International Civil Aviation Organization

The First Meeting of the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG/1)

Tokyo, Japan, 08 – 10 December 2010

Agenda Item 2: Development of Terms of Reference

DRAFT TERMS OF REFERENCE

(Presented by the Secretariat)

SUMMARY

This paper provides the draft Terms of Reference (TOR) for the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG), to be reviewed by the meeting.

1. INTRODUCTION

1.1 As a result of the increasing regional ATFM activities and the provisions of GPI- 6 Air Traffic Flow Management, the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/18, September 2007) adopted Conclusion 18/7 for the conduct of a regional ATFM Seminar.

1.2 The ICAO Asia/Pacific Air Traffic Flow Management (ATFM) Seminar/Workshop was graciously hosted by the Japan Civil Aviation Bureau (JCAB), Ministry of Land, Infrastructure, Transport and Tourism from 7 to 9 October 2008, and was held at the ACROS FUKUOKA Convention Centre, Fukuoka, Japan.

1.3 APANPIRG/19 (Bangkok, September 2008) noted that the Workshop would be tasked with identifying and recommending appropriate regional objectives, for example:

a) Development of a high level ATFM Concept of Operations for the Region;
b) Enhancement of the draft ATFM Communications Manual;
c) Develop mechanisms for data gathering, collation and sharing;
d) Review activities of the Bay of Bengal ATFM Task Force.

1.4 APANPIRG/20 (Bangkok, September 2010) made the following conclusion:

Conclusion 20/11 – ATFM Steering Group and Concept of Operations

That a regional ATFM Steering Group be constituted and tasked with preparing an Asia/Pacific Regional ATFM Concept of Operations based on analysis of regional data and traffic flows. The ATFM Steering Group should consider the outcomes and recommendations from the October 2008 ATFM Seminar/Workshop (Fukuoka, Japan) and information about the CAR/SAM ATFM Project contained in IP/3 to APANPIRG/20 as guidance in deriving its Objectives and Terms of Reference.

2. DISCUSSION

2.1 A complete copy of the 2008 ATFM Seminar/Workshop is attached reference as **Appendix A**. The following is a brief summary of the meeting outcomes and recommendations.

Outcomes

1 An Asia/Pacific Regional ATFM Concept of Operations would need to be undertaken collaboratively between States over a period of time (*ATFMSG TOR*).

2 A high level ATFM Steering/Focus Group was necessary to analyze regional data and traffic flows ensure the harmonization/coordination of regional ATFM implementation plans (*APANPIRG Conclusion 20/11*).

3: Accurate and timely static and dynamic data is necessary to support ATFM (*ATFMSG TOR and APANPIRG Decision 20/21*).

4: A web-based 'virtual ATFMU' regarding regional ATFM matters had merit (*ATFMSG TOR*).

5: A view was expressed for accelerated implementation of structural airspace capacity-increasing measures in preference to use of ATFM (*ATFMSG TOR*).

6: Australia, Japan, Thailand and United States had significant regional ATFM knowledge and experience that could be beneficial to other Asia/Pacific States (*ATFMSG TOR*).

Recommendations

1: December safety analysis traffic sampling data should be used for airspace planning and implementation purposes.

After considering this proposal, the Regional Airspace Safety Monitoring Advisory Group (RASMAG) gave in-principle agreement to the concept. However, beyond agreeing to the expansion of the standardized template for the annual December traffic sample data (TSD) gathering to include the registration/tail number (if available) and en-route PBN approval (if available), regional RMAs were not able to accommodate extra workload or responsibilities in gathering and managing data. RASMAG recommended that release of data should be authorized by an appropriate oversight body, such as the Regional Office. Additionally, RMAs also clearly preferred that wherever possible implementing agencies obtained data directly from the States or parties involved in each implementation. APANPIRG/20 agreed to the following Decision in this respect:

Decision 20/21 – Expand use of safety monitoring data

That the arrangements for annual month of December traffic sample data by all States to satisfy airspace safety monitoring analysis called for by APANPIRG Conclusion 16/4 be expanded to enable this data to also be available for airspace planning and implementation purposes. This will apply only where such data is not otherwise available to regional or State implementing bodies and only with specific written authority of the ICAO Asia/Pacific Regional Office on each occasion.

2: Strategies should be developed with the objective of implementing formalized data sharing arrangements with relevant parties within, and between, States.

To be considered under the ATFMSG TOR.

3: ICAO ATS Planning Manual (Doc 9426) guidance material should be reviewed and utilized as the basis for development of Sector capacity assessments.

To be considered under the ATFMSG TOR.

4: The draft ATFM Communications Handbook for the Asia/Pacific Region should be developed as a regional guidance material.

APANPIRG/20 adopted the following Conclusion:
Conclusion 20/12–Adopt ATFM Communications Manual

That the Air Traffic Flow Management (ATFM) Communications Handbook for the Asia/Pacific Region, as shown in Appendix B to the APANPIRG/20 Report on Agenda Item 3.2, be adopted and circulated as regional guidance material.

Version 1 of the ATFM Communications Handbook is available on the APAC web site at http://www.bangkok.icao.int/edocs/ATFMComms_Handbook.pdf).

5: The ICAO regional Secretariat should provide ATFM Seminar/Workshop material to ICAO HQ for consideration in the 2009/2010 ICAO HQ ATFM work programme.

A dedicated officer is now employed at ATM Section, ICAO HQ, and has researched regional ATFM practices, including the Asia Pacific Communications Handbook, with a view to incorporating this into a Global ATFM Document in the near future.

2.2 A complete copy of the 2009 ATFM Regional Project for Latin America is attached as **Appendix B**. The following is a brief summary of the objectives and principles from that meeting.

Objectives

a) To develop a seamless and harmonized ATFM system;
b) To communicate and involve stakeholders during ATFM development and implementation;
c) To develop the applicable ATFM system regional and national documents; and
d) To provide ATFM training to all of the appropriate stakeholders.

Principles

- a. and e. ATFM shall:
  (1) optimize available airspace capacity;
  (2) be based on transparency and efficiency;
  (3) ensure that capacity is provided in a flexible and timely manner; and
  (4) be consistent with the ICAO Regional Air Navigation Plan.

- b. ATFM shall support operational decisions by air navigation service providers, airport operators and airspace users and in the following areas:
  (1) flight planning;
  (2) use of available airspace capacity during all phases of flight; and
  (3) the creation of a single publication for route and traffic orientation.

- c. ATFM shall seek to balance the financial impact on stakeholders with safety, and operational and technical benefits, taking into account global interoperability.

- d. ATFM shall take into consideration the requirements of the military, law enforcement, and search and rescue.

- f. ATFM recognizes that airspace is a common resource for all users, ensuring fairness and transparency, while taking into account security and defence needs.

- g. ATFM should be operated in accordance with the principles laid down in the ICAO Air Navigation Plan – FASID (Doc 7754), and contain the following functions:
  (1) ATFM central unit and Flow Management Positions;
  (2) Operators – general aviation, air carrier, military; and
  (3) Airport Operators.

- h. Military aircraft operating as general air traffic should be subject to ATFM.

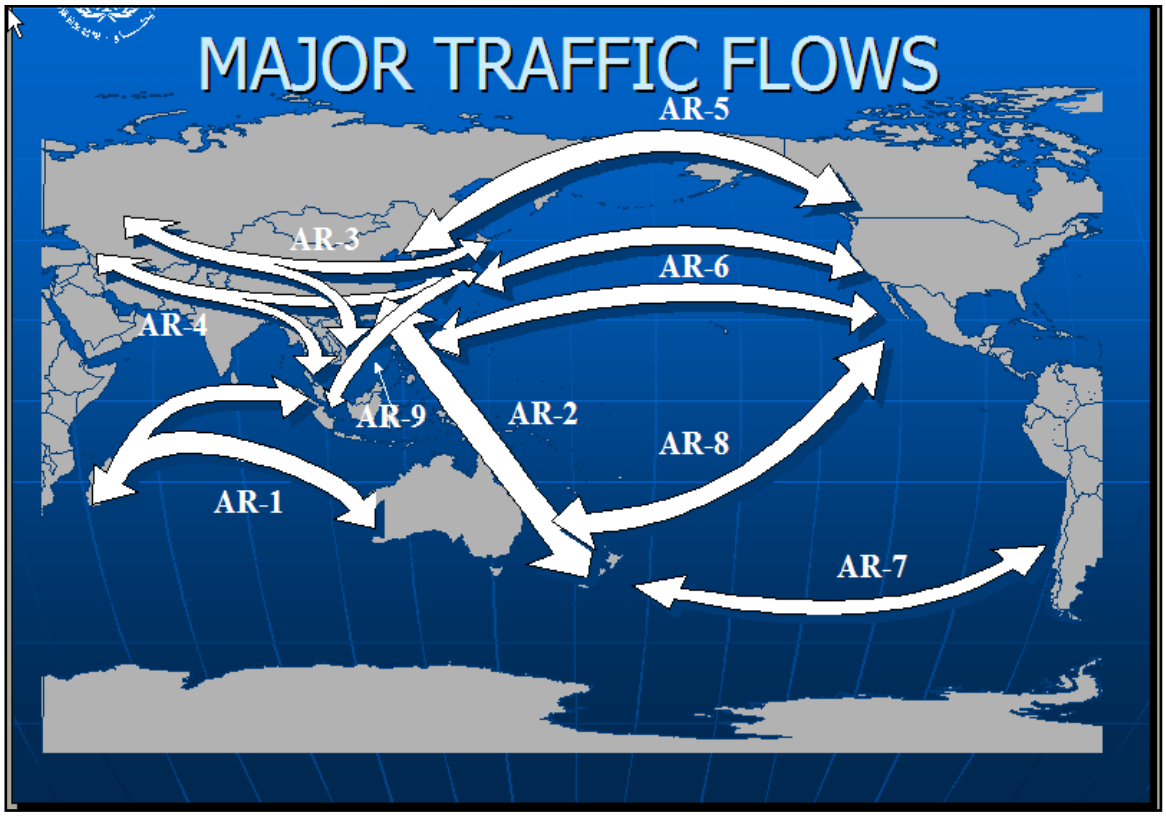
- i. States, air navigation service providers and air carriers should provide traffic data.

- j. ATFM shall apply within the Member States' airspace to all IFR flights.

- k. ATFM shall apply to:
  (1) Aircraft operators;
  (2) Air traffic service providers;
  (3) Airspace management entities;
  (4) Airport operators; and
  (5) Centralized flow management units.

2.3 A copy of the ICAO ATS Planning Manual (Doc 9426) guidance material in respect to ATFM is attached as **Appendix C**.

2.4 A copy of the ICAO Asia and Pacific Region Major Traffic Flows is indicated below.



2.5 Draft TOR are indicated below, for discussion by the Steering Group.

TERMS OF REFERENCE

AIR TRAFFIC FLOW MANAGEMENT STEERING GROUP

1. Having considered Doc 9426 guidance material, regional air traffic data and the Major Traffic Flows, and noting that recognized structural airspace capacity increasing measures have preference to use of ATFM, develop an Asia/Pacific Regional ATFM Concept of Operations;

2. Review and development of the *ATFM Communications Handbook for the Asia Pacific Region* (bearing in mind that this material may be superseded by Global Material);

3. Encourage and develop mechanisms for ATFM data gathering, collation and sharing between States, International Organizations and ICAO;

4. Review the safety and efficacy of ATFM systems in the Asia and Pacific Region, and make specific recommendations regarding ATFM, including any adjacent airspace affecting the Asia and Pacific Regions;

5. Encourage the development of an ATFM web site by Asia and Pacific Region States with significant experience in ATFM, which contains information on regional ATFM, including inter alia, real time flight delay data.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

(1) Note the information provided by this paper; and

(2) Discuss and establish the ATFM/SG TOR.

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INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT OF THE ICAO ASIA/PACIFIC AIR TRAFFIC FLOW MANAGEMENT SEMINAR/WORKSHOP

FUKUOKA, JAPAN, 7 – 9 OCTOBER 2008

The views expressed in this summary should be taken as those of the Seminar/Workshop and not of the Organization.

Adopted by the ATFM Seminar/Workshop
and published by the ICAO Asia and Pacific Office

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PART I – BACKGROUND OF THE ATFM SEMINAR/WORKSHOP

1. Introduction

1.1 The ICAO Asia/Pacific Air Traffic Flow Management (ATFM) Seminar/Workshop, graciously hosted by the Japan Civil Aviation Bureau (JCAB), Ministry of Land, Infrastructure, Transport and Tourism was held at the ACROS FUKUOKA Convention Centre, Fukuoka, Japan from 7 to 9 October 2008.

2. Attendance

2.1 The ATFM Seminar/Workshop was attended by 48 participants from 14 States – Australia, Bangladesh, Brunei Darussalam, Hong Kong China, India, Indonesia, Japan, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, United States, Viet Nam - and 3 international organizations – IATA, IFALPA and IFATCA. Late apologies were received from seminar presenter Mr. Ricardo Torres, Servicios a la Navegación en el Espacio Aéreo Mexicano (SENEAM), Mexico and the delegations from China and Mongolia.

2.2 A list of participants is at **Appendix A** to this report.

3. Inauguration and Opening of the Seminar/Workshop

Japan Civil Aviation Bureau

3.1 Mr. Yukio Yoshida, Director of the Fukuoka Area Control Centre and Air Traffic Management Centre (ATMC), JCAB welcomed delegates to the ICAO ATFM Seminar/Workshop. He thanked ICAO for arranging this event in Japan, as it was an honour for JCAB to host this important ICAO seminar and workshop in Fukuoka. Mr. Yoshida provided an overview of the history of air traffic in Japan, noting that the increases in traffic over time had led to periodic delays on occasion when the capacity of en-route airspace and airports was exceeded.

