**INTERNATIONAL CIVIL AVIATION ORGANIZATION**

**North American, Central American and Caribbean Regional Office**
**South American Regional Office**

**UNDP/ICAO Regional Project RLA/98/003**

**Transition to the CNS/ATM Systems in the CAR/SAM Regions**

# REPORT

## SECOND MEETING OF THE GREPECAS ATM/CNS SUBGROUP ATM COMMITTEE ATFM TASK FORCE – (ATFM/TF/2)

**(Bogotá, Colombia, 6 to 8 July 2006)**

# INDEX

# HISTORY OF THE MEETING

## ii-1 PLACE AND DURATION OF THE MEETING

According to the GREPECAS ATM/CNS Subgroup ATM Committee, and after the holding of the First Seminar on Air Traffic Flow Management in the CAR/SAM Regions, hosted by the Regional Project RLA/98/003, the Second Meeting of the ATFM Task Force (ATFM/TF/2) was held in Bogotá City, Colombia, from 6 to 8 July 2006.

## ii-2 OPENING CEREMONY AND OTHER MATTERS

Mr. José Miguel Ceppi, ICAO Regional Director, South American Office, opened both events and welcomed the participants, he expressed his gratitude to the Colombian authorities for their attendance and continuous support to the events carried out in Colombia, and gave a brief explanation of the issues to be reviewed during the meeting.

Mr. Ceppi highlighted the interest of States and International Organizations in air traffic flow management, demonstrated through the large number of participants both at the ATFM Seminar, as well as the ATFM Task Force Meeting. He also emphasized in the complexity to continue working with the same spirit of collaboration and regional cooperation which has been constantly expressed along these years. He pointed out the limited time available during the week to work with the tasks assigned by GREPECAS to this Task Force and encouraged an adequate and effective utilization of the time available.

Likewise, Mr. Fernando Augusto Sanclemente, Director General of UAEAC Colombia, on behalf of the UAEAC emphasized the importance of the matters to be dealt with and encouraged all the parties involved to complete the pending tasks. Mr. Fernando Augusto Sanclemente recognized the work carried out so far by all States and International Organizations and encouraged all participants to work hard during this week in order to reach the goals set and thus continue in the path to improve the provision of air traffic services in the referred area, inaugurating the meeting.

During the closing ceremony, Mr. Joe Hof, from the Delegation of United States and ATFM Task Force Rapporteur, thanked his election as Rapporteur and expressed his optimism on the activities addressed towards the ATFM implementation in the CAR/SAM Regions. Mr. Jorge Fernández, ICAO ATM/SAR Regional Officer, Lima, on behalf of ICAO, also thanked the presence of Mr. Fabián García Gómez, Head of the Flow Management Division, AENA, Spain, who dictated several conferences during the ATFM Seminar held in Bogotá Cit, Colombia, from 4 to 5 July 2006, and actively participated in the discussions of the different agenda items. Finally, Mr. Carlos Montealegre Deputy Director from the Unidad Administrativa de Aeronáutica Civil de Colombia, thanked the presence of the delegations and wished them a happy return to their homes.

ii-3 **SCHEDULE, ORGANIZATION, WORKING METHODS, OFFICERS AND SECRETARIAT**

The Meeting agreed to hold its sessions from 0900 to 1600 hours, with appropriate breaks. The work was done with the Meeting as a Single Committee, Working Groups and Ad-hoc Groups.

Mr. Joe Hof, delegate from United States, was elected as Chairman of the Meeting and Rapporteur of the ATM Committee Air Traffic Flow Management Task Force. Also, Mr. John Marlon Ferrer was designated ad of the Vice-Chairman of the Meeting, giving him the responsibility to assist Mr. Hof in the development of the Task Force activities.

Mr. Jorge Fernández Demarco, RO/ATM/SAR Regional Office, Lima, acted as Secretary, being assisted by Mr. Víctor Hernández, RO/ATM/SAR, Regional Office, Mexico, and by the ATFM Task Force Rapporteur.

ii-4 **WORKING LANGUAGES**

The working languages of the Meeting and its relevant documentation were English and Spanish.

ii-5 **AGENDA**

The following agenda was adopted:

Agenda Item 1: Documentation on air traffic flow management and GREPECAS policies

Agenda Item 2: Caribbean/South American ATFM Concept of Operations (ATFM CAR/SAM CONOPS)

Agenda Item 3: ATFM data bases

Agenda Item 4: Cost-benefit analysis

Agenda Item 5: Review of ATFM/TF Terms of Reference and Work Programme

Agenda Item 6: Other matters

ii-6 **ATTENDANCE**

The meeting was attended by 4 States of the CAR Region and 8 States of the SAM Region, as well as by 4 International Organizations: AENA, COCESNA, IATA and IFALPA, totalling 35 participants. The list of participants is shown in pages iii-1 to iii-7.

ii-7 **LIST OF WORKING PAPERS AND INFORMATION PAPERS**

| N° | Subject | Title | Prepared by |
|---|---|---|---|
| WP/01 | - | Agenda, Schedule and Working Methods | Secretariat |
| WP/02 | 1 | Documentation on air traffic flow management and GREPECAS policies | Secretariat |
| WP/03 | 2 | Caribbean/South American Concept of Operations | Secretariat |
| WP/04 | 3 | ATFM data bank | Secretariat |
| WP/05 | 4 | Cost-benefit analysis | Secretariat |
| WP/06 | 5 | Review of ATFM/TF Terms of Reference and Work Programme | Secretariat |
| WP/07 | 5 | Review of ATFM/TF Terms of Reference and Work Programme – Considerations of the initiatives of the Global GPIs plan on ATFM | Secretariat |
| WP/08 | 3 | Analysis of the functions of data bases related with CATFM service, especially those required in each State and other maters related, such as the format and integration of data in the Regional Centre | Brazil |
| WP/09 | 2 | Analysis of the stages proposed for the operational implementation of the Regional ATFM in order to take maximum use of available resources by States, either automated systems, equipment or the local personal experience. | Brazil |
| WP/10 | 2 | Analysis of the needs and characteristics of the strategic and tactical phases in the provision of CATFM service in the CAR and SAM Regions | Brazil |
| WP/11 | 2 | Possible mission, organizational structure, and responsibilities of a Central air traffic flow management unit | Uruguay |
| IP/01 | -- | General Information of the Meeting | Secretariat |
| IP/02 | -- | List of working papers and information papers | Secretariat |
| Flimsy 01 | 2 | Aircraft Movements Forecast | Secretariat |

ii-8 **LIST OF CONCLUSIONS AND DECISIONS OF THE MEETING**

# LISTA DE PARTICIPANTES / LIST OF PARTICIPANTS

## ARGENTINA

Omar Francisco Elías
Jefe Depto. Control de Gestión
Dirección de Tránsito Aéreo, CRA
Comodoro Pedro Zanni 250 (1104)
Ciudad Autónoma de Buenos Aires
República Argentina

Tel: 5411 43176507
Fax: 5411 43176507
E-mail: mailto:adimascio@yahoo.com.ar
buertcg@faa.mil.ar

Alfredo Roque Di Mascio
Jefe Centro I. Mantenimiento Radar, CRA
Comodoro Pedro Zanni 250 (1104)
Ciudad Autónoma de Buenos Aires
República Argentina

Tel: +5411 4317 6300
Fax: +5411 4317 6300
E-mail: adimascio@yahoo.com.ar
alfdimascio@yahoo.com.ar

Víctor Marcelo de Virgilio
Jefe de la División Contralor de Vuelos
Comando de Regiones Aéreas
Edificio Cóndor
Comodoro Pedro Zanni 250
Oficina 169, Sector Verde
Capital Federal, 1104
Buenos Aires, Argentina

Telefax: +5411 4317 6502 / 6411
E-mail: buertcodp@faa.mil.ar

María Estela Leban
Instructora
CIPE
Casilla de Correo 25
Aeropuerto Internacional Ezeiza (1802)
Provincia Buenos Aires
República Argentina

Telefax: +5411 4480 0409
E-mail: cipe@ciudad.com.ar
mariaestelaleban@infovia.com.ar

Juan José Jáuregui
Docente Instructor Curso Controlador Radar
Aeropuerto Internacional Ministro Pistarini
C.C. N° 25 – C.P. 1802 – Ezeiza – Buenos Aires
Argentina

Tel: +5411 4480-2408
Fax: +5411 4480-0409
E-mail: cipe@ciudad.com.ar
triplejuliet3@hotmail.com

Gustavo Guiastrennec
Controlador de Tránsito Aéreo
Fuerza Aérea Argentina
Aeropuerto Ezeiza
Buenos Aires, Argentina

Tel: +5441 4480 2203
Fax: +541 4480 0409
E-mail: guiastregus@yahoo.com

**BOLIVIA**

Miguel Angel Castillo Ochoa
Especialista ATM
Dirección General de Aeronáutica Civil
(DGAC
Edificio Palacio de Comunicaciones
Av. Mariscal Santa Cruz No. 1278, piso 4to.
Casilla Postal 1481
La Paz, Bolivia

Tel: +5912 211 4465
E-mail: mcastillo@dgac.gov.bo
dgacnav@caoba.entelnet.com.bo
Website: www.dgac.gov.bo

**BRASIL/BRAZIL**

Julio César de Souza Pereira
Oficial ATM, DECEA
Av. Gral. Justo 160, 2º Andar Centro
Río de Janeiro
RJ. CEP, Brasil

Tel: +5521 2101 6278
Fax: +5521 2101 6088
E-mail: atm3-9@decea.gov.br
jul10@terra.com.br

Juárez Franklin Gouveia
Oficial ATM
Av. Gral. Justo 160, 4º Andar Centro
Río de Janeiro
RJ. CEP, Brasil

Tel: +5521 2101 6612
Fax: +5521 2101 6490
E-mail: juarez.gouveia@ig.com.br

**CHILE**

Darío Retamal
Planificación Navegación Aérea
DGAC
Av. Miguel Claro 1314
Providencia, Santiago, Chile

Tel: +562 439 2186
Fax: +562 439 2454
E-mail: dretamal@dgac.cl

Francisco Vicencio Briceño
Supervisor de Control de Tránsito Aéreo
Centro Control de Área Santiago
Av. Miguel Claro 1314
Providencia, Santiago, Chile

Tel: +562 767 2001
Fax: +562 767 2001
E-mail: pancho@terra.cl

**COLOMBIA**

John Marlon Ferrer Olivares
Jefe de Grupo Procedimientos ATM
Centro Nacional de Aeronavegación
Unidad Administrativa Especial de Aeronáutica
Av. El Dorado No. 112 – 09
Bogotá, Colombia

Tel: +571 2662545 / 3067
Fax: +571 2663573
E-mail jferrer@aerocivil.gov.co

Jaime Gaviria Luna
Jefe de Grupo Aeronavegación Nacional
Centro Nacional de Aeronavegación CNA
Avenida El Dorado 112-09
Bogotá, Colombia
Tel: +571 2662213
Fax: +571 2663976
E-mail: jgaviria@aerocivil.gov.co

Harlem Mejía Oliveros
Constructor de Procedimientos
Controlador Aéreo
Centro Nacional de Aeronavegación, CNA
Unidad Administrativa Especial de Aeronáutica
Av. El Dorado 112 – 09
Bogotá, Colombia
Tel: +571 266 2545
Fax: +571 266 3573
E-mail: harmafe@gmail.com

Joy Carmel Caballero Bernal
Controlador radar experto
Centro Nacional de Aeronavegación CNA
Avenida El Dorado 112-09
Bogotá, Colombia
Tel: +571 2662545
Fax: +571 2663573
E-mail: joy.caballero@aerocivil.gov.co

Héctor Matamoros
Especialista Aeronáutico
Aeropuerto El Dorado,
Dirección de Telecomunicaciones
UAEAC, Centro Nacional de Aeronavegación
Avenida El Dorado 112-09
Tel: +571 266 3672
Fax: +571 266 3846
E-mail: hmatamor@aerocivil.gov.co

Katherine Andrea Vivas Moreno
Ingeniera de Proyectos División Vigilancia Aeronáutica
Unidad Administrativa Especial de Aeronáutica
Dirección de Telecomunicaciones
Avenida El Dorado, 112-09
Centro Nacional de Aeronavegación
Aeropuerto E Dorado, Bogotá, Colombia
Tel: +571 266 3605
Fax: +571 266 3689
E-mail: katherine.vivas@aerocivil.gov.co

**CUBA**

Fidel Ara Cruz
Jefe del Grupo ATM
IACC
Calle 23 No. 64
Vedado, La Habana, Cuba
Tel: +537 551 146
E-mail: fidel.ara@iacc.avianet.cu

**ESPAÑA**

Fabián García Gómez
Jefe de la División de Gestión de
Afluencia y Capacidad
AENA, España
Juan Ignacio Luca de Tena 14
28027, Madrid, España

Tel: +3491 321 3365
E-mail: fggomez@aena.es

**ESTADOS UNIDOS/UNITED STATES**

Joe Hof
FAA
Herndon, Virginia
USA

Tel: +703-9253113
E-mail: joe.hof@faa.gov

**PANAMÁ**

Franklin Knight
Controlador de Tránsito Aéreo
Dirección de Navegación Aérea

Tel: +315 9801
Fax: +315 9848
E-mail: fknights@aeronautica.gob.pa

Ana Teresa Montenegro de De León
Especialista en Procedimientos
Terminales, Sección Planificación
del Espacio Aéreo
Autoridad Aeronáutica de Panamá
Apartado 5006, Balboa, Ancón
Panamá

Tel: +507 315 9834
Fax: +507 315 9809
E-mail: anateresa09@hotmail.com
anadeleon@aeronautica.gob.pa

**PERÚ**

Jaime Arturo Contreras Benito
Inspector de Navegación Aérea
Dirección General de Aeronáutica Civil (DGAC)
Ministerio de Transportes y Comunicaciones
Jirón Zorritos 1201, Lima, Perú

Tel: +511 425 1780
Fax: +511 425 1780
E-mail: jcontrerasb@mtc.gob.pe
Website: www.mtc.gob.pe

**REPÚBLICA DOMINICANA/DOMINICAN REPUBLIC**

Johann Estrada
Coordinador USOAP
DGAC
Av. México Esquina 30 de Marzo
Santo Domingo, República Dominicana

Tel: +1809 221 2825
E-mail: cn-rd-usoap@dgac.gov.do

Francisco Bolívar León
Encargado de Navegación Aérea
DGAC
Av. México Esquina 30 de Marzo
Santo Domingo, República Dominicana

Tel: +1809 549 1310 Ext. 222
Fax: +1809 549 0326
E-mail: frankleon100@hotmail.com

**TRINIDAD Y TABAGO/TRINIDAD & TOBAGO**

Trevor Dowrich
Manager, Air Traffic Services
Trinidad and Tobago Civil Aviation Authority
P.O. Box 2163
National Mail Centre, Golden Grove Road
Piarco, Trinidad and Tobago

Tel: +1868 669 8789
Fax +1868 669 0635
E-mail tdowrich@caa.gov.tt
tdowrich@tstt.net.tt

Samuel Lampkin
Chief ATM Planning and Evaluation
Trinidad and Tobago Civil Aviation Authority
P.O. Box 2163
National Mail Centre, Golden Grove Road
Piarco, Trinidad and Tobago

Tel: +1868 669 4806
Fax: +1868 669 0635
E-mail: samlampk@tstt.net.tt

**VENEZUELA**

Raúl Antonio Spallone Márquez
Jefe División ATS
Instituto Nacional de Aeronáutica Civil (INAC)
Gerencia General de Servicios a la Navegación Aérea
Aeropuerto Internacional Maiquetía – La Guaira
Edificio ATC - Centro de Control Maiquetía, Piso 1
Municipio Vargas, Estado Vargas, Venezuela

Telefax: +58212 355 2912 / 4141403942
E-mail: r.spallone@inac.gov.ve
Website: www.inac.gov.ve

Piero Alviarez
Jefe del Servicio Integrado Tuy
Instituto Nacional de Aeronáutica (INAC)
Aeropuerto Nacional “Oscar Machado Zuluoga”
Carretera Nacional Charallave – Caracas
Vía Altos de Carumo
Aeropuerto Caracas. Torre de Control

Telefax: +58212 355 2912
E-mail: pieroalviarez@hotmail.com
Website: www.inac.gov.ve

Luis Chacón Peña
Instituto Nacional de Aeronáutica Civil (INAC)
Gerencia General de Servicios a la Navegación Aérea
Edificio ATC-Centro de Control Maiquetía
Municipio Maiquetía, Estado Vargas, Venezuela

Telefax:
E.Mail: lcp_67@hotmail.com

**COCESNA**

Uriel Urbizo Fley
Coordinador ATM
Corporación Centroamericana de
Servicios de Navegación aérea
Aeropuerto Toncontín
Apartado Postal 660
Tegucigalpa, D.C. Honduras, C.A.

