ICAO CIRCULAR

CIRCULAR 77-AT/12

May 1966

AIR TRANSPORT OPERATING COSTS

Prepared by the Secretariat of ICAO
and issued under the authority
of the Secretary General

INTERNATIONAL
CIVIL AVIATION
ORGANIZATION
MONTREAL • CANADA

Published in separate English, French and Spanish editions by the International Civil Aviation Organization. All correspondence, except orders and subscriptions, should be addressed to the Secretary General of ICAO, International Aviation Building, 1080 University Street, Montreal 3 (Quebec), Canada.

Orders for this publication should be sent to one of the following addresses, together with the appropriate remittance (by bank draft or post office money order) in U.S. dollars or the currency of the country in which the order is placed or in a freely convertible currency:

Regional Offices

France: Représentant de l'OACI, Bureau Europe, 3bis, villa Émile-Bergerat, Neuilly-sur-Seine (Seine).

Peru: Representante de la OACI, Oficina Sudamérica, Apartado 4127, Lima.

Senegal: Représentant de l'OACI, Bureau Afrique, Boîte postale 2356, Dakar.

Thailand: ICAO Representative, Far East and Pacific Office, P.O. Box 614, Bangkok.

United Arab Republic: ICAO Representative, Middle East and Eastern African Office, 16 Hassan Sabri, Zamalek, Cairo.

Sales Agencies

Argentina: Editorial Sudamericana S.A., Calle Alsina 500, Buenos Aires.

Australia: Robertson and Mullens, 107 Elizabeth Street, Melbourne, C. 1.

Canada: Department of Public Printing and Stationery, Ottawa (Ontario).

India: Oxford Book & Stationery Co., Scindia House, New Delhi *or* 17 Park Street, Calcutta.

Mexico: Editorial Hermes S.A., Ignacio Mariscal 41, México 4, D.F.

New Zealand: Government Printer, Government Printing Office, 20 Molesworth Street, Wellington.

United Kingdom: Her Majesty's Stationery Office, P.O. Box 569, London, S.E. 1.

International Civil Aviation Organization (Attention: Distribution Officer), International Aviation Building, 1080 University Street, Montreal 3 (Quebec), Canada.

FOREWORD

Terms of reference

1. The study that follows is a supplement to the Review of the Economic Situation of Air Transport presented to the ICAO Assembly in June 1965 and subsequently published as Circular 73-AT/10. In that Review (paragraph 6) it was indicated that other aspects of the economic situation of air transport would be dealt with in due course, one of the aspects cited being operating costs. The Assembly agreed * that economic studies of civil aviation developments should be continued as indicated in the Review and also in Council's Work Programme for the years 1966 to 1968.** Additionally this study of air transport operating costs provides background information for work to be done on two Assembly Resolutions: A15-6 calling for the preparation of forecasts of trends and developments in civil aviation; and A15-17 calling for studies on the development of air passenger travel.

Sources of information

2. The data on which this study is based have been drawn mainly from the Air Transport Reporting Forms filed at regular intervals by the Contracting States of ICAO. Additional information, however, has been obtained from States, airlines and aircraft manufacturers, as well as from ICAO economic publications and accumulated material on the economics of air transport available at ICAO Headquarters. The statistics refer only to the Contracting States of ICAO and when global totals or averages are given it should be noted that they exclude non-Contracting States, in particular, the USSR and the People's Republic of China.

Status of the study

3. This study has been prepared by the Secretariat of ICAO and is issued under the authority of the Secretary General.

---

* Report of the Economic Commission, Doc 8525, A15-EC/56, paragraphs 17 and 18.

** Budget Estimates, 1966-1968, Doc 8480, A15-AD/1, Appendix A, paragraph 64 (vii).

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

	Page
GENERAL SUMMARY	vii
I - THE NATURE OF AIR TRANSPORT OPERATING COSTS	1
Relationship between costs, fares and traffic	1
Approaches to the study of air transport cost	2
Terminology for the expression of operating cost	2
Grouping the components of operating cost	3
Relative importance of direct and indirect cost	5
Cost differences between international and domestic services	5
Factors affecting level of operating costs	5
Formulae for forecasting direct unit aircraft operating costs	7
Allocation of costs between passengers, cargo and mail	8
II - TRENDS OF OPERATING COSTS AND RELATED FACTORS 1951 - 1964	9
Unit costs on international and domestic services	9
Elements of direct cost	13
Elements of indirect cost	13
Changing relationship of the main cost items	15
Aircraft speed and capacity trends	15
Relationship between aircraft productivity and unit cost	17
Summary	19
III - DIRECT UNIT OPERATING COSTS FOR VARIOUS AIRCRAFT	21
Effect of aircraft performance characteristics on operating costs	21
Availability of data on aircraft performance characteristics	21
Performance characteristics of the main categories of aircraft	21
Passenger aircraft	23
Cargo aircraft	25
Helicopters	25