3.2 In order to tackle these issues, JCAB had taken initiatives to develop systematic ATFM procedures and had established an ATFM Centre in 1994. Ten years later, the ATFM Centre was expanded to include the functions of airspace management, international ATFM (as well as domestic ATFM), oceanic ATC and aeronautical information management. The present ATMC in Fukuoka was opened in October 2005 in response to the continuously increasing air traffic and needs of airspace users.

3.3 Japan is located in a strategically significant position connecting Asia and North/Central Pacific routes and plays a vital role in facilitating smooth traffic flows in the Asia/Pacific region. Mr. Yoshida stressed the importance of States working together, noting that JCAB considered that all ANSPs and aviation authorities in the region should get together and work collaboratively under the leadership of ICAO as no single country working alone was likely to be able to adequately address the requirements of international civil aviation.

ICAO Regional Office

3.4 Mr. Andrew Tiede, Regional Officer, Air Traffic Management with the ICAO Asia/Pacific Office, extended warm greetings and best wishes to all delegates on behalf of Mr. Mokhtar A. Awan, Regional Director Asia and Pacific Office, and thanked the JCAB for their very gracious consideration to ICAO in hosting this ATFM Seminar/Workshop. He also thanked the United States FAA for the very important leadership role that they had played in ensuring that the Seminar was well supported and able to receive information from a wide variety of sources.

3.5 To Mr. Tiede's knowledge, this was the first ATFM related Seminar that had been organized by ICAO for the Asia/Pacific region. He was encouraged by the interest that had been shown and drew attention to the effort put in by speakers at the seminar – in researching, preparing and delivering suitable material for presentation. Mr. Tiede thanked all presenters, and the administrations that made their participation possible, for their support to ICAO and the States of the Asia/Pacific region in advancing civil aviation matters in the region.

4. Officers and Secretariat

4.1 Mr. Andrew Tiede acted as the Moderator of the Seminar and Secretary to the Workshop. He was ably assisted in both these roles by Mr. Hiroshi Inoguchi, Director for International Policy Coordination with the JCAB and Ms. Leslie McCormick, International Operations Specialist, Air Traffic Control System Command Centre of the United States Federal Aviation Administration (FAA).

5. Working Arrangements, Language and Documentation

5.1 The working language of the Seminar/Workshop was English, inclusive of all documentation. Three information papers and six discussion papers were considered by the Workshop. A List of Seminar/Workshop papers has been included as **Appendix B.**

5.2 The ATFM Seminar/Workshop prepared a resource tool on CD-ROM, for retention and use by participants in developing their own knowledge, and that of their colleagues, about ATFM matters. The CD-ROM contains a copy of all the Seminar presentations and Workshop information and discussion papers, as well as relevant reference material.

PART II – REPORT ON THE ATFM SEMINAR/WORKSHOP

Objectives of the Seminar/Workshop

2.1 The Seminar/Workshop was informed that, in response to the increasing ATFM activities regionally and the provisions of GPI- 6 *Air Traffic Flow Management*, the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/18, September 2007) had adopted Conclusion 18/7 for the conduct of a regional ATFM Seminar during 2008.

2.2 Recognizing that the ATFM Seminar called for by APANPIRG/18 provided a good opportunity to influence regional ATFM planning, the ICAO Regional Office elected to include a 'Workshop' component to allow opportunity for recommendations to come forward. APANPIRG/19 (September 2008) noted that such a Workshop would be tasked with identifying and recommending appropriate regional objectives, for example:

a) Development of a high level ATFM Concept of Operations for the Region;
b) Enhancement of the draft ATFM Communications Manual;
c) Develop mechanisms for data gathering, collation and sharing;
d) Review activities of the Bay of Bengal ATFM Task Force.

2.3 Hence, the focus was now on an ATFM Seminar/Workshop that would address the following objectives:

a) To raise awareness of ICAO provisions regarding ATFM;

b) To enhance coordination and cooperation between ATFM providers and users in the Asia and Pacific Regions; and

c) To identify regional initiatives to optimize ATFM activities in order to gain the maximum benefits for all users.

Seminar/Workshop programme

2.4 The Seminar/Workshop adopted the programme shown in **Appendix C** to this report.

Seminar Activities

2.5 The programme incorporated information style seminar presentations during the first half of the event, under the broad headings:

- ATFM in the Asia/Pacific today, and
- ATFM in other Regions

2.6 Seminar presentations were made by ICAO, JCAB, Aeronautical Radio of Thailand Limited (AEROTHAI), Civil Aviation Authority of Singapore (CAAS), Airservices Australia, the United States, IFATCA, IATA and a number of IATA member airlines. The United States also presented information on behalf of SENEAM, Mexico. Importantly, the Seminar programme included a familiarization visit to the Fukuoka ATMC. This enabled Seminar/Workshop participants to observe JCAB's operations with focus on ATFM matters.

Workshop Activities

2.7 The Workshop component was accommodated in the second half of the 3-day programme, under the broad headings:

- Workshop Session 1 – Planning for ATFM, and
- Workshop Session 2 – Where do we go from here?

2.8 The Workshop examined the methodologies utilized and lessons learned from the implementation of long range ATFM procedures in the Bay of Bengal, as well as pre-tactical experiences with the Centralised Traffic Management System (CTMS) in Australia.

2.9 The Workshop was also informed about Japan's proposals for further development of ATFM in their areas of responsibility and an initial proposal for establishment of a regional ATFM initiative in East-Asia, possibly encompassing the Fukuoka, Beijing, Shanghai, Incheon, Taipei, Hong Kong and Manila FIRs. The Workshop received detailed information from the United States on methodologies useful for planning near term ATFM implementation.

PART III – OUTCOMES FROM THE ATFM SEMINAR/WORKSHOP

GPI-6 – Air Traffic Flow Management

3.1 The Workshop recalled that the ICAO Global Air Navigation Plan (GANP, Doc 9750) promulgates a performance based planning process that uses 23 Global Plan Initiatives (GPIs) to support the planning and implementation of performance objectives in the region. A specific GPI has been allocated for ATFM, termed *GPI/6 – Air Traffic Flow Management* (**Appendix D** refers). In particular, GPI-6 notes that, where warranted, States and regions should evolve to a collaborative-based approach to capacity management.

Outcomes and Recommendations from the Seminar/Workshop

3.2 The ATFM Seminar/Workshop, in its review of the information provided to the Seminar and arising from the discussions held during the Workshop, reached outcomes and made recommendations as outlined below.

ATFM Regional Concept of Operations

3.3 The ATFM Workshop recognized that the preparation of an ATFM regional Concept of Operations document for the Asia/Pacific Region represented a significant body of work, which would need to be undertaken in a collaborative manner between States over a period of time. In particular, analysis was necessary to indentify major traffic flows which would benefit from ATFM solutions. As a result of the size and complexity of the Asia/Pacific region it was likely that an approach whereby specify areas or sub regions were identified would be necessary, under overriding arrangements which ensured interoperability between the respective sub regions. For example, such ATFM sub regions could include:

- North Pacific
- East Asia (Fukuoka, Beijing, Shanghai, Incheon, Taipei, Hong Kong, Manila FIRs)
- South China Sea
- Bay of Bengal/Arabian Sea
- Cross polar route network Asia – North America

ATFM Seminar/Workshop Outcome 1:
That the preparation of an Asia/Pacific Regional ATFM Concept of Operations was a significant body of work that would need to be undertaken collaboratively between States over a period of time.

Lack of Asia/Pacific regional ATFM mechanism

3.4 The Seminar/Workshop considered that it was timely to look into the various developments of ATFM in each State or sub region and to examine ways to accelerate planning and implementation of ATFM in a collaborative manner. However, there was no current overall regional mechanism under the ICAO umbrella with which to specifically and collaboratively address ATFM matters. Although the Bay of Bengal ATFM Task Force was active, the Workshop recognized the very narrow focus of this Task Force, which was established to address an identified problem, namely the peak night time traffic flows from Asia to Europe via Afghanistan.

3.5 The ATFM Seminar/Workshop saw significant value in having available a regional oversight capability of some kind, in the form of a high level Steering/Focus Group to begin to analyze regional data and traffic flows and make recommendations with the objective of ensuring the harmonization/coordination of regional ATFM implementation plans. Such a capability could take

overall responsibility for regional matters including the development of an ATFM Concept of Operations and could also support implementation activities such as the Bay of Bengal ATFM Task Force in a number of discrete geographical areas, thereby increasing standardization whilst minimizing duplications of effort.

ATFM Seminar/Workshop Outcome 2:
The ATFM Seminar/Workshop recognized that there would be significant benefit in having a regional oversight capability of some kind, in the form of a high level ATFM Steering/Focus Group, to begin to analyze regional data and traffic flows and make recommendations with the objective of ensuring the harmonization/coordination of regional ATFM implementation plans.

Critical importance of data

3.6 The ATFM Workshop recognized the fundamental and critical need for accurate and timely data to be continuously available to support implementation and ongoing ATFM operations. This was essential in two aspects:

a) Static data identifying historical traffic loadings, for use as strategic planning and trend analysis, and

b) Dynamic real time data that was used for the tactical management of traffic in terms of commencement of ATFM measures

Static Data

3.7 The Workshop recognized that as a result of the Annex 11 provisions requiring that RVSM monitoring be conducted on a regional basis, APANPIRG/16 (August 2005) had endorsed the use of a standardized approach to the sampling of vertical and horizontal traffic data under the terms of Conclusion 16/4, adopting the month of December every year for the collection of a one month traffic sample data by all Asia/Pacific States. Although this data was currently used exclusively for airspace safety monitoring purposes, the Workshop considered it likely that this annual traffic count would provide a very useful source of data for airspace planning purposes in general and specifically to identify peak traffic loadings for ATFM purposes.

3.8 Consequently, the Workshop recommended that RASMAG review the situation, with the objective of expanding the use of the annual December RVSM data collection for airspace implementation planning in general (ATFM, PBN, ATS routes etc) and, under supervision of the Regional Office, this data be made available to implementation groups as required to support all regional ATM implementations. The Workshop recognized that perhaps one or two additional parameters would have to be included in the existing RVSM data templates, in order to make the data more widely usable.

Dynamic real time data

3.9 In a number of the examples described during the Seminar presentations, the importance of having advance notice of real time traffic demand was recognized as essential for accurate capacity balancing. A case study from Australia has been included as **Appendix E**.

3.10 Real time data on the numbers and location of flights, available well in advance, may enable ATFM solutions to be applied in a more timely and effective manner. This means that adjustments could be made by flight crews and operators in a managed and economic manner, for example before top of descent in terms of an arrival slot or before start and pushback in the case of a departure slot. Such strategies enable delays to be absorbed over longer periods of time, and in less complex and more fuel efficient phases of flight, particularly en-route cruise.

3.11 Efficient application of appropriate ATFM initiatives generally involves use of automated tools which are heavily data dependant. Sources of relevant data include ATC operational systems (radars, flight data processors), airline scheduling (e.g. OAG) and operational systems (including gate management), airport data systems (including reliable and dynamic [e.g. hourly] capacity forecasts, aeronautical meteorology (en-route and terminal area forecasts and actuals) and so forth. Importantly, the sharing of such data between adjacent ANSPs on a continuous and real time basis was recognized by the Workshop as a key activity in gaining ATFM benefits.

3.12 The Workshop recognized the necessity for formalized data sharing arrangements to be instituted between as many of these parties as possible with one primary party (logically the ANSP) charged with taking all data and turning it into a meaningful presentation for all parties. Accordingly, the Workshop recommended that the importance of real time data sharing for traffic management purposes be highlighted by way of appropriate State meeting papers and examples to the next ATM/AIS/SAR Sub-Group meeting, with the objective of developing regional strategies that recognized the long term need to share dynamic data within and between States.

ATFM Seminar/Workshop Outcome 3:
That accurate and timely static and dynamic data be continuously available to support ATFM implementation planning and ongoing ATFM operations.

ATFM Seminar/Workshop Recommendation 1:
That the present arrangements for annual month of December traffic sampling by all States for airspace safety analysis enabled by APANPIRG Conclusion 16/4 be expanded to enable this data to also be used, under authority of the ICAO Asia/Pacific Regional Office, for airspace planning and implementation purposes.

ATFM Seminar/Workshop Recommendation 2:
Recognizing that the sharing of dynamic data between adjacent ANSPs on a continuous and real time basis was a key requirement in realizing ATFM benefits, regional strategies be developed with the objective of implementing formalized data sharing arrangements with relevant parties within, and between, States.

Airspace capacity assessment

3.13 As a follow on to the data discussions above, the Workshop recognized the importance of establishing dynamic airspace capacity assessment mechanisms including airspace sector workload forecasting to enable timely activation of appropriate ATFM initiatives. Such activities would also depend upon adequate data being made available.

3.14 The Workshop was informed that the ICAO ATS Planning Manual (Doc 9426) contains guidance on methodologies for Sector capacity assessments. Some States have used these techniques to develop capacity calculations and relevant automation. As a result of information made available during the Seminar presentations, Japan and the United States were invited to share their expertise in these matters.

ATFM Seminar/Workshop Recommendation 3:
That guidance material in the ICAO ATS Planning Manual (Doc 9426) be reviewed and utilized as the basis for development of Sector capacity assessments.

