assigning values to each of the relevant attributes of the AMHS address. States within the Region may choose to assign their AMHS addresses based upon the recommendations found here.

3.2 MF-Addressing Format

ICAO Document 9880 (Reference 1) states that the AMHS shall be organizationally composed of AMHS Management Domains. These AMHS Management Domains may

elect to operate as either an Administration Management Domain (ADMD) or a Private Management domain (PRMD), depending on the national telecommunications regulation in force in the country where it operates and on its relationships with other Management Domains.

Each AMHS user within an AMHS Management Domain is assigned an Originator/Recipient (O/R) name, which is also referred to as a MHS-form address (MF-address). The attributes of a MF-address Shall comprise an AMHS management domain identifier (which known as a high level addressing) and low level attributes either XF or CAAS scheme.

The attributes of an AMHS management domain identifier are described in the table below.

Table 2.1-1 AMHS Management Domain Identifier Attributes

Attribute	Notation	Value
Country-name	C	XX
Administrative Domain Name (ADMD)	A	ICAO
Private Domain name (PRMD)	P	

3.3 MF-Addressing Scheme

An AMHS management domain should avoid deviating from the common AMHS addressing scheme and refrain from implementing a locally defined AMHS addressing scheme unless specific unavoidable constraints (e.g. regulatory) apply to the AMHS management domain.

The ATN SARPs have defined two addressing schemes format.

3.3.1 XF Addressing Scheme (translated Form Address)

ICAO Document 9880(Reference 1) stipulates that the XF-address of a direct or indirect AMHS user shall be composed exclusively of the following:

A) An AMHS Management Domain,as described in 2.1
B) An Organization-name Attribute (O):
Taking the four-character value "AFTN"
C) An Organizational-unit-name Attribute (OU): comprising a sequence of one single element, which takes the 8-character alphabetical value of the AF-address (AFTN-form address) of the user.

Attribute	Notation	Value
Country-name	C	XX
Administrative Domain Name (ADMD)	A	ICAO
Private Domain name (PRMD)	P	ATSO registered private domain
Organization-name Attribute	O	AFTN
Organizational-unit-name	OU	8-letters AFTN address

It is recommended that States who have already started implementing the XF-Address format can do so but should consider migrating to the MF-Address format as soon as is practical.

3.3.2 *Common AMHS Addressing Scheme* **(CAAS)**

common AMHS addressing scheme shall be composed exclusively of:

2.2.7.1.1.1   an   AMHS   management   domain   identifier   as specified in 2**.1**

2.2.7.1.1.2   an *organization-name (O)* attribute taking a value representing a geographical unit

2.2.7.1.1.3   An   organizational-unit-names   (OU)   attribute comprising a sequence of a single element which takes the four-character alphabetical value of the location indicator included in the AF-address of the user.

2.2.7.1.1.4   a *common-name* attribute **(CN)** which takes the eight-character alphabetical value of the AF-address of the user

Attribute	Notation	Assign By	Value
Country-name	C	ITU-T	XX
Administrative Domain Name (ADMD)	A	ICAO	ICAO
Private Domain name (PRMD)	P	ATSO	ATSO registered private domain
Organization-name Attribute	O	ATSO	A value representing a geographical unit
Organizational-unit-name	OU	ATSO	four-character alphabetical value of the location indicator included in the AF-address of the user.
Common Name	CN	ATSO	8-letters AFTN

			address

It has been proposed in the ATN Panel working groups that a common naming convention be used worldwide to help stream line the addressing scheme and to ensure compatibility and consistency with other neighboring regions. This scheme would be based on the work that has been ongoing in Europe. It was also stressed that if States have not already started their implementation programs for AMHS that when planning to do so that they should adopt the MF-Address format over the XF-Address format.
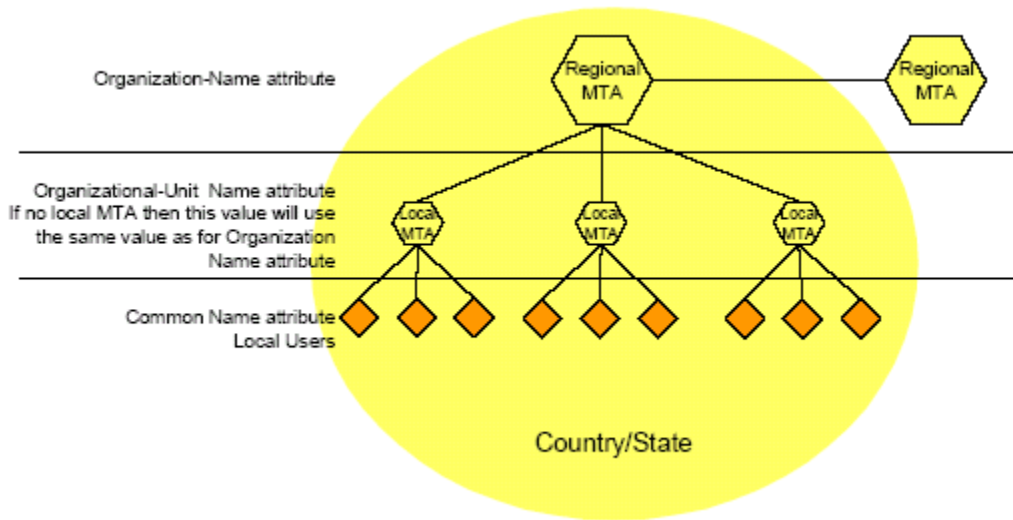
A complete list of attributes with different information concerning on the maximum length and type of allowed characters for each attribute type is provided in the following Table:

O/R address Attributes	Max Length
Country name	2 alpha or 3 numeric

ADMD name	24 PrintableString
PRMD name	24 PrintableString
Organisation name	64 PrintableString
Organisational unit name	32 PrintableString
Common name	64 PrintableString

Table XX: Mnemonic O/R address attributes maximum length and types

MID Region AMHS addresses

State		ATS Address					
State Name	**Nationality Letters or Designator**	**C**	**ADMD**	**PRMD**	**Addressing scheme**	**OU (for CAAS only)**	**Comments**
Bahrain	OB	XX	ICAO	OB	CAAS	see Table OB	confirmed by SL
Egypt	HE	XX	ICAO	HE	CAAS	HECA	confirmed by SL
Iran	OI	XX	ICAO	OI	XF		confirmed by SL
Iraq	OR	XX	ICAO	OR	XF		
Jordan	OJ	XX	ICAO	OJ	CAAS	OJAC	confirmed by SL
Kuwait	OK	XX	ICAO	OK	XF		
Lebanon	OL	XX	ICAO	OL	XF		
Oman	OO	XX	ICAO	OO	XF		
Qatar	OT	XX	ICAO	OT	XF		
Saudi Arabia	OE	XX	ICAO	Saudi Arabia	CAAS	OEJN	confirmed by SL

Syrian Arab Republic	OS	XX	ICAO	OS	XF		
UAE	OM	XX	ICAO	UAE	CAAS	OMAE	confirmed by SL
Yemen	OY	XX	ICAO	OY	XF		

2.3 AMHS Naming scheme

For the support of the extended ATSMHS, the directory name of an AMHS user shall comply with the provisions of Part IV of ICAO doc 9880.

- *To be developed* -

MID AHMS Implementation

Com Center	Instal lation	Oper ation	MTA Name	AFT N/A MH S Gate way	ATS UA	ATS service level	Protocol (IPS, ATN)	Remarks
Bahrain	**2008**	**-**	**MTA-OBBI-1**	**Y**	**Y**	**Extend ed**	**Dual Stack**	**Support IPv4 only**
Egypt	**2008**	**2010**	**MTA-HECA-1**	**Y**	**N**	**Extend ed**	**Dual Stack**	**Support IPv4 only**
Iran	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Iraq	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Jordan	**2008**	**2010**	**MTA-OJAM-**	**Y**	**Y**	**Extend**	**Dual Stack**	**Support IPv4**

			1			ed		only
Kuwait		-	MTA-OK-1	**Y**	**Y**	**Extend ed**		**Support IPv4 only**
Lebanon	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**
Oman	**2008**	**2009**	MTA-OOMS-1	**Y**	**Y**	**Extend ed**		**Support IPv4 only**
Qatar		**-**	MTA-OTBD-1	**Y**	**Y**			**Support IPv4 only**
Saudi	**2008**	**2010**	MTA-OEJN-1	**Y**	**Y**	**Extend ed**	**Dual Stack**	**Support IPv4 only**
Syria	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**
UAE	**2006**	**2009**	MTA-OMEA-1	**Y**	**Y**	**Basic**		**Support IPv4 only**
Yemen	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**

CHAPTER FOUR

Testing Strategy

4.1 Introduction

MID region adopted European AMHS testing strategy, to ensure common interpretation of the SARPs and reduce the changes of implementation, European Experience has shown that, although it is claimed that systems have been implemented according to the one set of protocol specifications, they are often not capable of inter-working. This is due to errors in implementation or to different interpretations of the specifications(SARPs). Testing and validation of systems according to the same set of principles aims at the detection of such errors and the prevention of incompatibility instances.

4.2AMHS testing Phases:

4.2.1 AMHS Conformance testing:

Conformance testing is recommended and can be performed in parallel with or after the acceptance testing of a new system, the main AMHS functional areas covered by conformance testing are:

- Transfer of messages probes and reports.
- Submission of messages and probes/ delivery of messages and reports
- Intercommunication with AFTN.
- Naming and addressing
- System Management functions

The Conformance testing methodologies, configurations and procedures are defined in Appendix D of EUR DOC 020 (AMHS Manual).