	Page
Performance characteristics of various aircraft types	25
Effect on depreciation	26
Effect on flight operations and maintenance	26
Future prospects for aircraft direct unit costs	26
1965 to 1970	26
After 1970	27
Variations in unit cost associated with a given aircraft type	27
Current economic environment	27
Route structure	28
Carrier decisions	28
Summary	28
IV - AIRLINE UNIT OPERATING COSTS	31
Airline costs and related performance criteria	31
Performance criteria	31
Payload capacity per aircraft	33
Aircraft speed	34
Capacity offered per aircraft hour	35
Aircraft utilization per day	36
Capacity offered per aircraft day	37
Capacity offered per airline staff member	38
Stage length	39
Capacity offered per flight	40
Capacity offered per station served	41
Summary	42

Page

APPENDICES:

1. - Financial Trends, 1951-1964: All Services 45

2. - Financial Trends, 1951-1964: International Services 47

3. - Financial Trends, 1951-1964: Domestic Services 49

4. - Aircraft Performance Characteristics, US Domestic Services: 1964 51

5. - Unit Operating Expenses, 1964: 41 Airlines 53

6. - Basic Air Transport Data, 1964: 41 Airlines 55

7. - Air Transport Performance Criteria, 1964: 41 Airlines 57

7A. - Rankings of Airlines according to Performance Criteria 59

8. - Air Transport Reporting Form F 61

9. - Note on the Breakdown of Operating Costs into Component Accounts. 63

10. - Note on Allocation of Unit Costs to International and Domestic Services 64

11. - Glossary of Terms Used in the Study 65

CHARTS:

1. - Unit Operating Cost and Capacity Offered per Aircraft Hour Trends on International Services: 1951 - 1964 . . . . . (1 facing)

2. - Distribution of Operating Costs: 1964 4

3. - Operating Costs per Unit Performed and Available (Total, Direct and Indirect) on International and Domestic Services: 1951 - 1964. . 10

4. - Direct Unit Cost Components, International and Domestic Services: 1951 - 1964 12

5. - Indirect Unit Cost Components, International and Domestic Services: 1951 - 1964 14

6. - Distribution of Operating Cost Components on International Services: 1951 - 1964 16

7. - Speed, Payload Capacity and Capacity Offered per Aircraft Hour on International and Domestic Services: 1951 - 1964 18

Page

8. - Capacity Offered per Aircraft Hour on Selected Passenger Aircraft, United States Domestic Service: 1964 22

9. - Capacity Offered per Hour on Selected Aircraft Types in US Domestic Service Related to Direct Unit Cost: 1964 24

10. - Aircraft Payload Capacity Related to Direct Unit Cost, 41 Airlines: 1964 33

11. - Speed Related to Direct Unit Cost, 41 Airlines: 1964 34

12. - Capacity Offered per Aircraft Hour Related to Direct Unit Cost, 41 Airlines: 1964 35

13. - Aircraft Utilization Related to Direct Unit Cost, 38 Airlines: 1964. . 36

14. - Capacity Offered per Aircraft Day Related to Direct Unit Cost, 38 Airlines: 1964 37

15. - Capacity Offered per Airline Staff Member Related to Total Unit Cost, 40 Airlines: 1964 38

16. - Stage Length Related to Total Unit Cost, 23 Airlines: 1964 39

17. - Capacity Offered per Flight Related to Total Unit Cost, 23 Airlines: 1964 40

18. - Capacity Offered per Airport Served Related to Total Unit Cost, 22 Airlines: 1964. 41

GENERAL SUMMARY

Nature of air transport operating costs

(1) Air transport operating costs are in the long period the prime determinant of the average level of the fares and rates charged for the carriage by air of passengers, cargo, and mail, and hence of the volume and growth of air traffic. This causative chain, however, is circular since the volume of air traffic also has a determining effect on costs, it being in practice difficult to achieve low unit costs in conditions of light demand. The fundamental importance of costs requires that they be kept under constant study both from the general and from the particular point of view, by ICAO and in each State by national agencies and airlines.