'Virtual' Regional ATFMU

3.15 The Workshop saw merit in establishing a regional website for ATFM matters, noting that no such capability existed at the present time. A website devoted to ATFM information would provide an archive of information for regional airports to be made available, such as the capacity information for Chep Lap Kok International airport provided by Hong Kong China in a discussion paper to the ATFM Workshop.

3.16 The meeting was informed that one model of such a "Virtual ATFMU" may be the US ATSCC website <www.fly.faa.gov> which provides and continuously updates relevant information.

ATFM Seminar/Workshop Outcome 4:

That the concept of a web based 'virtual ATFMU' along the lines of the US ATSCC example at <www.fly.faa.gov> showed merit for providing a 'one-stop-shop' of regional ATFM matters.

ATFM Communications Handbook

3.17 In its review of the draft *ATFM Communications Handbook for the Asia/Pacific Region*, the Workshop stressed that the Handbook should be written to ensure that the message examples contained therein were applicable to both voice and written ATFM communications.

3.18 The ATFM Workshop agreed in principle to the concept of a regional ATFM Handbook and recommended that the ICAO Secretariat present the draft ATFM Communications Handbook, as reviewed and updated by the Workshop (see **Appendix F**), to the ATM/AIS/SAR/SG for further refinement and eventual adoption by APANPIRG as regional guidance material.

ATFM Seminar/Workshop Recommendation 4:

That the draft ATFM Communications Handbook for the Asia/Pacific Region be advanced through the normal ICAO processes with the objective of gaining APANPIRG approval as a regional guidance material.

Relay outcomes of Asia/Pacific ATFM Seminar/Workshop to ICAO HQ

3.19 Recognizing that ATFM matters were on the programme of ICAO Headquarters for action during 2009/2010, the ATFM Workshop recommended that all material from the ATFM Seminar/Workshop be provided to ICAO HQ for their information and review. The Regional Office Secretariat would take this action once the Summary Report of the Seminar/Workshop was finalized.

ATFM Seminar/Workshop Recommendation 5:

That the ICAO regional Secretariat provides all material associated with the ATFM Seminar/Workshop to the ICAO Headquarters Secretariat for consideration in the ICAO HQ ATFM work programme scheduled during 2009/2010.

IATA position on ATFM

3.20 IATA expressed very clearly during the ATFM Workshop that their preference was for accelerated implementation of recognized structural airspace capacity increasing measures (RVSM, PBN, flexible use of airspace, use of more effective ATC procedures) in preference to use of ATFM. Notwithstanding, IATA recognizes that structural improvements will take time and accepts that use of traffic management and ATFM procedures in some circumstances is warranted.

ATFM Seminar/Workshop Outcome 5:
That IATA clearly expressed their preference for accelerated implementation of recognized structural airspace capacity increasing measures (RVSM, PBN, flexible use of airspace, use of more effective ATC procedures) in preference to use of ATFM. However, IATA recognizes that structural improvements will take time and accepts that use of traffic management and ATFM procedures in some circumstances is warranted.

Leverage Regional Know How

3.21 The Workshop recognized the significant ATFM expertise available in Australia, Japan, Thailand and United States. Methods to leverage this knowledge and experience for regional benefit would save time and effort, leading to earlier implementation of ATFM infinitives that would assist in meeting demand/capacity balancing objectives.

ATFM Seminar/Workshop Outcome 6:
That significant regional ATFM knowledge and experience lies with Australia, Japan, Thailand and United States and that access to and use of this expertise will be beneficial to other States of the Asia/Pacific region.

Closing of the Seminar/Workshop

3.22 In closing the Seminar/Workshop, Mr. Tiede thanked JCAB for their generosity in hosting the event. The support and hospitality from JCAB was excellent, with all in-country arrangements being well considered, efficient and productive. The Seminar presentations from Japan and the opportunity to inspect he operational arrangements at the JCAB ATMC had been very informative for all participants.

3.23 Mr Tiede also thanked the FAA for their long terms support and commitment. The material that had been presented by the FAA included documentation from other areas of the world that would form the basis for the preparation of ATFM related material for the region. He acknowledged the efforts of FAA and JCAB in preparing the basic document that had now been further developed into the draft *ATFM Communications Handbook for the Asia/Pacific Region.*

3.24 Mr. Tiede considered that all the presentations had been informative and relevant, again thanking presenters for their hard work. Additionally, the engagement of participants in the Workshop discussions had resulted in a number of worthwhile outcomes and recommendations that would be carried forward into related ICAO forums for further development.

INTERNATIONAL CIVIL AVIATION ORGANIZATION

TWENTIETH MEETING OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (APANPIRG/20)

Bangkok, Thailand, 7-11 September 2009

Agenda Item 3.2: Regional air navigation planning and implementation issues

REPORT OF THE CAR/SAM AIR TRAFFIC FLOW MANAGEMENT (ATFM) REGIONAL PROJECT FOR LATIN AMERICA (RLA/06/091)

(Presented by the United States of America)

SUMMARY

This Information Paper reports on the activities and accomplishments of the ICAO ATFM Regional Project for Latin America (RLA/06/091). This paper contains three (3) appendices supporting the work of the project: The first appendix is a questionnaire designed to gather information related to ATFM from the States; the second appendix is a draft ATFM Roadmap for the CAR/SAM region; and the third appendix is a draft CAR/SAM ATFM Manual. The States of the SAM Region approved and adopted the ATFM Roadmap for application in the SAM region at the 2nd SAM Implementation Group (SAM/IG/2) meeting held November 3-7, 2008 in Lima, Peru.

1. INTRODUCTION

1.1. The First Workshop/Meeting of the SAM Implementation Group (SAM/IG/1) was held at the ICAO South American Regional Office in Lima, Peru, as part of the Regional Project for Latin America (RLA/06/901). The stated goal of RLA/06/901, which sponsored the First Implementation Workshop/Meeting, was to attain interoperability and continuity for all users during all the flight phases throughout the regions; to meet the agreed upon safety levels; to develop economically optimal and environmentally sustainable operations; and to satisfy national safety requirements.

1.2. The Meeting was attended by 30 participants from 8 States of the SAM Region and by 3 International Organizations including ALTA, ARINC and IATA.

2. DISCUSSION

2.1 The Meeting considered that ATFM implementation in the SAM Region would require the development of detailed guidelines for States and International Organizations, including the following aspects:

a) Review experience in other regions;

b) Obtain and complete the information, taking note of the status in the participating States and organizations; and

c) Obtain and complete the information, taking note of the status in the participating States and organizations regarding the electronic databases required for the evolutionary phases of the ATFM system.

2.2 The Meeting felt that the development of the material required for ATFM implementation would require the hiring of experts to work to fulfill some of the tasks of the action plan. Consequently, the Meeting decided that certain tasks (1.2.1 and 1.2.2 described in the SAM/IG/1 Report) should be assigned to an expert hired by project RLA/06/901.

2.3 The work related to these tasks was accomplished by a hired expert from September 1-12, 2008 at the ICAO Regional Office in Lima, Peru. One result of this effort was the development of an ATFM Questionnaire to be completed by the States and International Organizations (**Appendix A**). Another result of the work was the development of a draft ATFM Roadmap for the CAR/SAM region (**Appendix B**). Directly related to the ATFM Roadmap is the draft CAR/SAM ATFM Manual that was also developed (**Appendix C**).

2.4 It is important to stress that the documents included in the appendices to this information paper are in ***draft*** form and will require additional discussion and exchange of ideas to develop the final products for the CAR/SAM region.

3. ACTION BY THE MEETING

3.1 The meeting is invited to review the information contained within this paper and supporting appendices, as well as consider the application of these ATFM accomplishments in the Asia and Pacific region.

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APPENDIX A

SAM/IG/1 TASK 1.2.1
ATFM QUESTIONNAIRE

The objective of this survey is to obtain information in order to learn about the current status in the participating States and Organizations with respect to:

a) The methods for estimating airport and ATC capacity; and

b) ATFM procedures for the following phases:
1) Airport strategic
2) Airport tactical
3) Airspace strategic
4) Airspace tactical

This information will allow the SAM Implementation Group (SAM/IG) to fulfil its planning and harmonizing objectives.

Mark with an "X" the corresponding answer. Please include your comments, if you deem pertinent. If necessary, use additional sheets. As applicable, send copies of requested electronic documents to mail@lima.icao.int

1. Does your administration currently have a method, whether basic or complex, for calculating airport capacity? If yes, please send an electronic copy of the methodology to mail@lima.icao.int

☐ YES ☐ NO

If yes, please provide any available airport capacity data for your main airports in the following table. Please note that for this table:

Total Capacity = Airport Acceptance Rate (AAR) + Airport Departure Rate (ADR).

Airport Name	Runway configuration	Airport Acceptance Rate (AAR) VFR	MVFR	IFR	Airport Departure Rate (ADR)	Total Capacity

Table 1

Comments

_____

_____

_____

2. Does your administration currently have a method, whether basic or complex, for calculating enroute sector capacity? If yes, please send an electronic copy of the methodology to mail@lima.icao.int

☐ YES ☐ NO

If yes, please provide any available airport capacity data for your main airports in the following table. Under the "Time Increments" column, please indicate if the sector capacity is computed by 15-minute increments, 60-minute increments, or some other increment.

ACC	Sector Name	Sector Altitudes	Sector Capacity	Time Increments

Table 2

Comments

_____

_____

_____

3. Does your administration currently have procedures in place to support the following phases of ATFM?

a) Airport Strategic

☐ YES ☐ NO

b) Airport Tactical

☐ YES ☐ NO

c) Airspace Strategic

☐ YES ☐ NO

d) Airspace Tactical

☐ YES ☐ NO

Comments

SAM/IG/1 TASK 1.2.2
ATFM QUESTIONNAIRE

a) Flow management data processing and display:

1. Does your administration have a system to receive, process, and display flight plan data (FPL, RPL, etc.)?

☐ YES ☐ NO

2. Does your administration have a database that includes airspace information (for example, ACC boundary coordinates, sector boundary coordinates, NAVAIDS, airways, special use airspace) and airport information (for example, runway and taxiway layout, ramp layout, parking gate information)?

☐ YES ☐ NO

3. Does your administration have an electronic ATFM system that displays airborne traffic?

☐ YES ☐ NO

4. Does your administration have a communication system that allows automated or manual exchange of messages to support ATFM decision making (for example, SLOT assignment messages, SLOT adjustment messages, delay reporting messages, alternate route messages)?

☐ YES ☐ NO

5. Does your administration have a system to monitor the status of the air navigation infrastructure?

☐ YES ☐ NO

6. Does your administration have a system to monitor and display the airport acceptance rates (AAR) at the main airports?

☐ YES ☐ NO

7. Does your administration have a system to monitor and display enroute sector capacity?

☐ YES ☐ NO

8. Does your administration have a system to monitor and display the mix of aircraft using the airspace or airports?

☐ YES ☐ NO

b) Surveillance systems:

1. On the following table, list the type of surveillance systems in use in your administration's airspace structure.

ACC Surveillance System	TMA Surveillance System	Other Surveillance System

Table 3

c) AIS/MAP:

1. On the following lines, list the AIS and map databases that your administration has available to support ATFM.

_____

_____

_____

_____

2. Are they available in an electronic format?

☐ YES ☐ NO

3. What is the AIS database update cycle?

☐ 28-DAY UPDATE ☐ 56-DAY UPDATE

d) Meteorological information:

1. On the following lines, list the specific meteorological products and/or websites that your administration has available to support ATFM.

e) Data for historical and statistical analysis:

1. On the following lines, list the type of databases your administration maintains to support the analysis of air traffic operations and meteorological activities.

f) Communication systems and processes in support of CDM and inter-facility coordination:

1. List the types of communication systems your operational units have with:

(a) other centralized ATFM organizations

(b) other FMUs, FMPs, and/or ATS units

(c) operators and airspace users

(d) airport authorities

(e) meteorological authorities

(f) aeronautical information services

(g) the transmission of radar and ADS data to the ATFM center

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APPENDIX B
CAR/SAM ATFM ROADMAP

ATFM

INTERNATIONAL CIVIL AVIATION ORGANIZATION

CAR/SAM ROADMAP FOR AIR TRAFFIC FLOW MANAGEMENT

(Lima, September 2008)

Version 1.0

Table of Contents

APPENDIX B

1. EXECUTIVE SUMMARY

1.1 GREPECAS determined that air traffic flow management (ATFM) implementation will help ensure optimum air traffic flow to/through specific airspace areas during periods in which the demand exceeds, or is foreseen to exceed, available capacity of the air traffic control (ATC) system. An ATFM system will help reduce ground and airborne delays and help avoid overloading the air traffic system.

1.2 In this connection, GREPECAS approved the CAR/SAM ATFM Concept of Operations (CAR/SAM ATFM CONOPS), which reflects the expected order of development events and should assist and guide the planners in the design and gradual implementation of an ATFM system.

1.3 The main stakeholders involved in ATFM include the organizations, bodies or entities which might participate, collaborate and cooperate in the planning, development, use, regulation, operation and maintenance of the ATFM System.

1.4 With regard to air traffic management, a number of airspace areas with common interests have been identified. The common interests are based on similar characteristics of traffic density, complexity and air navigation system infrastructure requirements. The identification of these airspace areas will help foster the implementation of the Global ATM Operational Concept. A description of such homogeneous and routing areas is attached to the CAR/SAM ATFM CONOPS.

