**ORGANISATION DE L'AVIATION CIVILE INTERNATIONALE**

**DIX-HUITIÈME RÉUNION DE PLANIFICATION ET DE MISE EN OEUVRE DU GROUPE REGIONAL AFI (APIRG/18)**
**Kampala, Uganda (27 – 30 mars 2012)**

**Point 3 de l'ordre du jour:** **Cadre de performance pour la planification et la mise en œuvre de la navigation aérienne dans la région AFI**

**3.4 Communications, Navigation et Surveillance (CNS)**

# SYSTÈMES DE COMMUNICATIONS

*(Note présentée par le secrétariat)*


| **RÉSUMÉ ANALYTIQUE** |
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| Cette note de travail présente le rapport de la quatrième réunion du sous-groupe Communications, navigation et surveillance (CNS/SG/4) tenue à Dakar, Sénégal, 25-29 juillet 2011) sur les questions relatives à la communication, pour examen par la réunion APIRG/18.<br><br>La suite à donner par la réunion APIRG/18 figure au **paragraphe 3** |
| **Références:**<br><br>• Rapport de la réunion OACI SP AFI RAN 2008, (Doc 9930)<br>• Rapport de la réunion APIRG/17<br>• Rapport de la réunion CNS/SG/4<br><br>*Note: Les références sont accessibles à partir du site Internet* ***: http://www.icao.int*** |
| **Objectifs stratégiques** : C (Protection de l'environnement et développement durable du transport aérien) |


## 1. INTRODUCTION

1.1 La quatrième réunion du sous-groupe communications, navigation et surveillance (CNS/SG/4) s'est tenue à Dakar, Sénégal, du 25 au 29 juillet 2011. Soixante et un (61) participants provenant de vingt-quatre (24) États and trois (3) Organisations Internationales ont pris part à cette réunion.

1.2 **L'Appendice A** contient les projets de conclusions et décisions formulés par la réunion CNS/SG/4.

1.3. La note de travail no. 24 examine les carences dans le domaine de communications.

## 2. ANALYSE

### Service fixe aéronautique (AFS)

*État de mise en œuvre et performance de services AFS*

2.1 La réunion a noté que les États avaient mis en œuvre les exigences pour les communications AFS tel qu'il figure dans le Plan AFI de navigation aérienne (ANP), les tableaux FASID CNS 1A (plan rationalisé RSFTA) et CNS 1D (plan ATS / DS), en utilisant la technologie numérique. Cependant, quelques-uns des circuits RSFTA requis (tels que Addis-Abeba/Asmara, Addis-Abeba/Djibouti) et circuits ATS / DS (comme Addis-Abeba/Asmara, Bujumbura/Kinshasa, Djibouti / Hargeisa, Kigali/ Kinshasa) ne sont pas mis en œuvre. (cf. Appendice A, Projet de conclusion 4/01)

*Disponibilité de circuit RSFTA*

2.2 La réunion a noté que la mise en œuvre des réseaux aéronautiques de télécommunications par satellite a considérablement amélioré la disponibilité des circuits RSFTA dans la Région. Cependant, le taux de disponibilité est resté en dessous du minimum spécifié de 97% indiqué dans le Plan AFI de navigation aérienne (Recommandation 9/3 de la réunion AFI / 7) dans certains cas, empêchant ainsi la distribution normale des messages liés à la planification et la coordination des vols entre les unités ATS, le service d'information aéronautique (AIS), les renseignements météorologiques d'exploitation (OPMET) et le service de la recherche et sauvetage (SAR), avec un impact négatif sur la sécurité et efficacité des opérations du transport aérien.

*Statistiques sur la durée d'acheminement du RSFTA*

2.3 La réunion a noté, à partir des rapports mis à la disposition du Secrétariat, que la durée d'acheminement prévue dans le plan régional de navigation aérienne AFI (ANP) n'a pas été respectée dans des nombreux cas. Afin de faciliter une analyse approfondie des causes profondes et identification des mesures correctives appropriées, les États responsables de l'exploitation des circuits RSFTA ont été rappelés de surveiller les statistiques sur la durée d'acheminement le 23e jour de chaque troisième mois (janvier, avril, juillet et octobre) de chaque année, et de les partager avec les partenaires, autres administrations et bureaux régionaux de l'OACI.

*Taux d'occupation des circuits RSFTA*

2.4 La réunion a souligné l'importance de mener l'évaluation des performances des circuits RSFTA sur base des statistiques recueillies pendant une période minimum de trois jours à l'intervalle de six mois à partir de 23 au 25 avril et octobre. Elle a donc demandé aux centres et stations RSFTA qui rencontrent des difficultés dans le calcul de nombre de caractères en raison des limitations du système, d'enregistrer les taux d'occupation des circuits conformément aux critères spécifiés dans le Doc. 8259 - Manuel sur la planification et aménagement du RSFTA.

*Vitesse de transmission*

2.5 La réunion a noté que tous les principaux circuits RSFTA fonctionnés à une vitesse de 9,6 kb / seconde ou 19,2 kb / seconde, tandis que certains liens avaient le potentiel de répondre à une vitesse de 64 kb / seconde, exigence indiquée pour les circuits dorsal du RSFTA.

*Examen du rapport de la première réunion du Groupe de travail sur la mise en œuvre du système AMHS dans la région AFI*

2.6 La réunion a examiné et approuvé le rapport de la première réunion du groupe de travail sur la mise en œuvre du système de messagerie ATS AFI (AFI AMHS/I/TF/1), qui a eu lieu du 19 au 20 mai 2011 au Bureau régional de l'Afrique centrale et australe de l'OACI, situé dans les locaux des Nations Unies à Nairobi, Kenya, en prélude à l'atelier régional sur le système de messagerie ATS qui a eu lieu du 17 au 18 mai 2011. L'atelier était basé sur les SARP de l'OACI et les instructions d'orientation contenues dans l'annexe 10 à la Convention de Chicago, Doc 9880 de l'OACI – Manuel de spécifications techniques détaillées du réseau de télécommunications aéronautiques (ATN) fondé sur les normes et protocoles OSI de l'ISO (2e Partie: Applications AMHS sol-sol)

2.7 La réunion a noté qu'un certain nombre d'États ont déjà mis en œuvre du système AMHS au niveau national, en attendant des directives pour les liens internationaux AMHS. Il a donc recommandé que les États AFI concluent des accords bilatéraux et / ou multilatéraux en utilisant le modèle mis en place par le Groupe de travail, et de mener des essais pour assurer l'interopérabilité entre leurs systèmes AMHS. Il a également demandé au Secrétariat de procéder à une enquête régionale sur la mise en œuvre de l'AMHS. L'intégralité du rapport sur AFI AMHS/I/TF/1 est accessible sur le site internet public de l'OACI (http://www.icao.int*)*.

2.8 La réunion a approuvé un projet de stratégie de mise en œuvre du système AMHS AFI développé par le Groupe de travail, comme indiqué à l'Appendice B à la présente note de travail, sous réserve d'autres modifications à apporter (si nécessaire) par le Secrétaire, sur base des données devant être fournies par les États, grâce à l'enquête régionale recommandée. (cf. Appendice A, Projet de conclusion 4/10).

2.9 La réunion a identifié les travaux à être effectués par le Groupe de travail, y compris l'élaboration d'un manuel du système AMHS dans la région AFI se basant sur le manuel du système AMHS pour la région EUR (Version 6.0), et d'un plan régionale de mise en œuvre du système AMHS. En conséquence, la réunion a convenu de modifier les termes de référence, la composition et le programme du groupe de travail de mise en œuvre du système AMHS comme indiqué dans **l'appendice C** à la présente note de travail.

2.10 La réunion a rappelé la lettre aux États AN 4/49.1-09/34 du 14 avril 2009, fournissant les États avec les procédures établies pour la coordination globale de l'information AHMS. Les États ont donc été invités à désigner des représentants à s'inscrire comme utilisateurs du Centre de gestion de messagerie ATS (AMC), et veiller à ce que les utilisateurs désignés soient dûment formés sur la plate-forme du site de l'AMC, avant qu'ils ne soient effectivement autorisés à enregistrer des données dans le site http://www.eurocontrol.int/amc, et communiquer aux bureaux régionaux de l'OACI des détails pertinents des utilisateurs AMC afin de faciliter leur accréditation, leur permettant ainsi d'accéder à au site AMC.

*Planification du Réseau de télécommunications aéronautiques (ATN) - projet d'architecture de routage de l'ATN dans la région AFI*

2.11 Le réunion a rappelé qu'en 2005, la réunion APIRG/15 a examiné un projet d'architecture de routage de l'ATN dans la région AFI I, qui fournit des conseils techniques sur la planification et la mise en œuvre de la transition vers l'ATN pour les communications sol-sol dans la région AFI. Le projet d'architecture de routage de l'ATN dans la région AFI a été distribué pour observations, et soutenu par les États. Par la suite, les travaux supplémentaires effectués par les gestionnaires de réseaux aéronautiques VSAT AFI ont formulé des propositions d'amendement, sur la base de l'infrastructure existante. Les

modifications proposées sont reflétées dans le projet d'architecture de routage de l'ATN dans la région AFI finalisé figurant à **l'appendice D** à cette note travail. (cf. Projet de conclusion 4/11).

*Les plans des vols manquants*

2.12 Le sous-groupe CNS a traité la question qui reste à établir des plans de vol manquants dans la Région AFI, en coordination avec le sous groupe ATM / AIM / SAR. Conscient des risques inhérents à la sécurité, les deux sous-groupes ont demandé au Secrétariat de coordonner une enquête régionale de trois jours du 15 à 17 août 2011, englobant les aspects opérationnels et techniques de traitement de plan de vol. (cf. Appendice A, Projet de conclusions 3 et 14).

**Service mobile aéronautique (AMS)**

*Communications à très haute fréquence (VHF)*

2.13 Le réunion a noté une amélioration significative relative à l'extension de la couverture VHF dans plusieurs FIR. Néanmoins, les possibilités d'étendre la couverture VHF ont été limitées dans de nombreux domaines où la mise en œuvre des stations distantes n'est pas possible.

*Communications par liaison de données entre contrôleur et pilote (CPDLC)*

2.14 Le réunion a noté que les Communications par liaison de données entre contrôleur et pilote (CPDLC) ont été mises en œuvre par les États et Organisations dans leurs FIR respectives[1], afin d'atténuer les défis géographiques qui limitent l'extension de couverture VHF dans certaines régions, ainsi que les limitations inhérentes à la communication HF. Elle a rappelé que l'exigence ACC AFI a été introduite dans le Plan régional de navigation aérienne (OACI Doc 7474) par la 13ème réunion d'APIRG en 2001, pour soutenir les opérations en route, ainsi que la conclusion 17/25 d'APIRG réitérant cette exigence.

*Performances de communication requises (RCP)*

2.15 La réunion a examiné le concept de performances de communication requises (RCP) tel qu'il est exposé dans le Manuel RCP de l'OACI (Doc 9869) et sa mise en œuvre dans la région AFI. Le type de RCP est une spécification de performance conçu pour servir comme un filet de sécurité possible dans la planification pour s'assurer que les différentes composantes infrastructurelles, opérationnelles et technologiques s'articulent bien avec les systèmes embarques et les systèmes au sol pour délivrer un service sûr, fiable et renouvelable. La réunion a réitéré la conclusion APIRG 17/26 demandant l'OACI de soutenir la mise en œuvre du concept de RCP en organisant des séminaires et des ateliers régionaux.