4.2.2 Underlying Network Testing.

Before starting doing testing with adjacent center, its recommended to test the infrastructure network, assigning IP address, take all security measure, permit access via port 102 only.

4.2.3 AMHS Interoperability testing:

Interoperability testing considered Mandatory testing in order to ensure the end-to-end interoperability between AMHS systems under test. First step to this testing the interconnection between pairs of systems should be established and checked. AT bilateral level, the following functional area should be covered:

+ Submission, Transfer and delivery operation (AMHS to AMHS)
+ Gateway operations (AFTN to AMHS, AMHS to AFTN and AFTN to AMHS to AFTN)
+ Stress traffic situations
+ Submission /Transfer/Delivery and relay operations.

The Interoperability testing methodologies, configurations and procedures are defined in Appendix E of EUR DOC 020 (AMHS Manual).

Additional functions can tested with trilateral test.

Configuration and report templates are at Appendix A of this doc.

4.2.4 AMHS Pre-operational testing:

Pre-operational testing should be carried out between the AMHS systems concerned before going into operation. The objectives of the AMHS Pre-operational Tests are:

1. To test the interoperability between the AMHS systems in an operational environment.

2. To test the integrity of the messages exchanged.

3. To test the message exchange after a disturbance (e.g. queued messages).

The messages used in the AMHS Pre-operational Tests are generated either:

      • Manually; or

      • using parallel duplicated traffic;

The preoperational testing methodologies, configurations and procedures are   defined in Appendix F of EUR DOC 020 (AMHS Manual).

Configuration and report templates are at Appendix B of this doc.

Chapter 5

Underlying Network

5.1 Background

The designers of OSI assumed that this model (and the protocols developed within the framework of this model) would come to dominate computer communications, eventually replacing proprietary protocol implementations and rival multi-vendor models as the Internet Protocol Suite (IPS).This has not happened. Although many useful protocols have been developed in the context of OSI, the overall seven-layer model has not flourished. Instead, the IPS architecture has become dominate. There are a number of reasons for this outcome. Perhaps the most important is that the key IPS protocols were mature and well tested at a time when similar OSI protocols were in the development stage. Another reason is that the OSI model is unnecessarily complex.

At the time of starting the ATN specifications in the early 90ties, there was a common believe that the OSI model would become the ultimate standard for data communication. In this view, the high level technical requirement was set up that the ATN shall use ISO communication standards

5.2 OSI/ISO Standard

MID Region states agreed to deploy ATN/IPS as a standard network in the region, and in order to ensure interoperability with Adjacent Region, its recommended that all centres have connection with ICAO Region utilising ATN/OSI, should have the capability to use this protocol.

5.2.1 NSAP Addressing Plan

To find a suitable ATN addressing convention that would be acceptable for use in the MID region requires a routing architecture that minimizes routing updates and over heads within the ground ATN infrastructure for both ground-ground and air-ground services and applications.

The ATN addressing convention must allow for an addressing scheme that is:

- Practical - to provide autonomous administration of ATN addresses for States and Organizations, and
- Flexible - to allow for future expansion and/or routing re-configuration of the ground ATN infrastructure with minimal re-assigning of ATN addresses.

The recommendations proposed in the MID Regional ATN Addressing Plan take advantage of the work performed by the European ACCESS1 Project (Reference 3).

1 ACCESS (ATN Compliant Communications European Strategy Study) is a project funded by the European Commission and jointly produced by the following companies and administrations: National Air Traffic Services (NATS), Deutsche Flugsicherung (DFS) and Service Technique de la Navigation Aerienne (STNA).

5.2.1.1 NSAP Address Format

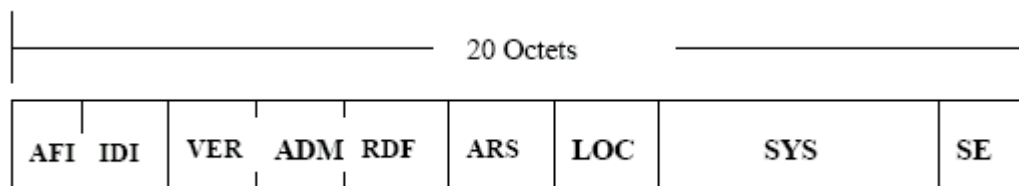The structure of the Network Service Access Point (NSAP) address is depicted in Figure 5.

Figure 5 NSAP Address Format

The NSAP address structure contains 9 fields, which are described in Table 4.2-1.

Field Name	Field Description	Size	Syntax	Number of Characters/ Digits	Field Encoding
AFI	Authority and format Identifier	1 Octet	Decimal	2 Digits	BDC
IDI	Initial domain Identifier	2 Octets	Decimal	4 Digits	BCD
VER	Version	1 Octet	Hex	2 Digits	Binary
ADM	Administration Identifier	3 Octets	Alpha or Hex/Alpha	3 Characters 2 Digits/ 2 Characters	IA-5 Binary/ IA-5
RDF	Routing Domain Format	1 Octet	Hex	2 Digits	Binary
ARS	Administration Region Selector	3 Octets	Hex	6 Digits	Binary
LOC	Location	2 Octets	Hex	4 Digits	Binary
SYS	System Identifier	6 Octets	Hex	12 Digits	Binary
SEL	NSAP Selector	1 Octet	Hex	2 Digits	Binary

Table 4.2-1 - Encoding Rules for the ATN NSAP

3 Recommendations For NSAP Address Fields Assignments

5.2.1.2 The AFI and IDI Fields

The ATN Internet SARPs (Reference 1) require allocation of the following values:

- Decimal for the AFI field to indicate the type of NSAP being used. This value has been assigned the character sequence "47".
- Decimal for the IDI field to designate ICAO. This value has been assigned the character sequence "0027".

As recommended in Reference 1, ATN NSAP addresses and NETs will be written as the character sequence "470027+" where the "+" is used to separate the Binary Coded Decimal (BCD) fields from subsequent Hexadecimal fields.

Hence the AFI and IDI fields will be set to 470027 for fixed ATSC systems/domains and for mobile ATSC systems/domains.

5.2.1.3 The VER Field

The VER field is used to partition the ATN Network Addressing domain into a number of sub-ordinate Addressing Domains.

The values currently specified in Reference 1 for the VER field are summarized in Table

3.2-1.

VER Field Value	Network Addressing	Common NSAP	Value to be used by

	Domain	Address Prefix for Domain	States of MID region
[0000 0001]	Fixed AINSC	470027+01	
[0100 0001]	Mobile AINSC	470027+41	
[1000 0001]	Fixed ATSC	470027+81	470027+81 (ATSO Iss and Ess)
[1100 0001]	Mobile ATSC	470027+C1	470027+C1 (General Aviation)

Table 3.2-1 - Defined Values for the VER Field

5.2.1.4 The ADM Field

The ADM field is used to further partition the ATN Network Addressing Domain. The field designates a single State or Organization. Depending on what the VER field is set to will determine what values should be used in the ADM field.

When the VER field is set to "81" (Fixed ATSC), the ATN SARPs permits two possible ways for encoding the ADM field.

The first method recommends that the State's three character alphanumeric ISO country code is used, as defined in ISO 3166. States may choose this method, however it will provide less flexibility than the second method for the addressing of regional entities (e.g. regional RDCs or regional organizations that are not country specific).

The second method that is recommended for use in the MID region is to use the first octet of the field to define the ICAO region. This would permit the reduction of the routing information that would otherwise be generated. It is recommended that the remaining two octets of the field will further identify the country, RDCs and the regional organizations that are not country specific as follows:

- For the identification of a country, it is recommended that States use the ICAO two letter location indicator (Reference 4) instead of the two character alphanumeric ISO 3166 country code. The structure of the ICAO two letter location indicator allows for a more efficient identification of a location. For example, indicators starting with the same letter "V" designate several countries in the same local region (e.g. Thailand, Sri Lanka, India, Cambodia etc.). The second letter will actually define the specific country within this local region (e.g. "VT" for Thailand, "VC" for Sri Lanka etc.). Where a country has several ICAO two letter location indicators allocated to it, the assigning authority of the ADM field will be responsible in determining the preferred location indicator to represent that country. For example, the indicators "VA", "VI", "VO", "VE" are assigned to India and one of these indicators will be selected to represent India. The encoding of the ICAO two letter location indicators will be upper case alphanumeric values.

- For regional organizations that are not country specific, it is recommended to allocate a lower case alphanumeric value so as there will be no conflict with the ICAO two letter location indicators.

- For the addressing of RDCs (e.g. Island RDCs, Backbone RDCs), in particular for those that are not country specific, it is recommended to allocate codes with the most significant bit set to 1 in the second octet. Valid values would be in the hexadecimal range [8000 – FFFF].

ICAO MID Regional group would be the allocation authority of the ADM field.

In summary, the values allocated for the ADM field is indicated in Table 3.3-1.