(2) To facilitate comparisons, operating costs are here studied on a unitary basis and expressed in terms of United States cents per tonne-kilometre of air transport sold, or produced and offered for sale. The convention is followed of dividing these costs into their direct and indirect components, the former being those related directly to the characteristics of the aircraft (flight operations, maintenance and overhaul and depreciation) and the latter those related to sales and service, ground support, and administration. Direct cost accounts, in the world average, for a slightly larger proportion of the total than does indirect cost. Among the seven main components of total operating cost the most important is flight operations (including flight crew and fuel expenses) which amounts to a little more than a quarter of the whole. The level of costs is determined by a large number of factors of varying importance which may be roughly divided into four groups according to whether they are related primarily to (a) the characteristics of the aircraft flown, (b) the economic environment, (c) the route structure over which the airline operates, (d) the policy decisions of the airline. No satisfactory method has yet been evolved for the allocation of costs among the main categories of load--passengers, cargo, and mail.

(3) This Study examines air transport operating costs from three points of view. First, an analysis is undertaken in Section II of the trends apparent in the period from 1951 to 1964 of the average figures for unit costs, direct and indirect, and for related performance factors for the airlines of ICAO Contracting States (summarized in Section II, paragraphs 12-15). Second, direct unit costs and related performance characteristics associated with the operation of various aircraft types are analysed in Section III, mainly on the basis of data covering United States domestic operations in the year 1964 (summarized in Section III, paragraphs 17-19). Third, also for the year 1964, unit costs, direct and indirect, for 41 airlines chiefly concerned with scheduled international passenger operations are correlated in Section IV with a set of performance criteria calculated for these airlines (summarized in Section IV, paragraphs 13-16).

Unit cost and performance trends: 1951-1964

(4) Concerning the global trends, it is observed that the general decline in average unit costs from 1951 to 1964, amounting to 14 per cent in terms of units sold or 27 per cent in terms of units offered (the difference being the result of simultaneously declining load factors), was confined largely to international services on which the cost per tonne-kilometre available dropped 41 per cent. This development may be attributed mainly to declines of over 50 per cent in each of two direct cost components--flight operations and maintenance and overhaul--on these international services. This decline in unit costs on international services accompanied a parallel rise in average aircraft payload capacity and speed, and a clear inverse relationship may be observed between the two trends with the rates of decrease in unit costs and increase in aircraft productivity (payload capacity x speed) both accelerating from 1959, the year in which the long-range jet aircraft were introduced into service.

Direct aircraft operating costs - 1964

(5) The analysis of direct aircraft operating costs and related performance characteristics, based on data covering United States domestic operations in 1964, demonstrates the inverse relationship between direct unit costs and aircraft productivity (payload capacity x speed). In the progression from twin-engine piston aircraft to four-engine jet, direct unit cost falls as productivity rises, but there is a sharp break between the four-engine piston and turbo-prop aircraft on the one hand and the three- and four-engine jets on the other. The latter are about four times as productive and half as expensive to operate as the former which they have replaced on most long-haul routes. This fact explains the acceleration, noted in the previous paragraph, in the rates of unit cost decrease and productivity increase beginning in 1959 when the jets first appeared. The analysis in Section III also brings out the considerable increase in productivity and reduction in unit cost that result when large piston or jet aircraft are operated in all-cargo rather than primarily passenger configuration.

(6) For the immediate future, up to 1970, it is suggested that the continuing improvement of engine and airframe and the production of stretched versions of current jet aircraft will result in further declines in the direct unit costs associated with short-, medium-, and long-range jets, and thus in the continuation of the general decline in average unit costs, and eventually in some reduction in fares. It also appears that the particularly low unit costs of all-cargo jets should, as these aircraft carry an increasing proportion of the traffic, contribute to an appreciable reduction in all-cargo rates. After 1970 these trends may be expected to continue and to be reinforced by the appearance of much larger subsonic jets with perhaps 500 seats. Supersonic transports are also expected to appear, starting about 1972, but lack of operational experience makes it difficult to foresee their effect on direct unit costs.