*Document sur les liaisons de données opérationnelles dans le monde (GOLD)*

2.16 Le réunion a été mise à jour sur les développements concernant Document sur les liaisons de données opérationnelles dans le monde (GOLD), visait à faciliter l'harmonisation mondiale de l'exploitation des liaisons de données existantes et résoudre les différences régionales et/ou nationales affectant une exploitation sans couture. Il contient aussi des performances de communication requises (RCP) et des spécifications de surveillance basées sur le document DO-306 de la RTCA/ED-122 de l'EUROCAE, ainsi que des lignes directrices sur la surveillance post-mise en œuvre et les actions correctrices pour traiter un certain nombre de problèmes relatifs aux services de communications de données par satellite.

[1] En 2011, les procédures CPDLC étaient opérationnels / prévues à Antananarivo, Brazzaville, Dakar terrestres, Dakar Océanique, Johannesburg, Maurice, Ndjamena, Niamey, Sal Océanique, et Seychelles.

2.17 La réunion a noté que le GOLD a été finalisé et adopté par l'APANPIRG, les groupes[2] NAT SPG et SAT. Elle a donc recommandé son adoption par le groupe APIRG pour remplacer le Manuel d'exploitation FANS-1/A (FOM) adopté par la réunion APIRG/16 (cf. conclusion 4/15).

*Examen du rapport de la Deuxième Réunion du Groupe de gestion de fréquences de la région AFI (AFI/FMG/2)*

2.18 La réunion a examiné le rapport de la Deuxième Réunion du Groupe de gestion des fréquences de la région AFI qui a eu lieu à Dakar, Sénégal, 18-19 avril 2011, tel que présenté par le Secrétariat et le Rapporteur (ASECNA). Après avoir examiné les termes de référence du FMG tel que défini par la réunion APIRG/17, et les activités pertinentes du Groupe de travail F (Fréquence) (WG/F) du Groupe d'experts des communications aéronautiques, le FMG a évalué les progrès réalisés dans la mise en œuvre des conclusions et des décisions de sa première réunion (AFI / FMG / 1)[3] et depuis la réunion APIRG/17. Le Groupe a également examiné les activités préparatoires de la CMR-12 de l'UIT au niveau mondial et régional, y compris le travail de l'ACP de l'OACI, l'atelier de l'OACI (décembre 2010), la réunion préparatoire de la conférence de l'UIT (CPM / 2) et la réunion préparatoire de l'ATU (février 2011). L'intégralité du rapport de AFI/FMG/2 peut être téléchargé à partir du site public de l'OACI (www.icao.int / ESAF, www.icao.int / WACAF).

2.19 Le sous groupe CNS a approuvé les termes de référence du Rapporteur AFI / FMG, ainsi qu'un plan d'action pour FMG AFI dont les tâches comprennent des questions spécifiques devant être traités par les États et les administrations:

- Suivi et compte rendu à APIRG sur l'état des capacités disponibles dans les différentes bandes aéronautiques.
- Examen des SARP de l'OACI et document d'orientation;
- Coordonner les activités pour le processus de planification des fréquences aéronautiques et protection du spectre aéronautique ;
- Maintenance des listes AFI COM en fournissant les données pertinentes;
- Soutien à la position de l'OACI aux CMR de l'UIT à travers les initiatives nationales et régionales.

2.20 Les termes de référence du groupe FMG AFI, sa composition et son futur programme de travail figure à **l'appendice E1** à cette note de travail, ainsi que le plan d'action du Groupe. Les termes de référence du Rapporteur du Groupe sont également indiqués à **l'appendice E2**. (*cf. appendice A, Projet de conclusion 4/18)*

*Examen de la position de l'OACI, y compris les mises à jour et les préparatifs de la CMR-12 de l'UIT*

2.21 La réunion a été informée que le Conseil de l'OACI, à sa 3e séance de sa 193e session le 15 juin 2011, avait approuvé la position actualisée de l'OACI sur les questions critiques pour l'aviation inscrites à l'ordre du jour de la Conférence mondiale des radiocommunications de 2012 (CMR-12) de l'Union internationale des télécommunications (UIT). Elle a rappelé la position originale de l'OACI qui a été

[2] La FAA des États-Unis reconnaît le GOLD dans sa circulaire consultative (AC) 20-140A - *Lignes directrices pour l'approbation de conception des systèmes sur les liaisons de données opérationnelles dans le monde qui soutiennent les services de la circulation aérienne (ATS)*, et AC 120-70B - *Processus d'autorisation d'exploitation pour l'utilisation du système sur les liaisons de données opérationnelles dans le monde*

[3] *La Première Réunion du Groupe de gestion de fréquences de la région AFI (AFI/FMG/1)s'est tenue à Dakar, Sénégal en septembre 2009*

envoyée aux États contractants de l'OACI sous couvert de la lettre réf. E 3/5- 09/61 du 30 juin 2009, et qui avait mentionné qu'avant la tenue de la CMR 12 les nouveaux développements résultant des études en cours par l'OACI et l'UIT pourraient exiger la présentation de matériel supplémentaire à la conférence. Les mises à jour approuvées contiennent le matériel supplémentaire sur base des derniers résultats des études de l'OACI et de l'UIT.

2.22 L'attention de la réunion a été attirée sur le fait que la position de l'OACI serait soumise à la CMR-12 en tant que note d'information. En tant que tel, le soutien actif des États a été considéré comme le seul moyen d'assurer que les résultats de la CMR-12 reflètent le besoin de l'aviation civile relatif au spectre de fréquences aéronautiques (Résolution A36-25 de l'Assemblée de l'OACI).

2.23 Le réunion a encouragé les États ou organisations à participer à l'Atelier régional de fréquence du spectre de l'OACI en vue de préparation de la CMR-12 et la 25e réunion du Groupe de travail F (Fréquence) du Groupe d'experts des communications aéronautiques (ACP-WG/F/25) tenues à Dakar du 6-14 octobre 2011.

*Nécessité d'une feuille de route pour les technologies CNS*

2.24 Le réunion a noté que lors de sa 37e session, l'Assemblée de l'OACI a demandé au Conseil d'organiser une douzième Conférence de navigation aérienne en 2012 (AN-Conf/12), pour développer la planification à long terme pour l'OACI fondée sur une mise à jour le plan mondial de navigation aérienne (GANP) et que la Conférence pourrait particulièrement développer les feuilles de route sur les communications, la navigation, la surveillance, l'avionique et l'information aéronautique.

2.25 Le réunion a donc décidé que le programme de travail du Sous-groupe CNS devrait comprendre l'élaboration de feuilles de route régionales devant être extraits des feuilles de route mondiales de l'OACI. Ces feuilles de route pourraient assurer la compatibilité entre les systèmes de navigation aérienne.

2.26 La réunion a également demandé aux États de promouvoir la prise de décision et le partenariat collaborative au sein de l'industrie aéronautique pour le développement et la mise en œuvre des solutions intégrées pour les composants d'infrastructure CNS, selon les priorités identifiées, et a fait appel à la CAFAC, l'OACI et d'autres institutions pertinentes de faciliter les modalités de financement nécessaires pour financer les programmes intégrés visant à améliorer l'infrastructure régionale, y compris les aspects des ressources humaines, basés sur la feuille de route pour les technologies CNS

*Enquête mondiale sur les équipages des aéronefs*

2.27 En ce qui concerne l'avionique, l'IATA a présenté lors de la réunion les résultats d'une enquête mondiale menée en 2010, couvrant 218 flottes des compagnies aériennes et plus de 6000 aéronefs.

2.28 La réunion a souligné l'importance d'avoir des informations complètes sur l équipage des aéronefs aux fins de la planification et mise en œuvre de système de navigation aérienne et a demandé aux États AFI de fournir des informations détaillées aux bureaux régionaux de l'OACI concernant le niveau d'équipement et les capacités de leurs aéronefs immatriculés. (Cf. appendice A, Projet de conclusions 4/19 et 4/20)

*Examen de Programme de travail futur et composition du Sous-groupe CNS*

2.29 Sous ce point de l'ordre du jour, le Sous-groupe CNS a examiné et actualisé son programme de travail et sa composition comme indiqué dans **l'Appendice F** à la présente note de travail. (cf. **appendice A**, Projet de conclusion 4/21).

*Examen des conclusions et décisions de la seizième Réunion informelle de coordination pour l'amélioration des services de la circulation aérienne au-dessus de l'Atlantique Sud (SAT/16) relatives à CNS*

2.30 Le réunion a été présentée avec les résultats de la réunion SAT/16 relative au sous-groupe CNS d'APIRG. Elle a noté en particulier que les États membres et organisations SAT avaient développé des initiatives de coopération efficaces visant à assurer une mise en œuvre coordonnée des systèmes CNS (AMHS, GNSS, SSR et ADS-C / CPDLC) à travers des protocoles d'entente visant à assurer leur interopérabilité et interconnexion, et a recommandé que les États AFI qui participent à des activités SAT doivent promouvoir de telles initiatives dans la Région AFI.

*Les lignes directrices de planification et de mise en œuvre pour les systèmes de communications, navigation et surveillance (CNS)*

2.31 La réunion a examiné les stratégies pour la mise en œuvre des initiatives du Plan mondial (GPI) sur les systèmes CNS tels que décrits dans le Plan mondial de navigation aérienne (Doc 9750), et a adopté les stratégies pour la Région AFI**. L'Appendice G** à la présente note de travail fournit une description détaillée des stratégies adoptées.

## 3. SUITE À DONNER

3.1 La réunion est invitée à:

a) Prendre note du rapport de la quatrième réunion du sous-groupe Communications, navigation et surveillance sur les questions relatives aux communications, tel qu'est présenté dans cette note de travail et;

a) noter que les projets de conclusions 4/13 et 4/14 et décision 4/11 de la réunion CNS/SG/4 figurant à **l'appendice A** à cette présente note de travail, ont déjà été mises en œuvre;

b) adopter le projet de conclusions 4/01, 4/10, 4/15, 4/18, 4/19, 4/20 et décision 4/20 de la réunion CNS/SG/4 figurant à **l'appendice A** à cette note de travail ; et

c) adopter le projet d'architecture de routage de l'ATN dans la région AFI figurant à **l'appendice D** à cette note de travail.