Tel: +504 234 3360
Fax: +504 234 3360 Ext. 1322
E-mail: uurbizo@cocesna.org
Website: www.cocesna.hn

**IATA**

Manuel Góngora
Manager Safety, Operations & Infrastructure
IATA Latin American & Caribbean
703 Waterford Way, Suite 600
Miami Florida, USA 33126
U.S.A.

Tel: +1 305 779 9844
Fax: +1 305 266 7718
E-mail: gongoram@iata.org
Website: www.iata.org

**IFALPA**

Salvador Gayón Aguilar
Vicepresidente Ejecutivo CAR/JAM.
Palomas 110, Col. Reforma Social
Del. Miguel Hidalgo
C.P. 11650, México, D.F.
México

Tel: (5255) 5091 5954
Fax: (5255) 5020 9160
E-mail: sgayon@prodigy.net.mx

Jorge Mario Medina
Representante IFALPA Colombia
Bogotá, Colombia

Tel: +571 621 6380
Fax: +571 6021357
E-mail: fiscal.acdac@cable.net.co

Mauricio Leyva
Representante IFALPA Colombia
Bogotá, Colombia

Tel: +571 621 6380
Fax: +571 6021357
E-mail: mauleyva@cable.net.co

**OACI / ICAO**

Jorge Fernández Demarco
RO/ATM/SAR
Oficina Regional Sudamericana
Apartado Aéreo 4127, Lima 100, Perú

Tel: +511 575 1646 / 575 1476
Fax: +511 575 0974 / 575 1479
E-mail: jf@lima.icao.int
Website: www.lima.icao.int

Víctor Hernández Sandoval
RO/ATM/SAR
Oficina Regional NACC
Presidente Masaryk 29 – 3er piso
Col. Chapultepec Morales
11570 México, D. F. México

Tel: +5255 5250 3211/5250 3310
Fax: +5255 5203 2757
E-mail: vhernandez@mexico.icao.int

**Agenda Item 1: Documentation on air traffic flow management and GREPECAS policies**

1.1. The Meeting noted that in several CAR/SAM Flight Information Regions in the past years, air operations saturation periods have occurred. In some airports there have been traffic increases up to 13% and it is foreseen that this problem will continue due to the projected growth of operations. The meeting was informed that some States have already taken the initiative of implementing ATFM measures to solve this problem. The meeting also recalled that operators have expressed their concern for the high cost of fuel how this crisis affects airlines, and the fuel savings campaign initiated by IATA. The fuel savings campaign is designed to achieve the greatest possible efficiency in the use of fuel and help overcome the cost problem.

1.2. It was informed that according with Annex 11, ATFM should be implemented in airspace where air traffic demand at time exceeds, or is expected to exceed, the declared capacity of the air traffic control services concerned. ATFM implementation should be based on regional or multilateral agreements.

1.3. The meeting agreed that ATFM implementation should be made in phases in order to permit a progressive evolution and achieve the desired system capacities. According to Doc 9854, Global Air Traffic Management Operational Concept, each phase should be implemented based on operational requirements, descriptive documents, operational models, and the following sequence:

a) Strategic ATFM

b) Pre-tactical ATFM

c) Tactical ATFM.

1.4. The meeting agreed that ICAO guidelines should be followed. These guidelines are established in Doc 4444, PANS- ATM, and establish the basic procedures for implementing the phases of ATFM service. In addition, Doc 9854 depicts improvement guidelines for airspace organization and management (AOM), flexible use of airspace (FUA), airport operations and Traffic Synchronization (TS), and Airspace User Operations (UO) related to ATFM. The management procedures for the application of the ATFM measures and services should be prescribed in a regional ATFM manual or handbook. After access should be developed, in coordination with aircraft operators, and should initially consider implementation of measures aimed at improving the use of the existing system capacity based on the development of strategic plans to balance forecast demand and capacity.

1.5. When reviewing the airspace organizational and management aspects, the meeting recognized that for ATFM system implementation, the totality of airspace should be considered as an available resource for users. Dynamic and flexible airspace management should be established wherein any restriction be considered only on a temporary basis. In order to achieve this, one of the objectives of the ATM system is to encourage the flexible use of the global airspace through the optimization and equitable balance in the use of airspace between civil and military users. This is facilitated through strategic coordination and dynamic interaction of civil and military air traffic services including real-time civil/military controller-to-controller coordination.

1.6. It was also recognized that the flexible use of airspace (FUA) should not be designated purely as civil or military, but rather as a continuum in which all user requirements are accommodated to the greatest possible extent. FUA should result in the removal of large tracts of permanent restricted airspace or special use airspace to accommodate specific individual airspace uses. Blocking airspace of certain dimensions should be on a transient basis.

1.7. To the extent possible, airspace should also be structured so that it is free from operational discontinuities, inconsistencies, and differing rules and procedures. Alignment of airspace classifications, introduction and better utilization of data link communications, improved flight plan processing, and airspace management coordination tools and ATFM message exchange capabilities should be encouraged. These will lead to progressively flexible and dynamic airspace management.

1.8. that the meeting noted that States and Territories should review their airports' ATS organization and airspace management to promote increased efficiency, flexibility and optimization for the benefit of users and service providers. Other ATFM aspects to be resolved in the short-term include the following:

a) enhancing civil/military coordination and cooperation aimed at achieving dynamic and flexible use of airspace

b) developing an ATFM operational procedures manual for common regional application, including methods to determine the airport capacity and ATS capacity;

c) publishing applicable national regulations and ATFM procedures in Doc 7030 and in the AIP;

d) publishing available service capacity according to ICAO guidelines;

e) establishing improvements regarding surveillance and automated systems for aircraft data processing as well as the development and co-ordination of ATFM messages;

f) planning for human resources and required training aspects;

g) developing improvements of traffic forecasts;

h) encouraging improvements of random routes and the development of and ATS routes network; and

i) encouraging new operational agreements between ATS users and providers for ATFM implementations, especially in those areas where flow problems are already present.

1.9. In order to improve the efficiency of air operations, the Meeting considered that in the short term operational agreements between ATS units should be updated or established and adopted the following Draft Conclusion:

**DRAFT**
**CONCLUSION ATFM/TF/2/01 ATFM Operational Agreements**

That CAR/SAM States/Territories/International Organizations, which so require and that have not done so, review operational bilateral agreements among ATS units and include measures to balance demand and capacity not later than **30 November 2007**.

1.10. In some States, the implementation of the ATFM services has already been carried out. Therefore, it was deemed pertinent to request that the CAR/SAM States/Territories/International Organizations which have already done so provide their related documentation to the ICAO Regional Offices websites.

1.11. On the other hand, the meeting considered information on the current status of the CAR/SAM States/International Organizations with regard to their ATFM activities and, where applicable, the methodology used for its implementation. ICAO shall take the pertinent actions to establish fora where such information shall be incorporated as a means to share their experiences in other States of the CAR/SAM Regions.

1.12. Another aspect reviewed was the methodology to be used for the assessment of airport capacity and ATS, and it was noted that there is scarce experience on this matter in the CAR/SAM Regions. In this connection, and in order to attend these important tasks, the meeting was of the opinion that ICAO make the greatest effort to organize in 2007 an event where the most adequate methods to establish the airport ATS capacity will be analyzed.

1.13. The meeting recognized that management of the balance between demand and capacity will facilitate the path towards a seamless, global, harmonized, and inter-operable air traffic management (ATM) system. The merging efforts, data, knowledge, ideas, and concepts will contribute great financial benefits, enhance safety, increase system capacity, and improve effectiveness of air operations. **Appendix A** to this part of the report includes: best practices for demand and capacity balancing (DCB) management in airports and ATS; basic criteria to assess ATC workload; and planning requirements of ATM human resources. The meeting was informed through a power point presentation made by the delegate of Argentina on the demand and capacity methodology which is shown in **Appendix B** to this part of the report.

1.14. The collaborative decision-making (CDM) process facilitates the planning, coordination, and dynamic application of ATFM initiatives for efficient airspace and airport management. The process results in an efficient use of resources and capacities in air operations, as well as in financial benefits for users and ATS providers. CDM should be part of the planning, decision making, implementation and follow-up activities. **Appendix C** to this part of the report includes the basic characteristics of a CDM process.

1.15. On the other hand, ATFM works should consider human resources optimization and savings. The dynamic use of communication means such as internet video conference, teleconferencing, e-mail, telephone and facsimile should be encouraged during the ATFM coordination period.

# APPENDIX A

## Demand capacity balancing (DCB) management

Capacity is maximum number of flights which can be handled from gate to gate can be measured by daily, monthly and/or annually to monitor performance system in effective, average and future manner in:

- Airport – acceptance arrival rate
- Terminal and enroute – maximum number of flights in sector/FIR

The purpose of DCB management is to establish sufficient capacity to provide service to normal and peak time traffic levels; to increase capacity.

When all the agreed requirements are adequately covered, the service capacity is 100%; the latter reduces when said requirements are restricted in their operation; the more restriction of resources corresponds less service capacity.

A periodical record of all the aspects concerning the declared capacity should be carried out, in order to be able to determine when it is reduced or needs to be increased, the responsible ATS authority shall ensure that agreed safety levels are not jeopardized.

Among the most important DCB management aspects are the following:

**ATS capacity** - In order to attain its maximum efficiency, the following aspects should be analyzed

- Airspace and route structure - the operation of all the types of aircraft foreseen with the user's preferred profiles should be allowed; the final objective is to attain a dynamic and flexible use of airspace.
- High and low sector, TMAs, restrictions, etc.
- Available infrastructure and navigation accuracy of the aircraft using the airspace and routes in regard with agreed regional air navigation requirements
- ATC workload
- Weather aspects

**Airport capacity** - The development and establishment of a master plan aimed at optimizing the available airport capacity should be fostered; and the future service requirements should also be studied with regard to the following aspects:

- Runway and taxiway
- Airport capacity (timing use of runway, taxiways, and ramp) delays, restrictions, SLOTS, etc.
- Airport acceptance rate: considering additional services such as ramp, immigration, custom, and others related for:
    - VFR operations
    - IFR operations

**Basic criteria to assess ATC workload**

It should carry out an analysis of ATC workload under following considerations:

- Average operations volume
- Short and medium terms (2010/2015)
- Personnel increments and decrements, upon operational justification
- Average percentage of last 6 months
- Increase one ATCO when the total rate number is higher than 50%
- Determining required personnel to cover week days off, vacation periods and others
- Justify changes for other factors
- Adequately cover positions in accordance with ATS unit purposes
- Traffic volume, specially peak time periods during the shift
- Avoid affecting service
- Equitable distribution of workload
- ATCOS available during their journey
- Average operations that ATC personnel (ACC) may handle in one shift (e.g. 8 Hrs)

**E.g. RADAR duties**

| | | | |
|---|---|---|---|
| Tc | = | COMMUNICATION TRANSFER | 30” |
| COM | = | COMMUNICATION (INSTRUCTIONS) | 75” |
| C | = | SEPARATION | 45” |
| | | | 150” |

$$C = \frac{3600}{TC+COM+S} = \frac{3600}{150} = 24 \text{ OPS/h}$$

24 OPS X 8 = 192

Average of operations that ATC personnel (ACC) may handle in one shift (e.g. 8 Hrs)

**NON RADAR duties**

| | | |
|---|---|---|
| COR | = | COORDINATION |
| CO | = | COMMUNICATION |
| S | = | SEPARATION |
| TCO | = | COMMUNICATION TRANSFER |

$$C = \frac{3600}{COR+CO+S+TCO} = \frac{3600}{240} = 15 \text{ OPS/h} : 105$$

**ATC Capacity Sector**

$$C = \frac{3600}{TFC}$$

| | | |
|---|---|---|
| C | - | Capacity |
| TPS | - | Flight sector average time |
| TFC | - | Average time performing ATC duties (Control Transferring, Communication Separation) |

**Planning requirements of ATM human resources**

Upon specific operational requirements, when possible, the following requirements for ATM human resources planning should be analyzed:

- Air Traffic Controller - TWR
- Air Traffic Controller - APP
- Air Traffic Controller - Area
- Air Traffic Controller – Radar/APP
- Air Traffic Controller Radar/Area
- ATC Operational Supervisor
- ATFM coordinator
- ATC/OJT Instructor
- ATS airspace planning Officer
- ATS regulations Officer
- ATM Quality Assurance Officer and Safety Officer
- ATM internal auditor Officer

An appropriate ATM human resources planning also should seen:

a) Number of operations (VFR/IFR)

b) ATC service management required in airspace sectors

c) The impact of new implementation and technical communication improvements (CPDLC, ADS, etc.) in the ATC workload

d) the ATCO workload not be higher than 80% of individual capacity during the shift peak hour

e) Additional activities such as capture flight plan data, coordination, transfer or a combination of these

f) individual ATCO capacity may increase up to 100% with an assistant

g) the total of ATS personnel should be calculated annually considering vacation period and other foreseen absence variables

h) the operational capacity should foreseen as additional aspect the supporting personnel (planning, organization, supervision, administration)

i) the higher the unit more precise calculations should be done

j) Once the number of human resources has been assessed the non used capacity should be seen as reserve to cover emerging cases when capacity increases are required.

- - - - - - - - - - - - - - - - - - - - -

# APPENDIX B

## METHOD TO CALCULATE DEMAND AND CAPACITY

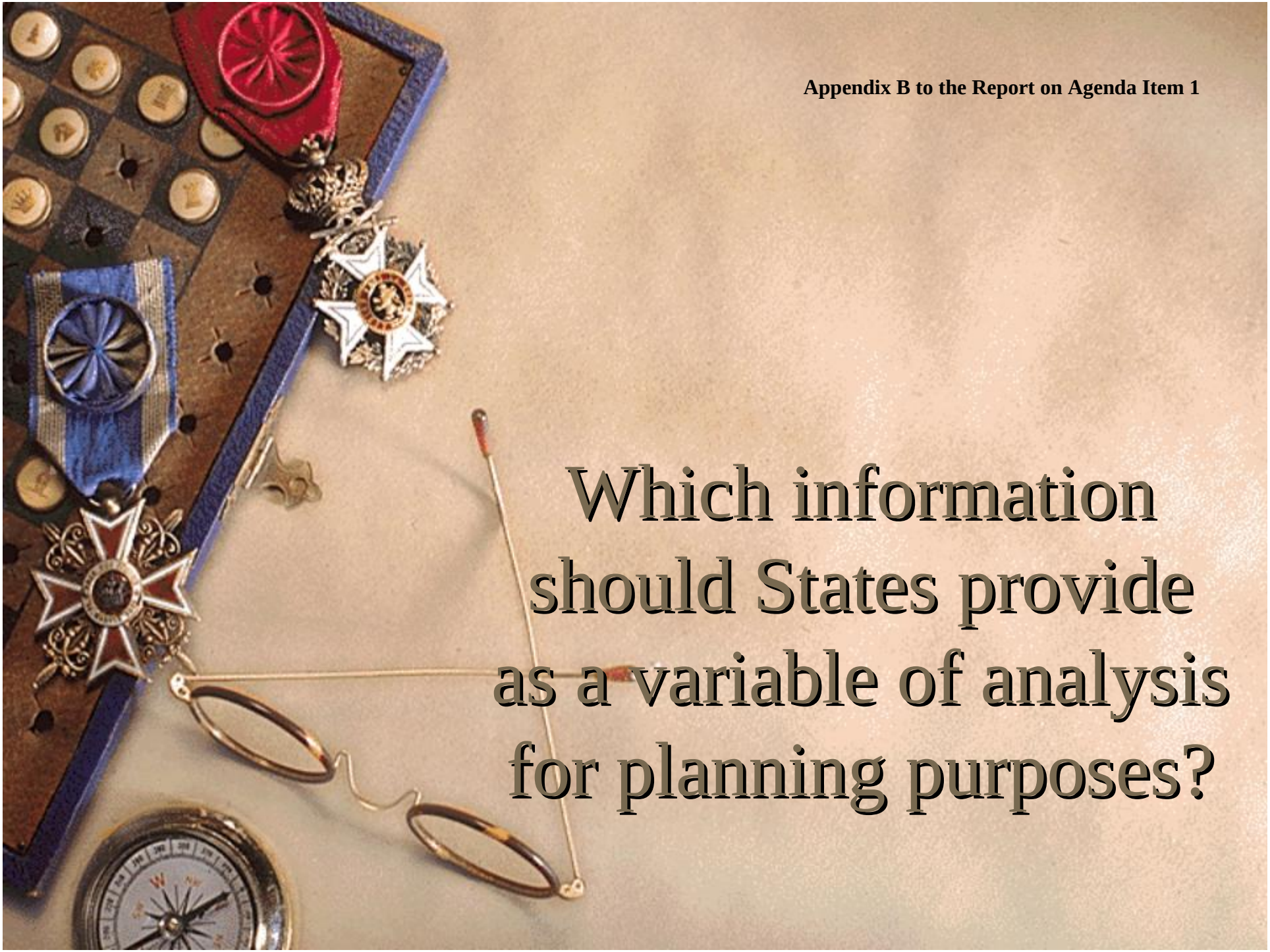
Definition of demand: traffic flow
Variables which determine it: Historical data – statistical data
Current data – periodical monitoring
Amount future estimated – projection of the demand

Projection of the demand are the different values that it will adopt along time (in an estimate manner), assuming that there is a constant scenario. A function of linear demand is obtained, same which projected in a temporary horizon permits to calculate the amount of operations which the capacity should have. It has two characteristics. Quantitative, qualitative.

