



CONFERENCE ON THE ECONOMICS OF AIRPORTS AND AIR NAVIGATION SERVICES

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Agenda Item 3: Specific issues related to air navigation services economics and management
Agenda Item 3.3: Cost allocation and charging systems

METHODOLOGICAL GUIDE FOR ESTIMATING AIRPORT AND AIR NAVIGATION SERVICE COSTS

(Presented by member States² of the Latin American Civil Aviation Commission
(LACAC))

SUMMARY

Since 1998, the Latin American Civil Aviation Commission has been working on the economic management of airports in strict coordination with airport operators, airlines, and regulatory bodies, and, as a result of that, has developed a methodology to estimate the cost of airport and air navigation service rates and charges. This document is submitted to the consideration of the Conference for its implementation by ICAO member States.

Action by the Conference is in paragraph 6.

1. INTRODUCTION

1.1 LACAC has urged member States to use a methodology for setting rates and charges that follows ICAO guidelines and takes into account the Council statements to contracting States on airport and air navigation services charges, the Airport Economics Manual and the Manual on Economics of En Route Air Navigation Services.

1.2 During GEPEJTA/9, held in Asunción, Paraguay, in March 2002, the experts analysed the methodology applied by concessionaires for collecting airport rates and charges in member States, and deemed it necessary to establish a standard methodology for the Region that would allow Administrations to work more decisively on the establishment of airport costs, taking into account the new civil aviation stakeholders and the different realities of member States.

¹ Spanish version provided by LACAC.

² Argentina, Aruba, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

1.3 A group was created to fulfil the task “Methodological guide for estimating the cost of airport and air navigation services in the region”, made up by Chile, Brazil, Colombia, OSITRAN, *Aeropuertos Argentina 2000* and AITAL/IATA. The group completed its work with a document that was examined by the LACAC Executive Committee at its LXII meeting in Lima, Peru. It was felt that this document had to be published through a Resolution of the LACAC Assembly, which, at its XV meeting (November 2002) urged member States to take into consideration the methodological guide for estimating the cost of airport services in the region.

2. APPLICABILITY OF THE METHODOLOGICAL GUIDE FOR ESTIMATING THE COST OF AIRPORT AND AIR NAVIGATION SERVICES IN THE REGION

2.1 There is no doubt that the guide approved by the XV Assembly of LACAC is strongly supported by the methodological procedures used in the conceptual definition. The concepts defined in the guide and the cost allocation processes are permanent and unquestionable.

2.2 The proposed guide defines a process for allocating resources--and therefore costs--to the different services that are provided, through the various instances that participate in the operation of the organisations.

3. MAIN OBJECTIVES OF THE COST SYSTEM PROPOSED IN THE METHODOLOGICAL GUIDE

3.1 To know the operating cost of the various units in the organisation, whether operational, technical, or administrative in nature.

3.2 To determine direct, indirect, and total costs of the main services provided by the organisation.

4. ICAO RECOMMENDATIONS REGARDING COST SYSTEMS AND AIR NAVIGATION SERVICES

4.1 To develop and maintain cost systems that will allow users and providers to understand the actual cost of the service provided, as well as a transparent cost-recovery system that is fair and equitable for all users.

4.2 The Council recommends that en-route air navigation service charges should, inasmuch as possible, be contained in a single charge per flight; that is, there should be a single charge for all en-route air navigation services provided by a State or group of States in the airspace to which the charges are applied. These should be based on:

- a) the distance flown within a defined area; and
- b) the weight of the aircraft.

4.3 When the distances flown or aircraft types are notably homogeneous, the distance and weight factors can be done without, be it separately or together, as applicable.

4.4 Under some circumstances, it may be appropriate to use a combination of uniform charges per flight and charges based on the parameters recommended above, in order to acknowledge the existence of a fixed cost element in the provision of air transport services.

5. RECOMMENDATION TO STATES

5.1 The allocation of costs to air traffic control services has been based on the division of services into categories: aerodrome control, approach control, and area control. The division of services into categories based on airspace sections and flight phase will depend on the characteristics of a given airspace, defining the most appropriate method for each, taking into account costs based on a transparent and fair cost system.

5.2 The **attached** document contains Resolution A15-13 on a “*Methodological Guide for estimating the cost of airport and air navigation services in the region*”.

6. ACTION BY THE CONFERENCE

6.1 The Conference is invited to:

- a) take note of this working paper and of LACAC Resolution A15-13 **attached** hereto;
- b) make the comments it may deem appropriate; and
- c) urge the States to apply Resolution A15-13.