1.7 As established in ICAO documents, ATFM cannot be restricted to the area of one State because of its far-reaching effects on the flow of air traffic elsewhere. ATFM should be implemented within a region, or within a defined area, as a regional ATFM centre. The main objectives of the regional ATFM centre include: assist ATC in making the maximum use of its airspace and capacity; issue flow management initiatives, as required, in order to maintain a safe, orderly and expeditious flow of air traffic; ensure that air traffic volume is compatible with declared capacities; develop a description of the principles and functions of flow management units (FMU); and establish the requirements for equipping flow management units and regional ATFM centres. The regional ATFM centre will be supported by FMUs established in each ACC within the region or defined area of application.

1.8 GREPECAS established a simple phased ATFM implementation strategy in order to ensure maximum utilization of available capacity and permit all parties concerned to obtain sufficient experience. The implementation will be initiated with the application of basic ATFM procedures at airports and then progress in an evolutionary manner to reach more complex phases, without the immediate need for a regional ATFM centre. GREPECAS noted that the implementation of a regional ATFM centre would require further studies to define the operational concepts, systems requirements and institutional aspects for its implementation.

1.9 In view of the need for harmonized ATFM planning, it is considered advisable to prepare an ATFM Roadmap to provide guidance to air navigation service providers, airspace operators and users, international organisations, and others regarding the applications that should be implemented in the short term (2008 – 2010) and medium term (2010 – 2014) in the CAR/SAM Regions.

1.10 The CAR/SAM ATFM Roadmap will provide material for regional projects regarding the implementation of ATFM as well as guidance for national implementation plans.

2. INTRODUCTION

2.1 The CAR/SAM ATFM Roadmap is being developed by the CAR/SAM States and Territories together with concerned international organizations such as COCESNA, IATA, IFALPA, and IFATCA. It is intended to assist the main stakeholders of the aviation community with planning a harmonized and coordinated transition to ATFM applications. The main stakeholders of the aviation community that benefit from this roadmap are:

- Airspace operators and users.
- Air navigation service providers.
- International organizations.

2.2 ATFM is a service designed to assist ATC with making the maximum efficient use of its airspace. This is done by balancing system demand with capacity in order to maintain a safe, orderly and expeditious flow of traffic.

2.3 In its beginning applications, ATFM need not involve complicated procedures or tools. The goal is to collaborate with system stakeholders and communicate operational information to airspace operators and ATC providers in a timely manner. In the initial application of ATFM, this can be accomplished via point-to-point telephone calls designed to exchange pertinent weather information, system constraints, and other information of operational significance. Examples include relaying information on known runway closures, volcanic activity, and reroute information. Significant benefits can be realized by applying the initial levels of ATFM service.

2.4 In more advanced applications, ATFM requires a continuous analysis and monitoring of traffic flows, regular coordination between traffic management units, and dynamic use of traffic management initiatives and programs. This involves the development, maintenance, and use of flight plan data bases, electronic flight data displays, and telephone conference systems.

2.5 Because ATFM is a collaborative process, it is ever improving, growing, and changing with a focus on meeting the operational needs of the stakeholder community. The establishment of a Collaborative Decision Making community is therefore an important key to the long-term success of ATFM.

3.0 OBJECTIVES OF THE ATFM ROADMAP

The following strategic objectives apply to the CAR/SAM ATFM Roadmap:

a) That CAR/SAM States, Territories, and Organizations will work together to develop a seamless and harmonized ATFM system in the CAR/SAM regions.
b) To communicate with and involve all of the appropriate stakeholders during the development and implementation process.
c) To develop the applicable regional and national documents necessary for the support of the ATFM system.
d) To provide training to all of the appropriate stakeholders with regard to the principles and processes of ATFM in the CAR/SAM regions.

4.0 PRINCIPLES OF ATFM IMPLEMENTATION

The implementation of ATFM in the CAR/SAM Regions will be based on the following principles:

a) Development of a Collaborative Decision Making process based on the concepts of teamwork, trust, and communication;
b) Use of the existing system capacity on a first-come, first-served basis without compromising safety;

c) Completion of the necessary coordination to make every possible attempt to increase available capacity before resorting to the application of ATFM measures;
d) Equitable distribution of delays among operators when taking pertinent measures to balance air traffic demand with system capacity; and
e) Application of Safety Management System processes to the ATFM services provided.

5.0 ATFM DEVELOPMENT STRATEGY

5.1 The initial development of ATFM in the CAR/SAM regions can be characterized by the following steps.

a) Develop and apply a common methodology to determine:
1) airport capacity; and
2) enroute sector capacity

b) Identify and apply weather products that can be commonly used to assess weather impact to the system.
1) METAR and TAF information
2) Prognostic websites and charts
3) Satellite websites and charts
4) Other

c) Identify the personnel and operational phone numbers that will serve as the point of contact for ATFM issues at each:
1) ACC
2) TMA
3) Control Tower
4) Airline Operations Center
5) Weather Office
6) Military Flight Operations Center
7) General Aviation Operations Center
8) Airport Operations Center
9) Other

d) Develop a local database to analyze the arrival and departure demand at key airports for the following time increments:

1) annually
2) monthly
3) daily
4) hourly

e) Discuss, develop, and apply basic traffic management initiatives and procedures to balance air traffic demand with system capacity.

1) Example 1: Request expanded miles-in-trail between arrivals to the same airport from adjacent sectors or ACCs.

2) Example 2: Have adjacent sectors or ACCs call-for-release of departures to a constrained airport in order to fit them into the arrival flow.

3) Example 3: Coordinate reroutes with adjacent ACCs for flights to a

constrained airport to avoid

f) Develop and utilize point-to-point (for example, ACC-to-ACC, control tower-to-airline operator) phone calls for the initial application of traffic management initiatives.

g) Develop the applicable procedures manuals and training materials to support this initial ATFM phase.

h) Establish an implementation date for this phase of ATFM.

i) Train the appropriate personnel regarding the process and procedures of this phase of ATFM implementation.

j) Implement the processes and procedures.

k) Evaluate the results and coordinate changes as necessary.

l) Other.

Initial ATFM Development Steps (2008 – 2010)	
a) Develop and apply a common methodology to determine: 1) airport capacity; and 2) enroute sector capacity	March 2009
b) Identify and apply weather products that can be commonly used to assess weather impact to the system. 1) METAR and TAF information 2) Prognostic websites and charts 3) Satellite websites and charts 4) Other	March 2009
c) Identify the personnel and operational phone numbers that will serve as the point of contact for ATFM issues at each: 1) ACC 2) TMA 3) Control Tower 4) Airline Operations Center 5) Weather Office 6) Military Flight Operations Center 7) General Aviation Operations Center 8) Airport Operations Center 9) Other	March 2009
d) Develop a local database to analyze the arrival and departure demand at key airports for the following time increments:	

1) annually 2) monthly 3) daily 4) hourly	June 2009
e) Discuss, develop, and apply basic traffic management initiatives and procedures to balance air traffic demand with system capacity.	August 2009
f) Develop and utilize point-to-point (for example, ACC-to-ACC, control tower-to-airline operator) phone calls for the initial application of traffic management initiatives.	November 2009
g) Develop the applicable procedures manuals and training materials to support this initial ATFM phase.	December 2009
h) Establish an implementation date for this phase of ATFM.	December 2009
i) Train the appropriate personnel regarding the process and procedures of this phase of ATFM implementation.	March 2010
j) Implement the processes and procedures.	June 2010
k) Evaluate the results and coordinate changes as necessary.	September 2010

5.2 The intermediate development of ATFM in the CAR/SAM regions can be characterized by the following steps.

a) Develop a CAR/SAM flight plan database with the flexibility to allow operators to input, modify, or cancel their arrival / departure flight plan information.

b) Discuss, develop, and apply more advanced traffic management initiatives and procedures to balance air traffic demand with system capacity.

1) Example: Establish an electronic route database to facilitate the coordination and implementation of reroutes around volcanic activity, hurricanes, severe turbulence, etc.

c) Develop and utilize ATFM telcons among facilities in the CAR/SAM regions.

d) Update the procedures manuals and training materials to support this intermediate ATFM phase.

e) Establish an implementation date for this phase of ATFM.

f) Train the appropriate personnel regarding the process and procedures of this phase of ATFM implementation.

g) Implement the processes and procedures.

h) Evaluate the results and coordinate changes as necessary.

i) Other.

Intermediate ATFM Development Steps (2011 – 2012)	
a) Develop CAR/SAM flight plan database with the flexibility to allow operators to input, modify, or cancel their arrival / departure flight plan information.	March 2011
b) Discuss, develop, and apply more advanced traffic management initiatives and procedures to balance air traffic demand with system capacity.	June 2011
c) Develop and utilize ATFM telcons among facilities in the CAR/SAM regions.	September 2011
d) Update the procedures manuals and training materials to support this intermediate ATFM phase.	December 2011
e) Establish an implementation date for this phase of ATFM.	December 2011
f) Train the appropriate personnel regarding the process and procedures of this phase of ATFM implementation.	March 2012
g) Implement the processes and procedures.	June 2012
h) Evaluate the results and coordinate changes as necessary.	September 2012

5.3 The advanced development of ATFM in the CAR/SAM regions can be characterized by the following steps.

a) Develop a process for electronic exchange of both textual and visual flight data.

1) Example: SYNCHROMAX (Brazil), PROSAT (Mexico), TFMS (USA) - (previously, ETMS), an interface between these two systems, or another system yet to be defined.

b) Develop and implement regional ATFM command centers to coordinate inter-facility traffic management initiatives, flows, etc.

c) Update the procedures manuals and training materials to support this advanced ATFM phase.

d) Establish an implementation date for this phase of ATFM.

e) Train the appropriate personnel regarding the process and procedures of this phase of ATFM implementation.

f) Implement the processes and procedures.

g) Evaluate the results and coordinate changes as necessary.

h) Other.

Advanced ATFM Development Steps (2014 – 2015)	
a) Develop a process for electronic exchange of both textual and visual flight data.	January 2014
b) Develop and implement regional ATFM command centers to coordinate inter-facility traffic management initiatives, flows, etc.	June 2014
c) Update the procedures manuals and training materials to support this intermediate ATFM phase.	December 2014
d) Establish an implementation date for this phase of ATFM.	December 2014
e) Train the appropriate personnel regarding the process and procedures of this phase of ATFM implementation.	March 2015
f) Implement the processes and procedures.	June 2015
g) Evaluate the results and coordinate changes as necessary.	September 2015

EXPLANATION OF TERMS

The development of this document is based on the understanding of important terms and expressions that are described below:

Stakeholders involved in ATFM -

The ATFM stakeholder community includes the organizations, bodies or entities which could participate, collaborate and cooperate in the planning, development, utilization, regulation, operation, and maintenance of ATFM system. Among them are:

Aerodrome Community - The air traffic control authorities, aerodrome authorities, commercial, military, and general aviation operators, and other parties involved in the provision and operation of the physical infrastructure needed to support the take-off, landing, and ground handling of aircraft.

Airspace Providers - Refers, in general terms, to Contracting States/Territories in their capacity as airspace owners with the legal authority to permit or deny access to their sovereign airspace. The term may also be applied to organizations of the State assigned responsibility for establishing the standards and guidelines for use of the airspace.

Airspace users - Refers to the commercial, military, and general aviation operators that utilize the sovereign airspace of States/Territories/Organizations.

ATM service providers - All of the organizations and personnel (e.g., controllers, engineers, technicians) involved in the provision of ATFM services to airspace users.

Military aviation - Refers to the personnel, aircraft, and equipment of military organizations that serve a vital role in the security of States/Territories.

International Civil Aviation Organization (ICAO) -Considered the only international organization in position to efficiently coordinate the implementation activities of global ATM.

Air Traffic Flow Management (ATFM) - A service established with the objective of contributing to a safe, orderly and expeditious flow of air traffic by ensuring that ATC capacity is utilized to the maximum extent possible and that the traffic volume is compatible with the capacities declared by the appropriate ATC authority.

Air Traffic Management (ATM) - A service which comprises airspace management, air traffic flow management, and air traffic services.

ATM Community - All the organizations, bodies or entities which might participate, collaborate and cooperate in the planning, development, use, regulation, operation and maintenance of the ATM System.
Air Traffic Management System - ***A system which provides ATM through the integration and cooperation of personnel, information, technology, facilities and services. It also involves the support of on-board and space-based communications, navigation and surveillance.***

Air Traffic Volume - The number of aircraft within a defined airspace or aerodrome movement area in a given period of time.

Capacity (for ATFM purposes) - The maximum number of aircraft that can be accommodated in a defined airspace or aerodrome (throughput) in given period of time.

CAR/SAM ATFM Roadmap - A document offering appropriate guidance for air navigation service providers, airspace operators and users, international organizations and other appropriate ATM community members that describes the ATFM applications that will be implemented in the short, medium and long term in the CAR/SAM Regions.

Regional ATFM Center - A flow management unit responsible for the provision of air traffic flow management across multiple area control centers.

Collaborative Decision Making - an operating philosophy and the associated technologies that enable traffic managers and aviation industry representatives to respond in a timely manner to constraints in the airspace system.

Demand - The number of aircraft requesting to use the ATC system in a given time period.

Efficiency - The ratio of the cost of ideal flight to the cost of procedurally constrained flight.

Flow Management Position / Flow Management Unit (FMP/FMU) - ***A position or working unit established in an appropriate air traffic control unit to ensure the necessary interface between the local ATFM and a centralized ATFM unit.***

Homogeneous ATM area - An airspace with a common ATM interest, based on similar characteristics of traffic density, complexity, air navigation system infrastructure requirements and other specified considerations, wherein a common detailed plan will foster the implementation of ATFM.

Main Traffic Flow - The concentration of a significant volume of air traffic on the same, or similar, flight trajectories.