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**APPENDICE A**

**PROJET DE CONCLUSIONS ET DE DÉCISIONS**

| **PROJET DE CONC. / DEC. NO.** | TITRE / TEXTE |
|---|---|
| **Point 4 de l'ordre du jour - Service fixe aéronautique (AFS)** | |
| **Projet de conclusion 1.4** | **Besoin d'aide de l'OACI dans la résolution des carences AFS**<br><br>Il est conclu que les bureaux régionaux de l'OACI devraient explorer toutes les voies pour aider les États concernés à rétablir / mettre en œuvre des circuits non-opérationnels se basant sur les exigences du plan régional de navigation aérienne de la région AFI. |
| **Projet de conclusion 4/10** | **Stratégie de mise en œuvre du système AMHS AFI**<br><br>Il est conclu que la stratégie AHMS figurant à l'**Appendice B** à cette note de travail soit adoptée pour la Région AFI. |
| **Projet de décision 4/11** | **Projet d'architecture de routage de l'ATN dans la région AFI**<br><br>Il est conclu que le Secrétariat:<br><br>1. envoie aux États et organisations le projet d'architecture de routage de l'ATN pour la région AFI figurant à **l'appendice D** à cette note de travail, pour leurs observations finales d'ici 30 septembre 2011;<br><br>2. par conséquence finaliser le projet d'architecture de routage de l'ATN pour adoption par la réunion APIRG/18. |
| **Projet de conclusion 4/13** | **Nécessité des enquêtes plus approfondies sur les plans de vol manquants**<br><br>Il est conclu que, compte tenu de la haute priorité à accorder à la question de plans de vol manquant, les unités de services de la circulation aérienne (ATSU) dans la région AFI ont fait des rapports et mener des enquêtes sur les plans de vol manquants au cours de la période de 15 à 17 août 2011. Les résultats de leurs investigations devraient être compilés en utilisant le formulaire ci-joint à ce rapport, et communiqués aux bureaux régionaux de l'OACI. |

| PROJET DE CONC. / DEC. NO. | TITRE / TEXTE |
|---|---|
| **Projet de conclusion 4/14** | **Enquêtes sur la perte de messages RSFTA dans la Région AFI**<br><br>Il est conclu que, afin de mieux analyser et atténuer la perte de messages RSFTA, y compris les messages de plan de vol dans la région AFI, Les centres RSFTA ont mené une enquête de trois jours (15-17 août 2011) sur les performances du RSFTA, en utilisant les formulaires et modèles de messages à être envoyée par le Secrétariat. Ce faisant, ils devraient:<br><br>1. utiliser les adresses RSFTA de leurs ATSU respectives dans la Région AFI;<br>2. fournir la disponibilité du (des) circuit (s) RSFTA impliqué (s), basé sur la configuration de routage appliquées, et<br>3. fournir les durées d'acheminement ; |
| **Point 5 de l'ordre jour – Service mobile aéronautique (AMS)** | |
| **Projet de conclusion 4/15** | **Adoption du Document sur les liaisons de données opérationnelles dans le monde (GOLD)**<br><br>Il est conclu que, afin d'assurer l'harmonisation régionale et mondiale des opérations de liaison de données, le document sur les liaisons de données opérationnelles dans le monde (GOLD) soit adopté pour la Région AFI, et remplace le Manuel d'exploitation FANS-1/A (FOM).<br><br>Note: L'Afrique du Sud coordonne la tenue de GOLD pour la Région AFI. |
| **Point 8 de l'ordre du jour – Questions relatives au Spectre de Fréquences Aéronautiques** | |
| **Projet de conclusion 4/18** | **La mise en œuvre du Plan d'action AFI FMG**<br><br>Il est conclu que les États et organisations AFI mettent en œuvre le Plan d'action proposé par le Groupe de gestion des fréquences AFI comme indiqué à **l'Appendice E** à cette note de travail. |
| **Point 9 de l'ordre du jour – 37ème Assemblée de l'OACI (2010) et douzième Conférence de navigation aérienne (AN/Conf/12, 2012) – questions CNS** | |
| **Projet de conclusion 4/19** | **Importance de l'information sur les équipages des aéronefs dans la planification et mise en œuvre du système de navigation aérienne**<br><br>Il est conclu que, les États AFI doivent tenir compte des données disponibles et fiables et prévisions sur le niveau d'équipages et les capacités d'aéronefs lorsqu'ils prennent leurs décisions concernant la planification et mise en œuvre de systèmes de navigation aérienne |

| PROJET DE CONC. / DEC. NO. | TITRE / TEXTE |
|---|---|
| **Projet de conclusion 4/20** | **Capacités et Equipages des aéronefs immatriculés dans des États AFI**<br><br>Il est conclu que, les États AFI devraient soutenir les enquêtes sur le niveau d'équipages et capacités des aéronefs en fournissant aux bureaux régionaux de l'OACI des informations détaillées concernant les aéronefs immatriculés. |
| **Point 10 de l'ordre du jour - Programme de travail futur et composition du sous-groupe CNS** | |
| **Projet de décision 4/21** | **Futur programme de travail pour le Sous-groupe CNS**<br><br>Il est conclu que le futur programme de travail et la composition du Sous-groupe CNS soient modifiés comme l'indique l'**appendice F** à cette note de travail. |

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**APPENDIX B**

# STRATEGY FOR IMPLEMENTATION OF THE ATS MESSAGE HANDLING SYSTEM (AMHS) IN THE AFI REGION

## TABLE OF CONTENT

## 1. Introduction

The ATS Message Handling System (AMHS), which has been defined in the ICAO Aeronautical Telecommunication Network (ATN) standards, is intended to be a replacement for the current legacy Aeronautical Fixed Telecommunications Network (AFTN).

In order to assist States /Organizations on the matters relating to the implementation of ATS Messages Handling System (AMHS) in the AFI region and to ensure a uniform, smooth and harmonious implementation and regional interoperability, the AMHS/I/TF was requested to develop a Draft AFI AMHS Implementation Strategy.

## 2. Object of the document

This document presents the draft AFI strategy to guide States and/or Organizations in implementation of AMHS within the AFI Region as required by the terms of reference of the AFI AMHS/I/TF meeting, Nairobi, Kenya, 20-21 May 2011. The document contains:

- A background about the states of AMHS implementation in AFI and other Regions
- an AFI implementation strategy
-

## 3. Background

The exchange of ATS messages, as part of the Aeronautical Fixed Service (AFS) defined in ICAO Annex 10 Volume II is an essential function to the safety of air navigation and to the regular, efficient and economical operation of ATS provision. The Aeronautical Fixed Telecommunications Network (AFTN/CIDIN) has so far provided an effective store-and-forward messaging service for the conveyance of text messages, using character-oriented procedures. However, with regard to the future requirements in the exchange of ATS messages and the technological evolution, AFTN/CIDIN technology is now becoming obsolete, and is not sufficiently flexible to support messaging functions found in modern messaging systems (such as transfer of binary information and data folders).

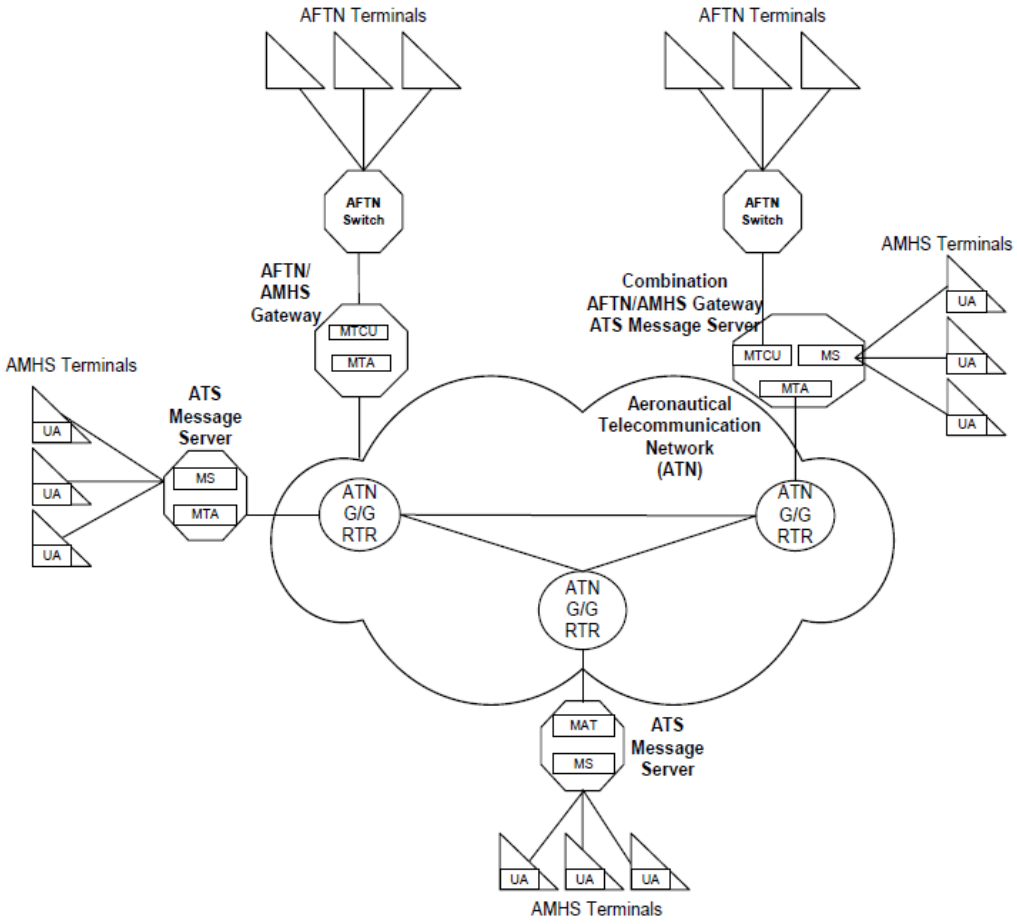
With a view to meet the critical requirements of the aviation community for enhancing its ground data communications by means of up to date technology, ICAO has specified that the Aeronautical Telecommunications Network (ATN) may replace the existing networks based on AFTN. The Aeronautical Telecommunication Network (ATN) will enable seamless communications between ground users (e.g. ANSPs, Airlines) and aircraft.

The most recent development with regard to messaging in the ATS environment is the ATS Message Handling System (AMHS). The AMHS is a natural evolution from AFTN/CIDIN and replaces the telegraphic style of working with a modern Message Handling System based on international Standards. The AMHS, being an ATN application utilizes the infrastructure of the ATN network; however this is not a prerequisite for the initial deployment of AMHS.

The AMHS is designed according to the International Telecommunication Union's (ITU) X.400 messaging standard which provides the core messaging framework similar to modern day email messages for the use of exchanging messages between Air Traffic Service users over the ATN. As an X.400-based system, the AMHS is specified in such a way that messages can be transferred from the sender to the recipient by passing reliably through intermediate AMHS systems. The AMHS system at the originating station, when it first receives a newly submitted message, must determine the AMHS system that will receive the AMHS message. This may be:

- the destination AMHS,
- a relay AMHS, or
- the AFTN.
-

### 3.1 OVERVIEW OF AMHS




:
In terms of functionality, the AMHS comprises the following components:

- the Message Transfer Agent (MTA) which performs the function of the message switch,
- the User Agent (UA) which performs the user access to the MTA and provides an appropriate user interface,
- the Message Store (MS) which provides the intermediary storage between MTA and UA and is usually co-located with the MTA, and
- the Access Unit (AU) which provides for intercommunication with other Messaging.

Three categories of AMHS end systems are defined for the support of the ATS Message Handling Service:

- the ATS message server (MTA)

- the ATS message user agent (UA)
- the AFTN/AMHS gateway.