ATTACHMENT

RESOLUTION A15-13

**METHODOLOGICAL GUIDE FOR ESTIMATING THE COSTS OF AIRPORT AND AIR
NAVIGATION SERVICES IN THE REGION**

WHEREAS one of the functions of the Latin American Civil Aviation Commission (LACAC) is to foster and support co-ordination and co-operation among the States in the Region for the orderly development and best possible use of air transportation within, to and from Latin America;

WHEREAS LACAC, in accordance with its bylaws, is authorised to perform economic studies of air transport in the region;

WHEREAS the airport privatisation and/or concession processes in the Latin American States have affected the costs of airport and air navigation services;

WHEREAS the aviation industry plays an important role in the world economic activity;

WHEREAS communications and information technology have made globalisation possible, and the latter been possible thanks to the presence of aviation worldwide;

WHEREAS the aeronautical industry is facing situations stemming from the new world dynamics, deregulation and liberalisation, as reflected in alliances, mergers, consolidations and increased competition over prices and tariffs;

WHEREAS aeronautical authorities, which are responsible for safeguarding aviation safety and which are subject to budgetary restrictions imposed by States that have social spending priorities, also have serious problems in being able to support the growth in demand in the sector;

WHEREAS there is a need for aeronautical authorities, airlines and airport terminal administrators to act as co-operating partners in seeking solutions to the problems of the sector;

WHEREAS both ICAO Document 9562 “Airport Economics Manual”, and Document 9161/3 “Manual on Air Navigation Services Economics” set down guidelines for estimating aeronautical service fees and charges;

WHEREAS the aforementioned ICAO documents and guidelines recommend basing the value of aeronautical service fees and charges on a cost methodology and the reinvestment of their proceeds in aeronautical activities;

WHEREAS the costs of airport and air navigation services in the region should be established with absolute transparency for the information of all interested parties.

THE XV ASSEMBLY OF LACAC

RESOLVES to urge member States to take into account the following methodological guide for estimating the costs of airport services in the region:

METHODOLOGICAL GUIDE FOR ESTIMATING THE COSTS OF AIRPORT AND AIR NAVIGATION SERVICES IN THE REGION

1. BASES FOR A SOUND FINANCING SYSTEM

A long-lasting financing system is that which permits all of the actors in a sector—that is, the airlines—to cover their costs and to earn reasonable profits to maintain the investment. The same thing happens with airport concession holders, which must build, invest and maintain a good level of service at passenger terminals, inasmuch as the latter should receive appropriate facilities in return for the tariffs they pay.

The State or aeronautical entity must recover the cost of providing efficient services, and this will permit it to guarantee a good service to passengers and concession holders, offering them to participate in reasonably profitable businesses.

Contracts between the State and private entities that operate airport services should be submitted to competitive bidding, in which the required conditions, formulas for evaluation and criteria used are established and communicated to all parties with complete transparency.

Both the bidding procedure and the awarding of the final contract should be clearly defined. Furthermore, the State should reserve the right to take the necessary measures to follow up and exert the operational control of the concession.

Mechanisms must be established to prevent privatisations from generating excessive increases in charges and fees for airport services.

2. INCOME

Under the self-financing policy, the operator of the airport and air navigation services infrastructure should charge for the services it provides to its users. The rationale is that each user should cover the cost of the service it uses. These charges should be made in accordance with the following concepts:

- a) Aeronautical fees: These refer to the sum charged for air navigation services, airport services (landing, lighting, parking, etc.), aeronautical meteorological services, and others.
- b) Aeronautical charges: These refer mainly to the amount charged to passengers in exchange for the facilities that the organisation provides them with at air terminals.
- c) Concessions: This charge is for the rental of spaces at airport terminals and of infrastructure belonging to the organisation, which it turned over to operators, as in the case of hangars, land and other elements.

Chapter 1

3. PROPOSAL OF A SYSTEM OF AERONAUTICAL COSTS

A system of aeronautical costs is proposed below, whose purpose is to define the general criteria to be used to structure this cost system and to analyse the necessary data to carry out the costing process:

3.1 System objectives

It is possible to determine different types of costs, depending on the purpose of said information. Inasmuch as the organisation needs that information to support its management activity and as a strong foundation on which to rest a system of aeronautical tariffs that are representative of costs and that, at the same time, permits the organisation to be self-financing, this costing system should make it possible:

- a) To know the operating costs of the different units of the organisation, whether operational, technical or administrative.
- b) To determine the direct, indirect and total costs of the main services provided by the organisation.