Routing area - An area that encompasses one or more major traffic flows, defined for the purpose of developing a detailed plan for the implementation of ATM systems and procedures.

Traffic Management Initiatives - Techniques used by traffic managers to balance air traffic demand with available capacity.

APPENDIX B

ACRONYMS
Lista de Acrónimos/ List of Acronyms

ACC	Centro de control de área	Area control center
AFTN	Red de telecomunicaciones fijas aeronáuticas	Aeronautical fixed telecommunication network
AIP	Publicación de Información aeronáutica	Aeronautical Information Publication
AIS	Servicio de información aeronáutica	Aeronautical information service
ANP	Plan navegación aérea	Air navigation plan
ANS	Servicios de navegación aérea	Air navigation services
ANSP	Proveedor de servicios de navegación aérea	Air navigation service provider
AO	Operador de aeronave	Aircraft operator
APP	Oficina de control de aproximación	Approach control facility
AAR	Regimen de aceptacion del aeropuerto	Airport Acceptance Rate
ADR	Regimen de salida del aeropuerto	Airport Departure Rate
ATC	Control de tránsito aéreo	Air traffic control
ATFM	Gestión de la afluencia del tránsito aéreo	Air traffic flow management
ATM	Gestión del tránsito aéreo	Air traffic management
ATS	Servicios de tránsito aéreo	Air traffic services
CAA	Administración de aviación civil	Civil aviation authority
CAR/SAM	Regiones Caribe y Sudamérica	Caribbean and South American Regions
CATFM	Dependencia de Gestión de la afluencia del tránsito centralizada	Centralized air traffic flow management unit
C/BA	Análisis de costo/beneficios	Cost/benefit analysis
CDM	Toma de decisiones en colaboración	Collaborative Decision Making
CNS/ATM	Comunicaciones, navegación y vigilancia/gestión del tránsito aéreo	Communications, navigation, and surveillance/air traffic management
CTA	Area de control	Control Area
FDPS	Sistema de procesamiento de datos de vuelo	Flight data processing system

FIR	Región de información de vuelo	Flight information region
FMP	Puestos de gestión de afluencia	Flow management position
FMU	Dependencia de organización de la afluencia	Flow management unit
FPL	Plan de vuelo	Flight plan
GREPECAS	Grupo regional de planificación y ejecución CAR/SAM	CAR/SAM regional planning and implementation group
IATA	Asociación del Transporte Aéreo Internacional	International Air Transport Association
IFALPA	Federación Internacional de Asociaciones de Pilotos de Líneas Aéreas	International Federation of Air Line Pilots' Associations
IFATCA	Federación Internacional de Asociaciones de Controladores de Tránsito Aéreo	International Federation of Air Traffic Controllers' Associations
LOA	Carta de acuerdo	Letter of Agreement
MET	Servicios meteorológicos para la navegación aérea	Meteorological services for air navigation
NOTAM	Aviso al Personal Encargado de las Operaciones de Vuelo	Notice to Airmen
OACI/ICAO	Organización de aviación civil internacional	International civil aviation organization
PANS ATM	Procedimientos para los servicios de navegación aérea –Gestión de tránsito aéreo	Procedures for Air Navigation Services –Air traffic management
PIRG	Grupo regional de planificación y ejecución	Planning and implementation regional group
PROSAT	Pronóstico de Saturación	PROSAT
RNAV	Navegación de área/Area Navigation - RNAV Route: Ruta de navegación de área	Area navigation route
RNP	Performance de navegación requerida	Required Navigation Performance
SID	Salida Normalizada por Instrumentos	Standard Instrument Departure
STAR	Llegada Normalizada por Instrumentos	Standard Instrument Arrival
SYNCHROMAX	SYNCROMAX	SYNCHROMAX
TBD	A ser determinado	To be determined

TELCON	Tele-conferencia	Telephone conference
TFMS	Sistema de gestión de la afluencia del transito (previamente, ETMS)	Traffic Flow Management System (previously, ETMS)
TMA	Area de control terminal	Terminal management area
TMC	Coordinador de la gestión del transito	Traffic Management Coordinator
TMI	Iniciativa de gestión del tránsito	Traffic management initiative
TWR	Torre de control	Control Tower
WSO	Oficina del servicio meteorológico	Weather Service Office
WWW	Red mundial	World Wide Web

— — — — — — —

APPENDIX C
CAR/SAM ATFM MANUAL

1. Introduction

1.1 Definition of ATFM

a. ATFM is a function established with the objective of producing a safe, orderly, and expeditious flow of traffic while minimizing delays. This is accomplished through continuous analysis, coordination, and dynamic use of traffic management initiatives.

1.2 Purpose.

a. The purpose of ATFM is to balance air traffic demand with system capacity to ensure the maximum, efficient use of the system airspace. This is accomplished by ensuring that capacity is utilized to the maximum extent possible and that air traffic volume is compatible with the capacities declared by the appropriate air traffic service providers.

1.3 Implementation.

a. Implementing of ATFM shall be established in accordance with a view to optimizing available capacity in the use of airspace and enhancing air traffic flow management processes. It shall be based on transparency and efficiency, ensuring that capacity is provided in a flexible and timely manner, consistent with the recommendations of the ICAO Regional Air Navigation Plan.

b. Implementing shall support operational decisions by air navigation service providers, airport operators and airspace users and shall cover the following areas:

1. flight planning;
2. use of available airspace capacity during all phases of flight; and
3. the creation of a single publication for route and traffic orientation.

c. Implementing shall seek to balance the financial impact on stakeholders with expected safety improvements and the operational and technical benefits, taking into account the requirement for global interoperability;

d. Implementing shall take into consideration the requirements of the military, law enforcement, and search and rescue communities.

e. ATFM implementing will aim at optimizing available capacity in the use of airspace and enhancing flow management processes. It shall also be based on transparency and efficiency, ensuring that capacity is provided in a flexible and timely manner.

f. It recognizes that airspace is a common resource for all categories of users that needs to be used flexibly by all of them, ensuring fairness and transparency while taking into account security and defense needs of Member States and their commitments with international organizations.

g. Air traffic flow management should be based on principles of partnership operated in accordance with the principles laid down in the ICAO Air Navigation Plan – FASID (Doc 7754), and contain the following functions:

1. Central unit for air traffic flow management

2. Flow Management Positions
3. Operators – general aviation, air carrier, military
4. Airport Operators

h. Military aircraft operating as general air traffic should be subject to air traffic flow management measures when operating or intending to operate within airspace to which air traffic flow management measures apply.

i. Member States, air navigation service providers and air carriers provide data to SYNCHROMAX or TFMS (previously ETMS) through the appropriate networks on a voluntary basis.

j. ATFM shall apply within the Member States' airspace to:

1. all flights intended to operate or operating as general air traffic and in accordance with the instrument flight rules (IFR); and

2. all phases of those flights.

k. ATFM shall apply to each of the following parties, or anyone acting on their behalf, involved in air traffic flow management activities:

1. Operators,
2. Air traffic service providers
3. Entities involved in airspace management
4. Airport operators
5. The entity charged by Member States with the provision of a single central unit for flow management.

2. Chapter 1: Demand and Capacity

2.1 In order to balance demand and capacity, it is first necessary to determine the airport acceptance rate (AAR), airport departure rate (ADR), total airport capacity, and the sector capacity. Once these capacities are established, steps can be taken to monitor and evaluate the air traffic demand and implement measures to balance demand with declared capacity. While there are a variety of methods to compute these values, the CAR/SAM Regions have agreed to use the following methodology:

a. Determining the AAR, ADR, and Total Airport Capacity**.**

1. Definitions:

(a) **Airport Acceptance Rate (AAR):** A dynamic parameter specifying the number of arriving aircraft that an airport, in conjunction with terminal airspace, ramp space, parking space, and terminal facilities can accept under specific conditions during any consecutive 60 minute period.

(b) **Airport Departure Rate (ADR)**: A dynamic parameter specifying the number of departing aircraft that an airport, in conjunction with terminal airspace, ramp space, parking space, and terminal facilities can depart under specific conditions during any consecutive 60 minute period.

(c) **Total Airport Capacity**: A dynamic parameter specifying the *total* number of arriving and departing aircraft that an airport, in conjunction with terminal airspace, ramp s

pace, parking space, and terminal facilities can manage under specific conditions during any consecutive 60 minute period.

b. Administrative considerations:

1. Identify the organization responsible for the establishment and implementation of the AAR, ADR, Total Airport Capacity, and sector capacity.

2. Establish the AAR, ADR, and Airport Capacity for the airports identified by the States, Territories, and Organizations.

3. Review and validate the associated AAR, ADR, Total Airport Capacity, and sector capacity values at least once each year.

2.1 Determining AAR:

TO BE DETERMINED

2.2 Determining ADR:

TO BE DETERMINED

2.3 Determining Total Airport Capacity:

TO BE DETERMINED

2.4 Determining Sector Capacity:

TO BE DETERMINED

2.5 Monitoring demand
1. Airport
2. Sector

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4.0 Chapter 3: Traffic Management Initiatives (TMI)

4.1 Definition
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4.3 Types
1. Altitude initiatives
a. Capping

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2. In-trail initiatives
   a. Miles-in-trail
   b. Minutes-in-trail
   c. Call for release (enroute spacing)

3. Fix balancing
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5. Reroutes
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   a. Ground delay programs
   b. Ground stops

4.4 TMI approval authority

4.5 TMI processing

5.0 Chapter 4: Communications and Coordination
5.1 Communicating traffic management information.
1. Planning telephone conferences
2. Operational telephone conferences
3. Web pages
5.2 Operations plan
5.3 Implementing Traffic Management Initiatives
5.4 Adjusting Traffic Management Initiatives
5.5 Cancelling Traffic Management Initiatives

6.0 Chapter 5: Organization and structure
6.1 Line of authority
6.2 Regional Traffic Management Center
1. Mission: Monitors and manages the flow of air traffic throughout the designated airspace system in order to produce a safe, orderly, and expeditious flow of air traffic while minimizing delays.

2. Duties
   a. Analysis
   b. Coordination
   c. Intra-facility
   d. Inter-facility
   e. Telephone conferences
   f. CDM approach
   g. Documentation
   (1) Operational log

6.3 Local Traffic Management Unit
1. Mission: Monitor and balance flows of air traffic within their area of responsibility.
2. Duties
   a. Analysis
   b. Coordination

c. Intra-facility
d. Inter-facility
e. Telephone conferences
f. CDM approach
g. Documentation

(1) Operational log

7.0 Chapter 6: System Performance Metrics
7.1 Actual arrival and departure counts for main airports
7.2 Delay information

8.0 Chapter 7: Collaborative Decision Making
8.1 Organization
1. Roles and responsibilities

9.0 Chapter 8: Common ATFM Terminology

9.1 **General**

1. The primary goal of these guidelines is to develop terminology and phraseology for the exchange of ATFM messages between units providing ATFM services. The terminology and phraseology contained herein are intended to both reflect the current use of plain language and provide a basis for standardization and harmonization.

2. Although there are various plain language words and phrases in use today by ATFM service providers, these words and phrases can be organized into a modular and structured method of delivery to ensure communication harmonization and reduce the incidence of misunderstanding between units providing ATFM service.

3. It is not the intent of these guidelines to provide detailed information on ATFM concepts, procedures, and initiatives; however, since not all readers may be familiar with ATFM terms used in the examples, a brief description of ATFM initiatives is provided at Attachment 1. The list is not all-inclusive and does not preclude the innovation and application of other procedures that will result in improved service.

4. These guidelines include the concept of modular and structured ATFM messages and define an ATFM message's components as who, what, where, when and why. These five components are described as follows:

a. Who: The ATFM service unit being contacted followed by the ATFM service unit that is initiating the contact.

b. What: The ATFM objective to be achieved.

c. Where: The location of the ATFM objective to be achieved.

d. When: The time and/or duration of the ATFM objective to be achieved.

e. Why: The reason for the ATFM objective.

5. There is no module regarding “how” the ATFM restrictions should be achieved by the counterpart ATFM service provider. It is the counterpart’s responsibility how they fulfill the requested ATFM restrictions within their airspace. However, the center being asked for the ATFM restrictions may collaborate with the originating center on the type and method of ATFM measure

application. It should be noted that once information is exchanged regarding an ATFM restriction, it is considered MANDATORY unless otherwise agreed.

6. Below are the examples of possible ATFM messages:

- FAA COMMAND CENTER, THIS IS ABCD COMMAND CENTER … REQUIRE 100 MILES IN TRAIL REGARDLESS OF FLIGHT LEVEL ON R220, R580 AND ALL PACOTS TRACKS FOR TRAFFIC LANDING NARITA ESTIMATING FIR BOUNDARY FROM 0100 UTC UNTIL 0500 UTC DUE TO SEVERE WEATHER.
- ABCD COMMAND CENTER, THIS IS FAA COMMAND CENTER… CAPACITY RESTRICTION: LOS ANGELES HAS STARTED FLOW RESTRICTIONS FOR ALL AIRCRAFT LANDING LOS ANGELES DUE TO EARTHQUAKE. APPROACH HAS REQUESTED GROUND STOPS FOR ARRIVALS UNTIL FURTHER NOTICE.

9.2 **ATFM Message Components**

1. The use of a modular and structured ATFM message provides for consistent ATFM message design and delivery. Each of the ATFM message's five components can contain plain language elements that when combined provide a complete ATFM message. The harmonization achieved lies in the delivery of an ATFM message that has all of the required components in a structured format while making allowances for different plain language elements. This is of particular benefit for ATFM service providers that use different ATFM terminology or for non-native English speaking ATFM service providers.