### 3.2 Technical provisions

The provisions pertaining to AMHS, such as SARPs, technical manuals and /or specifications and general guidance material are now available and the Industry has so far developed systems to provide AMHS along these guidelines. The following ICAO documents constitute the main references:

- Annex 10, Volume II, Chapter 4
- Annex 10, Volume III, Part I, Chapter 3
- Doc 9880 Part IIB
- Manual for the ATN using IPS Standards and Protocols (Doc 9896)
- Doc 9705

### 3.3 Requirements for the Network

The performance network to support the AMHS is very important to ensure a reliable AMHS service. From the ICAO SARPS, AMHS could be implemented using ISO or IPS protocols. There are already national AMHS implementations in place, based on the TCP/IP protocol suite. In addition, ANSPs have the necessary TCP/IP expertise on hand from various national applications. The broad market of TCP/IP products would facilitate rapid implementation with reasonable costs.

In the AFI Region, the States adopted to implement the AMHS under ATN/IPS as the ground-ground network in line with several ICAO Regions. Today, the majority of the links of current AFTN circuits are configured at 9600 kbps.
The implementation of the AMHS requires more bandwidth because of the overhead of the protocol. The network speed in areas of high traffic density is 64 kbps with at least 32 kbps in general. The AFI strategy will thus have to take into account the necessity of increasing the network capacity through the implementation of a successful ATN network.
This increased capacity will necessarily have an associated cost and may require the upgrade of the network infrastructures.

### 3.4 Status of AMHS implementation Activities

At present, there are many initiatives and activities aiming at a rapid implementation and operation of the ATS Message Handling System (AMHS). At the level of ICAO, Regional working groups are tasked with the development of guidelines and the coordination of implementation. Regional AMHS workshops are conducted to facilitate coordination between States and exchange of information with manufacturers. In addition, trials and operational implementations are underway.

The 17th APIRG meeting, Ouagadougou, Burkina Faso, 2-6 August 2010 per conclusion 17/17 set up a Task Force to coordinate and plan for the implementation of AMHS in the AFI Region; and the SAT/16 meeting Recife, 02-06 May 2011 per conclusion 16/13 calls States to participate in the forthcoming regional Seminars and workshops organized by ICAO to support the implementation of AMHS regional Plans requirements.
Today, some AFI States have already installed AMHS systems, conducted trials and demonstrations for implementation of AMHS and have taken actions for the introduction of AMHS operationally on a national basis. It is therefore necessary to develop a regional strategy, in order to conduct a standardized and harmonized implementation process within the AFI Region.

## 4. AFI AMHS IMPLEMENTATION TIMEFRAME

The implementation of the AMHS will follow several stages. Currently, only a very few states within the AFI region have AMHS infrastructures and the necessary network capacities. The AFI strategy should therefore take into account the experience gained from the equipped countries and progress studies conducted.

**2011 –2013 Experimentation**

During this period, pioneer and new States will continue to install AMHS systems. The experimentations and testing of interoperability will be expedited. This phase will allow the constraints related to the implementation and especially to the interconnections to be determined.

**2011 - 2015 Validation of the architecture ATN – Upgrade of the network capacities**

The harmonization and the increase of the network capabilities are necessary for the implementation of the AMHS. Several projects related to satellite VSAT networks of the AFI region are currently on going and in particular the audit of the AFISNET network which will involve some modifications to the network.

During the current phase, the ATN architecture will be validated and the increase of the capabilities of the various connections will be completed. These modifications can involve the modifications of the network infrastructure;
Due to the financial resources which it could require, the priority will be given to the main links establishing the ATN Backbone, which will allow to conduct effectively the experiments and to validate the ATN backbone.

During this period, the priority will be given to the systems of extremity AMHS in case of replacement of AFTN switches.

This deadline takes into account the necessary time for the validation of the ATN and AMHS architectures as well as the planning and the mobilization of the necessary financing.

**From 2015 - Deployment in the main centers**

In 2015, it can be considered that the ATN backbone and the network capabilities are quite completed.

The systems of extremity ATN / AMHS will then be deployed in the main centers with an AMHS/AFTN Gateway if required.

**From 2017 General Deployment**

From 2017 onwards, all the End Systems of the network will have to be AMHS compatible. Various end-system such as the automated systems for the management of ATS data will be updated and the exchange l of ATS messages through the AMHS.

## 5. STRATEGY FOR IMPLEMENTATION OF THE AMHS IN THE AFI REGION

Considering the initiatives related to the AMHS implementation in the AFI region and the AMHS implementation activities progress in the other ICAO regions and in Industry, the AFI

States/Organizations should take into consideration the following strategy to implement AMHS in the AFI region.

Considering:

1) The requirements for a reliable, secured and homogenous ground-to-ground Aeronautical Telecommunication Network to support the ATS Message Handling System (AMHS);

2) The availability of ICAO SARPs and technical manuals for the ATN/AMHS, the availability of equipment and readiness of vendors to support the AMHS ground-to-ground communications;

3) The availability of AMHS Transition and Implementation guidance materials required to assist States to ensure harmonization of procedures and protocols and thereby assure interoperability within the region;

4) The need for States using the currently AFTN systems for communication with other States and Regions to migrate gradually and harmoniously to the AMHS system by replacing the aging AFTN switches with ATS Message Transfer Agents (MTA);

5) The efforts of AFI States to take over and implement ATN/ AMHS; and

6) The need to support States to ensure a uniform, smooth and harmonious implementation;

The general strategy for the implementation of AMHS infrastructure in the AFI Region is as follows:

a) Deploy a backbone network of ATN/IPS to provide a reliable infrastructure to initially support ground-to-ground applications (AMHS, AIDC…);

b) Use the TCP/IP communication protocol for the initial implementation of ATS Message Handling Systems, as a transition mechanism to enable AMHS operations to commence ahead of eventual full SARPs compliance;

c) The backbone States to implement in the short term a interoperable AMHS infrastructure and to conduct trials and studies on bilateral and multilateral basis in AFI region and on inter-regional basis to validate the operational implementation of AMHS and AMHS/AFTN Gateway;

d) The BBIS states with interface to other regions that adopt TCP/IP or, should establish connection based on bilateral agreement;

e) The none backbone States, to implement gradually AMHS when replacing their aging current AFTN systems and to connect to backbone States using the ATN/ IPS protocols and the appropriate security provision ;

In order to achieve the above strategy the following is required of states and organization in the AFI Region:

a) States shall provide implementation in compliance with Annex 10 SARPS and ICAO Manuals, and with the Plans, Policies and AMHS Transition and Implementation guidance Materials adopted by APIRG;

b) Backbone States shall upgrade their network capability and later migrate to an IP sub-network capability for interconnection with other Backbone States and Non-backbone States.

c) States shall work co-operatively to assist each other on a multinational basis to implement the ATN and AMHS in an expeditious and coordinated manner and to ensure system inter-operability; and

d) States shall organize training of personnel to provide necessary capability to maintain and operate the ground-to-ground ATN/AMHS infrastructure and applications.

**Strategy implementation plan**

| | Short Term 2011-2013 | Mid-Term 2014-2017 | Long Term2018-2023 |
|---|---|---|---|
| APIRG Technical Provision | Development of AFI Technical Provisions | Implementation based on the AFI Technical Provisions | |
| Telecommunications Infrastructure | Upgrade of ANSP VSAT Networks and Validation of the AMHS Topology | Integration of AFI VSAT Network and Implementation of the AMHS Topology | Full Operational Implementation of AMHS Backbone and Applications |
| Implementation of AMHS | Operation of the existing AFTN System and Progressive Implementation of AMHS Systems on National or Regional Basis | Implementation Of AMHS Systems at all main AFTN Centers and Trials on Inter-Regional Links | Completed Transition of all the AFTN Centers and Full Operational Implementation |
| Operational Deployment | AMHS Trials on National/Regional basis | Pursue of Trials on Regional basis and Operational Implementation | Full AMHS Operational Implementation |

**Conclusion**

The implementation of the ATN / AMHS requires the commitment of all the actors as was reaffirmed during the first meeting of the AMHS TASKFORCE. It will require the implementation of new systems of extremity ATN as well as the availability of an ATN network combining capabilities and adequate performances.

--END---

**APPENDIX C**
**TERMS OF REFERENCE, WORK PROGRAMME AND COMPOSITION OF THE AFI ATS MESSAGE HANDLING SYSTEM IMPLEMENTATION TASK FORCE (AFI AMHS/I/TF)**

## 1-TERMS OF REFERENCE

1) Conduct a comprehensive review of ICAO Standards and Recommended Practices (SARPs) pertaining to the Air Traffic Services Message Handling Service (ATSMHS) application as specified in Annex 10 – *Aeronautical Telecommunications* - Volume II and Volume III, and guidance material contained in ICAO *Manual on detailed specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI standards and protocols* (Doc.9880), *Global Air Navigation Plan* (Doc 9750) and other relevant provisions;

2) Collect and analyze information on the status of AFI ANSPs ATS Message Handling Systems plans, including ongoing upgrades to existing systems and;

3) On the basis of the above, develop a coordinated AFI transition strategy and plan with associated timelines to enable the streamlined coordinated implementation of AMHS.

**Considerations**

In addressing its terms of reference, the Task Force should consider, *inter alia,* the following aspects:

1) AFI AMHS systems should be:

   a. implemented in accordance with ICAO SARPs and technical specifications, and
   b. interoperable with systems implemented by other ICAO Regions.
   c.

2) Personnel training for operational migration from AFTN to AMHS;

3) AFS network backbone capabilities;

4) Systems that transition early will need to be capable of handling both AMHS and AFTN messages;

5) Establishment of an Information Management system to track implementation timelines; and

6) Impacts to users (compliance to new flight plan format, availability of qualified personnel, etc).

## 2-WORK PROGRAMME

| Task No. | Global Plan Initiative | Subject | Target date |
|---|---|---|---|
| 1 | GPI-22 | **Conduct of a Regional Survey on:**<br>1. AFS circuits specifications (circuit type, modulation rate, protocol, ITU code, VSAT network)<br>2. AMHS implementation status (implementations, plans, levels of service, protocols, implementation challenges, level | CNS/SG/5 2013 |

| Task No. | Global Plan Initiative | Subject | Target date |
|---|---|---|---|
| | | of knowledge on AMHS and ATN, etc.)<br>*Team Leader: Secretariat*<br>*Team members: All Task Force Core members*<br>*References:*<br>• *APIRG/15 Report*<br>• *ICAO Annex 10 (Vol. 2 and Vol.3)*<br>• *ICAO Doc 9880* | |
| 2 | GPI-22 | **Draft AFI AMHS Implementation Plan**<br>1. Draft AFI ATN Architecture<br>2. Draft AFI ATN Network Service Access Point Addressing Plan<br>3. Draft AFI AMHS Implementation Plan<br>a. AFI FASID CNS1B Table<br>b. AFI FASID CNS1C Table<br>*Team Leader: Rwanda*<br>*Team members: Angola, Ethiopia, Kenya, Mozambique, Rwanda, Sudan, Zimbabwe and ASECNA*<br>*References:*<br>• *Report of the Second Meeting of AFI ATN Planning Task Force*<br>• *AFI Air Navigation Plan, FASID (CNS)*<br>• *ICAO Annex 10 (Vol. 2 and Vol.3)* | CNS/SG/5 2013 |
| 3 | GPI-22 | **Draft AFI AMHS Manual**<br>1. Introduction<br>2. AFI AMHS Requirements<br>3. AFI ATS Messaging Service Profile<br>4. System implementation - Guidelines for system requirements<br>5. AMHS management<br>6. Tests and validation of systems<br>7. Operational procedures and recommendations<br>8. Miscellaneous<br>9. Appendices<br>*Team Leader: South Africa (ATNS)*<br>*Team members: Somalia (CACAS), South Africa, Tanzania, Uganda and ASECNA*<br>*References:*<br>• *ICAO EUR AMHS Manual (Doc 020)*<br>• *ICAO Annex 10 (Vol. 2 and Vol.3)*<br>• *ICAO Doc 9880* | CNS/SG/5 2013 |

**3-COMPOSITION**

***Core members:*** *Algeria, Angola, Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Niger, Nigeria, Rwanda, Senegal, South Africa (ATNS), Sudan, Tanzania, Tunisia, Uganda, Zimbabwe, ASECNA, IFATSEA and Roberts FIR.*

***Other members:*** *All AFI States and Air Navigation Service Providers (ANSPs) with implemented and planned AMHS systems.*

***Note:*** *Members should nominate suitable experts involved in aeronautical telecommunications operations and systems engineering.*

-END-

**APPENDIX D**

**AFI**

**ATN ROUTING ARCHITECTURE PLAN**
**(DRAFT)**

## EXECUTIVE SUMMARY

This document provides technical guidance on the Planning and Implementing the transition to the Aeronautical Telecommunication Network (ATN) for ground communication within the ICAO AFI Region.