3.2 Basic concepts

- a) Cost: Cost is understood to be the value of the goods sacrificed and of the production resources used in the process to obtain future benefits, goods or services. For purposes of economic and financial data management, cost is measured in monetary units. Under this approach, the value of all goods and resources used to produce or provide the organisation's services is considered an integral part of the cost.
- b) Cost objective: The element comprised of any activity or set of activities, whose separate costs must be known -*e.g.*, services, products, processes, departments, projects and, in general, any defined unit of the organisational structure.
- c) Real cost: The costs effectively incurred during a given period to provide a service, manufacture a product or execute a process.
- d) Mean cost: The total cost incurred to provide a service or operate a unit, divided by the level of activity over the period or by a unit of time.
- e) Direct cost: Those costs that can be easily associated or identified with a given cost objective.
- f) Indirect cost: Those costs that, because they are not easily identifiable with a given cost objective, must be distributed among the different objectives that share the use of the respective resources.
- g) Total cost: It is the sum of the direct and indirect costs and, therefore, considers all of the resources sacrificed to obtain the good or service.
- h) Predetermined costs: These are estimated costs, based on the evolution of real costs and the level of activity budgeted, generally estimated for an accounting period.
- i) Operational unit: This is the unit of the organisation that is responsible for providing the final service to the user.

- j) Technical support unit: This is the unit that, while not providing the final service to the user, provides some service within the organisation, and its cost must be distributed among the units it supports.
- k) Administrative unit: The organisation that shares the responsibility for co-ordinating and administering the efforts of the operational and support units.

3.3 Proposed criteria

3.3.1 Cost items

A cost system, in the first place, measures by collecting the corresponding information organised by item, normally according to their nature, and subsequently allocates or distributes the costs among the different cost objectives.

The cost system structure presented involves four major cost items, which account for all of the resources used to produce the services:

- a) Human resources: These should reflect the total cost of providing the necessary and appropriate personnel to the organisation for obtaining the services. This item must consider all remunerations paid to the personnel of the organisation. It should also include the cost of training and advanced training needed by officials to fulfil their professional duties efficiently. Also to be included as part of the human resource cost are the direct or indirect benefits enjoyed by officials, such as expenses in preventive and curative care, social welfare, productivity bonds and others which, while not part of their fixed pay, are part of the conditions inherent to the labour market and legislative situation to which the organisation is subject.
- b) Infrastructure, facilities, equipment and assets: These should consider the value to the organisation of their wear and tear from being used to provide services. This item should cover the full depreciation cost of terminals, runways, constructions in general, navigation aid systems, communication systems, data processing systems, vehicles, facilities and movable property in general, whose duration is longer than one accounting period. This cost represents the replacement value of those goods and, as a result, the depreciation estimate should correspond to the useful life of the goods.
- c) Inputs: This includes the cost of the consumer elements needed for the operation of all units. This item reflects all consumer elements needed for the operation, from spare parts for sophisticated equipment, to the paper used in the offices. Only the cost of the elements consumed should be recorded, and not the cost of the inputs acquired, for occasionally supplies are purchased to cover the needs of more than one accounting period. Furthermore, materials can be consumed that were purchased during previous periods.
- d) Operating expenses: These should include all spending on items that are not inputs, such as outsourced services, energy, communications, transport, project assessment, financial expenses; in general, all expenditures that are not for personnel, inputs or actual investment.

3.3.2 Investments

The primary objective of the organisation should always be to provide the necessary safety and support for air operations and, to that end, investments should be made in new technological solutions.

The purpose of the depreciation value considered in the cost system is to recover the capacity of the infrastructure, equipment and facilities lost during service provision. Nevertheless, meeting demand increases and covering the cost of implementing new technologies go far beyond the depreciation cost estimated by the system.

Therefore, the cost of developing new capacities--which means actual investment for the organisation--should be provided for. Basically three investment channels can be distinguished, depending upon State policies that respond to different realities, to wit, the State, the organisation responsible for providing the services itself, and private enterprise.

- a) The organisation itself: In this case, the service provider organisation should include, by estimating predetermined costs, the cost of a development programme, whether for airport infrastructure or for the technological development of new capabilities.
- b) Private enterprise: Confronted by a situation of growing investment needs, scarce financial resources and high social opportunity costs, States must implement airport concession programmes. These consist of the participation of the private sector in the building and/or expansion of passenger and cargo terminals and operation of aeronautical and non-aeronautical services that may be defined at each airport. In this case, it is the private party that provides the services and then charges for and collects the passenger facilitation rate for the services it renders. This implies that it will be the responsibility of the private party to determine the value to be charged to passengers for the use of the building, based on some financial criterion, despite the existence of a regulatory framework to control this situation, agreed upon beforehand with the aeronautical authority and the State. In this way, the service that is paid for through the “embarkation charge” ceases to be a service that the organisation provides and, furthermore, is no longer a financial cost for it. The same thing will happen in the case of the privatisation of other services that are provided within the airports, such as boarding bridges, embarkation vehicles, air cargo and other concessions, whether aeronautical or non-aeronautical.
- c) The State: In smaller airports, which, because of their traffic levels, are not attractive to the private sector, the State must participate through the investment. The organisation, to the extent that this larger cost is transferred to it, should consider it among its costs.