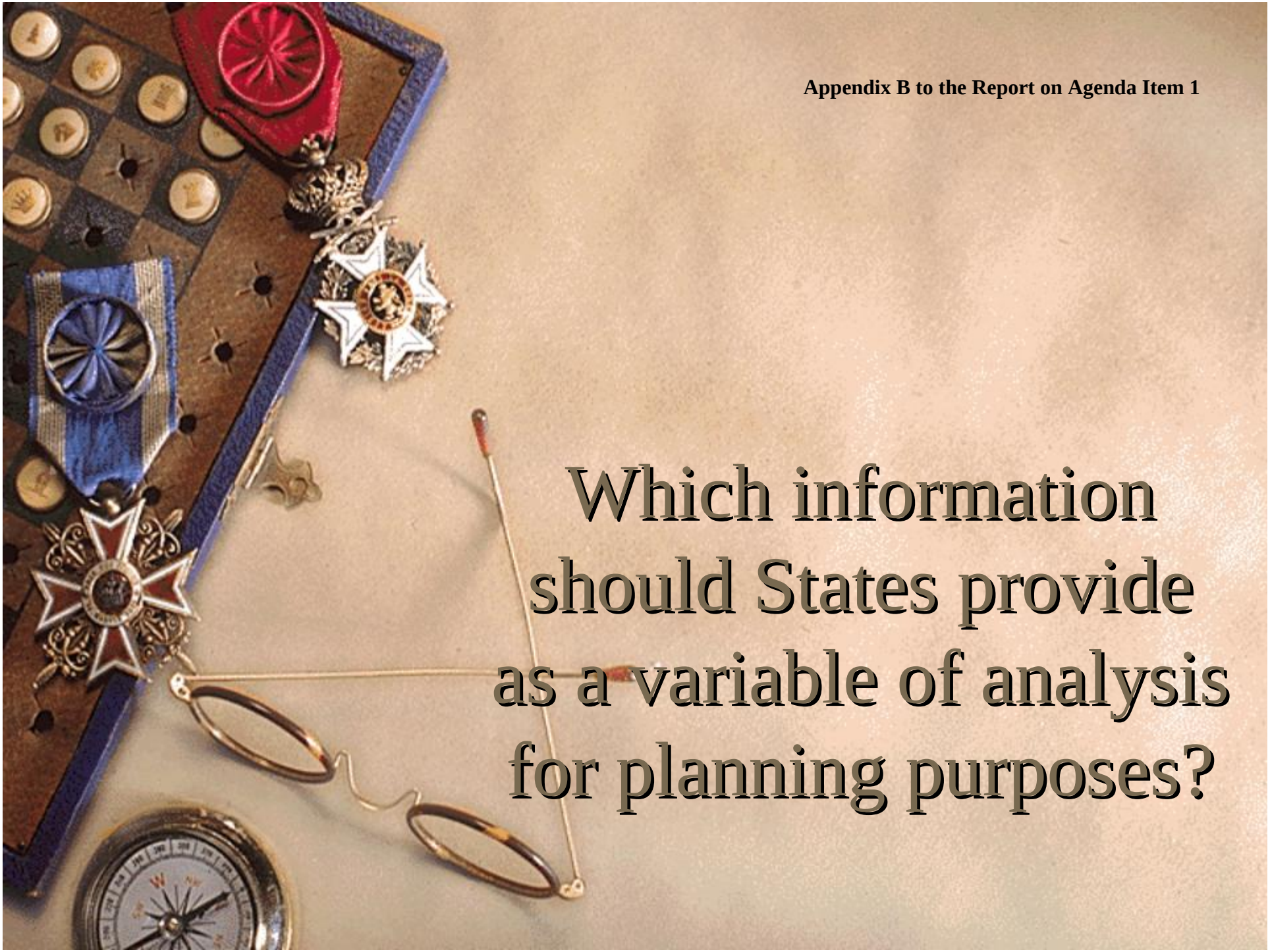
Qualitative characteristics: domestic and international.

Quantitative characteristics: time/amount – it defines the system capacity of the service

Subsystems should be defined, within them, identify the processes, and must be simplified so as to express them in function to time and amount of two variables defining capacity.



# Which information should States provide as a variable of analysis for planning purposes?



# Which information should States provide as a variable of analysis for planning purposes?

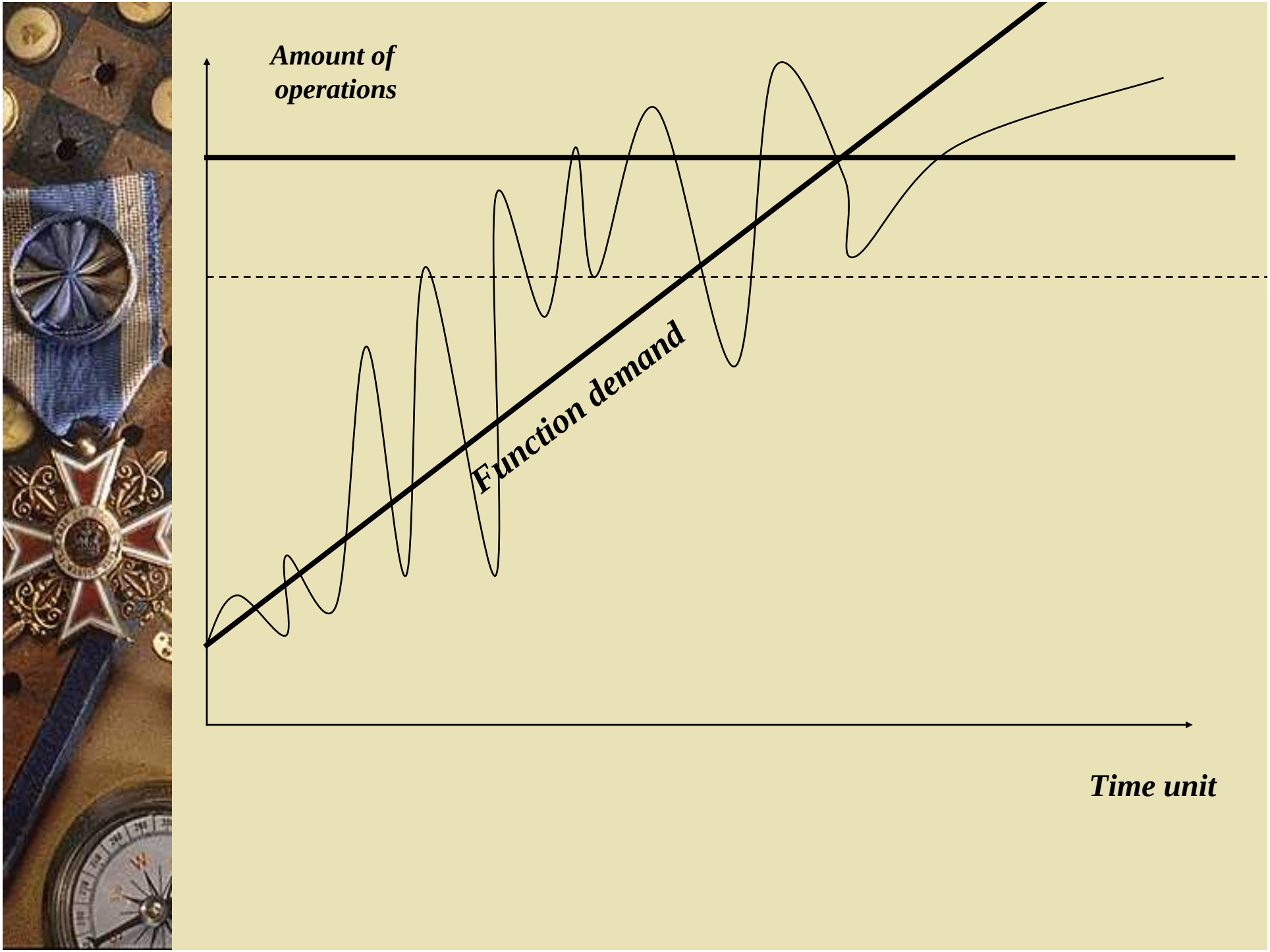
# Capacity/ Demand

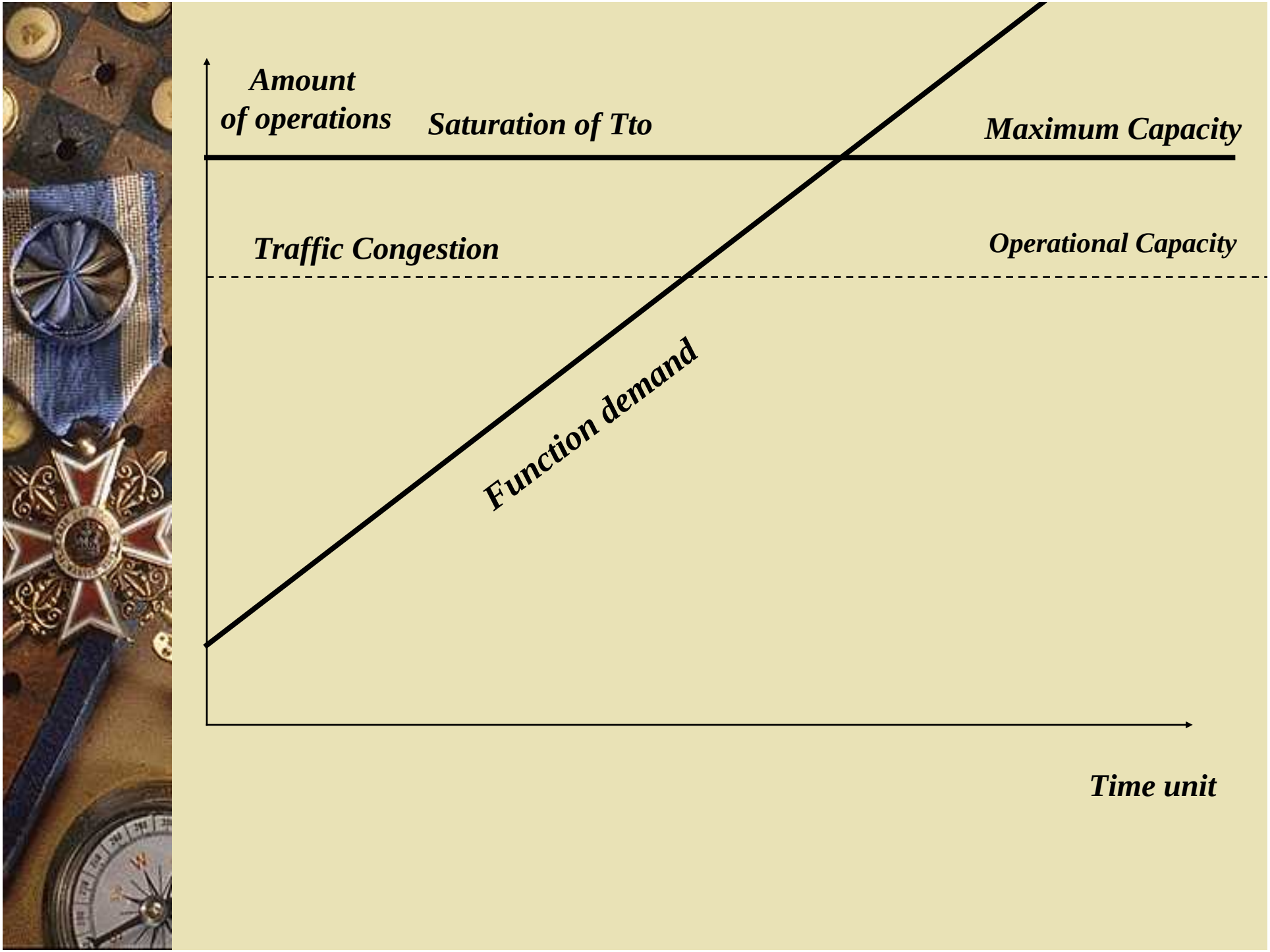
# Demand

- Historical data
- Current data
- Future estimation of the demand

# Traffic flow

- Time
- Amount of operations


Amount of operations
Function demand
Time unit

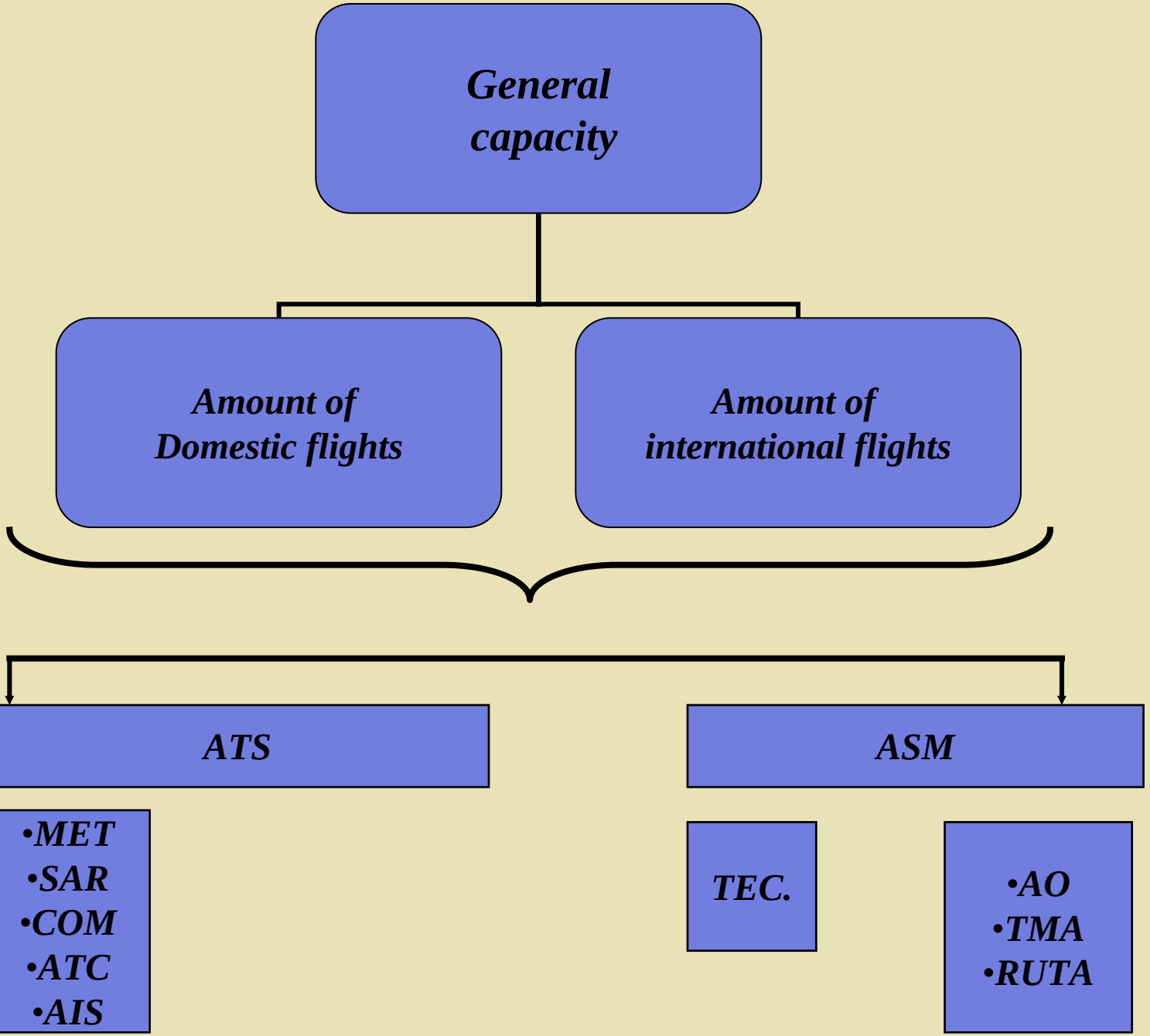

Amount
of operations
Saturation of Tto
Maximum Capacity
Traffic Congestion
Operational Capacity
Function demand
Time unit

# Capacity

Maximum Number of operations which may be managed door-to-door which may be measured by a defined time unit.