The routing architecture is based upon the need for a ground-ground infrastructure to eventually replace the existing AFTN infrastructure. For this reason, the routing architecture uses the existing AFTN 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 be suitable as the routing architecture for the introduction of the air-ground communication requirements.

## INTRODUCTION

This document presents an initial plan for the routing architecture within the AFI Region.

***Terms used***

***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.

***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.

***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.*

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

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

***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.

***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.

***Acronyms used***

AFTN - Aeronautical Fixed Telecommunication Network

BIS - Boundary Intermediate Systems
BBIS - Backbone Boundary Intermediate Systems
CLNP - Connectionless Network Protocol
EBIS - End Boundary Intermediate Systems
ES - End System
IDRP - Inter-Domain Routing Protocol
IS - Intermediate System
PDU - Protocol Data Unit

**ROUTING DOMAIN FUNDAMENTALS**

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 ystems (that typically operate together) into clusters. These clusters have two major properties:

- they are controlled by a single administration/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 administration or 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.

***Intra-Domain Routing***

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.

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

***Inter-Domain Routing***

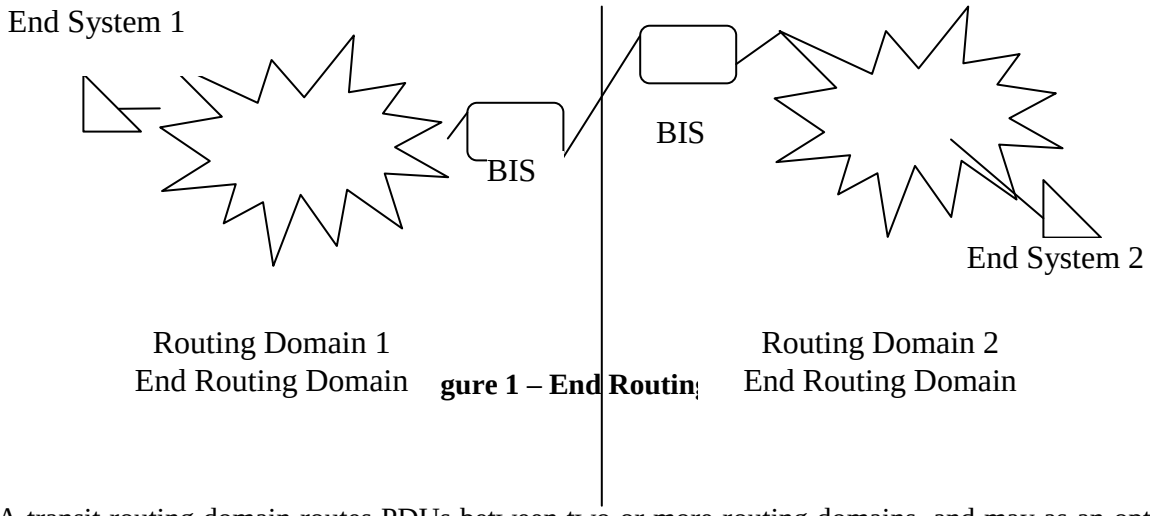
The central definition of routing in the ATN is concerned with inter-domain routing. This is a particularly difficult problem since by the very nature of inter-domain routing, the information received cannot be fully trusted.
Inter-domain routing is based upon the mutual distrust of the received routing 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.)

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

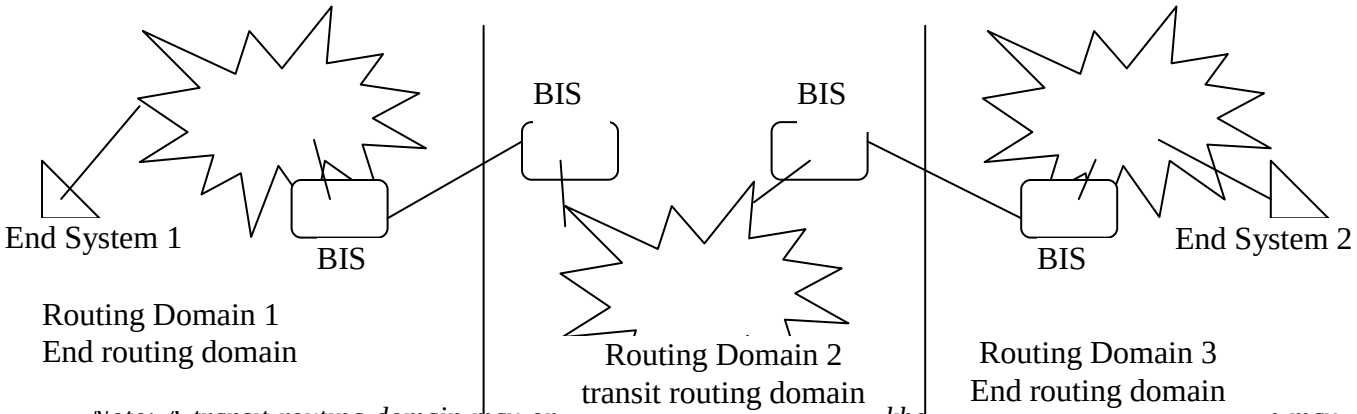
***Types of Routing Domains***

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.




**gure 1 – End Routin**

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.




*Note: A transit routing domain may or kbo 1 may consist of BISs none of which are backbone routers.*

**Figure 2 – Transit Routing Domains**

***Routing Domain Construction***

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.

**ROUTER FUNDAMENTALS**

All routers discussed within this document are ICAO Doc. 9880 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. 9880 within the limits of their own States. These router are internal State issues and outside the scope of this document.*

***Boundary Intermediate System Overview***

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".

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

***Router Types***

There will be two primary types of BISs employed within the Region:

- Backbone BISs (BBISs), and
- End BISs (EBISs).

**Backbone BISs**

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.

BBISs can be further subdivided into Inter-regional BBISs and Regional BBISs. Inter-regional Backbone BBISs are those backbone routers that connect to BBISs in other regions.

Regional BBISs are backbone routers that only connect to routers within the Region.

*Note 1: 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 2: 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 3: The interconnection 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 4: It is possible for some States to provide transit routing from their routing domains to the routing domains of other States using BISs that are not backbone routers.*

**End BISs**

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.

**AFI REGIONAL ROUTING ARCHITECTURE**

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

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 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.

The third 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 fourth 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.

***Regional Backbone***

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

The rationale for defining Regional backbone sites is based upon existing VSAT networks in the AFI Region and the flow of both AFTN traffic and possible future air-ground ATN traffic.
Within the Region there exist four VSAT networks (AFISNET, CAFSAT, NAFISAT and SADC) that can be used to simplify the definition of the backbone architecture.

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.

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.
The initial AFI BBISs sites are defined in the following table by identifying those communication centres that are participating in more than one VSAT network as shown at **Attachment A**. Additional backbone

sites will need to be identified in the future for increased reliability of the interconnections between the networks. This is done in subsequent paragraphs.

| Item | ATN backbone router site | State |
|---|---|---|
| 1 | Antananarivo | Madagascar |
| 2 | Dakar | Senegal |
| 3 | Dar es Salaam | Tanzania |
| 4 | Johannesburg | South Africa |
| 5 | Kinshasa | Dem. Rep. of Congo |
| 6 | Luanda | Angola |
| 7 | Mauritius | Mauritius |
| 8 | N'djamena | Chad |

**Table 4.1 - Definition of initial AFI ATN Backbone router sites**

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

**AFI 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
- Alternate routing.

**Availability**

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

**Reliability**

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

**Capacity**

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

**Alternate 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 backbone routers to guarantee alternate routing paths in case of link or router failure.

**Routing policies**

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.

***Inter-Regional Backbone***

The second component of the AFI Regional 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.

To re-state from the previous section, the Inter-Regional BBISs provide communication from routers within the AFI 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.)

Within the current AFTN network environment, the following locations have been identified to initially serve centres outside the AFI Region:

| Entry/Exit Centre | Region served |
|---|---|
| Addis Ababa | Middle East |
| Algiers | Europe |
| Casablanca | Europe |
| Cairo | Europe, Middle East |
| Dakar | South America |
| Johannesburg | Asia/Pacific, South America |
| Nairobi | Asia |
| Tunis | Europe |

**Table 4.2 - Centres with circuits to other Inter- Regional Backbones**

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.

**Long Term Implementation**

The transition to a fully implemented ATN requires that connectivity amongst the ICAO regions be robust. That is, there is the need to ensure alternate paths and reliable communication. Table 4.2 presents a minimal Inter-Regional Backbone that provides a minimum of 2 circuits to other ICAO regions that communicate directly with the AFI Region. For longer term implementation of the ATN, it would be advisable to have 3 circuits to each Region.

**Initial Implementation**

Note: Information is needed on the plans of States in implementing ATN.

The initial implementation of the ATN, outside of the AFI Region, will most likely be in North America, Europe and Asia/Pacific. Therefore, initial transition planning in AFI may focus on Europe and Asia/Pacific.

For connecting to Europe, there should be four (4) Inter-Regional BBISs. For example, the following locations would be candidates for such routers: Algiers, Cairo, Casablanca and Tunis.

*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.*

For connecting to the Middle East, Inter-Regional BBISs may be located at the locations of the existing AFTN centres, Cairo and Addis Ababa. However, these routers would not be needed until such time as ATN traffic is destined for that Region and the location of the routers would be determined at that time.
For connecting to the ASIA/PAC, Inter-Regional BBISs may be located at the locations of the existing AFTN centres, Johannesburg and Nairobi. However, these routers would not be needed until such time as ATN traffic is destined for that Region and the location of the routers would be determined at that time.
For connecting to the SAM Region, Inter-Regional BBISs may be located at the locations of the existing AFTN centres, Dakar and Johannesburg. However, these routers would not be needed until such time as ATN traffic is destined for that Region and the location of the routers would be determined at that time. In the future, Luanda could be added for interface with the SAM Region.