3.3.3 Requirements for implementing a cost system

The following basic requirements should be considered for the implementation of an aeronautical cost system:

- a) Existing organisational structure: In order for the cost information to be useful, the organisation must have an organisational structure that allows for a clear assignment of responsibilities and the spheres of action of each of them. The objective here is to associate expenses and income with organisational units, insofar as possible; the latter should be used as cost accumulation units for purposes of the cost system.

- b) Appropriate system for collecting basic data: It will be necessary to consider the quality of the information to be issued, the processes needed for producing it, the controls and validation processes to be used. Likewise, the multiplicity of independent processing or reprocessing must be minimised by using centralised information that is accessible by all of the units that interact with the system. The information recording processes must be reliable and should permit the implementation of appropriate communications with the cost system, which uses information from different sources and systems.
- c) Information of representative quality: The data fed to the cost system should faithfully represent the normal behaviour of the organisation in providing services; in other words, possible disturbances that, due to a particular situation, could have a significant effect on the costs or amount of services provided should be corrected, and the system provided with the information that would correspond to its normal operation.
- d) Defined production or process functions: Among the variables to be considered in designing a cost system, it will be necessary to identify the processes in each unit of the organisation that is related to the provision of the services. Non-operational units provide services that are intended to satisfy internal customers. For purposes of the cost system, interactions with the operational units will be considered. The operational units carry out the necessary activities to provide services to external customers of the organisation. In order to conduct assignment processes that duly reflects the effort devoted to providing each service, it will be necessary to determine very precisely the resources used to render each of them, whether financial, human or others.
- e) Defined services and associated levels of activity: On implementing a cost system, it will be necessary to have a clear definition of the services provided by the organisation. Information about the resources used per unit and the income it may earn is of little value unless it can be compared with information about the level of activity of the services rendered by that unit. The efficient use of fixed costs will translate in a reduction of the unit costs, as the volume of services provided increases.

3.3.4 Cost methodology

The cost system to be implemented should provide cost information at the level of internal units of the organisation and of the final services it provides.

Cost information per unit uses the existing organisational structure to accumulate within each of the defined units the resources used to provide the services, whether to other components of the organisation or to external customers.

The distribution of costs incurred by the support and administrative units to the operational area of the organisation constitutes the first stage of the cost assignment process. This distribution process should consider a sole distribution base that is representative of the effort and use of resources provided to each operational unit to which the costs are being distributed.

The following stage of the process should consist of the assignment of the costs of the operational units to the services. Each of the units has already absorbed all of the costs of the support and administrative units. Because of its importance, this distribution stage requires a very exact identification of the assignment bases, which will then be used to allocate all of the accumulated costs to the different services provided. It will be necessary, for this purpose, to make a thorough

analysis of the activities carried out within each operational unit.

The basis for assignment is the list of resources employed in the unit and in providing each of the services it renders using those resources

Finally, the mean and marginal cost information is determined by using the data at the activity level for the different services provided.

3.3.5 Tariff-setting principles

Tariff setting should adhere to the following general principles:

- a) It should be equitable and non-discriminatory; that is, the same value should be charged to all users for the same service.
- b) It should represent mean costs, in the degree to which the organisations that provide the services are not profit-oriented, but have self-financing objectives.
- c) The airport network should be self-financing through its charges to users, including the cost of providing infrastructure.
- d) The air navigation aid and air traffic control systems should be self-financing through the corresponding charges to users.
- e) It should work to eliminate crossed subsidies and exemptions.
- f) Its structure should be as simple as possible.

4. METHODOLOGY FOR COLLECTING INFORMATION ON INCOME AND EXPENSES OF A STATE

4.1 Identification of the State (Example)

Number of airports and aerodromes	90
Size of the airspace	26.8 million km ²
Radio aids	125
Radars	14 (6 miles)
Total passengers	4,479,867
Total cargo	304,077,000 Kg
Total operations	142,432
Commercial operations	137,475
Cargo operations	4,957
Personnel involved	3,200

4.2 Methodological proposal for cost analysis

4.2.1 Objective

To measure the flow of income and expenses of the aeronautical system of each country, in order to determine the values of costs and their appropriate application in the tariffs charged to users, measured in standard service levels.