Number ⟶ Time Unit

Q ⟶ t


General capacity
Amount of Domestic flights
Amount of international flights
ATS
ASM
•MET
•SAR
•COM
•ATC
•AIS
TEC.
•AO
•TMA
•RUTA

# AIS

- Delivery time
- Amount of information

# COM

- Time
- Amount of communications

# ATC

- Technology:  system availability
- FF.HH.: Time/ training courses
- Regulation: Amount of

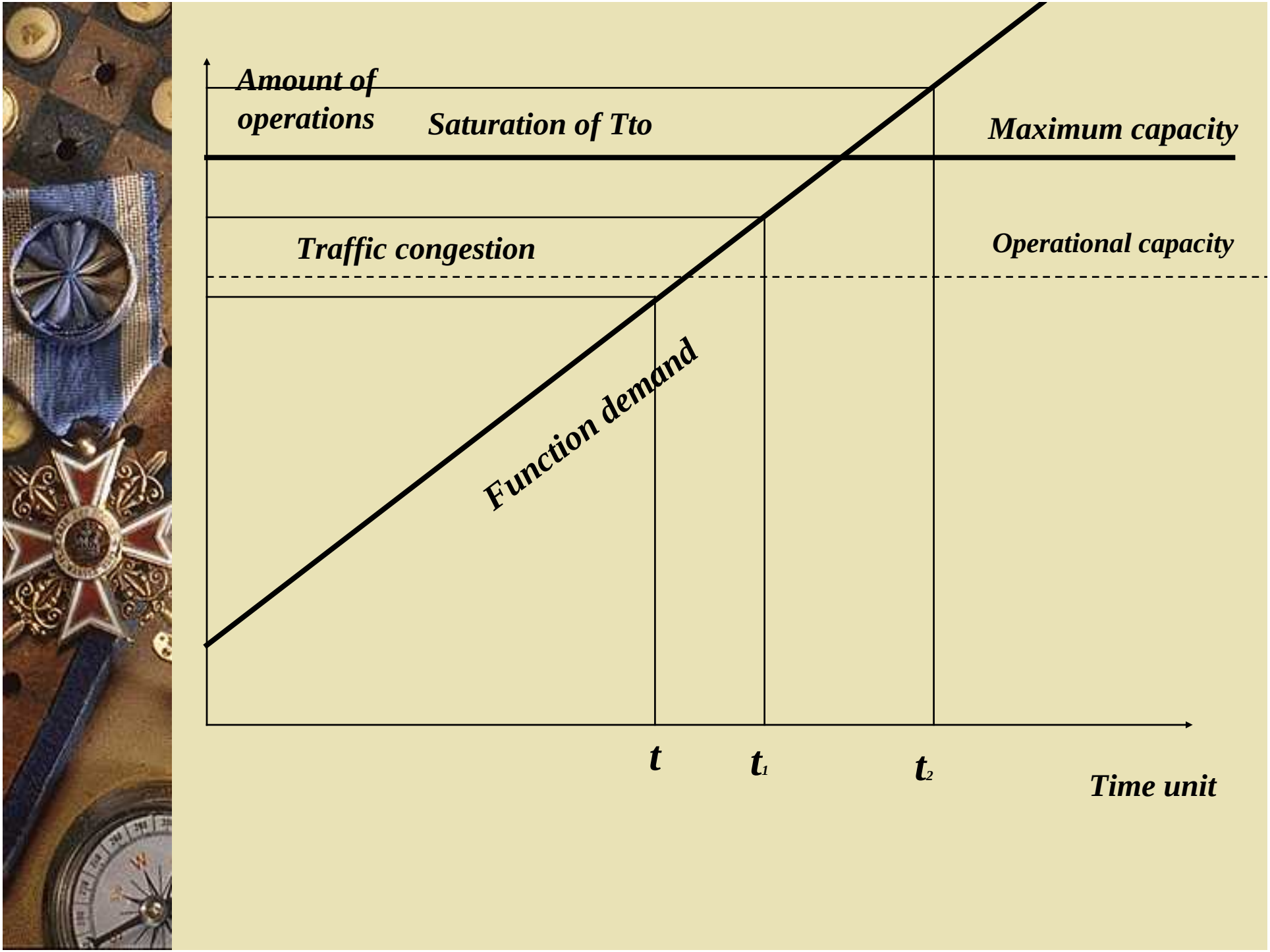
  operations/shift/annual provision

  Time/incidents

# ASM

- AO: air: runway: time/amount of operations
  taxi runway:
  platform
  ground: terminal, parking
- TMA: amount of operations/time
- Route: amount of operations/time

| *systems* | | *processes* | *amount* | *Point of Balance* | *Indi-cator* | *Devia-tion* |
|---|---|---|---|---|---|---|
| ATS | COM | | | | | |
| | ATC | | | | | |
| | AIS | | | | | |
| | | | | | | |
| ASM | Tech | | | | | |
| | Airspace | AO/APP | | | | |
| | | TMA | | | | |
| | | Route | | | | |


Amount of operations
Saturation of Tto
Maximum capacity
Traffic congestion
Operational capacity
Function demand
t
t1
t2
Time unit

# ATM
# AIR TRAFFIC MANAGEMENT

**SAFETY**

**ATS**

**ASM**

**ATFM**

**HUMAN FACTORES**

**ANNEXES / RELATED DOCUMENTS**

# APPENDIX C

## COLLABORATIVE DECISION MAKING (CDM) PROCESS

The purpose of Collaborative decision-making is satisfy the convened levels of capacity and efficient use of resources, and allows that all members of the ATM community, especially airspace users, to participate in ATM decision-making that affects them. The level of participation reflects the level to which the decision will affect them.

Collaborative decision-making applies to all layers of decisions, from longer-term planning activities through to real-time operations. It applies across all concept components of the ATM system and is an essential element to achieving an acceptable solution, which takes into account the needs of those involved. ; the rules for determining priorities for access to an ATM resource will have been collaboratively agreed in advance, applied both actively and, through agreed procedures, passively.

Effective information management and sharing will enable members of the ATM community to each be aware, in a timely manner, of the needs, constraints and priorities of other members in relation to a decision-making issue. Collaborative decision making can occur between airspace users directly, without any involvement of an ATM service provider. Any member of the ATM community can propose a solution

Where a service provider is involved in collaborative decision making because of a requirement of the ATM system, it is often the ATM service provider who will propose a solution for consideration of the airspace user, as the service provider is aware of the requirements of other users and service providers and the collaboratively agreed rules for resolving competing requests for an ATM resource. However, because it is an information rich environment where the airspace user may have access to the same information as the service provider, the airspace user will understand why the particular solution is proposed.

A user can propose an alternative solution that addresses a user's preference that is not known to the service provider. In the same way the service provider can reject the user's proposed solution because of an ATM requirement that the user is not aware of.

*Information management*

Information management aims at integrating the ATM network in the information sense, not just in the system sense, forms the basis for the migration from past one-to-one message exchange concept to the future many-to-many information distribution , to geographically dispersed sources which collaboratively updating the information, with many geographically dispersed destinations.

Information managing the quality, integrity and accessibility of this complex, growing web of distributed will ensure that the information needs of ATM stakeholders, both within as well as outside the ATM network, will be satisfied in a much more flexible and cost-effective manner than previously.

Decision-making is a normal operational process, but decisions will be of a better quality and engender greater confidence because accurate and validated information in the right form, in the right place and at the right time. An open systems environment and better information management will allow information sharing on a much wider basis than hitherto, and will support a permanent dialogue between the various partners, throughout all phases of flight.

Automated systems are big support for CDM and ATM en-route services. The aim of these systems is conformance and safety monitoring.

*Phases of flight*

Trough CDM in the departure and landing phase of flight, ATM service delivery management might ensur that flights can get to the runway in time for their take-off slot and at the same time to integrate them with all the other departing and arriving flights in order to ensure safety and to optimize the use of the parking locations, ramps, taxiways and runways. The ATM service delivery management will ensure that service providers are given access to real-time data on projected arrivals and departures, runway loading, airport congestion, parking locations and environmental considerations, in order to reduce the inefficiencies in aircraft and vehicle movements. Within the en-route phase of flight, ATM service delivery management will be involved in matching ATM service capabilities with demand — e.g. traffic flow characteristics — by a range of means, including, inter alia, dynamic re-sectorization in ATM service centres, changes to route structures or airspace organization, or changes to conflict management modes.

During the course of a flight — from its inception at a scheduling or planning stage, through its actual operation, to its completion at an arrival parking location
a) planning — integration into the ATM environment to achieve a close match between user preferred trajectory and system delivered trajectory;

b) ramp —moving of the aircraft in and out of the parking locations;

c) surface-departures — moving aircraft from ramp to departure queue;

d) departure —the departure queue and the runway are managed to launch aircraft from the queue into the airspace;

e) dispersion — where aircraft get up and out of the terminal into the en-route structure;

f) cruise — in which the aircraft is at altitude and moving towards its destination, but it is not yet subject to actions related to its arrival phase;

g) collection — the state in which aircraft are sequenced and spaced to bring them into the terminal area for arrival;

h) approach — in which aircraft are assigned to runways and onto the surface;

i) surface-arrival — moving aircraft off runways and to the ramp; and, once again

j) ramp — working the aircraft into the parking location.

**Agenda Item 2: Caribbean/South American ATFM Concept of Operations (ATFM CAR/SAM CONOPS)**

2.1 One of the tasks shown in the ATFM Task Force work programme of the ATM Committee is to prepare the necessary documentation on ATFM for the CAR/SAM Regions. The pertinent documents for homogeneous implementation in the CAR/SAM Regions include the ATFM Operational Concept as well as a Manual or ATFM regional document as established by the PANS/ATM (Doc 4444) where the procedures addressing the provision of ATFM service are prescribed.

2.2 The CAR/SAM ATFM operational concept is a high-level document. Its main objective is to define and regulate ATFM implementation in a homogeneous manner in the CAR/SAM Regions. It takes into account that, while ATFM planning in both regions will be carried out jointly, the system implementation itself shall be carried out according to the needs of each one of the regions involved.

2.3 In this connection, a unique ATFM operational concept for both regions shall enable a coherent and harmonized approach to ensure effective and equitable service. The concept will identify and determine the objectives, principles, functions, and minimum requirements on which the service implementation and ATFM Units required would be based.

2.4 The meeting analysed a draft ATFM concept of operations. This document, as presented, would serve as a basis to develop the definitive concept of operations and includes the following:

**Definitions**

2.4.1 In order to facilitate the reading and comprehension of the document, it was agreed to include a chapter with the most important definitions in order to avoid any erroneous concepts or interpretations.

**Actors involved in the ATFM**

2.4.2 It was deemed pertinent to identify the main actors involved in ATFM and include a chapter in this connection.

**Special flights exempt from the application of ATFM measures**

2.4.3 The meeting analyzed this matter and considered that a chapter should be included to indicate which aircraft, such as air ambulance flights, humanitarian flights, search and rescue operations, and States aircraft in international flights --, would be exempt from the application of ATFM measures. The States would continue to have discretion regarding the measures that would be adopted in domestic flights on this matter.

**Editorial amendments**

2.4.4 The meeting agreed to eliminate the last two lines of paragraph 2.4, as well as to move paragraph 7.1.3 from its current position and include it immediately under paragraph 7.2 "Principles in which ATFM will be based."

2.4.5 It was also concluded that paragraph 7.4 should be divided and the text corresponding to equipment and required training for personnel exercising ATFM functions should be improved.

**Aircraft Movements Forecast en-route and main airports in the CAR/SAM Regions**

2.4.6 Among the aspects revised, the group identified the need to modify the chapter related to trends and passengers traffic forecasts and include the aircraft movement forecasts for routes and main airports of the CAR/SAM Regions. Information is available from the report of the Sixth Meeting of the GREPECAS Air Traffic Forecasts Group. The Meeting reviewed a document of en-route and airport aircraft movements and considered that the information related with en-route movements in the main traffic flows could be included in the CONOPS as they appear, in spite of the fact that such flows do not correspond to the CAR/SAM Air Navigation Plan flows. However, the group agreed that the data related with aircraft movements at the main 25 airports in the regions would not be appropriate.

2.4.7 In this matter, the meeting considered that the best approach would be to request the information of movements in the years 2002 through 2005 for the main airports of each one of the CAR/SAM States/Territories/International Organizations contained in the CAR/SAM ANP and process such information for its further inclusion in the CAR/SAM ATFM CONOPS. The meeting requested ICAO Secretariat to take the pertinent measures to obtain such information.

**ATFM implementation Strategy**

2.5 When reviewing this chapter of the concept of operations, the meeting was of the opinion that a simple implementation strategy was necessary. The strategy should be in phases and in such a manner to ensure maximum utilization of the available capacity and to allow all parties concerned to obtain sufficient experience.

2.6 It also noted that the experience gained in other Regions, and by some States of the CAR/SAM Regions, enables States to apply basic ATFM procedures at airports without the immediate need for a Regional Centre. It noted that the development of a Regional Centre will require extensive studies to define operational concepts, system requirements, and institutional aspects for the implementation of ATFM in the CAR/SAM Regions.

**ATFM implementation phases**

2.7 The meeting considered that, in order to maximise the use of all resources available in the regions, personnel, equipment, facilities, and/or automated systems, the ATFM implementation process should be established, planned, and conducted in phases, according to the following sequence:

**Strategic airport phase**

2.8 Strategic airport phase is the simplest ATFM phase, from the operational point of view and requires the least automated systems for implementation. It basically requires a data bank with information on scheduled flight plans (OAG and/or RPL), airport capacity data, and an airport data display system.

2.9 The meeting felt that at this phase, it would not be necessary to make significant investments nor to have highly experienced personnel. In the short term, Air Traffic Flow Management Units (FMU) would have a tool to commence the strategic ATFM at their airports.

2.10 Likewise, it considered that this phase includes as a first step to evaluate the available capacity at the main airports, and in the corresponding ATS, using a recognized methodology. This evaluation is a vital part of the programme.

**Tactical airport phase**

2.11 This phase supplements the strategic airport ATFM by including other non-scheduled flight information (mainly filed flight plans - FPL) and ATS messages concerning flight plans.

2.12 In this connection, the meeting agreed that the problems would be defined for each State on the basis of current processing of filed flight plans and ATS messages, as well as the means used to transmit plans and messages.

**Strategic airspace phase**

2.13 The meeting noted that in this ATFM phase, it is necessary to define the operational concepts and the requirements of an ATFM processing system. It is necessary to take into account that management covers the airspace, and, therefore, flight plans must be simulated. There must be a good knowledge of current ATC flight plan processing systems in the States in order to achieve the highest level of integration with the ATFM system.

2.14 Air Traffic Flow Management Units (FMU) or Flow Management Positions (FMP) will be necessary but not sufficient for ATFM application. There must be adequate telecommunications to support data messages between the FMU/FMP and the Centralized ATFM.

2.15 An aircraft performance database, ATC capacity data, and airspace data display system should be added to the data bank. An assessment should be made of the need for immediate application of wind data.

**Tactical airspace phase**

2.16 The meeting was of the opinion that the tactical airspace phase complements the strategic airspace phase with the inclusion of other non-scheduled flight information (mainly filed flight plans - FPL) and ATS messages concerning flight plans.

2.17 The problems would be defined for each State, based on both the current processing of filed flight plans and ATS messages and on the means used for the transmission of plans and messages. In this sense, the meeting recognized that further assessment should be made of the need for immediate application of wind data and the update of flight plans with radar information.

**ICAO Strategic objectives and global plan initiatives**

2.18 The meeting deemed that it was pertinent to associate ATFM implementation to the ICAO strategic objectives and the initiatives of the global plan (GPI). This will be accomplished by including a paragraph on this matter in the chapter corresponding to Operational Procedures.

**Mission, Structure and Responsibilities of a Centralized ATFM**

2.19 The Meeting recalled that GREPECAS/13 approved the objectives, principles and functions of a Centralized ATFM for the CAR/SAM Regions. During the meeting the task force members were presented with a possible mission, organizational structure and responsibilities of a centralized ATFM. These aspects could be used as a starting point for further development as the project advances.

2.20 Also, the meeting considered that the information provided was very valuable and it could be part of an organization and operational manual of the centralized ATFM. This manual shall be developed further -- either by the ATFM Task Force or by their own implementation groups. The meeting deemed pertinent to include as **Appendix A** to this part of the report a summary of the material presented. This material may be used as guidance material for the development of the mentioned document. In addition, and in order to reflect this matter in the ATFM CONOPS, it decided to incorporate a text on this matter.