(7) The point is emphasized, in Section III, that the direct unit costs associated with a particular aircraft depend not only on the characteristics of the aircraft, but also on the conditions under which it is operated. If these conditions are not favourable, the low-cost potential of the aircraft will not be realized. The lowest direct unit costs can be achieved only with the big jet aircraft on long-haul operations. Whatever the stage length, however, whether long, medium or short, the lowest direct unit costs of which an aircraft is capable can be achieved only when the operating conditions are such as to permit a high level of flight frequency, aircraft utilization, and load factor. Great care must therefore be taken to select the aircraft best suited to the route structure on which it must operate. Where this has been done, direct costs will be kept to the minimum by taking all possible steps to increase traffic and to ensure managerial efficiency.

Airline unit costs and performance criteria - 1964

(8) The total unit costs, direct and indirect, achieved by 41 airlines engaged primarily in scheduled international passenger operations in 1964 are correlated in Section IV with a series of performance criteria calculated from basic traffic, fleet and personnel data. These criteria, which are selected as reflecting in varying degree some of the factors that determine costs, include aircraft payload capacity, speed and utilization, capacity offered per aircraft hour, per aircraft day and per airline staff member, stage length and capacity offered per flight and per station served. The correlations clearly show, in each case, unit cost declining as the numerical value of the criterion increases. It also appears that there is a relationship between the criteria since the airlines that rank high in one tend to rank high in all. Thus where the average stage length is long, the aircraft operated tend to have a high average payload capacity and speed. In these circumstances, assuming reasonable traffic density, utilization tends to be reasonably high as also do capacity offered per flight and per station served.

(9) In other words, with any given traffic density, the lowest unit costs are generally achieved by the long-haul operators. Conversely those airlines with short and medium average stage lengths tend to use smaller, slower aircraft at generally lower rates of utilization, to offer less capacity per flight and per station served, and, as a result, to have higher unit costs. Within this general framework, and recognizing the need for short- and medium-haul operations, it might sometimes be possible for carriers to reduce their unit costs by modification of their operations. If demand can be augmented or average stage length increased, then flight frequencies, utilization rates and load factors can be expected to improve and it may become feasible to operate larger, faster aircraft and achieve lower unit costs.