4.2.2 Background

Appropriate application is understood to mean that the charges for services provided correspond to concurrent costs (whether direct or indirect, fixed or variable).

Aeronautical system is considered to be the set of facilities and services that are provided by different entities for the operation of the entire aeronautical industry.

4.2.3 Methodology

The proposed methodology is contained in two areas:

- a) Size of the sphere of action of the aeronautical system: Corresponds to the information that makes it possible to size the resources assigned based on the size of the tasks entrusted. In this connection, it is necessary to know the following:
 - Number of airports and their category.
 - Size of the airspace to be controlled.
 - Number and type of radio navigation aids.
 - Passengers, air operations and tonnes of cargo transported over the last three years.
 - Characteristics and size of general aviation.
 - Number of persons involved.
- b) Economic result: This means identifying the income and costs (understood in its broad sense, encompassing expenditures, expenses and any paid cash flow) of the various entities that operate in the sector, in order to identify the possible diversion outside the aeronautical sector of the income received or the incorporation of elements that are not concurrent and do not represent services provided.

The proposed identification for the income is as follows:

- Services: In this column, all aeronautical and non-aeronautical services offered at the airports of the country should be identified.
- Purpose of the collection: That which encompasses the service in terms of charges, fees, concessions, fuel, etc.; that is, the legal name of the collection.
- Amount collected: This is the income received for each collection purpose over a one-year period.

- Service payer: This is the party that must pay for said service.
- Collecting agency: This is the party that receives the money from the payment for the said service.

The proposed identification for costs and investment is as follows:

- Purpose of the cost: Item or type of expense that originates the cost. It is the monetary value used to produce the services.
- Payer of the cost or expense: Provider of the service, the maintainer and others that make the disbursements to pay for the services.
- Amount: Value incurred in dollars over the year.

5. PROPOSED SUBJECTS OF STUDY FOR TARIFF COLLECTION

In order to make the tariff setting system transparent, it must be based on costs. Therefore, the first step will be to determine the values of the resources that are used to provide a service that will generate the costs. Subsequently, there must be a system to convert those costs into tariffs:

5.1 Objective

To provide a tariff-setting system that is transparent, self-adjustable, and that permits the parties that provide the services to recover their full costs and users to pay known, equitable and non-discriminatory values for aeronautical services, and that is unchanging over time

5.2 Principles and criteria

In order to meet the proposed objective, a system must be based on certain elements that guide and shape its development.

5.2.1 Principles

- *Equitable and non-discriminatory tariff*
- Represents the real cost
- Permits self-financing
- Eliminates cross subsidies and exemptions
- Variable tariffs according to the maximum take-off weight (MTW)
- Considers the separation of aeronautical services from commercial airport services
- Considers the private concession system
- Considers only the State investment in the airport network for social returns
- Competitive tariffs
- Technical and transparent adjustability
- Simple tariff system

5.2.2 Criteria

a) Capital:

- *Depreciation due to technological obsolescence: Inasmuch as the investment in equipment for air navigation systems represents a significant part of the total cost, it is more the technological progress than the use of the factor that depreciates the capital. The same applies to most of the facilities needed to ensure the safety of air operations.*
- *Large capacity versus use: Taking into account the previous point, it is a question of increasing the economies of scale in such a way that maximum use is made of the installed capacity, thus reducing the marginal cost of operations.*
- *Cost according to switch on-switch off: Inputs used to keep the system operational increase the operating cost because their operation is not proportional to the flow of aircraft that use them.*
- *Large economies of scale: Considering the differing capacities of the various facilities, an effort should be made to achieve operations that are close to the optimum for each facility.*

b) Maximum take-off weight (MTW):

- *According to the cost of providing the service: There are cost components that are related to the size (MTW) of the aircraft; furthermore, in order to have the capacity to support the operations of aircraft with larger MTWs, facilities require larger investments.*
- *According to the user's income (MTW^d): Larger aircraft mean larger incomes; furthermore, the users' operational costs, in which aeronautical charges are just one more cost, are proportional to their MTWs. That same proportion should be considered to estimate tariffs.*

c) Exemptions:

- *The system should be conducive to eliminating exemptions. Those that cannot be eliminated should be quantified and their real effect on costs determined, while verifying the possible recovery of these subsidies by the State, which is the one that determines these exemptions.*

d) Meteorological and certified services:

- *The tariffs determined for these services will be equivalent to the actual cost of providing them.*

e) Concessions:

- *Market value: This criterion should prevail in the values applied to concessions. It is equitable and non-discriminatory and at the same time ensures an income proportional to the economic value of the good under concession.*

- *Competitive biddings: The greatest transparency is obtained by using this criterion to grant concessions.*
- *Land only.*
- *Transparency: Because what are being granted in concession are goods belonging to the State, this criterion is essential to ensure the proper management of the system.*

5.3 Concept of collection target

5.3.1 Target: This is a specified quantity of resources to be attained, which consider, aside from costs and investments, the level of activity that will allow for operation and the continuity of operations and the provision of services.