VER Field Network Addressing Domain	ADM Field Values
Fixed AINSC	Derived from the set of three-character alphanumeric characters representing an IATA airline or an Aeronautical Stakeholder Designator.
Mobile AINSC	Derived from the set of three-character alphanumeric characters representing an IATA airline or an Aeronautical Stakeholder Designator.
Fixed ATSC	To allow for efficient routing information to be exchanged, it is proposed that the ICAO Regional code be used in the first octet of the ADM field followed by the ICAO two-letter location indicator for countries. The Regional codes are shown below. Regional Codes: [1000 0000] Africa [1000 0001] Asia [1000 0010] Caribbean [1000 0011] Europe [1000 0100] Middle East [1000 0101] North America [1000 0110] North Atlantic [1000 0111] Pacific [1000 1000] South America For example Thailand would be represented by the following

	hexadecimal sequence: 815654. Table 4.3.3-2 provides further examples for a selected number of countries. Where a two letter country code is not applicable, the following rules would apply: ICAO would assign lower case alphanumeric characters using a two letter value to organizations that wish to be based in a particular region. For example, if an organization is to be based in the Pacific region and wanted to be represented by the characters 'sa', this would be represented by the following hexadecimal sequence: 877361 ICAO would assign regional codes for RDCs where a country code or organization code is not applicable. Values would be assigned with the most significant bit set to 1 in the second octet. For example a RDC established in the Pacific region would be represented by the following hexadecimal sequence: 878100.
Mobile ATSC	As for Fixed ATSC

Table 3.3-1 - Defined Values for the ADM Field

Fixed or Mobile MID ATSC Addressing Domain	Hexadecimal Code of the ADM Field	Comment
Australia	875942	Pacific Region + 'YB'
China	815A42	Asia Region + 'ZB'
India	815649	Asia region + 'VI'
Fiji	874E46	Pacific Region + 'NF'
Japan	81524A	Asia Region + 'RJ'
New Zealand	874E5A	Pacific Region + 'NZ'
Singapore	815753	Asia Region + 'WS'
Thailand	815654	Asia Region + 'VT'
Viet Nam	815656	Asia Region + 'VV'

Table 3.3-2 – Example of Proposed ADM Value Assignment for Selected

MID Region Entities

5.2.1.5 The RDF Field

The RDF field is historical and is not used. Therefore the RDF field shall be set to [0000 0000].

5.2.1.6 The ARS Field

The ARS field is used to:

• Distinguish Routing Domains operated by the same State or Organization (in Fixed Network Addressing domains); and
• Identify the aircraft on which the addressed system is located (in Mobile Network Addressing Domains).

Each State or Organization identified in the ADM field will be responsible for assigning the values for the ARS field.

In accordance with the SARPs, for a Mobile Network Addressing Domain, the 24-bit ICAO Aircraft Identifier is inserted in the ARS field. However, no specific values have been specified for Fixed Network Addressing Domains.

The ARS field shall be assigned in a manner that simplifies the routing of data and makes provision for any potential lower level organizational units that could, in the future, operate an ATN Routing Domain.

The MID Regional ATN Addressing Plan recommends the ARS field be decomposed into three subfields as shown in Figure 4.3.5-1: Network ID, Network Group ID and Domain ID.

Figure 4.3.5-1 Proposed ARS Field Format

5.2.1.5.1 Network ID

Potential future operators of an ATN Routing Domain could be:

• A national Air Traffic Service Organization(s) (ATSO);
• A national military organization;
• A national meteorological organization; and
• An airport operator.

At present it is assumed that military organizations and meteorological organizations will not start up their own ATN Routing Domains and will be located within a national ATSO ATN Routing Domain. The same may apply to airport operators.

However in planning for the long term it is deemed necessary that provision is made available for these future possibilities.

In allowing for this possible expansion, it is recommended that the different ranges of values for the Network ID subfield be allocated to the different national organizations as follows:

- Hexadecimal values [00 – 1F] of the first octet of the ARS field be reserved for the addressing of domains and systems operated by the national ATSO.
- Hexadecimal values [20 – 3F] of the first octet of the ARS field be reserved for the addressing of domains and systems operated by the national military organization.
- Hexadecimal values [40 – 5F] of the first octet of the ARS field be reserved for the addressing of domains and systems operated by the national airport operators. (Note: this range matches the ASCII range of alphabetical upper case characters).
- Hexadecimal values [60 – 7F] of the first octet of the ARS field is reserved for the addressing of domains and systems operated by the national meteorological organization.
- Hexadecimal values [80 – FF] are reserved.

A national organization would then be able to register one or several values for the Network ID subfield within the range that has been reserved for its organization category.

In addition to the Network ID subfield being used for distinguishing the different national organizations, it is proposed that this subfield also be used for the identification of the particular role of the addressed domain. For example, setting the Network ID subfield to the hexadecimal value "01" would represent the set of operational Routing Domains of the national ATSO. Setting the Network ID subfield to hexadecimal "11" would represent the set of non-operational Routing Domains of the national ATSO. In using the Network ID subfield in this manner, allows national ATSOs to provide for a duplicate non-operational network to be used for trials and pre-operational testing. Similar arrangements could be used for the other national organizations.

- **NETWORK GROUP ID**

This subfield can be used to subdivide a ground ATN network into smaller groups. This field is unique within a particular network. This may be useful for future expansion by allowing regions to be formed within a particular network as defined by the Network ID. The formation of regions may be useful in helping contain the routing traffic exchanged within the network.

This subfield is also used to designate an RDC. RDCs can also be used to assist in the formation of regions within an Administrative Domain and they offer an additional level of flexibility when used to combine RDs into a confederation. RDCs are designated by setting the uppermost bit of this subfield to "1".

- **Domain ID**

This subfield is a unique identifier assigned to each Routing Domain in the Network Group.

Table 3.5.3-1 shows possible examples on how the ARS field could be used. In the table two Network Groups "01" and "02" are defined. These two Network Groups can for example represent two FIRs in a country. One of the two Network Group contains two RDs and the other one contains three RDs. These two Network Groups can also address the initial RDs in a country (i.e. two RDs) with a planned expansion towards five RDs.

Network ID	Network Group ID	Domain ID	Comment
01	**01**	01	Network ID "01" indicates an ATSO operational network that contain two Network Groups "01" and "02". Network Group "01" contains two RDs "01" and "02". Network Group "02" contains three RDs "01", "02" and "03".
		02	
	02	01	
		02	
		03	

Table 3.5.3-1 – Example of ARS Value Assignment

3.5.4 Addressing RDCs in the ARS field

The Network Group ID subfield is used to segregate the addressing space of actual RDs and RDCs. When the uppermost bit of the Network Group ID subfield is set to "1" the second and third octets of the ARS field are assigned from the RDC addressing space (i.e., 8000-FFFF) and must be unique within that addressing domain. Otherwise, the subfields are assigned from the NSAP Address Space as described above for the Network Group ID and Domain ID subfields.

Similar principles as explained in sections 3.5.2 and 3.5.3 for the addressing of RDs can be applied to the addressing of RDCs, as required:

- The second octet of the ARD field may identify a group of RDCs.
- The third octet of the ARS field identifies RDCs.
  - **The LOC Field**

The LOC field is used to:

- Distinguish Routing Areas within Fixed Routing Domains, identified by the ARS field; and
- Distinguish Routing Areas and Routing domains within aircraft identified by the ARS field.

The assignment of the LOC field value is the responsibility of the State or organization that is the addressing authority for the routing domain in which the identified routing area is contained.

To assist States or organizations, it is recommended that the LOC field be decomposed into two subfields as shown in Figure 3.6-1: Subdomain Group ID and Subdomain ID.
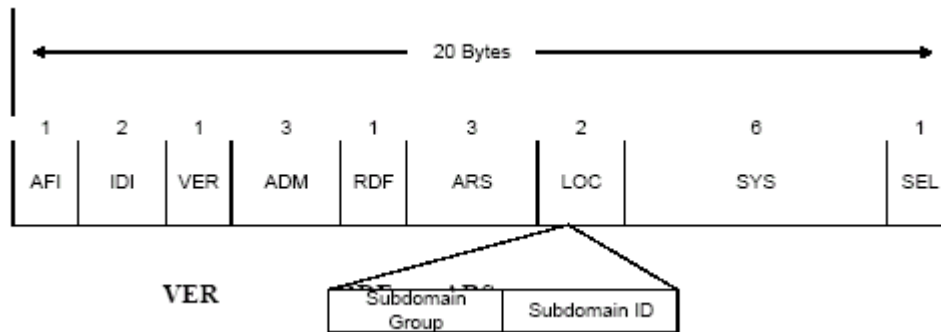
5.3 ATN using IPS standard:

The Internet Protocol suite (IPS) is made of four layers: media access, network, transport and application. There are three major physical components of the ATN/IPS: IPS host, IPS router and interconnecting sub networks.

5.3.1 Overview

The logical connection (links) of the AMHS topology implemented by means of a transport service could make use of the physical connectivity provided by a layer-3 network infrastructure.

ATS Message Server A   ATS Message Server B

Logical Connection
(AMHS Topdogy)

Application   Application
Presentation   Presentation
Session   Session
TSAP   Transport   Transport Connection   Transport   TSAP
Networks   Networks