2. As the modular and structured ATFM message may contain several different elements of plain language, this section will examine each of the five components and detail some of the possible plain language words and phrases that are in use today.

3. **WHO**: The **who** component identifies the ATFM service unit being contacted followed by the ATFM service unit that is initiating the contact. Examples of the who component:

- ABCD COMMAND CENTER THIS IS FAA COMMAND CENTER…
- FAA COMMAND CENTER, THIS IS ABCD COMMAND CENTER…

4. **WHAT**: The **what** component identifies the ATFM objective to be achieved. Objectives include but are not limited to:

REQUIRE
- (number) MILES [or MINUTES] IN TRAIL AT THE SAME FLIGHT LEVEL…
- (number) MILES [or MINUTES] IN TRAIL REGARDLESS OF FLIGHT LEVEL…
- A RATE OF (number) AIRCRAFT PER HOUR…
- FLIGHT LEVELS (number) AND (number) NOT AVAILABLE
- ONLY FLIGHT LEVELS (number), (number) AND (number) ARE AVAILABLE
- (route/airport/airspace) NOT AVAILABLE DUE (reason) ALTERNATIVE[S] IS/ARE (routes/airports)

5. **WHERE**: The **where** component represents the location of the ATFM objective to be achieved. It is often preceded by a modifying clause, indicating what aircraft or traffic the restriction will apply to. The modifying clause and the location combination are used to construct there where component.

Examples of location:

- …AT NIPPI…
- …NARITA AIRPORT…
- …ANCHORAGE APPROACH…
- …ON A337…
- …WESTBOUND ON PACOTS TRACK CHARLIE…
- …EASTBOUND ON A590…
- …INBOUND ON G344…
- …ON PACOTS TRACK 2 LANDING SAN FRANCISCO AIRPORT…
- …ON PACOTS TRACK ECHO BELOW FLIGHT LEVEL 350…
- …ABOVE FLIGHT LEVEL 300…
- …INBOUND TO TOKYO ACC…
- …INBOUND TO OAKLAND OCEANIC SECTOR 5
- ... WEST OF MARCC

Examples of what aircraft or traffic are included:

- …FOR ALL AIRCRAFT…
- …FOR TRAFFIC FASTER THAN 300 KNOTS…
- …FOR HEAVY AIRCRAFT…
- …FOR TRAFFIC LANDING…
- …FOR AIRCRAFT DEPARTING…
- …FOR TRAFFIC OVERFLYING…
- …FOR AIRCRAFT PASSING…

6. **WHEN**: The **when** component represents the time and/or duration of the ATFM objective to be achieved:

Examples of time/duration:

- …FROM 0300 UTC UNTIL 0600 UTC…
- …FROM NOW UNTIL 0600 UTC…
- …FROM 2300 UTC UNTIL FURTHER NOTICE…
- …UNTIL FURTHER NOTICE…

7. **WHY**: The **why** component represents the reason for the ATFM objective:

DUE TO/FOR…

- RUNWAY CLOSURE
- (SEVERE) WEATHER
- COMMUNICATION FAILURE
- RADAR FAILURE
- (significant event/natural disturbance such as FIRE or VOLCANIC ASH)
- STATE AIRCRAFT ACTIVITY
- MILITARY ACTIVITY
- EQUIPMENT OUTAGE
- EMERGENCY
- ATFM INITIATIVES IN (location)

9.3 **ATFM Message Types**

1. **Information to be shared prior to invoking the ATFM restrictions**: The information-sharing should be facilitated not only during the actual flow control but also (and more importantly) well prior to invoking the ATFM restrictions when the possibility of flow control arises.

The following phrases will make clear the distinction between the ATFM messages and the information provided for situation awareness:

- POSSIBLE TRAFFIC FLOW RESTRICTIONS
- CAPACITY RELATED INFORMATION

Examples of messages sent prior to invoking ATFM restrictions follow:

- FAA COMMAND CENTER, THIS IS ABCD COMMAND CENTER…**POSSIBLE TRAFFIC FLOW RESTRICTIONS**… XYZ AIRPORT HAS CLOSED ONE RUNWAY AND STARTED SNOW REMOVAL.
- FAA COMMAND CENTER, THIS IS ABCD COMMAND CENTER…**CAPACITY RELATED INFORMATION**…XYZ AIRPORT HAS ENTERED THE STORM ZONE OF THE HURRICANE.

2. **ATFM Initiative Message**: ATFM initiatives communicate air traffic flow restrictions/objectives from one air traffic service provider to another. They follow the five component structure described earlier:

a. Who: The ATFM service unit being contacted followed by the ATFM service unit that is initiating the contact.

b. What: The ATFM objective to be achieved.

c. Where: The location of the ATFM objective to be achieved.

d. When: The time and/or duration of the ATFM objective to be achieved.

e. Why: The reason for the ATFM objective.

Examples of ATFM initiatives follow:

- ABCD COMMAND CENTER, THIS IS FAA COMMAND CENTER …REQUIRE 30 MINUTES IN TRAIL AT THE SAME FLIGHT LEVEL FOR ALL AIRCRAFT LANDING CHICAGO FROM 0800 UTC UNTIL FURTHER NOTICE DUE TO STATE AIRCRAFT ACTIVITIES.
- FAA COMMAND CENTER, THIS IS ABCD COMMAND CENTER… FL350 AND BELOW NOT AVAILABLE FOR AIRCRAFT OVERFLYING XYZ DOMESTIC AIRSPACE UNTIL 0900 UTC DUE TO EMERGENCY.

3. **Coordination of aircraft exempted from ATFM initiatives**: The following phrases will be used for the coordination of aircraft which are exempt from ATFM restrictions:

- REQUEST EXEMPTION FROM ATFM
- COORDINATION OF ATFM EXEMPTION

4. The following types of aircraft may be exempted from ATFM restrictions:

- Aircraft in a state of emergency
- Aircraft engaged in search and rescue missions
- Aircraft operating for humanitarian reasons
- Aircraft carrying the head of State or distinguished visitors of State
- Aircraft carrying a patient who needs urgent medical treatment

Examples of messages requesting ATFM exemption follow:

- ABCD COMMAND CENTER, THIS IS FAA COMMAND CENTER…**REQUEST EXEMPTION FROM ATFM**…UAL123 IS CARRYING A PATIENT WHO NEEDS URGENT MEDICAL TREATMENT.
  UAL123…EXEMPTION APPROVED.
- FAA COMMAND CENTER, THIS IS ABCD COMMAND CENTER…**COORDINATION OF ATFM EXEMPTION**… UAL501A IS OPERATING SEARCH AND RESCUE MISSIONS.

5. **Information for the next coordination**: If it is possible and appropriate, the expected time of next coordination will be forwarded with the ATFM messages:

- I WILL CALL YOU AT 0400 UTC FOR FURTHER COORDINATION
- WE WILL CALL YOU AGAIN IN 30 MINUTES

An example of a message with information for the next coordination follows:

- ABCD COMMAND CENTER, THIS IS FAA COMMAND CENTER… REQUIRE 30 MINUTES IN TRAIL REGARDLESS OF ALTITUDE FOR ALL AIRCRAFT ON PACOTS TRACK 8 FROM 1000 UTC UNTIL FURTHER NOTICE DUE TO MILITARY ACTIVITY. I WILL CALL YOU AGAIN IN 60 MINUTES.

6. **Amendment:** The amendment of an ATFM message should be structured as the initial message and include similar elements but with additional modifiers. These modifiers may include:

- CHANGE
- AMEND
- REDUCE
- INCREASE
- DECREASE

7. Amendment messages should also identify which message is being amended, as several restrictions could be in place at one time. Examples of ATFM amendment messages follow:

- FAA COMMAND CENTER, THIS IS ABCD COMMAND CENTER…WE HAVE **CHANGED** THE RESTRICTION ON TRAFFIC FLYING PACOTS TRACKS CHARLIE, ECHO AND FOXTROT FOR XYZ AIRPORT. WE NOW NEED 20 MINUTES IN TRAIL AT THE SAME FLIGHT LEVEL ON PACOTS TRACKS CHARLIE, ECHO AND FOXTROT FOR TRAFFIC LANDING XYZ AIRPORT FROM NOW UNTIL 0900 UTC.
- ABCD COMMAND CENTER, THIS IS FAA COMMAND CENTER…WE HAVE **INCREASED** THE INBOUND RATE FROM 5 AIRCRAFT PER HOUR TO 10 AIRCRAFT PER HOUR FOR TRAFFIC BEYOND OAKLAND FIR UNTIL FURTHER NOTICE.

8. **Cancellation**: The cancellation of an ATFM message should be structured the same as the initial message and include similar elements but also contain a canceling word or phrase. It is normally not necessary to state the reason for the cancellation. A canceling word or phrase may include:

2. CANCEL
3. RESUME
4. RESUME NORMAL
5. RELEASE

9. Cancellation messages should also identify which message is being cancelled, as several restrictions could be in place at one time. An example of an ATFM cancellation message follows:

- FAA COMMAND CENTER, this is ABCD COMMAND CENTER…**CANCEL** the restriction on traffic beyond the XYZ FIR at this time. **Resume normal** traffic flow.

9.4 Description of Air Traffic Flow Management Initiatives

The following list is not all-inclusive and does not preclude the innovation and application of other procedures that will result in improved service.

Name	Description
Airborne holding	Planned holding of aircraft may be utilized. This is normally done when the operating environment supports holding and the weather conditions are expected to improve shortly; this ensures aircraft are available to fill the capacity at the airport.
Altitude	Utilized to segregate different flows of traffic, or to distribute the number of aircraft requesting access to a specified geographic region. **a. Capping**: Term to indicate aircraft will be cleared to an altitude lower than their requested altitude until they are clear of a particular airspace. Capping may apply to the initial segment of the flight or for the entire flight. **b. Tunneling**: Term to indicate traffic will be descended prior to the normal descent point at the arrival airport to remain clear of an airspace situation; e.g., holding.
Fix balancing	Assigning an aircraft a fix other than that in the filed flight plan in the arrival or departure phase of flight to equitably distribute demand.
Ground delay programs (GDP)	Aircraft are held on the ground in order prior to departure to manage capacity and demand at a specific location, by assigning arrival slots. The purpose of the program is to limit airborne holding.
Ground stops (GS)	GS is a process that requires aircraft that meet specific criteria to remain on the ground. Since this is one of the most restrictive methods of traffic management, alternative initiatives should be explored and implemented if appropriate. GSs should be used: **a.** In severely reduced capacity situations (below most user arrival minimums, airport/runway closed for snow removal, or aircraft accidents/incidents); **b**. To preclude extended periods of airborne holding; **c**. To preclude sector/center reaching near saturation levels or airport grid lock; **d**. In the event a facility is unable or partially unable to provide ATC services due to unforeseen circumstances; and **e**. When routings are unavailable due to severe weather or catastrophic events.

Name	Description
Miles-in-trail (MIT)	The number of miles required between aircraft that meet a specific criteria. The criteria may be separation, airport, fix, altitude, sector, or route specific. MIT are used to apportion traffic into manageable flows, as well as to provide space for additional traffic (merging or departing) to enter the flow of traffic.
Minutes-in-trail (MINIT)	The number of minutes required between successive aircraft. It is normally used in a non-radar environment, or when transitioning to a non-radar environment, or when additional spacing is required due to aircraft deviating around weather.
Reroutes	Reroutes are ATC routings other than the filed flight plan. They are issued to: **a.** Ensure aircraft operate with the "flow" of traffic. **b.** Remain clear of special use airspace. **c.** Avoid congested airspace. **d.** Avoid areas of known weather where aircraft are deviating or refusing to fly.
Sequencing programs	These programs are designed to achieve a specified interval between aircraft; they may be software generated or determined by ATFM personnel. Different types of programs accommodate different phases of flight. **1. Departure Sequencing Program (DSP)** - Assigns a departure time to achieve a constant flow of traffic over a common point. Normally, this involves departures from multiple airports. **2. En route Sequencing Program (ESP)** - Assigns a departure time that will facilitate integration in the en route stream. **3. Arrival Sequencing Program (ASP)** - Assigns fix crossing times to aircraft destined to the same airport.

9.5 Table of Abbreviations

The abbreviations listed here are those used by ATCSCC and other Command Centers that are not defined in the ICAO Doc. 8400 (PANS-ABC). The shaded abbreviations are considered to be the common terms between the two centers. The asterisk shows verbatim difference in the original collocation but the abbreviation still indicates the common object.