2.21 As a result of the discussions held on this matter, the Meeting adopted the draft CAR/SAM ATFM Concept of Operations, recognizing that work will be required to improve its structure and content. In this context, it created a group of experts to analyze its content and introduce the changes deemed pertinent. Some coordination dates were defined for the finalization of the referred document, and the following decision was approved:

**Decision ATFM/TF/2/02 CAR/SAM ATFM Concept of Operations**

That the experts shown in **Appendix B** to this part of the report take pertinent actions to review, and if such were the case, to introduce the changes required to the CAR/SAM ATFM Concept of Operations (CONOPS) from **Appendix C** in order to finalize and deliver to the Secretariat before **25 August 2006** so as to be presented at the ATM/CNS/SG/5 Meeting.

# APPENDIX A

## POSSIBLE MISSION, ORGANISATIONAL STRUCTURE, AND RESPONSIBILITIES OF A CENTRAL FLOW MANAGEMENT UNIT

### 1. Introduction

1.1 The Central Flow Management Unit, hereinafter called CFMU, is based on the ICAO concept of a centralised flow management organisation (CTMO), which foresees a CFMU supported by flow management positions (FMPs) in each area control centre (ACCs).

### 2. Analysis

The mission of the CFMU

2.1 The mission of the CFMU is to attain and maintain the highest level of quality in ATFM service to support ATS providers and aircraft operators, in keeping with agreed principles and policies.

2.2 For ATS providers: the provision of planned flight data (FPD), optimum use of capacity, smooth traffic flows, and overload protection.

2.3 For aircraft operators: advance notice of flight plans, and reduction of penalties due to congestion.

CFMU responsibilities

2.4 Based on the above, the CFMU is responsible for providing an efficient ATFM service within the area of responsibility of the States, Territories, and International Organisations that participate in the Project.

2.5 It will also be responsible for maintaining and improving the cost-effectiveness of all its operations, increasing automation and making use of the best technology available.

2.6 Furthermore, it must adapt its procedures and systems to the evolution of its scenario of operations, particularly to developments within ICAO and, more precisely, within its own region.

2.7 Another important responsibility to bear in mind is the periodic provision of reports and statistics on ATFM operations and delayed operations in order to facilitate the analysis and implementation of measures to mitigate their impact on air traffic flows.

2.8 Lastly, the CFMU has a responsibility *vis-a-vis* ATS providers and users in the sense of improving the procedures and the evolution of the system.

Basic organisation of a CFMU

2.9 The description given here of a CFMU is not intended to be all-encompassing, but rather sets forth a possible basic organisation to encourage a synergistic discussion of this subject.

2.10 In this sense, we believe that members of the States that participate in the Project should be represented in the Organisational Structure, from top management to the various less specialised positions.

2.11 For purposes of planning, coordinating, and implementing strategic, pre-tactical, and tactical ATFM, it is necessary to have a **Flow Management Department (FMD)**, which shall also assist in the development and management of the ATFM Programme components for the Region under consideration, providing advice and submitting detailed reports to the GREPECAS ATM Committee and, periodically, to other GREPECAS contributory bodies when so required.

2.12 It is also envisaged that there will be a need to have data on the available CNS infrastructure in the area of responsibility and to maintain and provide operational flight data. This could be managed by a **Flight Operations and Infrastructure Data Department (FOID)**, and would involve:

- Updating information on available CNS infrastructure
- Managing flight plan processing systems
- Updating information on repetitive flight plans
- Conducting periodic operational assessments of the system
- Training and certifying all personnel involved in its activities
- Maintaining a system of associated contacts in each participating State in the areas of interest, including the FMPs of each participating ACC.

2.13 Furthermore, there is a need to manage the provision, integration and technical support to facilities associated with the project, in order to fulfil the mission of the CFMU, which implies the establishment of an **Engineering Department (ENGD):**

- Acquiring and implementing the necessary systems and platforms to provide the systems with control and configuration display
- Ensuring the quality of the software used
- Integrating and deploying mission-critical systems
- General support to CFMU security and quality as a whole
- Ensuring the safety of CFMU technical systems
- Managing the inventory of critical spare parts and the backup necessary to support the system
- Interacting with other departments in any area specified by the general manager.

2.14 The **Development and Maintenance Department (DMD)** dealing with critical CFMU systems inherent to its mission, that will have to manage development and evolution projects and technical projects, maintain and develop the system architecture together with ENGD, and advise the general manager on the best way to manage the development of projects and system maintenance.

2.15 Lastly, there must be a **User Relations Office (URO)** for system users, and although its responsibilities and duties may be defined and refined later on, some of them can already be identified, namely:

- Identifying and dealing with user needs
- Conducting simulations and trials
- Obtaining sponsors for given studies
- Coordinating operational assessments
- Performing public relations and disseminating bulletins and any other material required by users
- Organising CFMU/international meetings
- Preparing and dispatching/receiving and distributing all correspondence and/or documents
- Others.

**APPENDIX B**

**FOLLOW-UP TABLE AND ASSIGNMENT OF RESPONSIBLE PERSONS FOR THE REVISION OF THE CAR/SAM REGIONS ATFM OPERATIONAL CONCEPT**

| | | |
|---|---|---|
| **Phase 1:** | **Deadline for coordination** | **21 July 2006** |
| **Phase 2:** | **Submission of draft CONOPS to Secretariat** | **25 August 2006** |
| **Phase 3:** | **Consolidated Document** | **29 September 2006** |

**Coordinators: John Hof and John Ferrer**

| N° Chap. | Title Chapter | Development and revision in charge of |
|---|---|---|
| - | Preface | Completed |
| - | Registry of amendments and corrigenda | Completed |
| - | Amendments to the Document | Completed |
| - | Content of the document | Secretariat |
| - | Acronyms | Secretariat |
| - | Definitions | Secretariat |
| 1 | Executive summary | Secretariat |
| 2 | History | Secretariat |
| 3 | Purpose of the document | Completed |
| 4 | Trends and aircraft traffic forecasts | Uriel Urbizo/Secrerariat |
| 5 | Main traffic flows | Completed |
| 6 | Main actors involved in ATFM | Secretariat |
| 7 | Special flights exempt from the application of ATFM measures | John Ferrer |
| 8 | Identification of areas, routes, and/or airports where air traffic congestion is produced. | Julio Pereira in coordination with Status which shall provide information |
| 9 | Objectives, Principles and functions of a Centralized ATFM | Completed |
| 10 | Mission, structure and functions of a Centralized ATFM | Héctor Matamoros, John Ferrer, Julio Pereira |
| 11 | Requirements of equipment and personnel for FMU/FMP and CATFM | Julio Pereira and Secretariat |
| 12 | Operational procedures<br>- Strategic phase<br>- Pre-tactical phase<br>- Tactical phase | Secretariat |
| 13 | ATFM Operational implementation | Secretariat |
| 14 | ATFM implementation strategy in the CAR/SAM Regions | Secretariat |
| 15 | Contingency plan | Completed |
| | Appendix X1 | Completed |
| | Appendix X2 | Completed |
| | Appendix X3 | Completed |

**Reference material**

Annex 11PANS ATM (Doc.4444)
Doc. 9426
Doc. 9854
Doc. 9750 New Global Plan and the initiatives of the Global Plan Initiatives (GPI)
ANP CAR/SAM

**APPENDIX C**

# INTERNATIONAL CIVIL AVIATION ORGANIZATION

# Caribbean/South American Air Traffic Flow Management Concept of Operation

# (CAR/SAM CONOPS ATFM)

| | |
|---|---|
| Version | Draft 0.0 |
| Date | July 2006 |

## FOREWORD

The *Caribbean/South American ATFM Concept of Operations (CAR/SAM CONOPS ATFM)* is published by the ATM/CNS Subgroup of the Caribbean/South American Regional Planning and Implementation Group (GREPECAS). It describes air traffic flow management concept operational to be applied in both regions.

The GREPECAS and its contributory bodies will issue revised editions of the Document as required to reflect ongoing implementation activities.

Copies of the *CAR/SAM ATFM Concept of Operations* can be obtained by contacting:

**ICAO NORTH AMERICAN, CARIBBEAN, AND CENTRAL AMERICAN OFFICE**

**MEXICO CITY, MEXICO**

| | | |
|---|---|---|
| E-mail | : | icaonacc@mexico.icao.int |
| Web site | : | www.icao.int/nacc |
| Fax | : | +5255 5203-2757 |
| Mail | : | P. O. Box 5377, México 5 D. F., México |
| Point of contact | | |
| E-mail | : | vhernandez@mexico.icao.int<br>lcary@mexico.icao.int |

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**LIMA, PERU**

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|---|---|---|
| E-mail | : | mail@lima.icao.int |
| Web site | : | www.lima.icao.int |
| Fax | : | +511 575-0974 / 575-1479 |
| Mail | : | P. O. Box 4127, Lima 100, Peru |
| Point of contact | | |
| E-mail | : | jf@lima.icao.int / ao@lima.icao.int |

The present edition (Draft Version 0.0) includes all revisions and modifications until July 2006. Subsequent amendments and corrigenda will be indicated in the Record of Amendment and Corrigenda Table, according to the procedure established in page 3.

The publication of amendments and corrigenda is regularly announced through correspondence with States, and the ICAO web site, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

## RECORD OF AMENDMENTS AND CORRIGENDA

| AMENDMENTS | | | |
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## AMENDMENTS TO THE DOCUMENT

1. The Caribbean and South American (CAR/SAM) ATFM Concept of Operations is a regional document that includes aeronautical scientific and technological advances; as well as the operational experiences, both of the CAR/SAM Regions as of the other ICAO Regions that may affect ATFM concepts and procedures therein established in the same.

2. Due to this particularity, the ATFM CONOPS is also a dynamic document, in permanent progress and permeable in order to accept every modification originated by the constant improvement in the aeronautical disciplines and activities that enable its harmonious use in the CAR/SAM Regions, ensuring air operations safety.

3. In order to keep this ATFM CONOPS updated and make the required changes and/or modifications, the following amendment procedures have been established.

4. The ATFM CONOPS consists of a series of loose-leaf pages organized in sections and parts describing the concepts and procedures applicable to ATFM operations in the CAR/SAM Regions.

5. The framework of the sections and parts, as well as the page numbering have been developed so as to provide flexibility, facilitating the review or the addition of new texts. Each Section is independent and includes an introduction giving its purpose and status.

6. Pages bear the date of publication, as applicable. Replacement pages are issued as necessary and any portions of the pages that have been revised are identified by a vertical line in the margin. Additional material will be incorporated in the existing Sections or will be the subject of new Sections, as required.

7. Changes to text are identified by a vertical line in the margin in the following manner:

| | |
|---|---|
| *Italics* | *for new or revised text;* |
| *Italics* | *for editorial modification which does not alter the substance or meaning of the text; and* |
| Strikethrough | ~~for deleted text.~~ |

8. The absence of change bars, when data or page numbers have changed, will signify re-issue of the section concerned or re-arrangement of text (e.g. following an insertion or deletion with no other changes).

Page

**Document content**

## GLOSARIO DE ACRÓNIMOS/ACRONYMS GLOSSARY

| | |
|---|---|
| ACC | Centro de control de área<br>Area control center<br>Aeronautical fixed service |
| AFTN | Red de telecomunicaciones fijas aeronáuticas<br>Aeronautical fixed telecommunication network |
| AIP | Publicación de Información aeronáutica<br>Aeronautical Information Publication |
| AIS | Servicio de información aeronáutica<br>Aeronautical information service |
| ANP | Plan navegación aérea<br>Air navigation plan |
| ANS | Servicios de navegación aérea<br>Air navigation services |
| ANSP | Proveedor de servicios de navegación aérea<br>Air navigation service provider |
| AO | Operador de aeronave<br>Aircraft operator |
| APP | Oficina de control de aproximación<br>Approach control office |
| ATC | Control de tránsito aéreo<br>Air traffic control |
| ATFM | Gestión de la afluencia del tránsito aéreo<br>Air traffic flow management |
| ATM | Gestión del tránsito aéreo<br>Air traffic management |
| ATS | Servicios de tránsito aéreo<br>Air traffic services |
| CAA | Administración de aviación civil<br>Civil aviation authority |
| CAR/SAM | Regiones Caribe y Sudamérica<br>Caribbean and South American Regions |
| CATFM | Dependencia de Gestión de la afluencia del tránsito centralizada<br>Centralized air traffic flow management unit |
| CBA | Análisis de costo/beneficios<br>Cost/benefit analysis |
| CNS/ATM | Comunicaciones, navegación y vigilancia/gestión del tránsito aéreo<br>Communications, navigation, and surveillance/air traffic management |
| FDPS | Sistema de procesamiento de datos de vuelo<br>Flight data processing system |
| FIR | Región de información de vuelo<br>Flight information region |
| FMU | Dependencia de organización de la afluencia<br>Flow management unit |
| FMP | Puestos de gestión de afluencia<br>Flow management position |

| | |
|---|---|
| FPL | Plan de vuelo<br>Flight plan |
| GREPECAS | Grupo regional de planificación y ejecución CAR/SAM<br>CAR/SAM regional planning and implementation group |
| MET | Servicios meteorológicos para la navegación aérea<br>Meteorological services for air navigation |
| OACI/ICAO | Organización de aviación civil internacional<br>International civil aviation organization |
| PANS ATM | Procedimientos para los servicios de navegación aérea –Gestión de tránsito aéreo<br>Procedures for Air Navigation Services –Air traffic management |
| PIRG | Grupo regional de planificación y ejecución<br>Planning and implementation regional group |
| TBD | A ser determinado<br>To be determined |
| TMA | Area de control terminal<br>Terminal management area |
| TWR | Torre de control<br>Tower |
| WWW | Red mundial<br>World Wide Web |

**Executive summary**

……

**History**

ICAO CNS/ATM Systems received support from the Tenth Air Navigation Conference held in 1991 at ICAO Headquarters in Montreal, Canada. The same year, the CAR/SAM Regional Planning and Implementation Group (GREPECAS) started to work towards a regional application of this new air navigation services concept.

Further, at the Eleventh Air Navigation Conference (AN-Conf/11, Montreal September 2003), States supported and approved the new ICAO ATM Global Operational Concept, which encourages the implementation of a services management system which enables an operationally continuous regional airspace through the application of ATM functions.

As per the guidance principles established by ICAO with regard to the facilitation of the inter-regional harmonization, the regional plans for CNS/ATM systems implementation in the regions should be prepared in accordance to the general profiles defined in the Global Air Navigation Plan for CNS/ATM Systems. After a careful analysis of the guidance principles of this Global Plan, GREPECAS adopted them and incorporating characteristics inherent to the CAR/SAM Regions, using as a basis the definitions of Homogeneous Areas and Main Traffic Flows. Homogeneous areas are those airspace portions with ATM requirements and similar complexity degrees, while main air traffic flows are airspace where a significant amount of air traffic exists.

From the analysis carried out by ICAO/UNDP Project RLA/98/003, it may be inferred that while in general terms in the CAR/SAM Regions environment, currently no traffic congestions are registered requiring a complex flow management, they have been identified in some airports and airspace sectors, mainly in special periods and specific hours, where some congestions are already produced, which should be avoided. These traffic congestions basically occur due to limitations in the airport infrastructure and to the lack of air traffic flow management.

In view of the above, GREPECAS considered that the early implementation of the ATFM shall ensure an optimum air traffic flow towards some areas or through them, during periods in which the demand exceeds or is foreseen to exceed the available capacity of the ATC. Therefore, an ATFM system should reduce aircraft delays both in flight and ground and avoid system overloading. The ATFM system shall assist the ATC to comply with its objectives and achieve a more effective utilisation of the airspace and airports available capacity. ATFM should also ensure that air operations safety is not compromised in case unacceptable levels of air traffic congestion occur and at the same time ensure that air traffic is effectively administered without applying unnecessary restrictions to flow.

**Purpose of the document**

This document on CAR/SAM Air Traffic Flow Management Operations Concept (ATFM) is oriented towards the description of a high level on the service to be provided in the CAR/SAM Regions in a specific time horizon. It explains the current situation and which shall be the future situation to be progressively reached through a series of specific change stages.

The operational concept described herein reflects the expected order of events which might occur and should assist and guide the planners in the design and gradual development of ATFM system, in order to provide safety and effectiveness, and ensure an optimum air traffic flow towards certain areas or through them during periods in which the demand exceeds or is foreseen to exceed the available capacity of the ATC system.