Transport
Network

Network Infrastructure

Network Connection

Considered levels of connectivity in the AMHS architecture
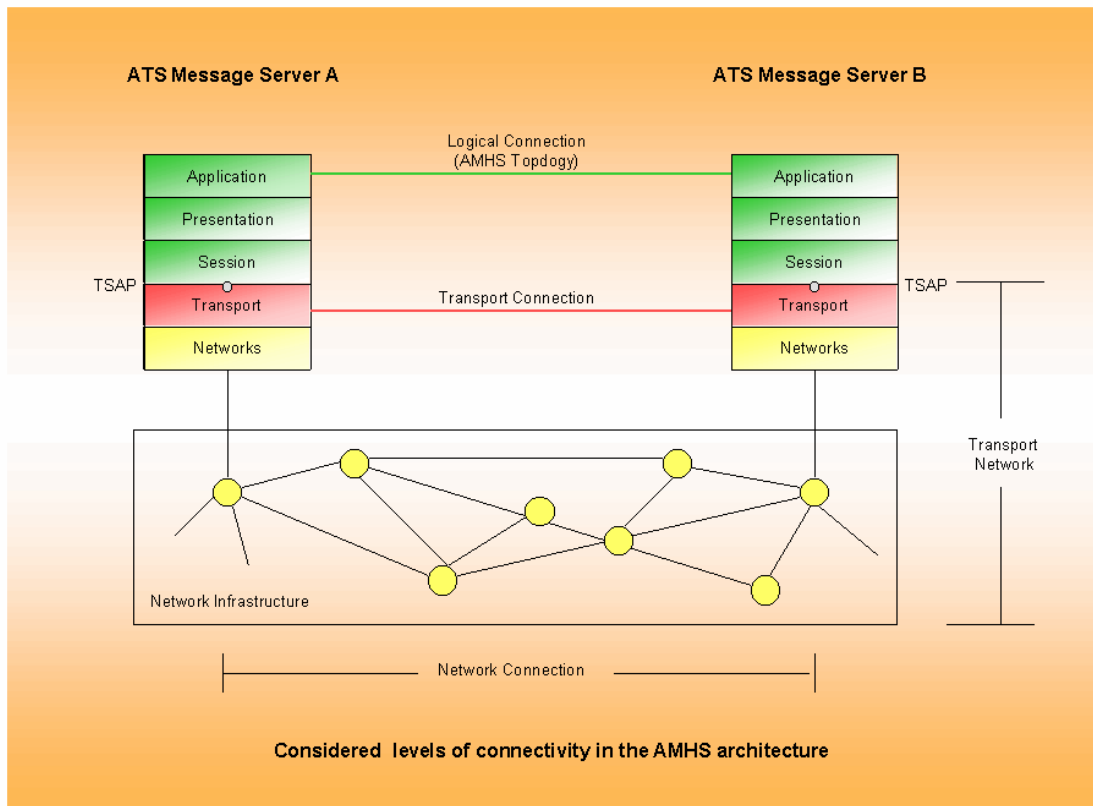
5.3.2 IPV6 internetworking

The Internet Protocol (IP) is an unreliable and connectionless protocol that is performed across various technologies of subnetworks. ATN/IPS makes use of IP version 6 (IPv6) (RFC 2640). In comparison with the preceding IPv4, the IP address space has been expanded and more flexibility is provided with additional features.

Mobile (airborne) nodes in the ATN/IPS shall implement Mobile IPv6 (RFC 3775) that allows IPS host to move in the internet from one network to another. Mobile host has two IP addresses , its original address, called home address and a temporary address, called the care-of address.

5.3.3. Interior and exterior routing

To provide sufficient flexibility for the establishment of routing policy in large TCP/IP environment, the Internet is divided into autonomous systems (AS), AS are uniquely identified by AS numbers in Doc 9896, Table 1-1 show the AS number of countries in MID region:

Country	AS Number	Country	AS Number
Bahrain	64590	Lebanon	64596
Egypt	64559	Oman	65256
Iran, Islamic Republic of	64582	Qatar	65269
Iraq	64583	Saudi Arabia	65278
Israel	64584	Syria	65290
Jordan	64588	United Arab Emirates	65299
Kuwait	64593	Yemen	65309

Table 1-1

Mid Region Main centers shall use dual stack IPS router which support IPv6 and IPv4 , IPS routers which support inter-domain dynamic routing shall implement the Border Gateway Protocol (BGP-4), and Static routes can be used with point-to-point Intra-domain connection or RIP routing protocol.

5.3.4 Border Gateway Protocol (BGP)

The Border Gateway protocol is the de facto standard exterior routing protocol in Internet, which allows routers in different Ass to cooperate in the exchange of routing information by means of message which are sent over TCP connections.

The BGP-4 algorithm has been expanded to solve the "multi-homing" issue of an AS, that means an AS can have multiple network interfaces so that the connectivity between Ass becomes fault-tolerant incase of network failure.
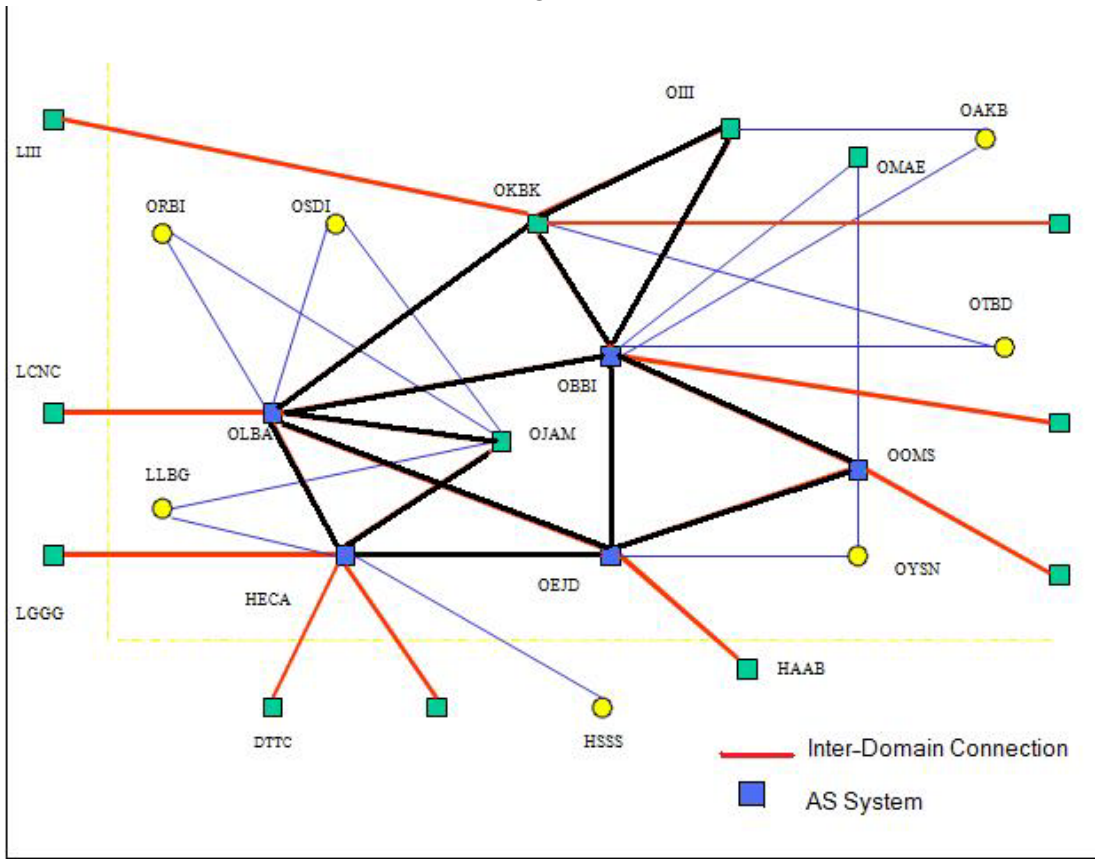
5.3.5 Transport Protocols

IPS host shall implement the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP), Furthermore ATN/IPS hosts are required to supporting the following registered port numbers:

- tcp 102 for ATSMHS

5.3.6 Transition Activities:

In addition to what is mentioned in 1.8

- Implementation of IPS Router that support IPv4 and IPv6 .
- Upgrade all systems to support IPv6.
- Implementation of Network Transition Mechanism.

5.3.7 Network Transition Mechanism

Three transitions mechanisms can assist countries to deploy the ATN IPS in a heterogeneous environment:

o Tunnelling: IPv6 has been specified to operate over a variety of lower layer interfaces such as Frame Relay, ATM, HDLC, PPP and LAN technologies. Tunnelling implies that a given protocol is encapsulated into another, meaning that IPv6 would be encapsulated into another functionally equivalent network protocol.

o Dual stack: The dual stack mechanism implies that an implementation handles more than one communications protocol for a given application or function by supporting both IPv4 and IPv6 protocols.

o Translation: Translation mechanisms imply the conversion from one protocol to another. Network Address Translation Protocol Translation (NAT-PT), have been developed in the context of the transition from IPv4 to IPv6 as both versions share a number of common features.

Example of Interoperability Test

Configuration and report Templates

AMHS Interoperability Tests
Jordan - United Arab Emirates

Configuration

CARC

GCAA

Document ID	:	**AMHS_INTEROP_CONF_JO-UAE_001**
Created / updated	:	**Eng. Mona An-Naddaf (CARC)**
Version	:	**1.0**
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Change History

Version	Change	Date	Page(s)
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0.2	IP address and tsel of the UAE system updated, Agreement upon real addresses	2010-02-04	all
0.3	Section 3.6.6 TCP parameters appended	2010-02-12	12
0.4	Release of AFTN/AMHS software of IUT-A Updated	2010-02-15	7
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0.6	Isode Release updated, Table 3-7 updated	2010-02-20	7 10
0.7	Reference /2/ updated	2010-02-28	5
0.8	Section 2.3 Network Infrastructure added	2010-04-08	8
0.9	Phrase from section 3.6.6 removed, Section 1.2 updated	2010-04-22	12 5
1.0	Final version	2010-04-26	all

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1 INTRODUCTION

1.1 Purpose and Scope

This document contains a description of the configuration for bilateral AMHS Interoperability Tests according to /1/ between the AFTN/AMHS operational switch of the Jordanian CARC and the AFTN/AMHS test system of the General Civil Aviation Agency (GCAA) of the United Arab Emirates (UAE).

In /1/ the two systems under test are named IUT-A and IUT-B. It is agreed between both test partners that

- **IUT-A is the Jordanian system**, and
- **IUT-B is the system of the U.A.E..**

The setup of the test systems will be as depicted in /1/, section 2.1, figure 1. Additional AMHS User Agents and/or AFTN User Terminals may be provided on either side.

Wherever possible, the parameters defined in /1/ are used. Additionally, configuration parameters to achieve connectivity on the network, transport, session and application layer are defined. Both partners agree to use real addresses, MTA names, passwords instead of those including the placeholders IUTA, IUTB.