***Routing between Backbone Routers and Routing Domains***

The third component of the AFI ATN routing architecture is the definition of the routing structure between end routing domains within the AFI Region through the regional ATN backbone. This is done by linking routing domains within the coverage area of each VSAT network to the ATN backbone sites on the same network. In this process additional backbones are identified.

Based upon the exiting VSAT network coverage areas, sub-regions are defined for routing efficiencies. These sub-regions are used to concentrate traffic. The goal of this architecture is to use the existing communication infrastructure and the facilities available at existing AFTN centres to the maximum degree possible.

Within the AFISNET area, six major routing domains can be identified:

- ASECNA member States, which could form a routing confederation
- Ghana
- Nigeria
- Roberts FIR
- Sal FIR; and
- Sao Tome and Principe.

Within the ASECNA ensemble, two additional backbones could be located at Brazzaville and Niamey to concentrate traffic as in the current AFTN.

In the Ghana domain, Accra is being linked to Sao Tome by VSAT for VHF extension. This facility could be used in the future to link the Sao Tome domain to the ATN. Thus Accra BIS will be a transit router for Sao Tome. For added reliability, Lagos BIS should transit through Accra, while Kano BIS is linked to N'djamena and Niamey.

In the SADC VSAT coverage area, each State constitutes a routing domain that will be linked to the Johannesburg BBIS.

In the NAFISAT coverage area, each State also constitutes a routing domain. The additional BBIS identified is at Khartoum. Each routing domain has at least two links to the ATN. The BB locations are defined in Table 4.3. The table is organized with one site identified as a potential backbone router site identified above. This site is listed first and in bold text. The remainder of the sites in each sub-region follows.

*Note: The identified backbone router sites are only examples. Actual backbone router sites will be determined by implementation schedules and States' willingness to implement backbone routers.*

| **Location (State) of BB (including amendments by AFI Aeronautical VSAT Networks Managers)** |
|---|
| **Addis Ababa (Ethiopia)**<br>Sub-Regional sites: None<br>Other BBIS sites: Khartoum, Nairobi, Jeddah<br>Other Regions: MID |
| **Accra (Ghana)**<br>Sub-Regional sites: None<br>Other BBIS sites: Dakar, Niamey<br>Other Regions: None |
| **Algiers (Algeria)**<br>Sub-Regional sites: None<br>Other BBIS sites: Casablanca, Tunis, Niamey<br>Other Regions: EUR |
| **Antananarivo (Madagascar)**<br>Sub-Regional sites: SADC:Johannesburg<br>Other BBIS sites: Mauritius<br>Other Regions: None |
| **Brazzaville (Congo)**<br>Sub-Regional Sites: NAFISAT:Nairobi, SADC:Kinshasa, Luanda<br>Other BBIS sites: Dakar, Niamey, N'djamena<br>Other Regions: None |
| **Cairo (Egypt)**<br>Sub-Regional Sites: Tunis<br>Other BBIS sites: Khartoum<br>Other Regions: EUR, MID |
| **Casablanca (Morocco)**<br>Sub-Regional Sites: EUR:Lisbon<br>Other BBIS sites: Algiers, Dakar<br>Other Regions: EUR |
| **Dakar (Senegal)**<br>Sub-Regional Sites: CAFSAT: Recife,Las Palmas, SADC:Johannesburg<br>Other BBIS sites: Casablanca, Niamey, Accra, Brazzaville, Conakry<br>Other Regions: SAM |
| **Dar es Salaam (Tanzania)**<br>Sub-Regional Sites: NAFISAT:Nairobi<br>Other BBIS sites: Kinshasa, Johannesburg<br>Other Regions: None |
| **Ezeiza (Argentina)**<br>Sub-Regional sites: SADC:Johannesburg<br>Other BBIS sites: None<br>Other Regions: AFI |
| **Jeddah (Saudi Arabia)**<br>Sub-Regional Sites: NAFISAT:Addis Ababa,Khartoum<br>Other BBIS sites: None<br>Other Regions: AFI |
| **Johannesburg (South Africa)** |

| **Location (State) of BB (including amendments by AFI Aeronautical VSAT Networks Managers)** |
|---|
| Sub-Regional Sites: AFISNET:Dakar,Antatanarivo, CAFSAT:Ezeiza<br>Other BBIS sites: Luanda, Kinshasa, Dar es Salaam, Plaisance<br>Other Regions: SAM, ASIA/PAC |
| **Kano (Nigeria)**<br>Sub-Regional Sites: None<br>Other BBIS sites: Niamey, N'djamena<br>Other Regions: None |
| **Khartoum (Sudan)**<br>Sub-Regional sites: NAFISAT:N'djamena, SADC:Kinshasa<br>Other BBIS sites: Cairo, Jeddah, Addis Ababa, Nairobi<br>Other Regions: MID |
| **Kinshasa (Democratic Republic of Congo)**<br>Sub-Regional sites: AFISNET:Brazzaville,N'djamena, NAFISAT:Khartoum<br>Other BBIS sites: Dar es Salaam, Johannesburg<br>Other Regions: None |
| **Las Palmas (Gran Canaria)**<br>Sub-Regional sites: AFISNET:Dakar<br>Other BBIS sites: Lisbon, Recife<br>Other Regions: SAM, EUR |
| **Lisbon (Portugal)**<br>Sub-Regional sites: CAFSAT:Casablanca<br>Other BBIS sites: Las Palmas<br>Other Regions: AFI |
| **Luanda (Luanda)**<br>Sub-Regional sites: CAFSAT:Recife, AFISNET:Brazzaville<br>Other BBIS sites: Johannesburg<br>Other Regions: SAM |
| **Nairobi (Kenya)**<br>Sub-Regional Sites: AFISNET:Brazzaville, SADC:Plaisance,Dar es Salaam<br>Other BBIS sites: Khartoum, Addis Ababa<br>Other Regions: ASIA/PAC |
| **N'djamena (Chad)**<br>Sub-regional sites: NAFISAT:Khartoum, SADC:Kinshasa<br>Other BBIS sites: Niamey, Brazzaville, Kano<br>Other Regions: None |
| **Niamey (Niger)**<br>Sub-Regional Sites: None<br>Other BBI sites: Dakar, Algiers, N'djamena, Kano, Brazzaville, Accra, Conakry<br>Other Regions: None |
| **Plaisance (Mauritius)**<br>Sub-Regional sites: NAFISAT:Nairobi<br>Other BBIS sites: Antananarivo, Johannesburg<br>Other Regions: None |
| **Recife (Brazil)**<br>Sub-Regional sites: AFISNET:Dakar, SADC:Luanda<br>Other BBIS sites: Las Palmas<br>Other Regions: AFI |
| **Roberts (Guinea)** |

| **Location (State) of BB (including amendments by AFI Aeronautical VSAT Networks Managers)** |
|---|
| Sub-Regional sites: None<br>Other BBIS sites: Dakar, Niamey<br>Other Regions: None |
| **Tunis (Tunisia)**<br>Sub-regional sites: NAFISAT:Cairo<br>Other BBIS sites: Algiers<br>Other Regions: EUR |

**Table 4.3 – Definition of Geographic Location of BB Sites**

***Routing within end domains***

The fourth component of the AFI routing architecture is the definition of routing within end domains.

**Routing Domains**

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.

The AFI 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 policies.
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. It should be noted that the establishment of routing confederations within the AFI Region could simplify considerably the routing architecture since a routing confederation can be viewed externally as a single routing domain.

**End BISs**

It is assumed that naming and addressing (and routing domain definition) will be done on a Regional basis. Further, 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. 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.

***AFI Regional Routing Architecture***

Summarizing the information presented above, the AFI Regional Backbone network will consist of at least one BBIS router in each of the sub-regions identified above. The actual location of the routers will be based upon implementation schedules and the choices of States.

The Inter-Regional BBISs may be configured to provide both Regional routing services and Extra-Regional routing services. However, these routers must be engineered with sufficient performance capabilities to provide such services.

The chart at **Attachment B** shows the configuration of the AFI routing architecture.

**Transition Issues**

This area needs further work. Information about plans of the States is required.

**ATN Transition**

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

***Initial Regional Implementation***

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

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

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

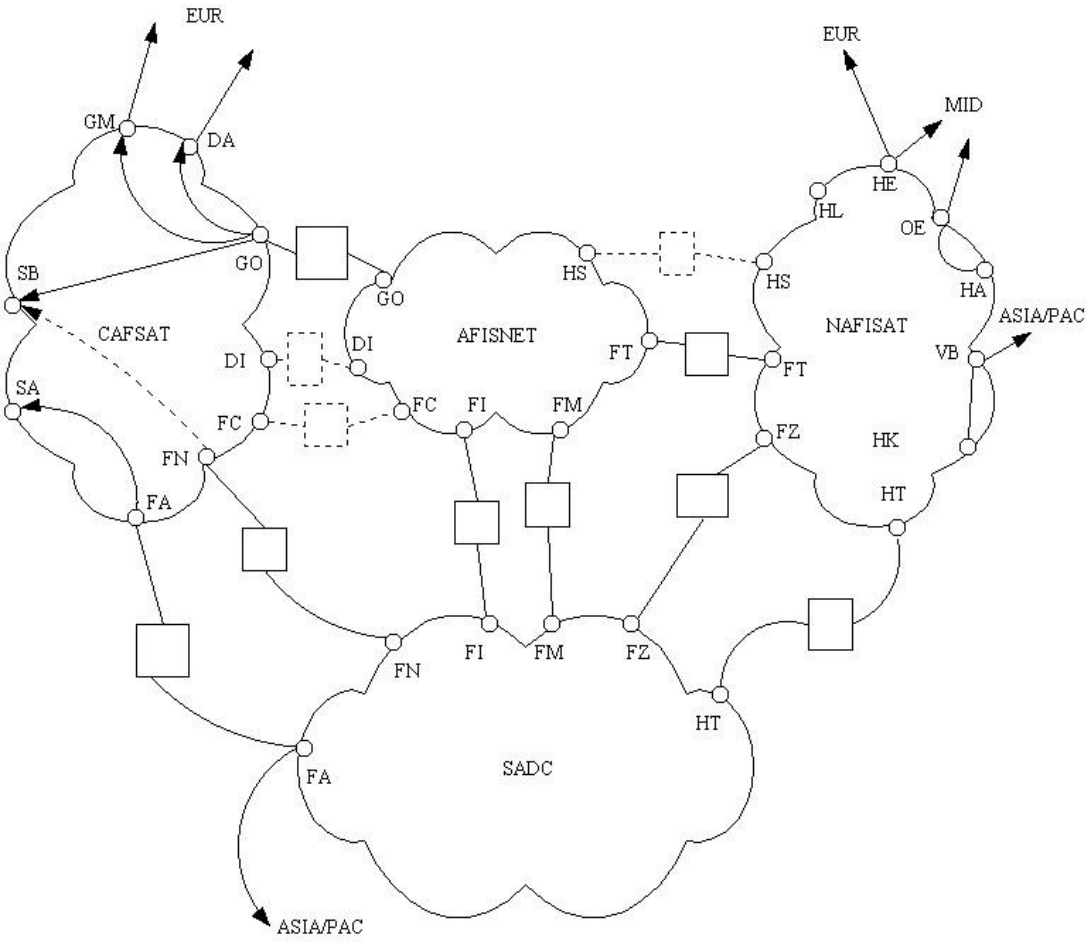
**Regional ATN Implementation**

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.