5.3.2 Considerations: In order to determine the collection target, the basis for all subsequent estimates is the level of activity. Once the level of activity foreseen for the period under study has been defined, the costs, income and investments associated with that level of activity can be estimated.

All of the factors that bear on the financing of the system in one way or another should also be considered. The following are among the most significant:

- *Analysis of the operations (level and type of activity) for each system airport and aerodrome.*
- *State investment policies, whether in new capacities or in social return projects, and their impact on the system.*
- *The impact the concessions to private parties will have on the income.*
- *The most important sources from the viewpoint of the operating income should also be determined.*
- *The cost of development required by the aeronautical system during the period under study.*
- *The cost of providing the services will be decisive in the calculation of the collection target, inasmuch as the latter should be on a level with the total costs of the system.*

Example:

Item	Accounting cost	Development cost	Total
Route	5,724,988		5,724,988
Approach	10,141,774		10,141,774
Landing	6,799,801		6,799,801
Parking	2,123,429		2,123,429
Passengers	10,543,135	17,200,000	27,743,135
Operation	2,096,090		2,096,090
Total	37,429,217	17,200,000	54,629,217

Comparison of costs and collection, by item:

Item	Cost	Collection	Cost/Collection
En-route service	5,724,988	2,436,891	2.35
Approach and landing	16,941,575	8,195,474	2.07
Parking	2,123,429	587,028	3.62
Passengers	27,743,135	21,104,118	1.31
Concessions and leases	0	3,995,578	0.00
Other services	2,096,090	1,775,919	1.18
Total	54,629,217	38,095,008	1.43

6. PROPOSED TARIFF SYSTEM

Based on the background information presented above, the tariff system is proposed below, which contains a simple and uniform structure for the tariffs of the different services provided to the users, whose generic formula is as follows:

$$\text{CHARGE} = F * K_i * X * \text{MTW}^a$$

The following paragraphs present the modalities for putting this conceptual proposal into practice:

In the above formula, “F” is a constant defined in such a way that allows for the total collection of the cost of providing the different services. In general:

$$F = C / S$$

Where “C” represents the total cost of providing the specified service during a given period of time (normally one year) and “S” represents the corresponding collection units. In general:

$$S = \sum K_i * X * \text{MTW}^a$$

In both the generic formula and in the previous one that defines “S”, the meanings of the parameters are as follows:

K_i = is a variable that represents the different levels or categories of a given service; e.g., in the case of the landing service, the “ K_i ” parameter could vary according to the category of the service provided.

X = is also a variable and represents the quantity or size of the service provided; in the case of the landing service, “ X ” will take the value of “1”. In the case of the parking service, “ X ” will represent a period of time and, in the case of the en-route service, it will indicate the distance for which the service was provided (km, miles).

a = is a constant that reflects the ratio between the MTW and the value of the service provided. Its value will range between “0.35” and “1”.

6.1 Defined services

6.1.1 En-route service

In this case, the cost of providing the service does not differentiate among aircraft with different MTWs; however, the value of the service from the viewpoint of the party receiving it is a function of MTW and grows with it. ICAO recommends adopting a tariff proportional to the square root of MTW, that is, “ $a = 0.5$ ”. Here, it is proposed that the determination of this parameter be based on the operational costs of aircraft, so that the tariff will represent a constant percentage of those costs. This parameter is calculated at 0.35 and is equivalent to approximately the cubic root of the MTW.

In this case, the variable “X” represents the distance covered. This distance should be calculated as the effective distance for which the service has been received.

As for the parameter “Ki”, its value depends on the type of service. In this respect, there are controlled flights that use airways and visual flights. In the case of controlled flights, the parameter is “1” and, for visual flights, it is equivalent to “0”, since no service is provided.

6.1.2 Approach service

For the approach service, the concept used for constant “a” should be the same as in the case of the en-route service, for the reasons already explained.

The variable “X” takes the value of “1”. Three categories are proposed for definition for the variable “Ki”, depending upon the equipment that exists to assist in the approach, with the following values:

Approach:(CT equipment, ILS, lights, others)

Ki = AP1	PRECISION	1.6
Ki = AP2	NON-PRECISION	1.0
Ki = AP3	WITHOUT SERVICE	0.0

6.1.3 Landing service

In this case, it has been estimated that the rate proportional to the MTW is sufficient to recover the costs and for that reason “ $a = 1$ ”.