1.2 Referenced Documents

Reference	Title, Document No.	Date of Issue
/1/	ICAO EUR Doc 020 – EUR AMHS Manual, Version 4.0, Appendix E	2009-04-02
/2/	AMHS Interoperability Tests Jordan – United Arab Emirates, Test Report	2010-04-26

1.3 Abbreviations

ACC	Area Control Centre
ADAMS	Aeronautical Data And Messaging System
ADMD	Administration Management Domain
AFTN	Aeronautical Fixed Telecommunication Network
AIRAC	Aeronautical Information Regulation and Control
AMC	ATS Messaging Management Centre
AMHS	ATS Message Handling System
ATN	Aeronautical Telecommunication Network

ATS	Air Traffic Services
C	Country
CAAS	Common ICAO AMHS Addressing Scheme
CARC	Civil Aviation Regulatory Commission
COM	Communication
CN	Common Name
DSA	Directory System Agent
DUA	Directory User Agent
DL	Distribution List
GCAA	General Civil Aviation Authority
HP	Hewlett Packard
ICAO	International Civil Aviation Organisation
IP	Internet Protocol
iSCSI	Internet Small Computer System Interface
IUT	Implementation under Test
LAN	Local Area Network
MCP	Monitoring and Control Position
MS	Message Store
MTA	Message Transfer Agent
MTCU	Message Transfer and Control Unit
MTS	Message Transfer System
O	Organisation
O/R	Originator / Recipient
OU	Organisational Unit
PRMD	Private Management Domain
PSAP	Presentation Service Access Point
SSAP	Session Service Access Point
TCP	Transmission Control Protocol
TSAP	Transport Service Access Point
UA	User Agent
U.A.E.	United Arab Emirates
XF	Translated Form

2 SHORT DESCRIPTIONS OF BOTH SYSTEMS AND THE NETWORK INFRASTRUCTURE

2.1 Short Description of IUT-A

IUT-A is the fully integrated ADAMS AFTN/AMHS system of the International COM Centre of Jordan in Amman/Marka. The system is operationally used since 04-Dec-2008. It currently serves 4 international AFTN links and more than 30 domestic AFTN users or systems.

The switch is composed of 2 HP ProLiant BL 460 Linux servers and 2 iSCSI SB 600 servers which form a high-available 2-node cluster. RedHat 5.0 ES is the employed Linux Operating System. An AFTN switch, an X.400 MTA based on an X.500 Directory Server and an MTCU are the main functional components of the switch. The switch is monitored and controlled by means of 4 Microsoft Windows based MCP working positions.

Avitech AFTN Stations and legacy systems are connected to the switch via asynchronous lines or TCP/IP connections. Furthermore, currently 4 AMHS User Agents AMHS@AviSuite are connected to the MTA by use of the P3 MTS Access Protocol via TCP/IP.

In addition to the MD and CAAS Address Look-Up Tables described in 3.3 the operationally used MD, CAAS and User Address Look-Up table entries as provided by the AMC for the AIRAC cycle "OPER.81", of 11-02-2010, are configured.

The User Agents include Directory User Agents (DUA) supporting automatic translation of AFTN addresses into AMHS addresses and vice-versa.

Component	Release
ADAMS Integrated AFTN/AMHS system	MHS r3.42.00
MTA, DSA and MS	Isode Rel. 14.4v4
AMHS User Agent	Avitech AMHS@AviSuite jamhs-t1-atu-2.0.1-01-SNAPSHOT-install
AFTN Station	Avitech AFTN Station, Rel. 6.6.4.5

Table 2-1: Components of IUT-A

2.2 Short Description of IUT-B

Component	Release
ADAMS Integrated AFTN/AMHS system	AIDA-NG V2.79.0002
MTA, DSA and MS	Isode-MTA, integrated in AIDA-NG
AMHS User Agent	AMHS-Mailbox, Integrated in AIDA-NG
AFTN Station	AFTN Mailbox, Integrated in AIDA-NG

Table 2-2: Components of IUT-B

2.3   Network infrastructure

The two systems are interconnected by means of an IP SEC tunnel through the public internet as depicted in Figure 2-1:
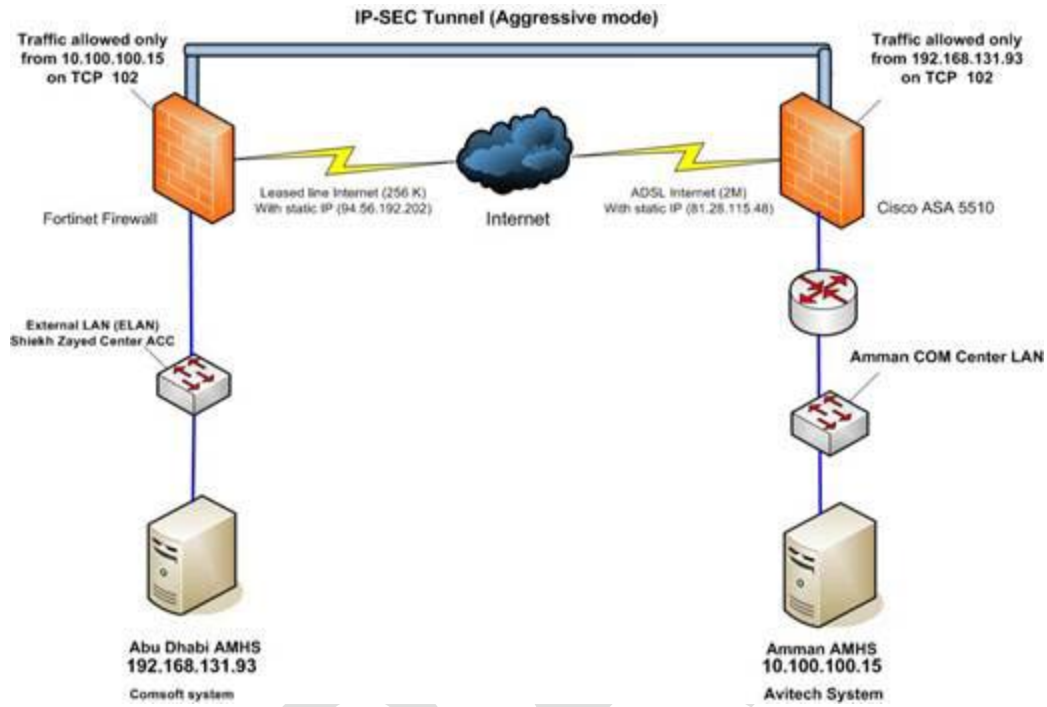
Figure 2-1: Network Infrastructure

3 CONFIGURATION OF BOTH SYSTEMS

3.1 Addressing Schemes

IUT-A implements the CAAS addressing scheme and IUT-B implements the XF addressing scheme.

3.2 User and DL Addresses

The test user and DL addresses used are derived from /1/, sections 3.1 and 3.2. In IUT-A

the following address space is used:

O/R Address Component	Value
C	XX
ADMD	ICAO
PRMD	OJ
O	OJAC
OU1	OJAM
CN	OJAMFTNA … OJAMMHSA …

Table 3-1: User Addresses in IUT-A

In IUT-A the following DLs are used:

Distribution List Name	Member Addresses included in the DL
OJAMDLLO	OMAEFTNA, OMAEFTNB, OMAEMHSA
OJAMDLRE	OJAMFTNA, OJAMFTNB, OJAMMHSA

Table 3-2: Distribution Lists in IUT-A

In IUT-B the following address space is used:

O/R Address Component	Value
C	XX
ADMD	ICAO
PRMD	OM
O	AFTN
OU1	OMAEFTNA … OMAEMHSA …

Table 3-3: User Addresses in IUT-B

In IUT-B the following DLs are used:

Distribution List Name	Member Addresses included in the DL
OMAEDLLO	OJAMFTNA, OJAMFTNB, OJAMMHSA
OMAEDLRE	OMAEFTNA, OMAEFTNB, OMAEMHSA

Table 3-4: Distribution Lists in IUT-B

3.3 Address Look-Up Table

In order to ensure correct translation of AFTN addresses into AMHS addresses and vice versa, the address look-up tables in both systems have to include the following entries:

Name	Nationality Letters	Country Name	ADMD Name	PRMD Name	Address scheme	ATNDir
Jordan	OJ	XX	ICAO	OJ	CAAS	C=JO
U.A.E.	OM	XX	ICAO	OM	XF	

Table 3-5: MD Look-Up Table

country-name	ADMD-name	PRMD-name	organization-name	organizational-unit-name
XX	ICAO	OJ	OJAC	OJAM

Table 3-6: CAAS Look-Up Table

Both IUT-A and IUT-B import the look-up tables AIRAC cycle "OPER.81" of 11.02.2010 which include the converting entries as specified in Table 3-5 and Table 3-6.

Note: With these tables the values of the "generic" look-up table as described in /1/, 3.4.1 are implicitly configured.

3.4 Routing Tables

The AFTN and AMHS routing tables must be in accordance with /1/, 3.3.1 (for IUT-A) and 3.3.2 (for IUT-B). Additionally, it must be ensured that operationally used addresses are not affected.