**Airlines passenger traffic forecasts and trends**

During the period 1994-2004, the Latin American and Caribbean Region's airlines passengers' regular traffic (in PKP) grew at an annual average of 3.3% (in comparison to the global annual average growth rate of 5.1%). Until year 2000 privatisation of national carriers fusions and inter-regional alliances, together with a wide rationalization of fleets and routes, counted among the measures that enabled airlines of the regions to capture a greater portion of traffic of United States – Latin America and Caribbean, one of the aviation markets with greater growth rate. After high traffic growth rates in 1997 and 1998 (9.5% and 7.8% respectively), the passengers traffic decreased in 1999 in a 0.3% but it was recovered in 2000 with a growth rate of 4.4%, decreasing again in 2001 in 5.1%. The traffic decreased in 1.6% in 2002 before recovering in 2003 (3.8%) and 2004 (8.4%). In some CAR/SAM areas the traffic growth in 2005 registered scopes of up to 13%.

It is foreseen that the traffic growth will continue to improve gradually at mid term, at the same time than the economical activity. A growth of Regular CAR and SAM Regions airlines passengers' traffic of 6.2, 5.5 and 5.6% in 2005, 2006 and 2007, respectively is foreseen, as compared to the global growth forecast of 7.6, 6.5 and 6.2%, respectively.

**Main traffic flows**

The CAR/SAM air navigation plan has identified several airspaces with common interests as regards air traffic management, based on similar characteristics of traffic density, complexity and air navigation system infrastructure requirements within which a common plan shall foster the implementation of an ATM Global Concept. Within these routing areas the main traffic flows have also been identified following the same or close flight trajectories between pairs of cities.

These routing areas and the respective traffic flows are described in the Table shown as **Appendix XX1** to this document.

**Identification of areas and/or routes where traffic congestion is produced**

Currently, saturation periods have been identified in several airports and traffic flows of the Bahamas, Central America, Mexico, Miami, Piarco and Santo Domingo FIRs.

TBD ……

**Objectives, principles and functions of a Centralized ATFM**

**Objective of the Centralized ATFM**

As established in the PANS ATM (Doc 4444) air traffic flow management should be implemented within a region or within other defined area, as a centralized ATFM organization with the support of flow management units (FMU) established in each ACC within the region or area of application.

The objective of the Centralized ATFMs shall be to contribute so that the ATC use to the maximum possible extent its capacity and, as required, shall issue flow management initiatives to maintain a safe, orderly and expeditious air traffic circulation, assuring that the traffic volume is compatible with the declared capacities.

The Regional ATFM structure should be composed in such a manner that each CAR/SAM Region State/Territory and International Organization may accede to a corresponding Centralized ATFM through an organization adequate to its needs and developed as per the guides determined on this matter.

Consequently, and aware of their operational needs in agreement with its reality as regards ATC service, air traffic and airport problems, as well as air traffic volume, administrations should define whether a FMU is necessary, which in addition to communicating with the Centralized ATFM, may manage and coordinate the implemented Flow Management Position (FMP) in ATC units which so require or adopt the direct communication process from these FMPs with the Centralized ATFM.

**Principles in which ATFM will be based**

The Centralized ATFM, to comply with its objectives, should be based on the following principles:

a) To be at disposal of all States/Territories and International Organizations in the region under their responsibility, considering the requirements of operators, airports, ATC units and other pertinent ATFM units.

b) Use a common and permanently updated database.

c) Take pertinent measures well in advance to prevent and/or minimize overloads.

d) Keep close and continuous coordination with flow management units (FMUs) and/or flow management positions (FMPs), aircraft and airport operators, corresponding ATC units and other pertinent Centralized ATFM units.

e) Take measures that ensure that existing delays are equitably distributed among operators.

f) Apply quality management to the services provided.

g) Base the implementation of ATFM measures in the collaborative decision making (CMD) process.

h) Favour, to the maximum possible, the use of the existing capacity without compromising safety.

i) Contribute in the achievement of the global ATM objectives.

j) Have the necessary flexibility to enable operators to change their arrival or departure schedules.

**Functions of a Centralized ATFM**

To provide Air Traffic Flow Management (ATFM) service, the Centralized ATFM should comply with the following activities:

a) Establish and maintain a data base in the region under its responsibility on:

- the air navigation infrastructure, ATS units and registered aerodromes;
- pertinent ATC and airport capacity; and
- flight data foreseen.

b) Establish a coherent chart of foreseen air traffic demand, a comparison with available capacity and determination of areas, and a time-frame of critical air traffic overloads foreseen;

c) Make the necessary coordination to make every possible attempt to increase the capacity available, when necessary.

d) When deficiencies in the capacity available matter may not be eliminated, determine and timely apply ATFM measures, as required, previously coordinated with aircraft operators and interested aerodromes.

e) Carry out a follow-up on the result of measures adopted.

f) Coordinate ATFM service with the other centralized ATFM units, when so required.

**Equipment and Personnel Requirements for FMU/FMP and the Centralized ATFM**

The implementation of the ATFM shall require to identify and determine which would be the minimum requirements for the implementation of the service and the Centralized ATFM, FMU, or FMP in each CAR/SAM Regions ATC unit.

*Note: A more detailed description of these requirements is shown in **Appendix XX2** to this document.*

Personnel performing in the Centralized ATFM as well as FMU/FMP functions shall require training and shall be qualified to provide an efficient flow management and capacity service.

**Operational procedures**

The operational procedures of the Centralized ATFM as well as those for the FMUs and FMPs should be developed in separate documents. These documents should describe the procedures applicable between the ATFM and all the FMUs/FMPs. Changes in these procedures shall be first agreed upon and shall be published as amendments to operational procedures prior to consultation to all parties involved.

The purpose of these documents shall be to assist personnel from the Centralized ATFM and FMUs/FMPs to establish a common understanding of the roles of each party interested in the effective provision of the flow management service and the capacity to the air traffic services control to aircraft operators.

ATFM measures should be addressed to traffic flows or flight series and to specific flights and days. To this end, planning, strategies development, and day-to-day monitoring, should be made. With regard to the above, ATFM activities could be developed in three phases: strategic -- up to 48 hours before the day of the operation; pre-tactical -- during 48 hours prior to the operation day; and, tactical -- during the day of the operation. During all ATFM phases, responsible units should maintain a close liaison with ATC and with aircraft operators to ensure an effective and equitable service.

**Strategic phase**

Strategic phase shall be initiated as soon as possible. At this stage, the balance between demand and capacity shall respond to fluctuations in schedules and demands, including air traffic increase, as well as annual changes in meteorological conditions, and the main meteorological phenomena. During collaborative decision-making, the available resources shall be optimized in order to have as much flow as possible, with which the basis to programme in advance flight schedules.

The strategic planning can be divided into a continuous data collection and interpretation process, a systematic and regular review of procedures and measures, and an international coordination process to ensure the compatibility and efficiency of national and international requirements.

Strategic planning has two main objectives, on one hand to identify imbalances between demand and capacity in ATC systems, whether in sub-utilised or saturated areas. And on the other hand, to use said information to recommend measures leading to increased capacity or effective use of the existing capacity.

Regarding the above, a method that could be used for identifying imbalances between demand and capacity is comparing available traffic forecasts with known capacity data.

**Pre-tactical phase**

At the pre-tactical stage, the demand and capacity balance will be achieved by evaluating the assignment of the means and ATS services provider resources available, the airspace users and aerodrome operators, and then comparing them with foreseen demands. In order to mitigate any imbalance, and whenever possible, through collaborative decision-making, some adjustments will be incorporated to:

- Available means
- Assignment of resources
- Trajectories foreseen
- Airspace organization; and
- Assignment of entry and exit hours in aerodromes and in specific airspace volumes.

Basically, the pre-tactical phase comprises the study of the demand for the day of operation (starting 48 hours before), comparing it with the capacity available on that day, adjusting the Strategic Plan or finishing different measures when necessary. At the end of the process, the agreed measures should be incorporated in a bulletin (ATFM Reporting Message) containing the restrictions and disseminated through the AFTN, SITA, etc.

**Tactical phase**

In the tactical phase, the function of the demand and capacity balance shall focus more closely in the demand step to adjust any imbalance. The following shall be taken into consideration:

- Meteorological conditions
- Infrastructure status
- Assignment of resources
- Schedule disturbance that may cause any imbalance.

Through collaborative decision-making, the measures shall comprise dynamic adjustments of airspace organization to be in balance with capacity. This may include dynamic changes of entry and exit hours in aerodromes, in specific airspace volumes, and in schedule adjustments by users.

The tactical activity is aimed at ensuring that the measures taken during the strategic and pre-tactical phases resolve the demand/capacity problems in the flows or areas of application, that the measures imposed are the minimum required and that the unnecessary measures have been eliminated, that ATC resources are properly used, and that maximum use is made of the existing capacity, without compromising safety.

It should also be noted that the existing delays are equitably distributed among operators.

In order to meet these objectives and comply with the above, the ATFM plan should be monitored in real time, in close contact with the ATC operation underway, where real-time access to data is critical.

In this tactical phase, the main ATFM measures being currently applied in this tactical phase are the use of SLOTS and en-routing application, trying to avoid significant penalties to operators.

**Centralized ATFM implementation strategy (ATFMC) in the CAR/SAM Regions**

GREPECAS/13 was of the opinion that two CAR and SAM scenarios should be taken into account, but that they could be modified insofar as the operational concept development and the implementation plans progress. The strategy is to develop a harmonized planning of a CAR and SAM interregional ATFM system.

In order to maximise its efficiency, it was considered that Centralized ATFM should have the responsibility of providing service on the maximum extension of airspace possible, provided that this is homogeneous. In accordance with ATFM planning in the CAR and SAM Regions, it will have at least two Centralized ATFMs, one for each region.

It was also considered necessary that the procedures during all the implementation process be developed in a harmonious manner among the ATFM units to avoid risking operational safety. This entails establishing a regional and interregional strategy to facilitate and harmonize all the implementation process. The ATFM Task Force will accomplish these planning and harmonization objectives while for the implementation, two scenarios will be established depending on the operational needs and own features of each CAR and SAM Region. The activation of two ATFM Implementation Groups is considered, one for each Region.

It was considered that operational implementation should be carried out in phases, according to ICAO Doc 9854 – *Global air traffic management operational concept*, in order to permit a progressive implementation and acquire necessary capacities for an adequate implementation. Each phase should be implemented, based on operational configurations, descriptive documents of the operational models and systems, as per the established strategy, and taking into account the following sequence:

a) strategic ATFM

b) pre-tactical ATFM

c) tactical ATFM

In order to harmonize the National Plans with the Regional CAR/SAM ATFM Regional Plan, it is necessary that the civil aviation administrations take the required measures and make a closer follow-up of the regional development of the ATFM and prepare a ATFM implementation programme where implementation needs are determined, the impact that will have in the national ATC system, air traffic services as well as in operations and airport services be analysed, and pertinent coordinations are established, which make it possible an integral regional, timely and harmonious implementation.

**Contingency plan**

In case of a partial or total interruption of the flow management service and the capacity and/or support services, ATFM and FMUs/FMPs will have the corresponding ATM contingency plans prepared as per GREPECAS guidelines, in order to help to ensure the safe and orderly movement of air traffic. These plans shall be incorporated to the documents related with operational procedures of the Centralized ATFM and FMUs/FMPs.

## Appendix XX1

## Table

### Routing Areas and Main Traffic Flows Identified in the CAR/SAM Regions

| -1- Routing Area (AR) | -2- Traffic flows | -3- FIRs involved | -4- Type of area | -5- Remarks |
|---|---|---|---|---|
| **Caribbean/South American Regions (CAR/SAM)** | | | | |
| AR 1 | Buenos Aires-Santiago de Chile | Ezeiza, Mendoza, Santiago | Low density Continental | SAM intra-regional traffic flow |
| | Buenos Aires-Sao Paulo/Río de Janeiro | Ezeiza, Montevideo, Curitiba, Brasilia | Low density Continental | SAM intra regional traffic flow |
| | Santiago de Chile-Sao Paulo/Rio de Janeiro | Santiago, Mendoza, Córdoba, Resistencia, Asunción, Curitiba, Brasilia | Low density Continental | SAM intra regional traffic flow |
| | Sao Paulo/Rio de Janeiro-Europe | Brasilia, Recife | Continental / Low density Oceanic | SAM/AFI/EUR inter regional traffic flow |
| AR 2 | Sao Paulo/Río de Janeiro-Miami | Brasilia, Manaus, Maiquetía, Curacao, Kingston, Santo Domingo, Port au Prince, Habana, Miami | Continental / Low density Oceanic | CAR/SAM/NAM inter- and intra-regional traffic flow |
| | Sao Paulo/Río de Janeiro- New York | Brasilia, Belem, Paramaribo, Georgetown, Piarco, Rochambeau, San Juan (New York) | Continental / Low density Oceanic | CAR/SAM/NAM/NAT inter- and intra-regional traffic flow |
| AR 3 | Sao Paulo/Río de Janeiro- Lima | Brasilia, Curitiba, La Paz, Lima | Low density Continental | SAM intra-regional traffic flow |
| | Sao Paulo/Río de Janeiro- Los Angeles | Brasilia, Porto Velho, Bogotá, Barranquilla, Panamá, Central América, Mérida, México, Mazatlán (Los Angeles) | Low density Continental | CAR/SAM/NAM inter- and intra-regional traffic flow |
| AR 4 | Santiago - Lima - Miami | Santiago, Antofagasta, Lima, Guayaquil, Bogotá, Barranquilla, Panamá, Kingston, Habana, Miami. | Continental / Low density Oceanic | CAR/SAM/NAM inter- and intra-regional traffic flow |
| | Buenos Aires - New York | Ezeiza, Resistencia, Asunción, La Paz, Porto Velho, Manaus, Maiquetía, Curacao, Santo Domingo, Miami (New York) | Continental / Low density Oceanic | CAR/SAM/NAM/NAT NAM inter- and intra-regional traffic flow |

| -1- Routing Area (AR) | -2- Traffic flows | -3- FIRs involved | -4- Type of area | -5- Remarks |
|---|---|---|---|---|
| | Buenos Aires - Miami | Ezeza, Resistencia, Córdoba, La Paz, Porto Velho, Bogotá, Barranquilla, Kingston, Habana, Miami | Continental / Low density Oceanic | CAR/SAM/NAM NAM inter- and intra-regional traffic flow |
| AR 5 | North of South America - Europe | Guayaquil, Bogotá, Maiquetía, Piarco (NAT-EUR) | Continental / high density Oceanic | SAM/NAT/EUR inter-regional traffic flow |
| AR 6 | Santiago - Lima - Los Angeles | Santiago, Antofagasta Lima, Guayaquil, Central Amérca, México | Low density oceanic | CAR/SAM /NAM intra- and inter-regional traffic flow |
| AR 7 | South America – South Africa | Ezeiza, Montevideo, Brasilia, Johanesburgo (AFI) | Low density oceanic | SAM/AFI inter-regional traffic flow |
| | Santiago de Chile - Isla de Pascua - Papeete (PAC) | Santiago, Pascua, Tahiti | Low density oceanic | SAM/PAC inter-regional traffic flow |
| GM-1 | Mexico, Toluca, Guadalajara, Monterrey, Mazatlán, La Paz, Acapulco, Puerto Vallarta, Huatulco, Cancún Gulf of Mexico— North America | Mexico, Houston, Miami; Albuquerque; Los Angeles | Continental/oceanic high density | CAR/NAM inter-regional major traffic flow |
| | Cancún, Guatemala, El Salvador, Nicaragua, Honduras, Costa Rica - Miami | Mexico, Central America, Havana, Miami | Continental/oceanic high density | CAR/NAM interregional traffic flow |
| GM-2 | Mexico, Cancun, La Havana, Nassau — Europe | Mexico, Havana, Miami - NAT-EUR | Continental/oceanic high density Major traffic flow | CAR/NAM/NAT/EUR inter-regional traffic flow |
| GM-3 | Costa Rica, Panama, Honduras Kingston, Haiti, Santo Domingo San Juan, The Caribbean — Europe | Central America, Panama, Kingston, Port-au-Prince, Curacao, Santo Domingo, San Juan – EUR | Oceanic high density | CAR/ NAT/EUR intra and interregional major traffic flow |
| | North America – East Caribbean | New York, Miami, Havana, San Juan, Santo Domingo Piarco | Oceanic high density | West Atlantic Route System CAR/NAM inter-regional traffic flow |

## Appendix XX2

## GENERAL CONSIDERATIONS FOR THE IMPLEMENTATION PROCESS OF A Centralized ATFM

The implementation of the Centralized ATFM should consider the following requirements:

a) Access to the operational status of the air navigation infrastructure.

b) Access to aeronautical information and cartography.

c) Access to meteorological information.

d) Database of:

- aerodromes;
- airport capacity;
- ATC capacity
- Air traffic demand
- Airspace structure
- Radio navigation aids
- Aircraft performance; and
- Utilization of airports and control sectors.

e) Access to flight planning data (FPL, RPL, etc.).

f) Flight plans processing.

g) Access to surveillance data (SSR, ADS, etc.)

h) Automated resources:

- Processing and data visualization system for flow management, having, among other thing, the following sub-systems:

  - Flight data processing
  - Airspace and airports structure data;
  - Situation analysis (capacity and demand);
  - Presentation of air traffic situation;
  - Monitoring of the operational status of the infrastructure;
  - Support to collaborative decision making (ATC slots, alternate routes, etc.).
  - Database maintenance.

i) Communication to coordinate with:

- Other centralized ATFMs
- Operators (airlines, general aviation, State, etc.);
- Airport management;
- FMUs and/or FMPs and/or ATS units;
- Aeronautical meteorological units;
- AIS units.

j) Human resources

- qualified personnel;
- support personnel;
- recurrent training.

k) Use of adequate tools for statistics

l) Infrastructure

- buildings
- equipment
- electrical power
- air conditioning
- supplies
- software

m) Implementation of FMUs and/or FMPs, as required.

n) Redundancy of critical systems.