-END-

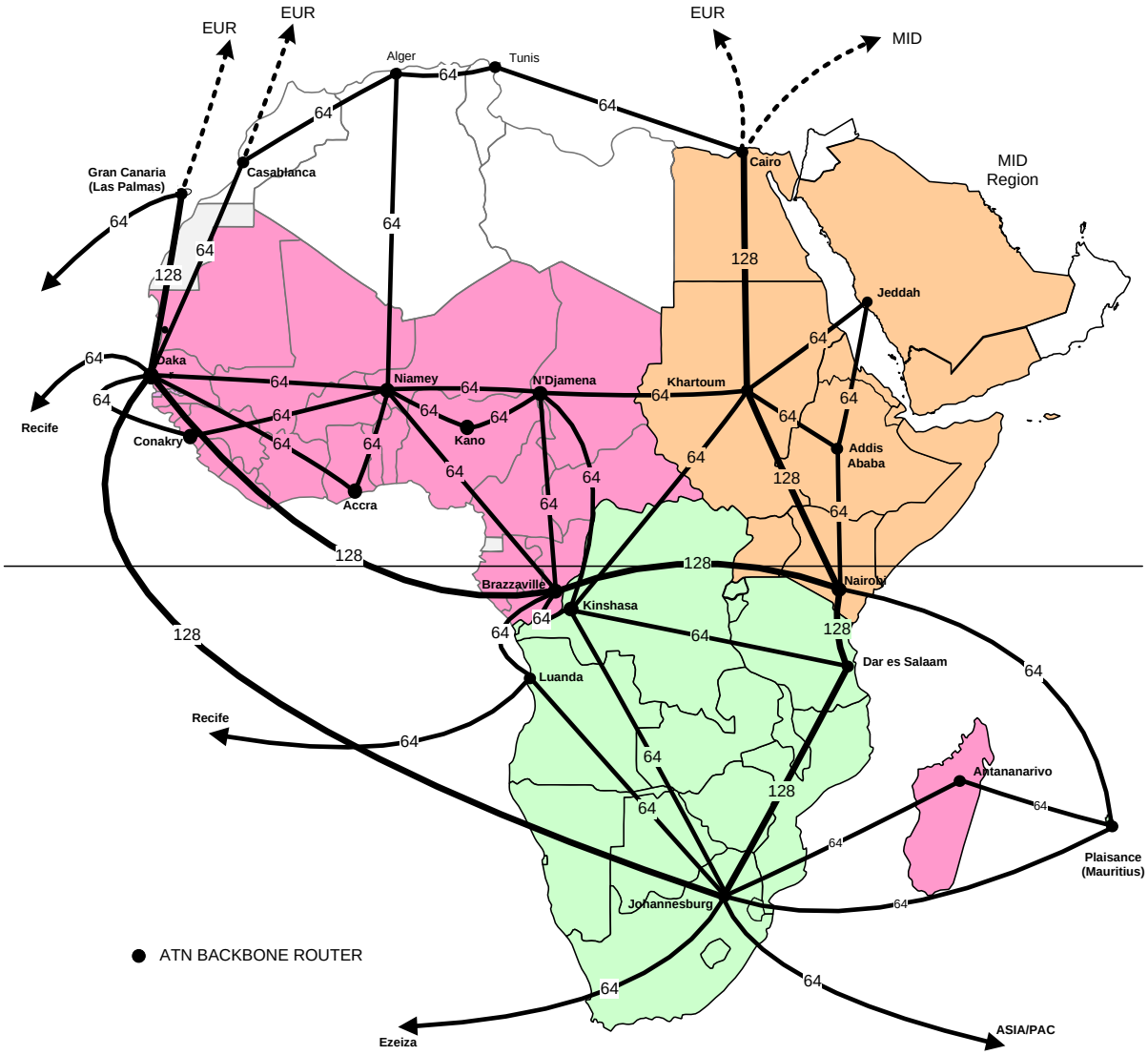
**Attachment A**

**INDENTIFICATION OF BACKBONE ROUTER SITES**



**Attachment B**

## ATN BACKBONE




## AFI ATN BACKBONE INTERCONNECTIVITY

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**APPENDIX E1**

**AFI Frequency Management Group (FMG) Action Plan**

| Action | By | deadline | Status of implementation |
|---|---|---|---|
| Development of the Terms of Reference for the Rapporteur of the AFI Frequency Management Group | Secretariat | 30/06/2011 | Completed |
| Allocation of necessary resources to ensure that the designated Officer is available to participate in all activities of relevance to his/her mandate | ASECNA | Continuous | Completed in 2011 and 2012 through hosting of AFI FMG/2 and WRC-12 preparatory workshop, as well as attendance at WRC-12. |
| Establishment of national regulatory provisions to protect the use of Fixed Satellite Service (FSS) for the provision of aeronautical telecommunications services | States/ICAO | 31/12/2012 | Follow up action to be taken on implementation of Recommendation 724 (WRC-07) |
| Development of a model of a national coordination framework to facilitate efficient dialogue between appropriate authorities and resolution of issues related to the provision, the optimum operation and protection of aeronautical telecommunications spectrum, | States/ICAO | 31/12/2013 | |
| Survey on AFI States policies and regulations pertaining to aeronautical telecommunications, and determination of areas of required assistance by AFI /FMG | ICAO | 31/12/2011 | Survey conducted. Data awaited from States |
| Coordination of trials on HF Propagation forecast with all States within the same frequencies allotment areas defined in AFI FASID Chart CNS 2. | States/ANSPs | 31/12/2012 | AMS Survey conducted in 2012, in coordination with IATA |
| Organization of regional workshops/seminars on the RCP concept (Doc 9869) as called for by APIRG Conclusion 17/26 to facilitate its implementation by AFI | ICAO | 31/12/2013 | |
| Review and update AFI database COM Lists | States/ICAO | 31/12/2012 | AFI COM Lists No.1, 2 and 3 are being updated in coordination with States |
| Finalization and maintenance of the Frequency Assignment Planning Software | States/ICAO | 31/12/2012 | Software under evaluation by ICAO Regional Offices |
| Coordination between States and stakeholders for the development of regional strategies, | States/ICAO | 31/12/2013 | |

| Action | By | deadline | Status of implementation |
|---|---|---|---|
| Specifications and criteria for software integrity validation | Rapporteur Cameroon, Ghana, Morocco, Rwanda and South Africa | 31/12/2013 | |

**APPENDIX E2**

**Draft Terms of Reference for the Rapporteur of the AFI Frequency Management Group (AFI FMG)**

## A. Terms of Reference

The Rapporteur of the AFI Frequency Management Group (AFI/FMG) nominated among the members of the Group is tasked to coordinate the activities of the Group. He develops his activities in the frame of the Action Plan driven from the outcomes of the meetings of the Group in particular through:

1. The follow up of the implementation of AFI/FMG Conclusion and Decisions that need coordinated activities on frequency spectrum management within AFI region;
2. The promotion of AFI Civil Aviation position to the AFI institutions involved in frequency spectrum management (African Telecommunication Union (ATU); African Broadcasting Union-ABU, Regional Direction of International Telecommunication Union (ITU)…)The Report to the ICAO Aeronautical Communication Panel bodies (AC Panel and AC Working Group F) on the current developing activities on frequency spectrum management in AFI Region;
3. The coordination with the similar Rapporteur on frequency management Group nominated in the neighboring ICAO regions
4. The provision to the report to APIRG/CNSG of the status of implementation of APIRGB Conclusions and Decisions pertaining to AFI/FMG activities.
5. Any other activities that could enhance the development of the optimum usage and ensure the protection of Aeronautical Frequency Spectrum.

## B. General List of actions

In the short and near term the main activities of the Rapporteur of AFI Frequency management Group can be listed as follows:

1. Ensure the complete collection of COM List
2. Ensure the follow up of the usage of the frequency planning software with feedback from AFI FMG Members
3. Participate to the analysis of the results of the surveys by users (ANSPs forecast on HF, IATA survey on VHF Coverage, Interferences mitigation issues…);

## C. Participation to meetings dealing with Aeronautical Frequency Spectrum

To develop efficiently his assigned tasks, the Rapporteur of AFI Frequency Management Group should be provided with the adequate resources aiming to ensuring his participation to the mayor events that could be of interest of the Group mandate.
In the other hand the Rapporteur should endeavor to ensure a relevant yearly planning of his activities allowing him to attend these meetings:;

The following meetings are activities with great relevance to AFI/FMG:

a) African Telecommunication Union Meeting for the preparation of WRCs;
b) ACP Working Group F meetings
c) CPM meetings
d) WRC meeting
e) Regional Seminar/Workshops on frequency spectrum management.

**APPENDIX F**
**TERMS OF REFERENCE, FUTURE WORK PROGRAMME AND COMPOSITION OF THE COMMUNICATIONS, NAVIGATION AND SURVEILLANCE SUB-GROUP (CNS/SG)**

**1. TERMS OF REFERENCE**

a) Ensure the continuing and coherent development of the AFI Regional Air Navigation Plan in the fields of aeronautical communications, navigation and surveillance (CNS), including the development of CNS elements of the AFI CNS/ATM Implementation Plan in the light of new developments, in harmony with the ICAO Global Air Navigation Plan (Doc 9750) and the plans for adjacent regions;

b) Identify, review and monitor deficiencies that impede or affect the provision of efficient aeronautical telecommunications and recommend appropriate corrective action;

c) Prepare, as necessary, CNS/ATM cost/benefit analyses for the implementation options of C, N an S elements; and

d) Study, as necessary, institutional arrangements for the implementation of C, N and S systems in the AFI Region.