The quality of the service provided does not depend upon the installed capacity of the system but, rather, on what each size of aircraft requires. Therefore, it is not deemed necessary to establish categories and the “Ki” parameter also takes the value of “1”. Obviously, variable “X” = 1.

6.1.4 Parking service

In this case, there are two factors that contribute to the cost of providing the service: the structural strength and the necessary dimensions, the latter being the more important. In general terms, the area occupied by an aircraft tends to be proportional to the square of its length, while its MTW tends to be proportional to the cube of its length. Thus, the occupied surface is approximately equal to the MTW raised to the two-thirds. However, an analysis of the weight and dimensions of several aircraft revealed that the correct value, whose adoption is proposed, is “ $a = 0.8$ ”.

The variable “X” represents the length of time the aircraft remains in the parking space.

Values were defined for the variable “Ki” in accordance with the location and scarcity of each type of space. The proposed categories and values are:

Parking:

Ki = ES1	Embarkations/cargo	1.0
Ki = ES2	Paved space	0.2
Ki = ES3	Unpaved space	0.0

6.2 Values of parameter “F”

As indicated above, parameter “F” should be defined in such a way that the total cost of providing the services is collected. To accomplish this, it is necessary to have information about the predetermined costs for the period and the corresponding level of activity for the different services provided.

Applying the aforementioned concepts to the information about costs and level of activity would produce the following table: (Example)

$$F = C/S$$

$$S = \sum Ki * X * MTW^a$$

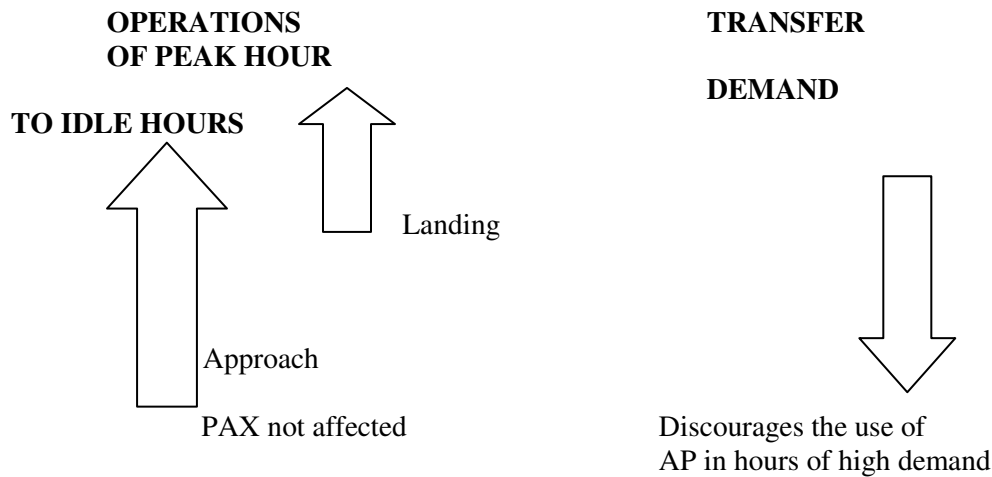
VALUES IN US\$ OF CONSTANT “F”					
Item and unit of measurement	Ki	Collection units	Weighted units	Collection target	Value of “F” (US\$)
En-route services 0.35 Ru (Km*Tn)	1	268,629,124	268,629,124	10,034,100	0.04
Approach			559,916	17,775,335	31.75
Ap-1 (Tn 0.35)	1.6	203,154	325,046		
Ap-2	1	234,870	234,870		
Ap-3	0	2,159	0		
Landing				14,297,212	2.53
At (Tn)	1	5,649,574	5,649,574	11,917,910	
Parking - first hour			1,852,436	3,721,697	
Es-1 (Hour*Tn 0.8)	1	1,184,273	1,184,273	2,379,302	
Es-2	0.2	0	0		
Es-3	0	3,962	0		
Parking - following hours			668,163	1,342,395	2.01
Es-1 (Hour*Tn 0.8)	1	539,136	539,136		
Es-2	0.2	645,137	129,027		
Es-3	0	61,200	0		
Boarding of passengers			7,285,802	48,625,000	6.67
Em-1 (Passengers)	3	1,493,091	4,481,703		
Em-2	1	2,749,093	2,749,093		
Em-3	0.7	78,580	55,006		

6.3 Congestion

Congestion can begin to occur when the flow of operations approaches 50% of the rated runway capacity.