	ATCSCC	Other Command Centers
AAR	Airport Acceptance Rate	
ACID	Aircraft Identification	
ADL	Aggregate Demand List	
ADR	Airport Departure Rate	
ADZY	Advisory	
AIM	Aeronautical Information Manual	
ALTRV	Altitude Reservation	Altitude Reservation
ANP	Air Navigation Plan	
AOA	Office of the Administrator	
AOC	Airline Operations Center	
AP	Air Patrol	
APREQ	Approval Request	Approval Request

	ATCSCC	Other Command Centers
APVL	Approval	Approval
ARINC	Aeronautical Radio Incorporated	
ARO	Airport Reservation Office	
ARTCC	Air Route Traffic Control Center	Air Route Traffic Control Center
ARU	Airspace Reservation Unit (Canada)	
ASM		Airspace Management
AT	Air Traffic	
ATCSCC	Air Traffic Control System Command Center	Air Traffic Control System Command Center
ATMC	Air Traffic Management Center	Air Traffic Management Center
ATMetC		Air Traffic Meteorological Center
ATO	Air Traffic Operations Program	
AUTODIN	Automatic Digital Network	
CARF	Central Altitude Reservation Function	
CCFMEX	Mexico Command Center	Centro de Control de Flujo de Mexico
CFMU	Central Flow Management Unit (Brussels)	Central Flow Management Unit
CCFP	Collaborative Collective Forecast Product	
CCWSU	Command Center Weather Service Unit	
CDM	Collaborative Decision Making	Collaborative Decision Making
CDR	Coded Departure Route(s)	Conditional Route
CDR	Continuous Data Recording	
CDT	Controlled Departure Time	
CFR	Code of Federal Regulations (formerly FAR)	
CGNA	Brazil Command Center	Centro De Gerenciamento Da Navegação Aérea
CIWS	Corridor Integrated Weather System	
COMSEC	Communications Security System	
CR	Collaborative Routing	
CT	Select Flights Ground Delay Program	
CTA	Controlled Time of Arrival	
CTAS-TMA	Center TRACON Automation System Traffic Management Advisor	
CVRS	Computerized Voice Reservation System	
CWA	Central Weather Advisory	

	ATCSCC	Other Command Centers
CWSU	Center Weather Service Unit	
DARC	Direct Access Radar Channel	
DCCWU	ATCSCC Weather Unit	
DOTS	Dynamic Ocean Track System	Dynamic Ocean Track System
DP	Departure Procedure	
DSP	Departure Sequencing Program	
EDCT	Expected Departure Clearance Time	Expected Departure Clearance Time
EFAS	Enroute Flight Advisory Service	
EFTO	Encrypt For Transmission Only	
EOF	Emergency Operations Facility	
EOR	Emergency Operations Room	
EPS	Engineered Performance Standards	
ESCAT	Emergency Security Control of Air Traffic	
ETE	Estimated Time Enroute	Estimated Time Enroute
ETMS	Enhanced Traffic Management System	
EUCARF	European Central Altitude Reservation Facility	
FA	General Ground Delay Program	
FAA	Federal Aviation Administration	Federal Aviation Administration
FADT	Fuel Advisory Delay Time	
FCA	Flow Constrained Area	
FDMS		Flight Data Management System
FDPS		Flight Data Processing Section
FEA	Flow Evaluation Area	
FP	Flight Plan	
FPL	Full Performance Level	
GA	General Aviation	
GAAP	General Aviation Airport Program	
GDP	Ground Delay Program	
GS	Ground Stop	
HARS	High Altitude Route System	
HDTA	High Density Traffic Airport	
IFCN	Interfacility Communication Network	
IFPFP	Individual Flight Plan From this Point	Individual Flight Plan From this Point

	ATCSCC	Other Command Centers
IFSS	International Flight Service Station	
INATS	Interruption of Air Traffic Service	
JCAB	Japan Civil Aviation Bureau	Japan Civil Aviation Bureau
LAA	Local Airport Advisory	
LADP	Local Airport Deicing Plan	
LOA	Letter of Agreement	Letter of Agreement
MAP	Monitor Alert Parameter	
MARSA	Military Assumes Responsibility for Separation of Aircraft	Military Assumes Responsibility for Separation of Aircraft
MEL	Minimum Equipment List	
MINIT	Minutes in Trail	
MIT	Miles in Trail	
MOS	Military Operations Specialist	
MTSAT	Multi-functional Transport Satellite	Multi-functional Transport Satellite
MVFR	Marginal Visual Flight Rules	
NADIN	National Airspace Data Interchange Network	
NAS	National Airspace System	
NAVAID*	Navigational Aid	Navigation Aid
NFDC	National Flight Data Center	
NMCC	National Maintenance Coordination Center	
NOAA	National Oceanic and Atmospheric Administration	
NOC	NAV CANADA National Operations Centre (Ottawa)	NAV CANADA National Operations Centre
NOM	National Operations Manager	
NOPAC	North Pacific	North Pacific
NOS	National Oceanographic Service	
NRP	National Route Program	
NTMO	National Traffic Management Officer	
NWS	National Weather Service	
OAG	Official Airline Guide	
ODP		Oceanic Air Traffic Control Data Processing System
OPSNET	Operations Network	
OTG		Oceanic Track Generator
OTR		Oceanic Transition Route

	ATCSCC	Other Command Centers
PACMARF*	Pacific Military Altitude Reservation Facility	Pacific Military Altitude Reservation Function
PACOTS	Pacific Organized Track System	Pacific Organized Track System
PMTC	Pacific Missile Test Center	
PO	Plan of Operation	
Pref Route	Preferential Route	
PT	Planning Team	
RA	Route Advisory	
RAA	Remote Airport Advisory	
ROT	Runway Occupancy Time	
SAA	Special Activity Airspace	
SOP	Standard Operating Procedure	
STMP	Special Traffic Management Program	
SUA	Special Use Airspace	
SVRW	Severe Weather	
SWAP	Severe Weather Avoidance Program	
TEC	Tower-Enroute Control	
TELCON	Telephone Conference	
TFM	Traffic Flow Management	
TIS	Traffic Information System	
TMC	Traffic Management Coordinator	Traffic Management Coordinator
TMCIC	Traffic Management Coordinator in Charge	
TMI	Traffic Management Initiative	
TMU	Traffic Management Unit	Traffic Management Unit
TSTM	Thunderstorm	
WSO	Weather Service Office	

DOCUMENT CHANGE RECORD
The following table records the complete history of the successive versions of the present document.

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— END —

Doc 9426

Chapter 1
Air Traffic Flow Management and Flow Control

1.1 INTRODUCTION

1.1. The objective of air traffic flow management (ATFM) service is to ensure an optimum flow of air traffic to or through areas during times when demand exceeds, or is expected to exceed, available capacity of the air traffic control (ATC) system. The term ATFM is used to embrace any activity concerned with the organization and handling of the flow of air traffic in such a way that, while ensuring the safe, orderly and expeditious flight of individual aircraft, the totality of the traffic handled at any given point or in any given area is compatible with the capacity of the air traffic control system. The term ATC capacity reflects the ability of the ATC system or any of its subsystems or operating positions to provide service to aircraft during normal activities, and is expressed in numbers of aircraft entering a specified portion of the airspace in a given period of time. The maximum peak capacity which may be achieved for short periods may be appreciably higher than the sustainable capacity. ATFM supports ATC in meeting its main objectives of preventing collisions between aircraft, expediting and maintaining an orderly flow of air traffic, as well as of achieving the most efficient utilization of available airspace and airport capacity. To be effective, an ATFM service must have continuous cooperation and co-ordination with participating ATC units and the various airspace users.

1. 1.2 In their planning and management of airspace, States should aim to promote flight safety, provide sufficient capacity to meet normal traffic demands, ensure maximum utilization of airspace, ensure compatibility with international developments, and balance the legitimate, but sometimes conflicting, requirements of all users. Airspace management (ASM) should be aimed at the most effective exploitation of the airspace in accordance with the requirements of the various airspace users. In some cases of conflicting requirements, .segregation of airspace in general may be the only feasible air traffic management solution. However, in order to make maximum use of airspace, more civil/military co-ordination must be achieved, with airspace being shared, either simultaneously or on a time-share basis, taking into account the different levels of aircraft equipage and the various ATC components.

1.1.3 The most efficient utilization of available airspace and airport capacity can be achieved only if all relevant elements of the air traffic system had been considered during the planning stage, applying a systems approach. The flow of traffic is hampered by bottlenecks in the system; a constraint anywhere in the system will contribute to capacity limitations. For that reason, neither the airport system nor the air navigation system should be considered separately in planning system improvements.

1. 1 .4 Present-day airspace utilization is not seen as being “optimal” and/or “flexible” in the broadest sense because of the existing discrepancy between ATC capacity and users’ demands, particularly during peak traffic periods. The inflexibility often associated with the present fixed route structure prevents the most efficient use of the airspace and the most economical conduct of flight operations. Shortcomings in communications, navigation and surveillance (CNS) systems, as well as the lack of harmonized system developments, are also identified as contributing factors to the current system shortcomings. The limited level of co-operative planning has led to, inter *dia.* duplication of facilities across national boundaries, limited sharing of radar data, significant variations in the application of separation minima, cumbersome ATC coordination procedures and the application of different cruising level systems. These shortcomings may result in delays or re-routing of the traffic, adversely affecting the regularity and economy of flights. In order to accommodate the growth of air traffic, an appropriate plan for air traffic management (ATM) should be established, aimed at optimizing the airspace utilization as well as maintaining an orderly flow of the air traffic.

1.2.4 Air traffic flow management (ATFM)

1.2.4.1 As indicated in 1.1.1 above, ATFM service is established to support ATC in ensuring an optimum flow of

air traffic to, from, through or within defined areas during times when demand exceeds, or is expected to exceed, the available capacity of the ATC system, including relevant aerodromes. ATFM should be developed as necessary to ensure this optimum flow.

1.2.4.2 An optimum flow of air traffic is not always possible due to various constraining factors, such as conflicting users' requirements, air navigation system limitations and unexpected weather conditions. In this connexion, alleviating measures, such as control of air traffic flow, will need to be considered, particularly when the ATC system can no longer fully cope with the volume of air traffic. Such measures frequently result in delays of flights prior to departure, in-flight holdings, use of uneconomic flight levels, re-routing and diversions, disruptions of flight schedule, economic and fuel penalties for aircraft operators, congestion on aerodromes or in terminal buildings and passenger dissatisfaction.

1.2.4.3 It should be noted that the control of air traffic flow is specified in Annex 11, 3.7.4, as follows:

"When it becomes apparent to an air traffic control unit that traffic additional to that already accepted cannot be accommodated within a given period of time at a particular location or in a particular area, or can only be accommodated at a given rate, that unit shall advise other air traffic control units and operators known or believed to be concerned and pilots-in-command of aircraft destined to that location or area that additional flights are likely to be subjected to excessive delay, or, if applicable, that specified restrictions are to be applied to any additional traffic for a specified period of time for the purpose of avoiding excessive delay to aircraft in flight."

1.2.4.4 The main causes of the air traffic congestion are:

a) accumulation of air traffic during specific periods of the year and also during certain times of the week and hours of the day, due to holiday patterns and travel habits of the public;

b) differences in the capacities of the various ATC systems or parts of these systems affected by traffic accumulations;

c) insufficient advance notice (to ATC units) of likely traffic demands which may cause overloading of the system at certain points, in certain areas, and/or during specific time periods; and

d) lack of proven techniques and procedures to restore, in critical situations, a reasonable balance between traffic demand and available ATC capacity by means acceptable to aircraft operators both from an operational and from an economic point of view.

1.2.4.5 The accumulation of air traffic may be due to the fact that operators adapt their services to their customers' demand and that the choice of routes and flight levels is limited, due to the need to share the airspace with other users, especially the military. In addition, operators may have to cope with restrictions imposed on them for environmental reasons, i.e. night curfews at aerodromes, noise abatement procedures, etc., which tend to concentrate the traffic in a narrow period of time.

1.2.4.6 The traffic handling capacities of ATC systems may be inadequate as a result of insufficient staffing of existing facilities, in terms of either the number of personnel or their qualifications. Inefficient ATC procedures may also limit ATC capacity, e.g. inadequate liaison and/or lack of letters of agreement between States, especially those relating to transfer of control of aircraft between adjacent States. Furthermore, lack of ATC equipment such as primary and secondary surveillance radar and electronic data processing equipment may cause difficulties in coping with the growth of air traffic.

1.2.4.7 Measures to control the flow of air traffic will need to be taken in certain cases to ensure a reasonable balance between the air traffic demand and the ability of the air traffic services to accommodate that demand. However, it should be emphasized that these measures are restrictive in nature and should be kept to the minimum and, whenever possible, be applied selectively so as to affect only that part of the over-all air traffic which causes the problem. The term "selectively" should not permit the use of any discriminatory practices by the ATC unit concerned. Any distinction between different parts of the air traffic should be based exclusively on categories such as arriving or departing air traffic or overflights, without any consideration of the type of flights (civil, military, scheduled, non-scheduled, etc.). When flow control measures are necessary for certain areas, they

should be applied only for the period when expected air traffic demand will exceed the capacity in those areas. Flow control measures should be established and co-ordinated in such a way that they will not cumulatively interact with each other on the same flights.

1.2.4.8 In the context of ATFM, the following types of flights should be granted exemption from flow control measures:

a) flights in a state of emergency, including flights subjected to unlawful interference;
b) flights operating for humanitarian reasons;
c) medical flights specifically declared by medical authorities;
d) flights on search and rescue missions;
e) flights with "Head of State" status*; and
f) other flights as specifically required by State authorities*.

** There may be occasions when, due to the number of priority aircraft involved (for example, meetings of Heads of States), it will be necessary to issue delays to such aircraft to ensure that safe handling capacity figures are not exceeded.*

1.2.4.9 In co-operating with ATC and aircraft/aerodrome operators to balance traffic demand and the capability of ATC to safely accommodate that demand, the ATFM service should permit full exploitation of ATC capacity, maximum flexibility in the use of the route structure to secure minimum delay for all flights and orderly distribution of traffic flows, while giving appropriate consideration to operators' requirements. Furthermore, advance information on overload situations should be provided to ATC and aircraft/aerodrome operators, and relevant air traffic statistics should be generated in order to promptly identify the bottlenecks in the system. It should be emphasized at this point that the successful implementation of ATFM and flow control will depend on the effectiveness of the communication and co-operation established among national ATS authorities, aircraft operators, controllers and military authorities.