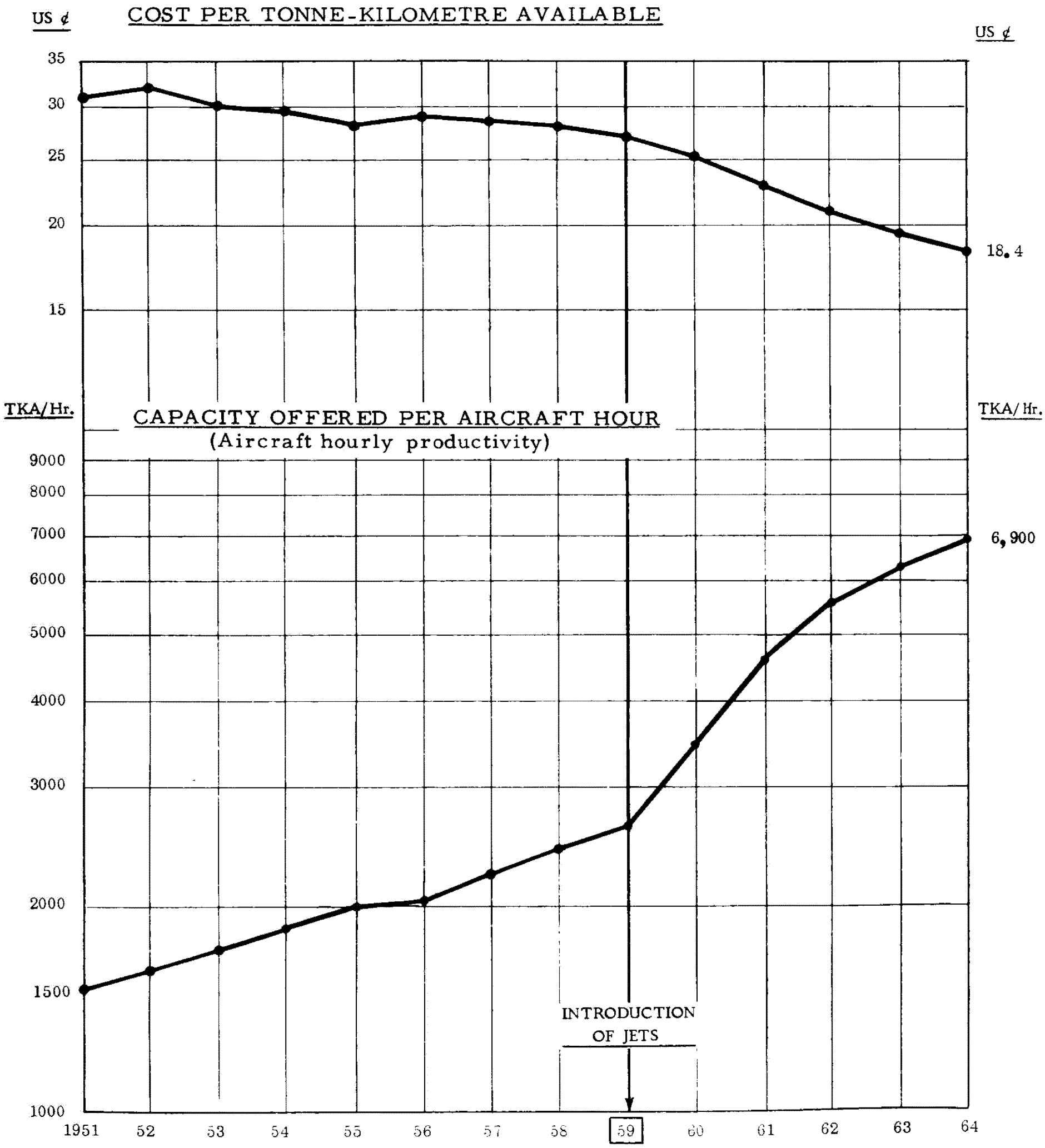
STUDY OF AIR TRANSPORT OPERATING COSTS

CHART 1

UNIT OPERATING COST AND CAPACITY OFFERED PER AIRCRAFT HOUR
COMPARISON OF TRENDS: 1951 - 1964

Scheduled Airlines of ICAO Contracting States, Scheduled and Non-Scheduled Operations

International Services



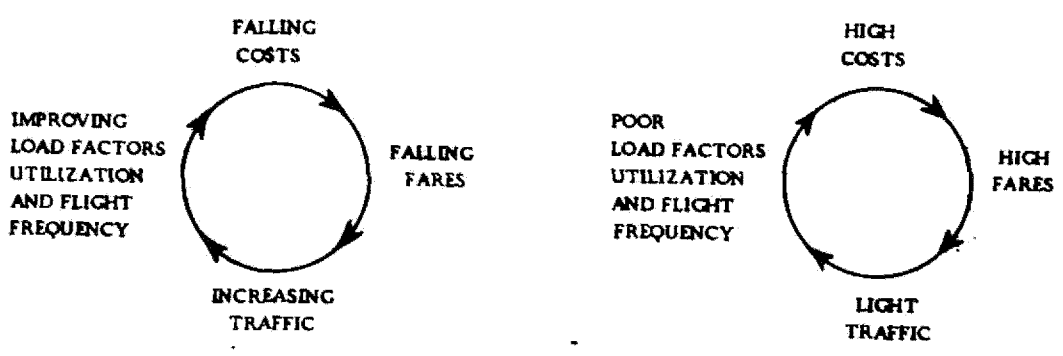
Note: This Chart is drawn to a logarithmic scale to show rates of change.

I - THE NATURE OF AIR TRANSPORT OPERATING COSTS

Relationship between costs, fares and traffic

1. The level of air transport operating costs is a fundamental element in the economy of the air transport industry. In general, the average revenue rate for all types of load must, unless subsidy is contemplated, be set high enough to cover costs and, if possible, to produce a positive operating margin. On the other hand this average revenue rate is prevented from rising too far above the level of costs by the need to consider the public interest and to stimulate traffic growth, often in the face of competition from surface transport. Operating costs thus have an important determining effect on average fares and rates and consequently also on the volume and growth of air traffic and on the extent to which air transport penetrates the total transport market. Air transport has certain competitive advantages over the various modes of surface transport, particularly speed, but these advantages can be most effective only when average costs, and hence average fares and rates are sufficiently low to be competitive with those of surface transport.