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**Agenda Item 3: ATFM data bases**

3.1 The Secretariat presented the electronic aspects related to air traffic flow management (ATFM) in the CAR/SAM Regions, based on the ATFM implementation phases defined in Doc 9854, Global ATM Operational Concept. This document provides near and medium term visions on the needs of electronic information for ATFM service to achieve a more efficient approach to balancing demand and capacity. Elements include a complete analysis of: airspace, flight operations, service demand for air operations, and other basic electronic elements.

3.2 The meeting noted that electronic data bases, in conjunction with surveillance and communication systems, are valuable tools for demand/capacity balancing activities. They provide automation methods to improve ATM situational awareness and assist airspace users and service providers solve problems while permitting full capacity operation in all weather conditions. The aim is to achieve real-time sharing of electronic data among ATFM stakeholders with sufficient integrity and accuracy.

3.3 It was recognized that systemic ATFM service coordination requires utilizing verbal communication and automated methods to ensure complete exchange information. Both methods provide common support analysis for situational awareness functions to the extent possible, such as collection of all available data pertaining to traffic capacity, traffic flows, points of congestion, peak hours, etc. Enhancement of communication capabilities improves information exchange, coordination activities, and increased collaboration and information sharing between airspace users and ATS providers. This gives all participants a more realistic picture of demand and available capacity.

3.4 The meeting recalled that telephone conferences (TELCONs) should be initiated periodically and hosted by the ATFMC, when needed, to discuss, evaluate, or problem solve any issues. The TELCON capacity should include at a minimum: operational supervisors within jurisdiction of appropriate FMUs, adjacent ACCs, TWR/APP facilities, and operators and user representatives for traffic flow management.

3.5 On the other hand, the traffic flow management position (FMP) is a work station that shall help to supervise and manage air traffic flows. The FMP analyzes and detects when the demand has exceeded, or is about to exceed, ATS and/or airport capacity, traffic flows, congestion points, peak hours, etc.,. A monitor alert (MA) function in FMP also establishes a dynamic numerical trigger value to provide notification on which sector/airport efficiency may be degraded during specific period of time. The MA shall help to reflect functional airspace or airport capabilities to the ATS provider and include operational factors such as NAVAIDs, meteorological conditions, and communications capabilities. The FMU coordinators must monitor, assess, and respond to appropriate electronic information in order to ensure that these elements operate efficiently.

3.6 Taking into consideration that the development of an homogeneous data base is important, the meeting considered appropriate that the ATFM Task Force incorporate into its work programme the need to examine the possible creation of a traffic flow management unit for each CAR and SAM Region. These units would be responsible for data reception, data processing, and dissemination of flight plan data. To this end, it decided to review the work programme as indicated under Agenda Item 5 of this report. Some of the issues which the ATFM/TF should revise in the future are to define operational requirements of FMUs, the interoperability aspects and protocols of ATFM automated systems, required training to different levels of collaboration and priority of tasks in the strategic action plan.

3.7 The information of data bases required to be developed according to the evolutionary phases for automated systems and ATFM communication are shown in **Appendix A** to this part of the report.

3.8 The meeting noted that, in addition to automated systems for ATFM implementation, the support of a broad, interoperable and easily accessible architecture database is necessary. This architecture should take into account the data analyses of mapping of aeronautical information with sufficient integrity, homogeneity and consistency -- mainly with respect to the formats.

3.9 Considering the complexity of data bases, their development should be permanently associated with the States' requirements – in accordance with the different ATFM implementation phases -- for future developments of the CAR/SAM Regions.

**ATFM initial data base characteristics**

3.10 The meeting was of the opinion that it should be envisaged in the CAR and SAM Centralized ATFM operational concept, that all activities will be integrated in a data base that will permit presentation of information on:

a) Flight intentions (as reflected in flight schedules--such as OAG--and flight plans);

b) Mapping information (about airports, airspace, SIDs, STARs, airways, aids, fixes, and EAC); and

c) Aircraft (concerning performance data).

3.11 In a future ATFM phase, radar data must be added to permit a better analysis of demand and better application of tactical ATFM measures. The meeting also was of the opinion that it will be essential to automate data collection and update procedures in order to permit immediate assessment of data consistency. Furthermore, interconnection should be available with the FAA ATCSCC data base, EUROCONTROL CFMU, the CAR/SAM Centralized ATFMs, and any airborne flight management systems (FMS).

3.12 The meeting considered that the preparation of the data bases, as well as its definition, shall be carried out by a specific experts group, who will analyse the data available in the CAR/SAM Regions well as its integration with ATFM.

3.13 On the other hand, it agreed that the data provided in this meeting related with data bases be included in **Appendix B** to this part of the report. This will allow it to be used as guidance material by the work group created to comply with this task

# APPENDIX A

***Electronic databases required for ATFM system***

1. Information management ensures that the information needs of ATFM stakeholders are satisfied in a much more flexible and efficient manner than previously. It is achieved by integrating all information to continuously maintain the best possible scenario of the past, present and future traffic situation. This becomes a common basis for decision making by all ATM stakeholders during their strategic, pre-tactical and tactical planning processes -- including real-time operations and post-flight activities. The electronic databases required in evolutionary phases for the ATFM system are:

a) Data processing and display for traffic flow management

- Flight planning and processing data (FPL, RPL, etc);
- Airspace and airport structure;
- Situational air traffic display;
- Automatic messages in CDM support (access to SLOTS, delay reporting alternative routes. etc.)
- Monitoring status of air navigation infrastructure;
- Airport acceptance rate capacity (AAR);
- ATC capacity;
- Traffic demand;
- Airspace structure and ATS routes network;
- Air navigation aids, radar, etc;
- Aircraft performance;

b) Surveillance data (SSR, ADS, etc.)

c) AIS (mapping, ATFM warnings, AIRAC updating, etc)

d) MET

e) For historical and statistical analysis of air operations, meteorology, etc.

f) Communication system to support CDM with:

- Other ATFMC;
- Other FMUs and/or FMPs and/or ATS units;
- Users and operators (airlines, general aviation, State, etc.);
- Airport authorities;
- MET authorities;
- AIS authorities

## EVOLUTIVE PHASES OF DATA BASES FOR ATFM AUTOMATED SYSTEMS

***Strategic***

1. Refers to long-term information required for a coordinated, strategic plan of demand and capacity up to or, in some cases, more than one year in advance of a particular airspace activity. While full schedule information might not be known until some months or weeks before a particular flight, normally certain data is available many years /months in advance, and aids in pre-planning. A strategic programming includes:

- historic demand from scheduled and non-scheduled flights,
- airspace availability or constraints,
- available capacity of ATM resources and the impact of operational changes (new procedures, new standards, etc);
- ATM and airport facilities availability,
- estimates on weather conditions;
- estimations of other non-forecast airspace user's demands.

2. This data can be used to aid airspace organization and management processes to get strategic demand and capacity balancing by adjusting capacity in advance. The main benefit through using electronic data in a strategic phase is improved processes, developing from a tactical or reactive system to one strategic or proactive, in which predictability is improved and allow the maximum flexibility and economy of operations for users in normal conditions.

3 Strategic ATFM database includes establish procedures and route structures to maintain or improve safety levels, capacity and efficiency in the use of airspace and of runways, and to best suit the traffic flows and to assist traffic separation in line with the different demands on airspace at different times of the day and night.

***Pre-tactical***

4. Implies adjustments to the coordinated strategic plan. During the pre-tactical phase, data received from all users and service providers -- such as confirmations, modifications, cancellations and additions -- must be analyzed and incorporated. That data should:

- be progressively refined and expanded, taking into account user preferences for flexibility, punctuality or service quality requirements;
- provide a framework that gives a good forecast of the traffic demand and the users' capabilities and resolves conflicts of interest between those parties and user groups that plan their activities up to years in advance;
- estimate the reserve capacity and airspace needed for those airspace users who, due to the tactical nature of their operations, cannot plan far in advance;

- set the rules and parameters, which broadly outline everyone's access to airspace, routes and airports; and
- provide estimates on the reserve capacity that may be needed for each day's traffic situation.

5. The pre-tactical data refers to statements of proposed flight plan, airspace regimes and reservations, route configuration and service provider limitations, capabilities and capacities. Normally this data is promulgated on a regional basis, hour-by-hour, at an agreed time before operation.

***Tactical***

6. Involves tactical final modifications. Prior to the flight, users determine the preferred flight trajectory that best addresses their operations and submit the requested trajectory to the demand and capacity balancing service provider for assessment and agreement.

7. This phase examines a flight request to see if it is acceptable or if there are any potential resource, capacity or congestion problems of which the user is unaware. If there are problems, demand and capacity balancing identify user-preferred solutions, giving the freedom to choose the most optimum flight within the system constraints. In this phase, real-time information exchange is required, such as:

- weather forecasts;
- current traffic demand and airspace reservations;
- predictability on a continuous basis of airport and airspace capacity and traffic densities for all day long;
- updated information hour-by-hour on forecast capacity constraints throughout areas and/or routes; and,
- assessment of the impact on the complete flight trajectory, i.e. from gate-to-gate.

8. Other interested parties who might need electronic information to improve the service that they supply or receive will benefit from more accurate arrival, departure and current flight trajectory information. These parties include, but are not limited to: customs and immigration authorities, meteorology departments, baggage handling, airport authorities and aircraft operators (refueling times, parking bays, etc.) and so on, will benefit from more accurate arrival, departure or current flight trajectory information.

# APPENDIX B

## GENERAL INFORMATION ON DATA BASES FOR ATFM

### Airport demand

1. Although the whole conceptual proposal must aim at a single integrated and centralised ATFM unit, the CAR/SAM States will have at their disposal, from the initial stage, the means and processes that allow them to have, using their own databases, a preliminary analysis of demand/capacity balancing for their airports.

### Airport slot

2. Upon establishing the demand/capacity balancing for a given airport, it will be possible, if necessary, to develop a supplementary tool for automatic airport slot reservations.

### Airport fees

3. Reports will be issued comparing foreseen and actual air traffic movement, with a view to procedures for collecting air navigation service fees.

### Operational description

#### *Reporting*

3.1 With the incorporation of radar information from the data bases, it will be possible to develop statistical flight reports and data, including a graphical representation of values. In general terms, it will be possible to obtain air traffic demand information for an aerodrome, point, marker, fix, ATS route, flight level, control area or sector, for planning or safety monitoring purposes (including RVSM and RNP requirements).

#### *Reception of information*

3.2 The data base should be prepared to receive all flight information, be it pre-scheduled (FPL/RPL/OAG), non-scheduled (FPL), or other information involving military and general aviation, as well as flight update messages.

#### *Data update*

3.3 The data base should permit flight data updates, be it manually through the ATFM, FMU operator, or “on-line”, through the radar processing system.

3.4 The Aircraft Situation Display, created on the basis of statistical data on air traffic movement and dynamic data, in addition to data from the synthesis of radar images, is one of the main outputs of this update, together with the issuance of the reviewed reports.

***Demand assessment***

3.5 The data base will provide airport demand information. However, an accelerated simulation system will provide airspace demand information. This process will be implemented in several stages--which can run parallel until the final integration--, namely:

a) Strategic model to analyse air traffic demand at airports

b) Tactical model to analyse air traffic demand at airports

c) Strategic model to analyse air traffic demand in ATC sectors

d) Tactical model to analyse air traffic demand in ATC sectors

**Operational requirements**

***ATFM data base***

3.6 The ATFM data base should be capable of conducting consistent data insertion, deletion, modification, and update operations required for retrieving information on air traffic flow and capacity management activities.

***Integrity and Data consistency***

3.7 The data base should employ the necessary techniques and methodologies to maintain data consistency with respect to collation or content.

***Inquiries***

3.8 It should be possible to make direct individual or related inquiries in the fields contained in the various tables of the data base

***Display***

3.9 It should be possible to adequately display traffic forecasts for a given time interval and for an airspace portion in microcomputers or other systems.

***Data communications***

3.10 Means of data communication compatible with ATFM requirements should be available.

***Access to other data banks***

3.11 Data already existing in other sectors should not be duplicated. ATFM should only have access to such information for the purpose of building the ATFM data base (for example: mapping, AIS, airlines, airports, other similar centres, etc).

**Agenda Item 4: Cost-benefit analysis**

4.1 When dealing with this agenda item, the meeting recalled that GREPECAS/13, based on the experience obtained in the implementation of different ATM functions in previous years, approved the MODEL ACTION PLAN FOR ATFM IMPLEMENTATION IN THE CAR/SAM REGIONS, so that the ATFM implementation groups take it into consideration in the development of their activities. Among the tasks which the action plan contemplates is Task 1.13 - *Provide data to the Cost Benefit Analysis.*

4.2 The meeting kept in mind that cost-benefit analysis is used to calculate the economical viability of an investment project; for example, to obtain the point in which the total benefit of the investment exceeds its total cost. In this connection, for the service providers, most of the benefits of CNS/ATM systems are increased capacity, flexibility, reliability reducing workload, etc.

4.3 Also, from the analysis carried out, it was considered that the development of the Business Case of a service provider or operator implies the financial cost-benefit analysis and other aspects. In particular, resultant changes in profitability must be taken into account. The evaluation of the net financial impact, in terms of updated value, should include not only the cost of the implementation and operation, but also positive changes produced as regards profitability, environment and/or social benefits.

4.4 In order to identify the different scenarios and detect specific variables contemplated in a cost-benefit analysis, it is advisable to have as accurate as possible details of the expenses which require investment, personnel expenses, and the identification of airspace sectors, current capacity of air navigation infrastructure and aerodromes selected and identify requirements and ATFM coverage.

4.5 As per the above, air navigation service providers (ANSPs) and users should collect all the pertinent information in order to prepare their own cost-benefit analysis and have this information available, at the time it is required, to attend Task 1.13 of the Action Plan, which the corresponding ATFM implementation groups should execute.

4.6 Finally, the meeting considered it necessary to encourage ANSPs to collect all the information required for the corresponding cost-benefit analysis. To this end, the minimum requirements and guidance material for the preparation of a cost-benefit analysis is shown in **Appendix A** to this part of the report. The meeting formulated the following conclusion:

**Draft**
**Conclusion ATFM/TF/2/03 Collection of information for the cost-benefit analysis**

That CAR/SAM States/Territories/International Organizations which have not yet done so, initiate the data collection for the financial cost-benefit analysis of the ATFM implementation project, using as guidance material the information shown in **Appendix A** to this part of the report.

# APPENDIX A

## MINIMUM REQUIREMENTS FOR THE PREPARATION OF A COST-BENEFIT ANALYSIS

**What is a cost-benefit analysis?**

1.1 The cost-benefit analysis is the process to place numbers in a reference currency in the different costs and benefits of an activity. When using it, we may calculate the financial impact of what we wish to achieve.

1.2 It should be used when comparing costs and benefits of the different decisions. A cost-benefit analysis by itself may not be a clear guide for making a good decision. There are other items to be taken into account; for example, the workload of ATCOs, safety oversight, legal obligations, environment protection, savings produced in users' operations, etc.

1.3 Cost-benefit analysis involves 6 basic steps:

a) Gather data from important factors related with each one of the decisions. This may be accomplised in brainstroming sessions.

b) Determine costs related with each factor. Some costs, such as labour will be accurate while others will be estimated.

c) Add total costs for each proposed decision.

d) Determine benefits in a reference currency for each deicsion.

e) Place the amounts of costs and total benefits in a relationship where benefits are the numerator and costs are the denomintor:

$$\frac{\text{BENEFITS}}{\text{COSTS}}$$

f) Compare the relationship for the different proposed decisions. The best solution, in financial terms, is that with the highest relationship between benefits to costs.