AFTN Routing Indicator	Routing Direction
OM	AFTN Circuit to JEDDAH
OMAEFT	MTCU
OMAEDL	MTCU
OMAEMH	MTCU
OJAMFT	AFTN Terminal(s)
OJAMDL	MTCU
OJAMMH	MTCU

Table 3-7: AFTN Routing Table in IUT-A

X.400 Routing Indicator	Routing Direction
/C=XX/ADMD=ICAO/PRMD=OJ	MTCU
/C=XX/ADMD=ICAO/PRMD=OJ/O=OJAC/OU1=OJAM/CN=OJAMMHSA	UA in IUT-A

X.400 Routing Indicator	Routing Direction
/C=XX/ADMD=ICAO/PRMD=OJ/O=OJAC/OU1=OJAM/CN=OJAMMHSB	UA in IUT-A
/C=XX/ADMD=ICAO/PRMD=OJ/O=OJAC/OU1=OJAM/CN=OJAMMHSC	UA in IUT-A
/C=XX/ADMD=ICAO/PRMD=OJ/O=OJAC/OU1=OJAM/CN=OJAMDLLO	DL
/C=XX/ADMD=ICAO/PRMD=OJ/O=OJAC/OU1=OJAM/CN=OJAMDLRE	DL
/C=XX/ADMD=ICAO/PRMD=OM	MTA-OMAE-1

Table 3-8: X.400 Routing Table in IUT-A

AFTN Routing Indicator	Routing Direction
* (default route)	AFTN_BOX
OMAEMHS	AFTN_MTCU
OMAEYFYX	SVC_BOX
OJ	AFTN_MTCU

Table 3-9: AFTN Routing Table in IUT-B

X.400 Routing Indicator	Routing Direction
/C=XX/ADMD=ICAO/PRMD=OM	X400_MTCU
/C=XX/ADMD=ICAO/PRMD=OM/O=AFTN/OU1=OMAEMHSA	X400_ASDU
/C=XX/ADMD=ICAO/PRMD=OM/O=AFTN/OU1=OMAEMHSB	X400_ASDU
/C=XX/ADMD=ICAO/PRMD=OM/O=AFTN/OU1=OMAEMHSC	X400_ASDU
/C=XX/ADMD=ICAO/PRMD=OM/O=AFTN/OU1=OMAEDLLO	DL
/C=XX/ADMD=ICAO/PRMD=OM/O=AFTN/OU1=OMAEDLRE	DL
/C=XX/ADMD=ICAO/PRMD=OJ	MTA-OJAM-1

Table 3-10: X.400 Routing Table in IUT-B

3.5 Local User Address Book

An address book for local use in any UA is defined in /1/, section 3.5.1. Alternatively, a UA may use the directory service, if implemented, for the automatic translation of AFTN addresses entered by the user into AMHS O/R addresses and vice versa.

3.6 General Parameters

The following general parameters are agreed between both test partners.

3.6.1 MTA Authentication Parameters

	IUT-A	IUT-B
MTA Name	MTA-OJAM-1	MTA-OMAE-1
Password	ICAO-OJAM-1	ICAO-OMAE-1
Authentication	simple	simple
Check Network Address	Yes	Yes

Table 3-11: MTA Authentication Parameters

3.6.2 X.400 Protocol Type

	IUT-A	IUT-B
X.400 Protocol Type	X.400 (1988)	X.400 (1988)

Table 3-12: X.400 Protocol Type

3.6.3 Dialogue Mode, Type and Number of Associations

	IUT-A	IUT-B
Dialogue Mode	monologue	monologue
Type	permanent	on demand with idle time of 30 seconds
Number	3, one association reserved for messages of MTS – Priority URGENT, one association reserved for messages of MTS – Priorities URGENT and NORMAL	3

Table 3-13: Dialogue Mode, Type and number of associations

3.6.4 Service Access Points

	IUT-A	IUT-B
PSAP	---	---
SSAP	---	---
TSAP	MHS	P1

Table 3-14: Service Access Points

3.6.5 Network Addresses

It is agreed that IPv4 is used on the network layer.

	IUT-A	IUT-B
IPv4 Address	10.100.100.15	192.168.131.93
Port No.	102	102

Table 3-15: Network addresses

3.6.6 TCP Parameters

	IUT-A	IUT-B
tcp_keepalive_time	60 seconds	60 seconds
tcp_keepalive_intvl	5 seconds	5 seconds
tcp_keepalive_probes	3	3

Table 3-16: TCP Parameters

4 TEST RESULTS

The test results will be documented in a separate test report /2/.

<u>End of document</u>

APPENDIX C

State   Bahrain (Manama)

State	Speed	Protocol	IP Address	Net Mask	Router Type	IP.V	
Riyadh	64k	Leased line	10.61.11.12	255.255.255.252	Motorola Vangurd 6435	IPV4	Voice
Tehran	64k	Leased line	172.16.10.2	255.255.255.0	Cisco2800	IPV4	AFTN,Voice
Kuwait	64k	Leased line	10.61.11.8	255.255.255.252	Motorola Vangurd 6435	IPV4	AFTN,Radar, Voice
Jeddah	64k	Leased line	10.61.11.48	255.255.255.252	Motorola Vangurd 6435	IPV4	CIDIN,Voice
Doha-1	64k	Leased line	10.61.11.32	255.255.255.252	Motorola Vangurd 6455	IPV4	Radar,Voice
Doha-2	64k	Leased line	10.61.11.56	255.255.255.252	Motorola Vangurd 6455	IPV4	AFTN,Voice
Dammam	64k	Leased line	10.61.11.44	255.255.255.252	Motorola Vangurd 6435	IPV4	Voice
AbuDhabi-1	64k	Leased line	10.61.11.12	255.255.255.252	Motorola Vangurd 6435	IPV4	Radar,Voice
AbuDhabi-2	64k	Leased line	10.61.11.16	255.255.255.252	Motorola Vangurd 6435	IPV4	CIDIN,Voice
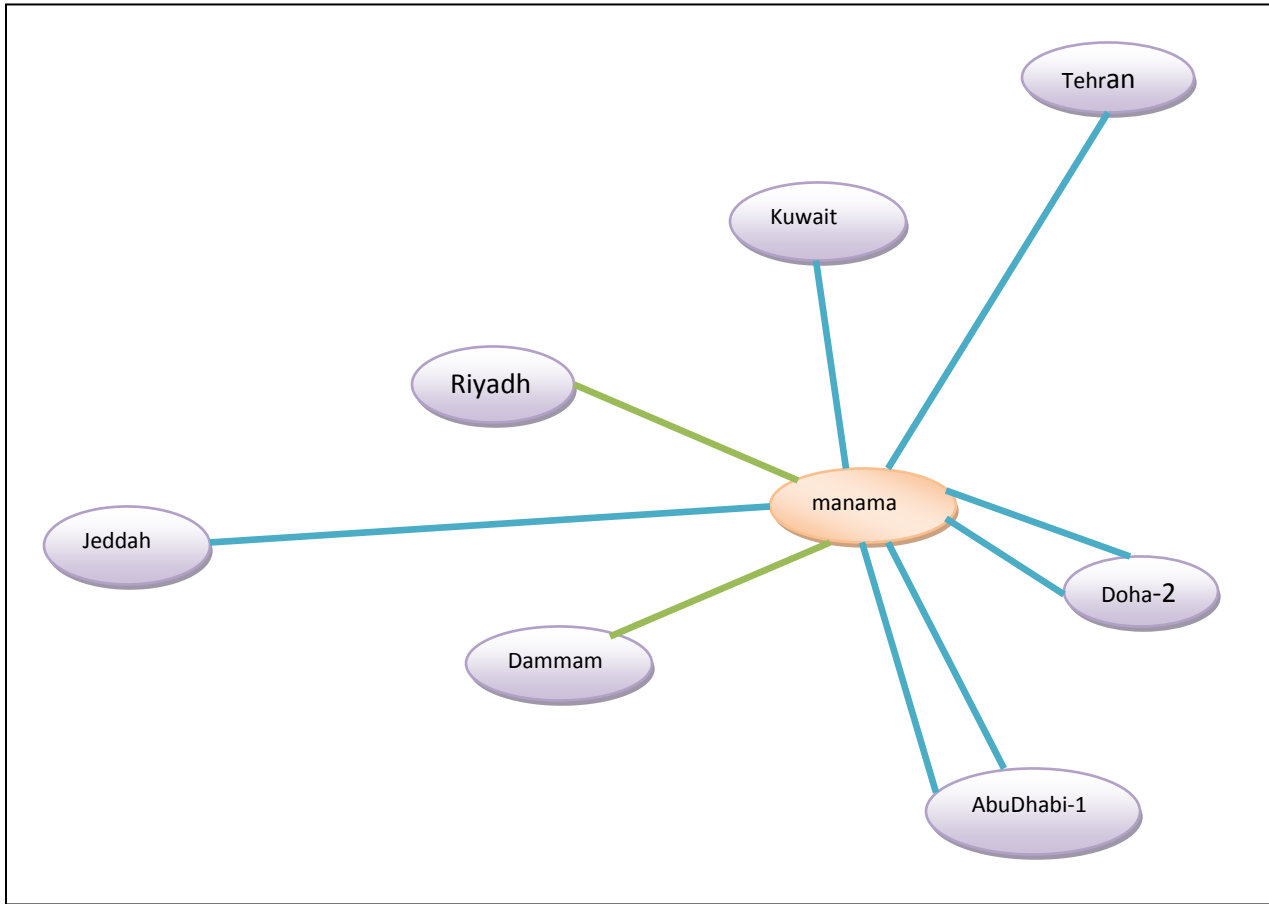
State   Egypt (Cairo)