2. The relationship between air transport operating costs and fares is obscured where the latter are controlled, but it remains generally true that the overall revenue rate tends to follow the movement of the average level of operating costs, though unevenly and with some delay. Thus when air transport costs are falling, as they have been notably since 1959, the consequent decline in average fares stimulates the overall growth of air traffic. On the other hand when costs are relatively high and static, fares tend to remain high and the volume of traffic depressed. This connection between operating costs and traffic volume via fares is moreover a circular relationship for while falling costs tend to lead, through lower fares to traffic growth, an increase in traffic tends, through improved load factors, flight frequencies, and aircraft utilization, to lead back to further reduced costs. Similarly while high costs tend to lead through high fares to light traffic; light traffic tends through poor load factors, flight frequencies, and aircraft utilization to lead back to high costs.* This relationship is illustrated below.



---

* Airlines naturally prefer to operate with the expansionist type of sequence shown in the left of the two diagrams but there are often difficulties in achieving this. Winter services, for example, tend to have a low elasticity of demand so that falling fares do not produce satisfactory increases in traffic; services between smaller communities also quickly reach a limit beyond which fare reductions produce little extra traffic; in regions where average incomes are small fares might have to be reduced to impossibly low levels to produce substantial increases in traffic; a variety of factors may also partially or wholly inhibit the effect of fare reductions (inadequate hotels, governmental restrictions, political disturbances).

Approaches to the study of air transport cost

3. The evidently fundamental importance of costs to the general situation of air transport requires that this subject be studied continually both in the general manner appropriate to an international agency and in a much more specific and detailed way by national administrations and operators. A general analysis of air transport costs of the sort undertaken here is a complex matter that must be approached from various points of view. In the first place, in order to obtain a broad understanding of the cost situation of air transport as a whole it is necessary to examine global average figures covering all of the airlines of ICAO Contracting States for which information is available and from these figures to determine the general trends of air transport cost, of the component elements of this cost, and of related performance factors. Next, in order to understand the limitations inherent in the equipment used there must be an examination of the costs associated with the operation of the various aircraft types presently in service. Then there is a need to undertake a comparative analysis of the cost levels achieved by those airlines for which information is available and to attempt to determine what are the most important factors affecting these airline costs.

Terminology for the expression of operating cost

4. Before proceeding with these analyses it may be useful, however, to examine briefly the term "operating cost" and to indicate what elements are included therein. It may be stated at the outset that the term does not include and that this study is not concerned with the "non-operating" elements of expense such as interest on loans, losses on the sale or retirement of equipment and income taxes. The terms "operating cost" or "operating expense", as usually employed in air transport affairs, refer to the cost of producing a certain quantity of air transport. For purposes of comparing one year, one aircraft type or one airline with another it is convenient to employ unit cost figures, that is the cost of producing one unit (aircraft hour, aircraft kilometre, tonne-kilometre or passenger-kilometre) of transport. In this study the unit employed is normally the tonne-kilometre which covers all categories of load: passengers, cargo and mail. For the sake of international comparability operating cost is expressed in one currency, here United States' cents.

5. Unit cost, stated in terms of cents per tonne-kilometre, may refer either to the cost of each unit of air transport produced (tonne-kilometre available) or to the cost of each unit sold (tonne-kilometre performed). The relationship between these two concepts is such that where half the units produced are sold, or the load factor is 50 per cent, the cost of the unit sold will be double the cost of the unit produced. In considering which concept to adopt it must be borne in mind that transport is a perishable product that cannot be stored. The unsold unit ceases to have value as soon as the aircraft starts its trip. It follows from this that when considering costs in relation to fares and rates it is generally desirable to speak in terms of cost per unit sold (tonne-kilometres performed). However in a study such as this, dealing with comparative analyses of airline costs and the factors that influence these including, particularly, the characteristics of the aircraft employed, it is normally preferable to express cost in terms of the unit produced (tonne-kilometres available or other units of capacity).