## INFORMATION REQUIRED FOR THE EVALUATION OF AN ATFM IMPLEMENTATION PROJECT

Following is an example of some criteria and elements that ANSPs and users would be required to contribute with the information that is required in attention to Task 1.13 – Provide information for the cost-benefit analysis" of the Action Plan for ATFM implementation in the CAR/SAM Regions.

### I. By the service providers

### 1. Situation with and without project (Impact)

a) Current situation.
b) Situation if ATFM were implemented.

### 2. Techcnical-operational aspects

a) Quantification of the demand in time. Historical data and forecasts.
b) Execution phases of the project and time required for each phase (study, coordination, quotation of equipment, obtaining of resources, acquisition, arrangements in hiring of personnel, training, acquisition/offices space, installation, operation, trials).
c) Time required for the system operation.
d) Requirements of the system in the short, mid and long terms.

### 3. Investment

a) Value of equipment acquired, with breakdowns for each system component.
b) Useful life cycle of each component
c) Value of intangible assets of the project (software, data entry information to feed the system), feasibility studies, technical-operational training, trials.
d) Physical value of infrastructure (if available)
e) Other investments: computers, printers, photocopying machine, office furniture, fax, etc.

### 4. Annual expenses

a) Professional, technical and administrative and security personnel required.

    i) Provision required per specialization in function of the operational hours of the system (H-24, H-12), upon requirement or other, such as administrative schedules.

b) Operational expenses

i) acquisition of services, communications service, security, cleaning, etc.
ii) renting of offices and other facilities.
iii) Maintenance
iv) General services (in case the current provision is not sufficient):

- water
- energy supply
- cleaning
- telephone/fax

c) Supplies:

- desk supplies
- paper, etc.

## II. By the users

### 1. Situation with and without project (impact)

a) Current situation
b) Situation if ATFM were implemented

### 2. Technical operational aspects

a) Assess the time demand. Historical data and forecasts.

### 3. Investment

a) Costs

i) Avionics equipment
ii) Supplies
iii) Planning
iv) Maintenance
v) Training
vi) Services acquisition

b) Benefits foreseen with ATFM

i) economy during flight hours
ii) expenses avoided
iii) others.

## MINIMUM REQUIREMENTS FOR THE PREPARATION OF A COST-BENEFIT ANALYSIS

Following is an example of some of the criteria and elements that selected airports could require from selected airports to contribute with the information that shall be required in attention to *Task 1.13– Provide information for the cost-benefit analysis" of the Action Plan for ATFM implementation in the CAR/SAM Regions,* which the ATFM implementation groups shall execute.

| Criterion | Elements |
|---|---|
| Non-regular traffic volume | Traffic arriving and departing |
| | Large amount of non-scheduled traffic (e.g. General Aviation) |
| Non-homogenous traffic mix | Integrated operations among heavy, medium and light aircraft |
| | Mixture of fast and slow aircraft |
| | Mixture of commercial and other traffic (e.g. training or General Aviation) |
| | Mixture of civil and military traffic |
| Delay situation unsatisfactory | Delays are higher than agreed with airlines as acceptable |
| | Delays are too high to achieve desired minimum connecting times |
| | Total delays per day and per month due to traffic congestion |
| Complex layout | Intersecting runways |
| | Converging runways |
| | Runways parallel but cannot be used independently of each other |
| | Aircraft need to cross active runway when taxiing |
| | Design permitting possible incursions in runway/taxiway. |
| | Complex deicing situation at airport (if applicable) |
| Airspace factors | Airspace surrounding airport limited, fragmented or used by neighboring airports |
| | SIDs and STARs over centres of population |
| Scope for efficiency improvement | Results achieved not sufficient relative to human resources employed |
| | Results achieved not sufficient relative to financial resources employed |
| Latent arrival capacity | Arrival demand is unsatisfied. Declared to attend arrivals capacity is sustained capacity less than existing daily normal capacity.? |
| Latent departure capacity | Departure demand is unsatisfied. Declared departure capacity to attend departures is less than existing daily normal capacity.? |
| High traffic volume | Every co-ordinated airport could be expected to have high traffic volume at least during peak periods of the day |
| | Estimate of traffic volume during peak hours of the day |

| | |
|---|---|
| Frequent low visibility conditions | Estimate number of days with low visibility |
| Technical improvements still to be implemented | Landing aids are not up to date |
| | Surveillance facilities are not up to date |
| | RNAV departures and arrivals have not been implemented |
| | Other facilities such as lighting, signs, etc. are not up to date and complete |
| Scope for improving work environment | ATCO working position does not have an optimised intelligent / ergonomic point of view, data presentation |
| | Tower to ground control and arrival/departure sector visibility has not been optimised (also from an ergonomic point of view) |
| | Social/contractual environment can be improved |
| Scope for optimising procedures | A strategic removal of conflicts between arrival and departure routes or sectors has not been implemented |
| | Reduced runway separation has not been implemented |
| | No adequate procedures to accelerate operations are used of aircraft in runway, keeping safety |
| | Conditional clearances have not been implemented |
| | Landing clearance is not based on adequate procedures to accelerate operations |
| | Non optimized runway occupancy time |
| | Visual turns are not carried out |
| Critical environmental sustainability issues | Airport in close proximity to residential areas |
| | Environmental regulations or constraints apply |
| | Major airport development envisaged |

**Agenda Item 5: Review of ATFM/TF Terms of Reference and Work Programme**

5.1 The meeting recalled that GREPECAS/12 approved the Terms of Reference and Work Programme of the ATFM Task Force (ATFM/TF) as proposed by the ATM/CNS Subgroup ATM Committee. During the Fourth Meeting of the ATM Committee, issues related with ATFM were dealt with and some agreements were reached regarding ATFM implementation in the CAR/SAM Regions The Meeting reviewed the different aspects that have a direct relationship with the implementation and then modified terms of reference and work programme of the task force. In this connection, the meeting examined the terms of reference and work programme and took note of the agreement reached during the revision of Agenda Item 3, ATFM Data Bases. As a result, it is requested to include a task and create a work group to examine it.

5.2 In this connection, and when discussing this agenda item, the European experience was presented with regard to the centralized management of flight plans through IPFS and how the system had enabled the Europeans to substantially improve the management of this data. In view of the above, the meeting deemed it pertinent that this matter be incorporated in the Task Force work programme and requested that this matter be reviewed by the GREPECAS AIS Subgroup.

**ATFM performance objectives for the CAR/SAM Regions related with the ICAO Global Plan Initiatives (GPI)**

5.3 The meeting took note of the GPI related to the newly revised Global Plan by the Air Navigation Commission on the basis of a roadmap to make use of available capabilities and ATM infrastructure and technology.

5.4 It was informed that all future work of the Regional Planning and Implementation Groups (PIRGs) should be justified and based on clearly-established performance objectives that support the ICAO Strategic Objectives. It was also informed that all the terms of reference of the PIRGs, including GREPECAS, are being reviewed to ensure that economic and human resources will be channelled in the most appropriate manner and that all the work, including that of the Secretariat, will support the business plan. The methods used to report on PIRG work to the Commission and to the Council will also be reviewed to make sure that progress is measured against deadlines and that performance objectives are met.

5.5 As a follow-up to the aforementioned, and considering that ATFM tasks are required to be amended in the CAR/SAM Regions, it agreed to adopt a performance-based approach to its work programme and to take steps to make sure that its work supports planning processes, ICAO Council directives, and ALLPIRG conclusions. Considering the need to continue harmonising ATM work in the CAR and SAM Regions, the meeting adopted the following:

**Decision ATFM/TF/2/04** **Update of ATFM Tasks According to ICAO Strategic Performance Objectives**

That, in order to support the evolution from a system-based approach to a performance-based approach, the ICAO Secretariat, in coordination with the Task Force members, draft and implement work programmes to support the ATFM performance objective, as shown in **Appendix A** to this part of the report, for the planning of future ATFM tasks of the CAR/SAM Regions, and be presented in the forthcoming meeting of the ATM Committee.

5.6 The terms of reference and work programme agreed upon, as well as the status of compliance of the corresponding tasks, are shown in **Appendix B** to this part of the report.

# APPENDIX A

## ATFM PERFORMANCE OBJECTIVE FOR THE CAR AND SAM REGIONS

**Improve demand and capacity balancing**

***Benefits***

The benefits of this performance objective are:

- reduction in weather- and traffic-induced holding, leading to reduced fuel consumption and emissions;
- improved and smoother traffic flows;
- improved predictability;
- improved management of excess demand of service in ATC sectors and aerodromes;
- improved operational efficiency;
- enhanced airport capacity;
- enhanced airspace capacity; and
- improved safety management.

***Strategy***

***Near term (2008)***

- identify key stakeholders (ATC service providers and users, military authorities, airport authorities, aircraft operators and relevant international organisations) for purposes of coordination and cooperation, using a CDM process;
- identify and analyse traffic flow problems and develop methods for improving efficiencies on gradual basis, as needed, through enhancements in current:
    - airspace organization and management (AOM) and airway structure (unidirectional routes),
    - communication, navigation and surveillance systems,
    - aerodrome capacity,
    - ATS capacity, and
    - ATS letters of agreement;
- define common elements of situational awareness between FMUs;
    - common traffic displays,
    - common weather displays (Internet),
    - communications (teleconferences, web), and
    - daily teleconference/messages methodology advisories
- develop methods to establish demand/capacity forecasting
- develop a regional strategy and work programme for harmonized implementation of ATFM service ; and
- monitor implementation progress.

***Strategy***

***Medium term (2010)***

- develop a regional strategy for the implementation of flexible use of airspace (FUA)
- define common electronic information and minimum databases required for decision support and alerting systems for interoperable situational awareness between Centralized ATFM units
- develop regional procedures for efficient and optimum use of aerodrome and runway capacity
- develop a regional ATFM procedural manual to manage demand/capacity balancing;
- develop a regional strategy and framework for the implementation of Centralized ATFM unit.
- develop operational agreements between Centralized ATFM units for interregional demand/capacity balancing; and,
- monitor implementation progress.

***GPIs***

The above is supported by GPI/1: flexible use of airspace; GPI/6: air traffic flow management; GPI/7: dynamic and flexible ATS route management; GPI/9: Situational awareness; GPI/13: aerodrome design and management; GPI/14: runway operations; and GPI/16: decision support and alerting systems.

**Global plan initiatives and their relationships to the major groupings**

| G P I | | En-route | Terminal Area | Aerodrome | Supporting Infrastructure |
|---|---|---|---|---|---|
| GPI-1 | Flexible use of airspace | X | X | | |
| GPI-2 | Reduced vertical separation minima | X | | | |
| GPI-3 | Harmonize level systems | X | | | |
| GPI-4 | Align upper airspace classifications | X | | | |
| GPI-5 | Area Navigation (RNAV) and Required Navigation Performance (RNP) | X | X | X | |
| GPI-6 | Air traffic flow management | X | X | X | |
| GPI-7 | Dynamic and flexible ATS route management | X | X | | |
| GPI-8 | Collaborative airspace design and management | X | X | | |
| GPI-9 | Situational awareness | X | X | X | X |
| GPI-10 | Terminal area design and management | | X | | |
| GPI-11 | RNP and RNAV SIDs and STARs | | X | | |
| GPI-12 | FMS-based arrival procedures | | X | | X |
| GPI-13 | Aerodrome design and management | | | X | |
| GPI-14 | Runway operations | | | X | |
| GPI-15 | Match IMC and VMC operating capacity | | X | X | X |
| GPI-16 | Decision support systems | X | X | X | X |
| GPI-17 | Implementation of data link applications | X | X | X | X |
| GPI-18 | Electronic information services | X | X | X | X |
| GPI-19 | Meteorological systems | X | X | X | X |
| GPI-20 | WGS-84 | X | X | X | X |
| GPI-21 | Navigation systems | X | X | X | X |
| GPI-22 | Communication network infrastructure | X | X | X | X |
| GPI-23 | Aeronautical spectrum | X | X | X | X |

**(GPI-6) AIR TRAFFIC FLOW MANAGEMENT**

**Scope:** The implementation of strategic, tactical and pre-tactical measures aimed at organizing and handling traffic flows in such a way that the totality of the traffic handled at any given time or in any given airspace or aerodrome is compatible with the capacity of the ATM system.

**Related ATM objectives:** Centralized ATFM; Inter-regional cooperative ATFM; Establishment of ATFM databases; Application of ATFM strategic planning; Application of pre-tactical ATFM planning; Application of tactical ATFM planning

**Description of strategy**

1.35 The implementation of demand/capacity measures, commonly known as air traffic flow management (ATFM), implemented on a regional basis where needed, will enhance airspace capacity and improve operating efficiency.

1.36 In the event that traffic demand regularly exceeds capacity, resulting in continuing and frequent traffic delays, or when it becomes apparent that forecast traffic demand will exceed the available capacity, the appropriate ATM units, in consultation with aircraft operators, should consider implementing steps aimed at improving the use of the existing system capacity, and developing plans to increase capacity to meet the actual or forecast demand. Any such planning to increase capacity should be undertaken in a structured and collaborative manner.

1.37 States and regions should evolve to a collaborative based approach to capacity management. The ATM Operational Concept envisages a more strategic approach to ATM overall, and through collaborative decision-making, a reduction in the reliance on tactical flow management. It is inevitable that tactical flow intervention will continue to be required; however closer coordination between airspace users and ATM service providers can reduce the need for routine tactical intervention which is often disruptive to aircraft operations.

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# APPENDIX B

## TERMS OF REFERENCE AND WORK PROGRAMME OF THE ATFM TASK FORCE

**ATM-ATFM/400: To develop an Air Traffic Flow Management (ATFM) system with a view to its future implementation in the CAR/SAM Regions.**

### 1. Terms of reference

Carry out specific studies in order to determine and elaborate guidance material on an Air Traffic Flow Management (ATFM) system to ensure an optimum air traffic flow in the CAR/SAM Regions.

### 2. Work Programme

a) Review the documentation on air traffic flow management and the policies globally established;
b) Review the ATFM regional plans of other regions;
c) Review the existing ATFM national plans;
d) In coordination with the GREPECAS Task Force on Institutional Aspects consider, in the development of all its activities the institutional aspects involved in a multinational environment;
e) Review the ATFM technical and operational aspects;
f) Identify the minimum requirements to implement ATFM;
g) Define the principles in which the CAR/SAM ATFM service will be based;
h) Evaluate different alternatives and strategies that may satisfy the future air traffic flow management in the CAR/SAM Regions;
i) Prepare the necessary ATFM documentation for the CAR/SAM Regions;
j) Harmonize the ATFM implementation plans among the CAR and SAM Regions as well as with other ICAO Regions; and
k) Present not later than ATM/6 Committee the documentation for their approval.

### 3. Composition

Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, El Salvador, Haiti, Jamaica, Mexico, Panama, Paraguay, Peru, Trinidad and Tobago, United States, Uruguay, Venezuela, COCESNA, IATA and IFALPA.

Rapporteur: Mr. Joe Hof

### 4. Task termination date

ATMC/6 Meeting

## ATFM/TF TASKS AND STATUS OF COMPLIANCE

| Task | Status | Remarks |
|---|---|---|
| Examine the documentation on air traffic management and the policies established at the global level. | Completed | |
| Examine the ATFM regional plans of other regions | Completed | |
| Examine existing national plans on ATFM | Ongoing | A forum was created to include experiences of States and International Organizations |
| In coordination with the GREPECAS Institutional Aspects task force, consider in the development of all its activities institutional aspects involved in a multinational environment | Ongoing | |
| Examine ATFM technical and operational aspects | Ongoing | |
| Identify minimum requirements to implement ATFM | Completed | Approved by GREPECAS |
| Define the principles on which CAR/SAM ATFM service will be based. | Completed | Approved by GREPECAS |
| Assess different alternatives and strategies which might satisfy the future air traffic flow management in the CAR/SAM Regions. | Completed | Approved by GREPECAS |
| Prepare the necessary ATFM documentation for the CAR/SAM Regions | Ongoing | |
| Harmonize ATFM implementation plans between CAR and SAM Regions, as well as with other ICAO Regions. | Ongoing | |
| Present not later than ATM/6 Committee, the documentation prepared for its approval. | | |

## Agenda Item 6: Other matters

### Forthcoming ATM Committee ATFM Task Force Meeting

6.1 In the light of the numerous tasks to be carried out, the meeting considered appropriate to carry out a new Task Force meeting during the first half of 2007. In this connection, Colombia proposed to carry out such meeting in San Andres Island. The meeting received this proposal with appreciation and highlighted the disposition of Colombia to continue collaborating with the CAR/SAM Regions and requested the ICAO Secretariat to make the corresponding arrangements, in order to define a date for the meeting.