State	Speed		IP Address	Net Mask	Router Type	IP.V	
Amman	64k	Leased line	10.10.10.2 192.168.12.7	255.255.255.0	Motorola Vangurd 6800	IPV4	AMHS, Voice
Athens	64k	Leased line	192.168.80.2	255.255.255.0	Cisco2800	IPV4	Voice
Athens	64k	Leased line	10.10.10.1	255.255.255.0	Cisco2800	IPV4	CIDIN,Voice
Jeddah	64k	Leased line	192.168.80.2	255.255.255.252	Cisco2800	IPV4	Voice
Jeddah	128k	Leased line	192.168.12.244	255.255.255.0	Motorola Vangurd 6455	IPV4	AMHS, Voice
Riyadh	64k	Leased line	192.168.80.2	255.255.255.0	Cisco2800	IPV4	Voice
Tripoli	64k	Leased line	10.10.10.1	255.255.255.0	Cisco1700	IPV4	AFTN
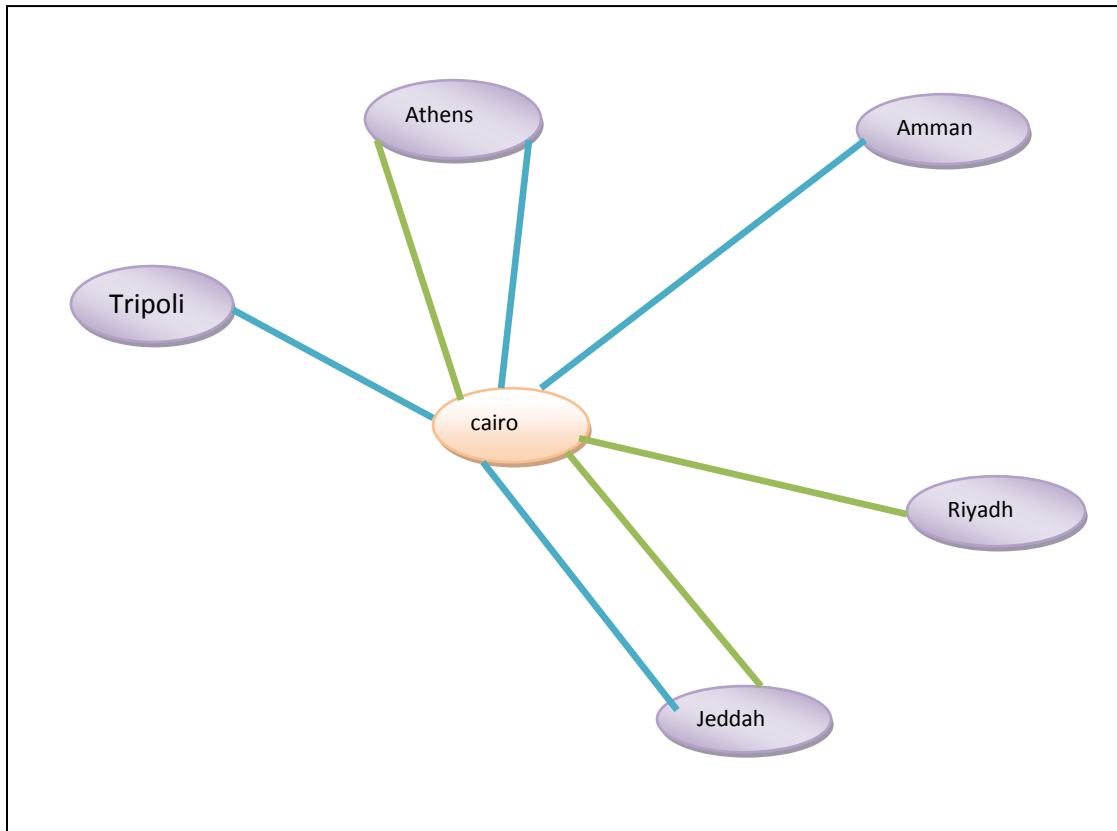
State   Saudi Arabia(Jeddah)

State	Speed		IP Address	Net Mask	Router Type	IP.V	
Cairo	128k	Leased line	192.168.12.0	255.255.255.0	Motorola Vangurd 6455	IPV4	AMHS,Voice
Amman	64k	Leased line	192.168.12.0	255.255.255.0	Motorola Vangurd 6455	IPV4	AMHS,Voice
Muscat	64k	Leased line	192.168.12.0	255.255.255.0	Cisco 2811	IPV4	AFTN,Voice
Manama	64k	Leased line	TBD	TBD	Motorola Vangurd 6435	IPV4	CIDIN,Voice
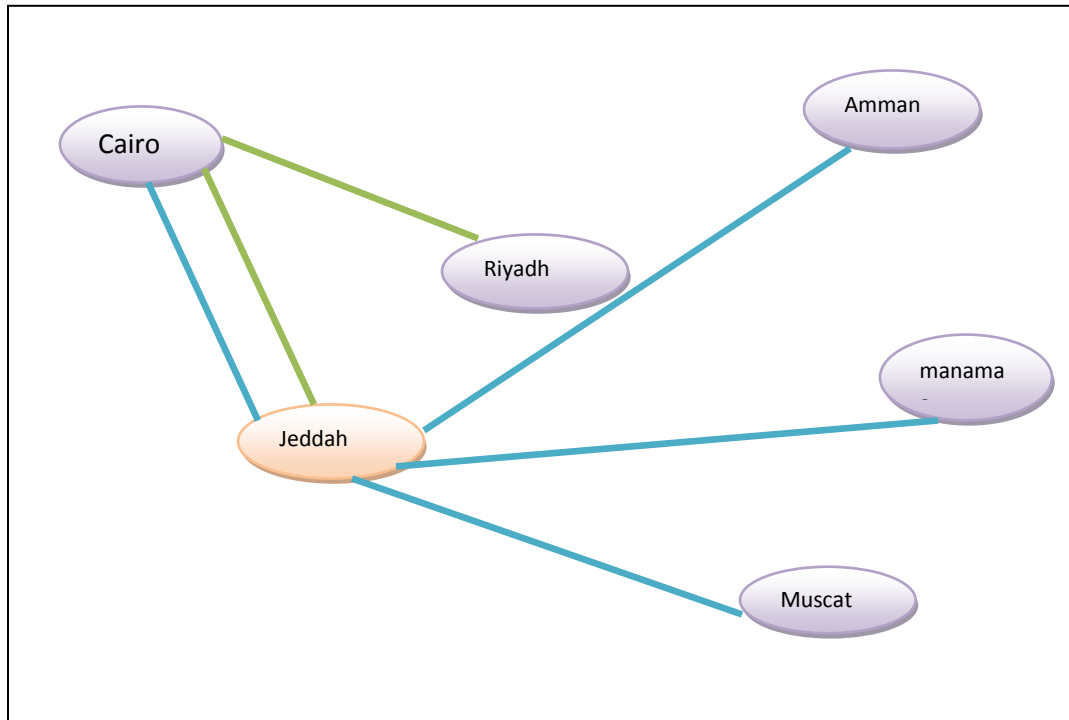
State   IRAN(Tehran)

State	Speed		IP Address	Net Mask	Router Type	IP.V	
Manama	64k	MPLS	172.16.10.0	255.255.255.0	Cisco2811	IPV4	AFTN,Voice
Baghdad	32k	V-SAT	TBD	TBD	Cisco2811	IPV4	AFTN,Voice
Ankra	64k	MPLS	172.16.13.0	255.255.255.0	Cisco2811	IPV4	AFTN,Voice
Kabul	32k	V-SAT	TBD	TBD	Cisco2811	IPV4	AFTN,Voice
Karachi	64k	MPLS	172.16.11.0	255.255.255.0	Cisco2811	IPV4	AFTN,Voice
Kuwait	64k	MPLS	172.16.12.0	255.255.255.0	Cisco2811	IPV4	AFTN,Voice
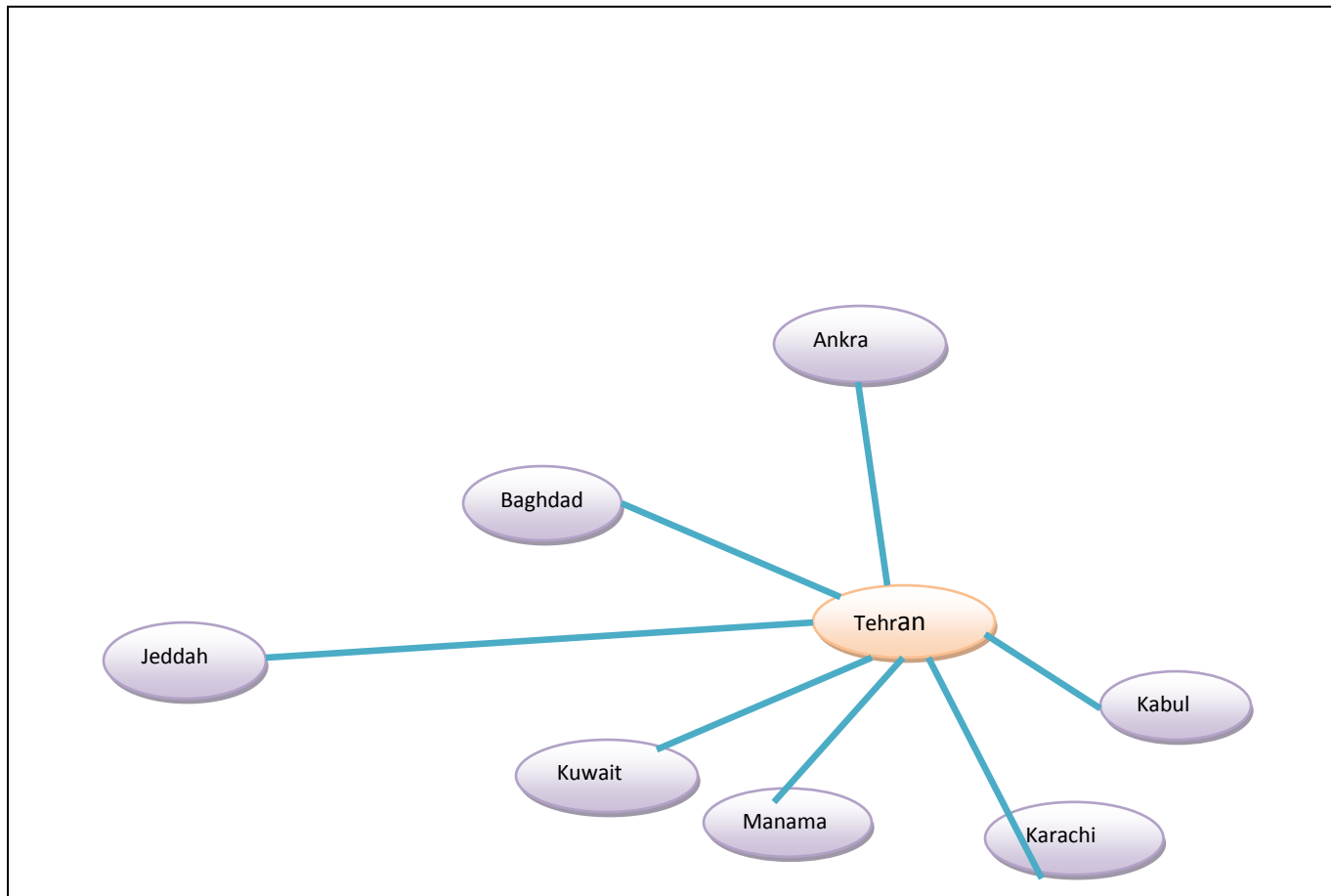
State   Jordan(Amman)