Grouping the components of operating cost

6. The cost of producing a unit of air transport capacity includes a number of components which, to facilitate analysis, are grouped in various ways. For example, they may be divided into fixed overhead and variable production costs or into direct and indirect costs. The latter method, which is widely used in the air transport industry, has been adopted for the purpose of this study. According to this division direct costs are those associated directly with the characteristics of the aircraft. In general these costs are not affected by the nature of the route on which the aircraft may be operated, but it should be mentioned that, on a unit basis, two items -- insurance and depreciation of flight equipment -- are related to aircraft utilization which is affected by the service pattern and frequency. Direct costs cover (1) flight operations (including flight crew, fuel and oil, flight equipment insurance, and rental of flight equipment) (2) maintenance and overhaul, and (3) depreciation.* Indirect costs, which cover all other items of operating cost, include (1) station and ground expenses (including landing and departure fees), (2) passenger services, (3) ticketing sales and promotion, and (4) general and administrative activities.** It should be noted that in this method direct costs do not correspond to the variable costs nor indirect costs to the fixed costs of customary economic theory since, for example, depreciation is classified as a direct cost while a number of the indirect cost items clearly vary with the volume of transport produced.

7. The separation of operating cost components may, as pointed out in the last paragraph, be carried out in different ways according to the operational aspects that it is desired to elucidate. For example the grouping of variable production costs may facilitate an analysis of airline traffic and route structures and the grouping of costs subject to influence by the carrier may be useful in comparing the efficiency of various airlines. For this study however the division into direct and indirect costs was considered preferable for a number of reasons. Much of the data available to the Secretariat is based on the direct cost concept as used by most aircraft manufacturers. This method of grouping costs is of particular interest to manufacturers and airlines when purchasing aircraft since it enables them to estimate in advance the direct operating cost of the aircraft in question by using formulae such as those referred to in paragraph 11 below. Also the extent to which average cost trends are affected by changing fleet composition and the extent to which airline costs are affected by the fleets they operate can be indicated more readily by reference to direct cost data. Indirect costs depend on the nature of an airline's operation, reflecting such operational factors as route structure, flight frequencies, traffic density and volume and managerial efficiency.

---

* See Note on Breakdown of Operating Costs into Component Accounts in Appendix 9 on p. 63.

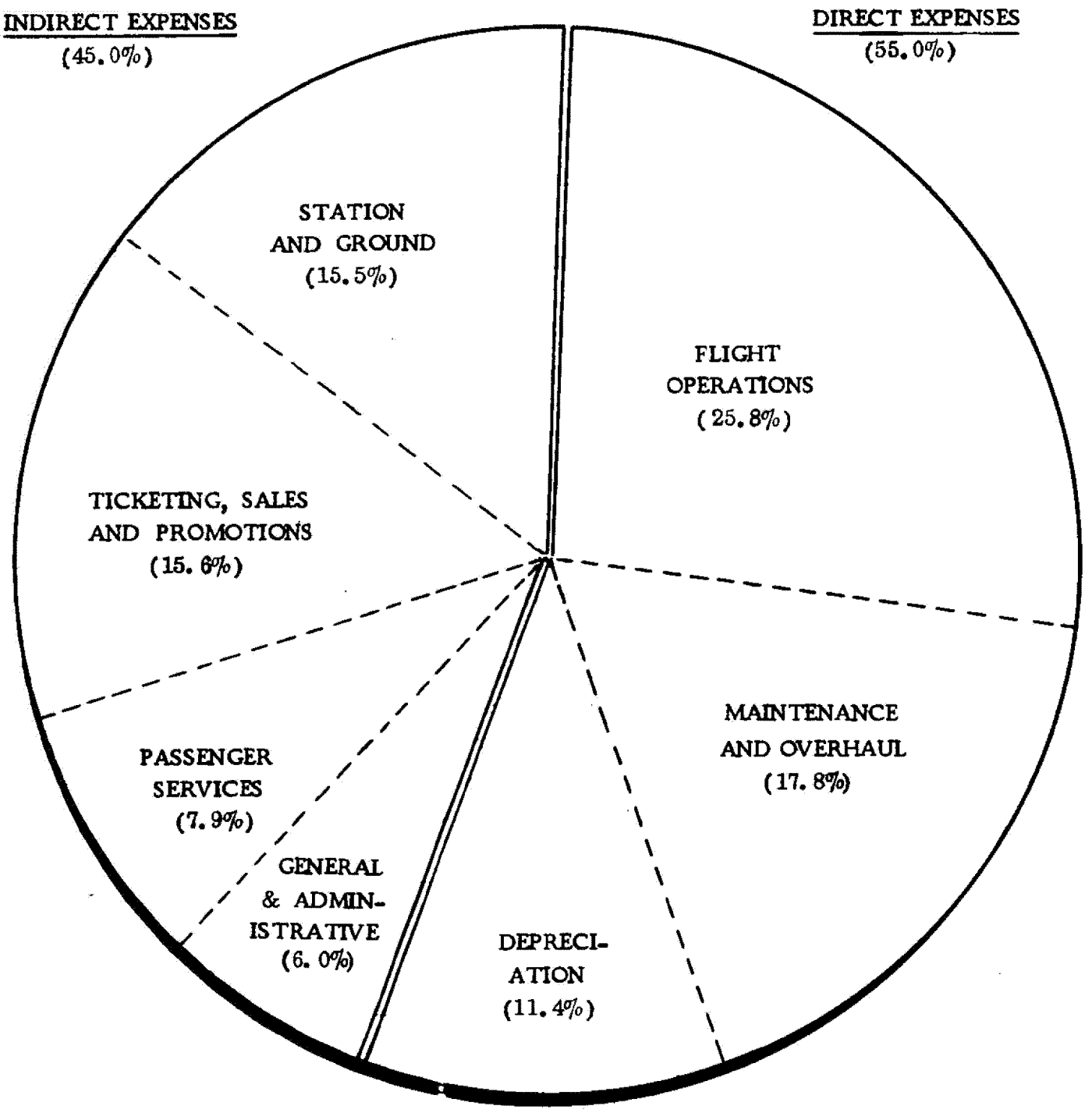
** These seven main components of operating cost, with their various sub-items are described more fully in the Instructions for ICAO Air Transport Reporting Form F, shown in Appendix 8 on p. 61.