**2. WORK PROGRAMME**

| Item | Global Plan Initiatives | Task description | Priority | Target date |
|---|---|---|---|---|
| | | **Communications** | | |
| 1. | GPI-22 | Follow up and monitor the implementation of VHF coverage in the AFI region in accordance with AFI/7 Rec. 5/12. | A | APIRG/19 |
| 2. | GPI-22 | Update the AFI AFTN routing directory | A | APIRG/19 |
| 3. | GPI-22 | In coordination with the ATM/AIM/SAR Sub-group, participate in the development of a communication infrastructure to support an AFI Central AIS Database (AFI CAD) | A | Continuing |
| 4. | GPI-17 | Monitor the development, and coordinate the implementation of guidance material for service level agreements between air navigations service providers and ATN service providers | A | APIRG/19 |
| 5. | GPI-17 | Review and update, if needed, the ICAO Register of AMHS managing domains and addressing information pertaining to AFI. | A | Continuing |
| | | **Navigation** | | |
| 6. | GPI-21 | Analyze and review the Report of the AFI GNSS Implementation Task Force. | A | Continuing |
| 7. | GPI-21 | Follow up and monitor the implementation of Phase 1 of the AFI GNSS Strategy. | A | Continuing |
| | | **Surveillance** | | |
| 8. | GPI -9 | Analyze and review CNS aspects of the report of the Aeronautical Surveillance Implementation Task Force. | A | APIRG/19 |
| | | **Communications, Navigation and Surveillance – General matters** | | |
| 9. | GPI -9 GPI-17 GPI-21 GPI-22 | Analyze, review and monitor the implementation and operation of aeronautical communications, navigation and surveillance (CNS) systems, identify CNS deficiencies and propose measures | A | Continuing |

| Item | Global Plan Initiatives | Task description | Priority | Target date |
|---|---|---|---|---|
| | | for their elimination, as required | | |
| 10. | GPI -9 GPI-17 GPI-21 GPI-22 | Give further consideration, as necessary, to the concept of multinational ICAO AFI air navigation facility/service addressed in the AFI/7 Report under Agenda Item 14 (AFI/7, Conclusion 10/6c). | C | Continuing |
| 11. | GPI -9 GPI-17 GPI-21 GPI-22 | In co-ordination with the ATS/AIS/SAR Sub-group, continue the evolutionary and harmonized development of the AFI CNS/ATM Systems Implementation Plan (AFI/7 Concl. 13/1). | A | Continuing |
| 12. | GPI -9 GPI-17 GPI-21 GPI-22 | In co-ordination with the ATS/AIS/SAR Sub-group, develop, as necessary, comprehensive business cases for competing CNS/ATM elements implementation options for the routing areas. | B | Continuing |
| 13. | GPI -9 GPI-17 GPI-21 GPI-22 | Co-ordinate plans developed by States, international organizations, airlines and industry for the implementation of the regional CNS/ATM systems implementation plan; and monitor CNS/ATM systems research and development, trials and demonstrations within the AFI Region and information from other regions. | B | Continuing |
| 14. | GPI -9 GPI-17 GPI-21 GPI-22 | Coordinate the implementation of ICAO Global Plan Initiatives pertaining to CNS and develop associated regional performance objectives. | A | Continuous |
| | | **Aeronautical Spectrum** | | |
| 15. | GPI-23 | Coordinate regional activities aimed at promoting ICAO position for ITU-WRC meetings, and improving aeronautical spectrum management and control in the Region. | A | Continuing |
| 16 | GPI-23 | Review the report of the AFI Frequency Management Group | A | APIRG/19 |

**Priority:**

A: High priority tasks on which work should be speeded up;

B: Medium priority tasks, on which work should be undertaken as soon as possible, but without detriment to priority A tasks; and

C: Lesser priority tasks, on which work should be undertaken as time and resources permit, but without detriment to priority A and B tasks.

**3. COMPOSITION:**

Algeria, Angola, Cameroon, Congo, Côte d'Ivoire, D.R. of Congo, Egypt, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Kenya, Malawi, Mali, Mauritius, Morocco, Niger, Nigeria, Senegal, South Africa, Spain, Sudan, Tanzania, Tunisia, Zambia, ACAC, ASECNA, IATA, and IFALPA.

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**Appendix G**
**Description of strategies for the implementation of the ICAO Global Plan initiatives pertaining to Communications, Navigation and Surveillance (CNS)**
***(Global Air Navigation Plan, Doc 9750)***

## 1. COMMUNICATION INFRASTRUCTURE (GPI-22)

**Description of strategy**

1.1. ATM depends extensively and increasingly on the availability of real-time or near real-time, relevant, accurate, accredited and quality-assured information to make informed decisions. The timely availability of appropriate aeronautical mobile and fixed communication capabilities (voice and data) to accommodate ATM requirements and to provide the adequate capacity and quality of service requirements is essential. The aeronautical communication network infrastructure should accommodate the growing need for information collection and exchange within a transparent network in which all stakeholders can participate.

1.2. The gradual introduction of performance-based SARPs and system-level and functional requirements will allow the increased use of commercially available voice and data telecommunication technologies and services. In the framework of this strategy, States should, to the maximum extent possible, take advantage of appropriate technologies, services and products offered by the telecommunication industry.

1.3. Considering the fundamental role of communications in enabling aviation, the common objective is to seek the most efficient communication network service providing the desired services with the required performance and interoperability required for aviation safety levels at minimum cost.

## 2. DATA LINK APPLICATIONS (GPI-17)

**Description of strategy**

2.1. The implementation of less complex data link services (e.g. pre-departure clearance, oceanic clearance, D-ATIS, automatic position reporting) can bring immediate efficiency benefits to the provision of ATS. Transition to the use of data link communications for more complex safety-related uses that take advantage of a wide variety of CPDLC messages, including ATC clearances, is already being successfully implemented.

2.2. Use of CPDLC and implementation of other data link applications can bring significant advantages over voice communication for both pilots and controllers in terms of workload and safety. In particular, they can provide efficient linkages between ground and airborne systems, improved handling and transfer of data, reduced channel congestion, reduced communication errors, interoperable communication media and reduced workload. The reduction of workload per flight translates into capacity increases and enhanced safety.

2.3. Communication data link and data link surveillance technologies and applications should be selected and harmonized for seamless and interoperable global operations. ADS-C, ADS-B and CPDLC are in service in various regions of the world but lack global harmonization. Current regional initiatives, including utilizing unique message subsets and CPDLC procedures, hinder efficient development and acceptance for global aircraft operations. Existing and emerging technologies should be implemented in a harmonized global manner in the near term to support long-term goals. Harmonization will define global equipage requirements and therefore minimize user investment.

2.4. FANS-1/A and aeronautical telecommunication network (ATN) applications support similar functionality, but with different avionics requirements. Many internationally-operated aircraft are equipped with FANS-1/A avionics initially to take advantage of data link services offered in certain oceanic and remote regions. FANS-1/A equipage on international business aviation aircraft is underway and is expected to increase.

## 3. NAVIGATION SYSTEMS (GPI-21)

**Description of strategy**

3.1. Airspace users need a globally interoperable navigational infrastructure that delivers benefits in safety, efficiency and capacity. Aircraft navigation should be straightforward and conducted to the highest level of accuracy supported by the infrastructure.

3.2. To meet those needs, the progressive introduction of performance-based navigation must be supported by an appropriate navigation infrastructure consisting of an appropriate combination of global navigation satellite systems (GNSS), self-contained navigation systems (inertial navigation system) and conventional ground-based navigation aids.

3.3. GNSS provides standardized positioning information to the aircraft systems to support precise navigation globally. One global navigation system will help support a standardization of procedures and cockpit displays coupled with a minimum set of avionics, maintenance and training requirements. Thus, the ultimate goal is a transition to GNSS that would eliminate the requirement for ground-based aids, although the vulnerability of GNSS to interference may require the retention of some ground aids in specific areas.

3.4. GNSS-centered performance-based navigation enables a seamless, harmonized and cost-effective navigational service from departure to final approach that will provide benefits in safety, efficiency and capacity.

3.5. GNSS implementation will be carried out in an evolutionary manner, allowing gradual system improvements to be introduced. Near-term applications of GNSS are intended to enable the early introduction of satellite-based area navigation without any infrastructure investment, using the core satellite constellations and integrated multisensory airborne systems. The use of these systems already allows for increased reliability of non-precision approach operations at some airports.

3.6. Medium/longer-term applications will make use of existing and future satellite navigation systems with some type of augmentation or combination of augmentations required for operation in a particular phase of flight.

## 4. WORLD GEODETIC SYSTEM – 1984 (GPI-20)

**Description of strategy**

4.1. The geographical coordinates used across various States in the world to determine the position of runways, obstacles, aerodromes, navigation aids and ATS routes are based on a wide variety of local geodetic reference systems. With the introduction of RNAV, the problem of having geographical coordinates referenced to local geodetic datums is more evident and has clearly shown the need for a universal geodetic reference system. ICAO, to address this issue, adopted in 1994 the World Geodetic System — 1984 (WGS-84) as a common horizontal geodetic reference system for air navigation with an applicability date of 1 January 1998.

4.2. Fundamental to the implementation of GNSS is the use of a common geographical reference system. ICAO adopted the WGS-84 Geodetic Reference System as that datum, and many States have implemented or are implementing the system. Failure to implement, or a decision to use an alternative reference system, will create a seam in ATM service and will delay the full realization of GNSS benefits. Completion of the implementation of the WGS-84 Geodetic Reference System is a prerequisite for a number of ATM enhancements, including GNSS.

## 5. SITUTIONAL AWARENESS (GPI-9)

**Description of strategy**

5.1. The further implementation of enhanced surveillance techniques (ADS-C or ADS-B) will allow reductions in separation minima and an enhancement of safety, increase in capacity, and improved flight efficiency, all on a cost-effective basis. These benefits may be achieved by bringing surveillance to areas where there is no primary or secondary radar, when cost-benefit models warrant it. In airspaces where radar is used, enhanced surveillance can bring further reductions in aircraft separation minima and improve, in high traffic density areas, the quality of surveillance information both on the ground and in the air, thereby increasing safety levels. The implementation of sets of quality-assured electronic terrain and obstacle data necessary to support the ground proximity warning systems with forward-looking terrain avoidance function as well as a minimum safe altitude warning (MSAW) system will benefit safety substantially.

5.2. Implementation of surveillance systems for surface movement at aerodromes where weather conditions and capacity warrant will also enhance safety and efficiency while implementation of cockpit display of traffic information and associated procedures will enable pilot participation in the ATM system and improve safety through greater situational awareness.

5.3. In remote and oceanic airspace where ADS-C is used, FANS capabilities exist on many air transport aircraft and could be added to business aircraft. ADS-B can be used to enhance traffic surveillance in domestic airspace. In this respect, it should be noted that the 1090 extended squitter is available and should be accepted as the global choice for the ADS-B data link.

5.4. At terminal areas and at aerodromes surrounded by significant terrain and obstacles, the availability of quality-assured terrain and obstacle databases containing digital sets of data representing terrain surface in the form of continuous elevation values and digital sets of obstacle data of features, having vertical significance in relation to adjacent and surrounding features considered hazardous to air navigation, will improve situational awareness and contribute to the overall reduction of the number of controlled flight into terrain related accidents.

## 6. AERONAUTICAL RADIO SPECTRUM (GPI-23)

**Description of strategy**

6.1. States need to address all regulatory aspects on aeronautical matters on the agendas for International Telecommunication Network (ITU) World Radiocommunication Conferences (WRC). Particular attention is drawn to the need to maintain the current spectrum allocations to aeronautical services.

6.2. The radio spectrum is a scarce natural resource with finite capacity for which demand from all users (aeronautical and non-aeronautical) is constantly increasing. Thus the ICAO strategy on aeronautical radio spectrum aims at long-term protection of adequate aeronautical spectrum for all radio

communication, surveillance and radio navigation systems. The process of international coordination taking place in the ITU obliges all spectrum users (i.e. aeronautical and non aeronautical) to continually defend and justify spectrum requirements. Civil aviation operations are expanding globally creating pressure on the already stressed and limited available aeronautical spectrum.

6.3. The framework of this initiative involves the support and dissemination by States of the ICAO quantified and qualified policy statements of requirements for aeronautical radio frequency spectrum agendas for ITU World Radiocommunication Conferences (WRC). This is necessary to maintain the current spectrum allocations to aeronautical services and ensure the continuing availability of adequate aeronautical radio spectrum and ultimately the viability of existing and new air navigation services globally.

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