If problems of congestion exist, use of the airport during the hours when this occurs could be discouraged by increasing the approach and landing rates, since both systems require investments. This surcharge should not be applied on a general basis, but should send off effective signals to the operators if runway restrictions exist during certain hours, since this capacity should be used by larger aircraft, which use the runways as much as smaller aircraft that transport less passengers.

A minimum landing and approach rate should be set during the hours of congestion, equivalent to the normal rate for aircraft with a given maximum MTW. Aircraft exceeding this maximum MTW should pay no surcharge. This is consistent with the intention of reserving the runway capacity when it becomes scarce for larger aircraft that carry more passengers. A generalised increase of rates during the hours of congestion would discourage aircraft of different sizes equally, thus failing to attain the proposed efficiency objective.



6.4 Annual operational rate (TOA)

Maintaining the principles of self-financing and of equitable, non-discriminatory rates that are representative of the real cost of providing the services, for the case of small aircraft (MTW < 5.7 Tn), the total cost of providing the different services to these aircraft during the period will be used as the basis for estimating the AOR. This cost, which represents the total cost to be recovered, is divided among the collection units (representing the sum of all the MTWs) corresponding to the aircraft currently registered in the Aircraft Registry.

The above is set out in the following table:

(Assumption: all aircraft with MTWs of < 5.7 pay service rates)

Category	N° of Pax	Ki	Collection units
Natl. Pax 1	2,749,093	1.0	2,749,093
Natl. Pax 2	78,580	0.7	55,006
International Pax	1,493,901	3.0	4,481,703
Total			7,85,950
Cost to be recovered (US\$)			48,624,996
Value of ‘F’ (US\$)			6.67

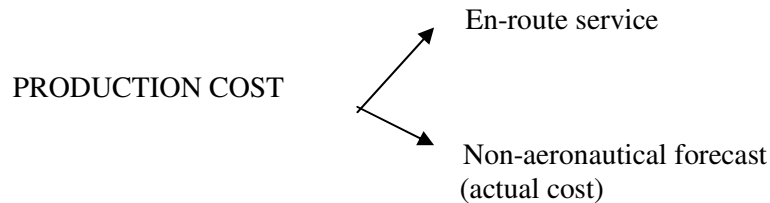
6.6 Other services

6.6.1 Meteorology

The cost of producing and distributing meteorological information should be divided into two areas: aeronautical and non-aeronautical meteorology.

The cost of aeronautical meteorology should be recovered through the aeronautical rates, since it is part of the cost of providing the aeronautical services.

The non-aeronautical meteorology cost should be totally covered by the users requiring that service, through charges for the different types of meteorological reports and studies.



6.6.2 Registrations and certifications

These duties shall be proportional to the capacity for payment (MTW^a), in the case of operations involving aircraft.

In any other case, the objective should be to recover the actual cost involved in the service provided (ETEAS, FBO, etc.).

CONCESSIONS

- Private PA → terminals
- DGA → FBO, ETEAS, Maintenance of vehicles, antennas, apron, helicopters
- Charge for land → Competitive bidding, market reference

Example:

Proposed tariff system					
Approach			617,308	19,638,634	718.90
Ap- 1 Tn 0.35	2	223,997	358,364		
Ap- 2	1	258,944	258,944		
Ap- 3	0	2,380	0		
Landing				15,313,324	2.46
At Tn	1	6,228,655	6,228,655	12,764,927	
Parking - first hour			2,042,311	3,986,203	
Es- 1 Hour * Tn 0.8	1	1,305,661	1,305,661	2,546,276	
Es- 2	0	0	0		
Es- 3	0	4,368	0		
Parking - following hours			763,650	1,437,805	1.95
Es- 1 Hour * Tn 0.8	1	594,398	594,398		
Es- 2	0	711,263	142,253		
Es- 3	0	67,473	0		
Boarding of passengers			8,032,597	52,080,764	6.48
Em- 1 Passengers	3	1,647,026	4,941,078		
Em- 2	1	3,030,875	3,030,875		
Em- 3	1	86,634	60,644		

6.7 Glossary of terms

- a) MTW= Maximum take-off weight
- b) AP1: First category (precision) approach service; AP2 second category (non-precision); AP3 third category (no service)
- c) ILS: Instrument landing system
- d) Pax: Passengers
- e) Collection U.: Collection units
- f) FBO: Fixed Base of Operations, normally provides services to executive aircraft.
- g) STAE(S): Specialised technical aeronautical entity(ies). These are organisations whose purpose is to perform technical aeronautical tasks and include: aircraft factories, aeronautical machine shops, repair centres, workshops, etc.

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