1.2.4.10 The ATFM service should fulfil the following basic strategic and tactical functions:

a) collection and collation of data on the air navigation infrastructure and on the capacities of the ATC system and selected aerodromes within the "ATFM area", including runway, taxiway and gates capacities. This embraces those areas in which traffic flow problems are likely to be encountered;
b) collection and analysis of data for all planned controlled flight operations into, out of, within and through the ATFM area;
c) determination of a coherent picture of expected traffic demand, including anticipated ad hoc traffic, comparison with available capacity and identification of areas and time periods of expected critical traffic loadings;
d) co-ordination with the appropriate ATS authorities in order to make every possible attempt to increase the available ATC capacity where required. In some particular situations it could be advantageous for national and local scheduling committees to be established, with representatives from national ATS, airport authorities, national and international operators. Such committees can make significant contributions when developing strategies to reduce the impact of peak demand periods; and
where ATC capacity shortfalls cannot be eliminated, determination and implementation in good time of suitable tactical measures co-ordinated throughout the ATPM area as necessary and with aircraft/aerodrome operators concerned.
e) where ATC capacity shortfalls cannot be eliminated, determination and implementation in good time of suitable tactical measures co-ordinated throughout the ATPM area as necessary and with aircraft/aerodrome operators concerned.

1.2.4.11 Whenever measures to control the flow of air traffic have to be applied in the form of delays, they should, if possible, be applied by ATC to aircraft on the ground rather than to aircraft in flight. Whenever application of such measures in the form of delays to airborne aircraft becomes unavoidable, the flights concerned should be informed as soon as possible. Whenever en-route holding becomes necessary, the aircraft concerned should be held as closely as practicable to the entry point of the area causing the restrictions.

1 .2.4.12 The introduction of flow control measures requires that the air traffic system capacity be accurately determined and an assessment made of the level of traffic demand above which the traffic flow will require regulation. Having determined this level, ATPM should provide the area control centre (ACC) serving a terminal area with information on an hour-to-hour basis (and to the best accuracy possible) regarding the planned times of arrival and departure of all aircraft during each period (15 or 30 minutes) when peak traffic conditions may be expected. Preferably, such predictions should be prepared three hours or more in advance and reviewed and revised periodically thereafter. Since such predictions require information on many aircraft that have not yet taken off or are otherwise not known to the ACC, special arrangements must be made by the ATPM to obtain this information from adjacent ACCs, the operators and/or other sources such as repetitive flight plans. Predicting the capacity of the system starts from a knowledge of capacity available under optimum operating conditions. It is then necessary to make allowance for adverse weather conditions, runway configurations at destination and the effect of forecast wind shift, runway unserviceability, inoperative en-route navigation and/or landing aids or any other factor which could adversely affect flight regularity. This information is then assessed by the ATPM service, in close co-operation with ATC, so as to arrive at a probable capacity figure for the system at any given time.

1 .2.4.13 Measures to regulate demand may take several forms. In simpler systems, ACCs exercising flow control to surrounding area control centres disseminate notices requesting that affected aircraft be spaced at prescribed intervals, e.g. one every ten minutes. Spacing of aircraft for flow control purposes should not be mixed with separation, but rather should be based on an “acceptance rate”, i.e. the number of aircraft accepted in a given period of time. This method of applying flow control is used by a number of ACCs without computer assistance. An improved and more sophisticated form of regulation of arrivals is possible with automated ATC systems, in which the controller is provided with computer assistance in the sequencing and spacing of aircraft in the terminal area. In this case, calculation of the delays which are caused by the sequencing and spacing operation can be transformed into clearances requiring aircraft to operate at reduced speed while still en route to the terminal area. Operation at reduced speed will enable aircraft concerned to absorb at least some of the delay while still en route. Reduced power settings may also be attractive to operators because of the consequent fuel savings. It should be noted, however, that reduced speed en route can frequently increase congestion in the en route segment and lead to increased sector complexity because of the incompatibility of speeds at the same flight level.

1.2.4.14 It should be noted that new technology in exploiting automation by means of aircraft situation display (ASD) is currently being used by the United States Federal Aviation Administration (FAA) to handle ATFM for both strategic and tactical purposes. A description of this implementation is contained in Appendix A.

1.2.4.15 Well before the application of flow control restrictions, predictions of the expected demand should be used to inform operators and pilots of anticipated delays. This advice should be widely disseminated, either by aeronautical fixed telecommunication network (AFTN) or voice circuits, alerting the aircraft/aerodrome operators to such delays, as well as to any diversions which may be required. Such notices can often reduce or even postpone the need for flow control restrictions. Appendix B outlines examples of typical messages for the control of air traffic flow.

1.2.4.16 Air traffic flow management cannot be restricted to the area of one State because of its far-reaching effects on the flow of air traffic elsewhere. Optimum flow of air traffic could be best achieved through an integrated central air traffic flow management service using internationally agreed procedures with a view to maintaining, in continuous co-operation with associated ATC units and operators, a balance between a traffic demand and the capability of ATC to accommodate that demand. Detailed
information covering the objectives, organization and operation of centralized ATFM organization (CTMO) is contained in the Air Navigation Plan - European Region (Dot 7754, Part V - ATM) and the European ATFM Handbook, Provisional Edition, 1991 (ICAO EUR Dot 003).

Appendix C
Techniques for ATC Sector/Position Capacity Estimation

1. INTRODUCTION

1. I Knowledge of the capacity of air traffic control sectors or ATC operating positions is necessary for two reasons. Firstly, for long-term planning, adequate warning is required of any future shortfall in capacity, as indicated by traffic forecasts. Secondly, if there is already a shortage of capacity requiring the application of flow control, it is necessary to know what the capacity is, in order to limit air traffic to a level which does not overload the system or penalize the operators excessively.

1.2 A considerable amount of work has been devoted in recent years to methods of estimating capacity. Of particular interest has been the work proposed by the United Kingdom, Directorate of Operation Research and Analysis (DORATASK Methodology for the assessment of ATC en-route sectors capacity - DORA Interim Report 8818; the application of this technique to current London Terminal Area Sectors - DORA Interim Report 8916; and calibration of the DORATASK Simulation Model on two en-route sectors at the London Air Traffic Control Centre - DORA Report, 8927) and the work by Messerschmidt, BGlkow und Blohm (MBB) of Germany resulting in the development of a procedure to quantify the control capacity of ATC working positions, known as the "MBB Method". The essence of both methods was to measure the necessary time for all control working actions and to relate this time to the total time available.

Note.- The most appropriate measure of capacity was likely to be the sustainable hourly traffic flow, rather than daily or annual flows. Such hourly capacities could be converted into daily or annual values.

2. SUMMARY OF THE "DORATASK"* APPROACH

** The United Kingdom DORATASK models were used to assess the capacity of airspace sectors and to determine constraints on traffic throughput in both terminal areas and en-route airspace; recently, they have been used to model the development of airspace in Southeast England beyond the year 2000.*

2.1 The proposed DORATASK work centred on the assessment of the workload carried by the radar controller, summing the time spent on routine and conflict resolution (observable) tasks on the one hand, and planning (non-observable) tasks on the other. In addition to these two interrelated elements of the controller's tasks, there was a third element - a "recuperation" time. This was a minimum proportion of time not allocated to specified tasks (observable or non-observable) but considered essential for the safe operation of the sector. The controller's time, therefore, is divided between observable tasks, non-observable tasks and periods of recuperation. Although the workload was determined by the sum of the time spent in observable tasks and non-observable tasks, the capacity is considered as the level of workload which leaves the controller a safe margin for recuperation.

2.2 Observable tasks are those which can readily be recorded and timed by an outside observer; examples include radiotelephony (RTF) and telephone communication, strip marking and direct-voice-liaison coordination. Routine tasks, for a particular aircraft, are those which must be carried out even if there are no other aircraft in the vicinity. In order to get from "A" to "B", all aircraft need to contact ATC to be given certain headings and flight level clearances and be handed off to the next sector. The sequence of instructions routinely given to an aircraft will be virtually fixed by the route it takes through the sector and by its origin and destination. The routine workload was, therefore, assessed by assigning aircraft to one of a set of standard flight profiles through the sector; associated with them were fixed sequences of tasks and, hence, a task execution time.

2.3 A simulation model was introduced to utilize the traffic sample to assess the number of occasions on which the controller would consider taking additional action because of the presence of another aircraft, including those not on the controller's frequency. The total observable workload was the sum of time spent on routine tasks and on conflict resolution.

2.4 The routine workload during (say) an hour's observation was dependent solely on the number of aircraft in each flight profile that enter the sector. The conflict resolution workload, however, would increase during a peak flow of traffic, as opposed to regular flow.

2.5 Non-observable tasks are those which are carried out almost continuously by the busy controller in parallel with the observable tasks, and which cannot generally be directly recorded or timed by the observer. These tasks, which include monitoring the radar screen and planning future actions, are, however, critical to the business of the sector controller. The non-observable workload was determined by calculating, for each aircraft within the sector area, how many strips it produces and how many other strips already present on the boards must be checked against it when it is first given to the radar controller. This number of checks was then multiplied by a "time per strip check" to give the total non-observable workload. The time for a strip check was not considered as a duration time for a physical task but as a factor calculated when the model was calibrated to reflect the time taken by the whole planning task. The latter was the main aspect of DORATASK which required more detailed research. This kind of workload would be increased significantly during a peak flow of traffic.

2.6 The workload measure for a given sector and traffic sample was the sum of the observable and non-observable workload times. To arrive at capacity it was necessary to determine a minimum proportion of time that the controller must have for recuperation if the sector was to continue to be operated safely. This proportion was likely to increase with the length of time that a "capacity" flow rate was expected to continue. Initially it was assumed that the sector would operate at capacity for no more than one hour without either the controller changing or the traffic declining. The amount by which the traffic flow was to be set at a lower rate in order for safe operation to continue was studied further. While it was assumed that the time spent per strip check, which determined the weight given to the planning workload, was two seconds, the following conclusions were derived:

"THE AVERAGE WORKLOAD AT CAPACITY MUST BE LESS THAN 80 PER CENT AND WORKLOADS OF 90 PER CENT MUST NOT BE EXCEEDED MORE THAN 2.5 PER CENT OF THE TIME."

2.7 The calibration of the DORATASK model was carried out in two parts. Firstly, the workload predicted by the model was compared with the observed workload during the study period and the model parameters were adjusted to align the two. Secondly, the workload was plotted against flow for a number of hours for two sectors whose capacity was agreed upon beforehand by other means; the criterion for setting the capacity as outlined in 2.6 above was derived from the results.

2.8 The principles of the DORATASK methodology of airspace sector capacity estimation remain fundamentally the same whether they are applied to the en-route sectorization or to the terminal control area (TMA) sectors. Three notable changes are, however, required in the implementation of the method in TMA sectors. Account must be taken of the workload involved in the control of stacks. The conditions used for identifying potential conflicts must be altered to allow for the additional complexity of a specific TMA route structure. Finally, the method for modelling the planning workload must be altered to reflect the fact that the controller relies principally on the radar screen for conflict detection, rather than on the stripboard.

3. SUMMARY OF THE "MBB METHOD"

3. 1 The "MBB Method" concerning the estimates of the capacity of an ATC working position was based on the quantification of the workload of a radar controller position. This was possible through:

a) categorization of all observed working actions, i.e. the number of "working units" the controller is able to perform;
b) time measuring of all observed categories; and
c) consideration of the airspace capacity which depends on the conflict risk within the sector and thus on sector structure and traffic characteristics.

Since not all of the working units could be observed, the corresponding times were registered indirectly. This was carried out through extra work to register the controller's "free capacity", i.e. time which the controller does not need to perform his control task.

3.2 The following working action categories have been defined in order to evaluate them concerning time:

a) length of RTF transmissions;
b) acting times (strip markings, sequencing the control strips for the preplanning); and
c) required time for information registration and processing.

This includes the following categories which can be directly observed in part only:

1) co-ordination dialogue between executive controller and co-ordinator;
2) visual notification of information via displays and strips;
3) utilization of all information in the thought- and decision-making process; and free capacity measured using the extra work.
4) The required time for the categories "information registration" and "information processing" had to be investigated indirectly. The above-mentioned need of time results from the difference between the need of time for the working categories which can be measured directly and the total time available.

3.3 Investigations during several observation periods showed that different traffic situations or kinds of traffic distribution resulted in different workloads. Therefore, a direct conversion of the need of time into the amount of aircraft which can be controlled was not possible. In this regard a further step had to be carried out, namely to evaluate each aircraft according to the workload and the corresponding need of time, which the control of these aircraft created at the working position according to type and phase of flight.

3.4 The weighting, defined as "degree of difficulty of the control task", was derived from measuring the lengths of RTF between controller and pilot. The basic value was the length of the RTF time for a fulfilled control task for the easiest possible way of an overflight without changing any flight parameter.

3.5 However, the MBB method was not indisputable. During the work on this method there were several modifications of the evaluation criteria which, in part, led to different results. First of all, the determination of the degree of difficulty of a sector was criticized, e.g. that certain elements of the controller work, such as the conflict resolution task, were not sufficiently reflected. Therefore, the load threshold values (as a capacity indicator) applied by the air traffic flow management unit for its work are today more or less "experiential values", gained from the experience of the controllers assessing their own units. Sector size modifications led to corresponding adaptation of the values, again based on controllers' experiences, but originally the MBB method gave the basic indication.

4. CONCLUSION

It should be noted that the foregoing methods are labour intensive and, more importantly, provide capacity estimates that apply only to the conditions of equipment, manning, traffic patterns, etc. which prevailed during the observations. They cannot readily be used to assess capacity under a future airspace organization, with different equipment or procedures, under different traffic loadings, or with different manning.