State	Speed		IP Address	Net Mask	Router Type	IP.V	
Cairo	64k	Leased line	10.10.10.1	255.255.255.0	Vanguard	IPV4	AMHS,Voice
Jeddah	64k	Leased line	10.10.10.1	255.255.255.0	Vanguard	IPV4	AMHS,Voice
Abu dhabi	2M	Public internet	TBD	TBD	Cisco 5510	IPV4	AMHS
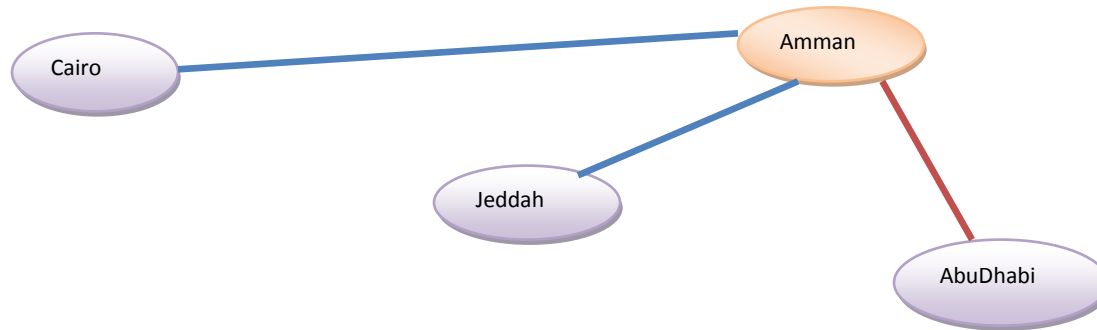
State   Iraq

State	Speed		IP Address	Net Mask	Router Type	IP.V	

Iraq did not submit -IP network Survey

State   Kuwait

State	Speed		IP Address	Net Mask	Router Type	IP.V	

Kuwait did not submit -IP network Survey

State   Oman

State	Speed		IP Address	Net Mask	Router Type	IP.V	

Oman did not submit -IP network Survey

State   Qatar

State	Speed		IP Address	Net Mask	Router Type	IP.V	

Qatar did not submit -IP network Survey

State   Syria

State	Speed		IP Address	Net Mask	Router Type	IP.V	

Syria did not submit -IP network Survey

State   UAE

State	Speed		IP Address	Net Mask	Router Type	IP.V	

UAE did not submit -IP network Survey

State   Yemen

State	Speed		IP Address	Net Mask	Router Type	IP.V	

Yemen did not submit -IP network Survey

APPENDIX D

Introduction

This survey has been redeveloped while analyzing the previous version. The purpose is for collecting information about the existing IP infrastructure between the states in-order to come with a unified IP scheme plan for the MID-Region IP network.

General Information:

State:	………………………………………..
Does IP network existing in place?	
❑ Yes ❑ No	
Is Aviation systems connected together over IP?	
❑ Yes ❑ No	
Who to contact if more details or clarification is required?	
Name:	………………………………………….
Title:	………………………………………….
Email:	………………………………………….
Telephone:	……………………. Fax: …………………….

Link Specific Information:

Please fill the following form **for each link** between you state and neighboring state within MID-Region:

#			
1	Connection From:	State: …………….	Location: ……………………
2	Connection To:	State: …………….	Location: ……………………
3	Service Provider:		
4	Link Speed:	………… Kbps	
5	Link Type:	❑ Leased Circuit ❑ Frame-relay ❑ V-SAT ❑ MPLS ❑ Other ……………………	
6	IP version:	❑ IPv4 ❑ IPv6	
7	IP Subnet:	❑ 10.__.__.__ Netmask: ___.___.___.___ ❑ 172.__.__.__ Netmask: ___.___.___.___ ❑ 192.168.__.__ Netmask: ___.___.___.___ ❑ Other: ……………. Netmask: ___.___.___.___	
8	Router / other	Manufacturer: …………….............. Model: …………………………….	
9	Router Interfaces Supported*:	❑ Async Serial ❑ Sync Serial ❑ Ethernet ❑ Other: ……………………	
	Router Interfaces Implemented	❑ Async Serial ❑ Sync Serial ❑ Ethernet ❑ Other: ……………………	
10	Supported Routing Protocols*:	❑ RIP ❑ OSPF ❑ BGP ❑ IS-IS ❑ Other: …………………..	
	Supported Routing Implemented	❑ RIP ❑ OSPF ❑ BGP ❑ IS-IS ❑ Other: …………………..	
11	Supported Voice	❑ SIP ❑ H.323 ❑ Other: ……………….	

	Signaling on router*:	
	Supported Voice Implemented	❑ SIP ❑ H.323 ❑ Other: ……………….
12	Data Applications in use*:	❑ AFTN/CIDIN ❑ AMHS ❑ OLDI/AIDC ❑ Other: ……………………..
13	Voice Applications in use*:	❑ ATC Voice ❑ VHF Voice ❑ Other Voice: ……………………
14	Data end user interface:	❑ Serial ❑ IP based (Answer Below) ❑ Other: ………………………………
15	Security measures between LAN and WAN*:	❑ Single-firewall (Type: ……………………………) ❑ IPS (Type: …………………………………………..) ❑ Dual-firewall (Types: …………………………....…..)
16	Voice end user interface*:	❑ FXS/FXO ❑ ISDN ❑ VoIP ❑ Other: ……………………..
	Optional cost in USD	
	Additional Info	

* Choose all that apply

APPENDIX E

NO	Description	Deliverables	Target date	Responsibility
1	Review of implementation problems and develop coordinated solutions	Updated the information in the ATN Router and AMHS planning tables and the implementation status		Members
2	Coordinate/compile the regional implementation schedule	maintain the AMHS Implementation Plan		ATN-IPS WG
3	Monitor Implementation			**ATN-IPS WG**
4	Development of Interim Database for routing tables	Database	AIRAC	Jordan/
5	MID - AMC			ATN-IPS Jordan
6	MID ATN AMHS will adopt IPv4 address assignment proposed by as an interim measure and will transit to IPv6 after the related implementation issues are resolved. This approach will be based on point-to-point IP network	Guidance Doc on IPv4 addressing plan to be developed		Egypt Haitham/ Lebanon/Mohammed Saad
7	facilitate implementation of VoIP in MID	develop the required guidance	July 2012	Mohammed (Bahrain)
8	develop a list of the documents which are need for MID-ATN Implementation	List of documents	Sep 2011	All
9	IP Network plan Analysis/requirement/financial/design		15 Sep 2011	Abdulla / Mona / Yasser
10	Proposal from PTT for IP network for the region		15/sep 2011	Mohammed (Bahrain)
11	Coordination for presentation from suppliers		1qtr 2012	Mohammed (Bahrain)

APPENDIX F

ATN/IPS WORKING GROUP

1.   Terms of Reference

1.1   The Terms of Reference of the ATN/IPS Working Group (ATN/IPS WG) are:

a) To promote regionally harmonized and agreed approach to transition planning to ATN in order for MID States to work collaboratively in developing their future transition arrangements towards the ATM system envisioned in the Global ATM Operational Concept; and

b) address regional planning and implementation issues, related to AFTN/CIDIN/AMHS and networking issues including the usage of the public internet and development of MID IP NET standards

1.2   In order to meet the Terms of Reference, the ATN/IPS WG shall:

a) Follow up on public Internet usage in the MID Region and document all Internet usage with particular attention to the safety/security of the data exchanged over the public internet;

b) development of the ATN planning and implementation document to be main source for planning and implementation guidance;

c) review and analyze the MID Region AFTN/CIDIN/AMHS plans and make suggestion for the improvement in accordance with the new development in the MID Region and coordinate the AMHS implementation;

d) develop MID IP Network common specification and implementation guidance;

e) develop AMHS implementation plan for the MID and related AMC implementation related materials;

f) develop task list for the work programme and provide updates to CNS SG; and

g) Provide the necessary support for the implementation of the IPS in the MID Region.

2.   Composition

ATN/IPS Group will be composed of experts nominated by MIDANPIRG Provider States.

Other representatives, who could contribute to the activity of the Group, could be invited to participate as observers.

- END -