CHART 2

DISTRIBUTION OF OPERATING COSTS-1964

Scheduled Airlines of ICAO Contracting States

All Services: Scheduled, Non-Scheduled, International and Domestic



Note: For basic data see Appendix 1

Relative importance of direct and indirect cost

8. The relative quantitative importance of the seven components of operating cost is shown in Chart 2. In 1964 for all of the services, scheduled, non-scheduled, international and domestic of the scheduled airlines of ICAO Contracting States direct costs accounted for 55 per cent and indirect costs 45 per cent of the total. On the international services of these airlines,* however, as shown in the following table, direct costs accounted for a lower and indirect costs for a higher proportion than on their domestic services. The trends exhibited by direct and indirect costs since 1951 are illustrated in Charts 3 and 6.

Distribution of operating costs, 1964

	Direct	Indirect
International services	52%	48%
Domestic services	60%	40%
All Services	55%	45%

Cost differences between international and domestic services

9. The differentiation between international and domestic services derives from four of the seven main cost items. The other three -- depreciation, station and ground, and general and administrative -- show little variation between the two sectors. Of the four items that do show significant variations, two under direct cost -- flight operations and maintenance and overhaul -- are proportionately less important, and two under indirect cost -- passenger services, and ticketing, sales and promotion -- are proportionately more important on international than they are on domestic services. The explanation of this difference is to be found in the facts that the new long range jets with their lower direct operating costs have been introduced in larger numbers on international than on domestic services thus reducing the cost of flight operations and maintenance and overhaul on the former while, at the same time, sharper competition on the international services causes passenger services and sales costs to be higher on this sector.

Factors affecting level of operating costs

10. The levels of the components of air transport cost are affected in varying degree by a large number of factors some of which are hardly susceptible of precise measurement. The more important of these factors can be grouped under four main headings. First there are those that depend directly on the characteristics of the aircraft used; second those that depend on the economic environment within which the

---

* See the Note on allocation of unit costs to international and domestic services given in Appendix 10 on p. 64.

operation is conducted; third those that depend primarily on the route structure that is selected by or imposed upon the airline; and fourth those that depend primarily on the decision of the carrier itself. A list of these factors grouped for the purpose of this study is given in the following table.

Factors affecting the level of operating costs

(Grouped according to their prime determinant)

A Characteristics of the Aircraft Used

a) capacity available for passengers and cargo (including mail) for given stage length and configuration

b) cruising speed

c) size of crew

d) fuel and oil consumption

e) value and state of depreciation of aircraft and spares

f) required time between overhauls

B Current Economic Environment

a) salary and wage levels

b) general level of prices including fuel and oil prices

c) level of aircraft rental fees

d) landing fees and charges for use of air navigation facilities

e) level of demand for air transport capacity

f) general economic situation including competition with air and surface transport

g) size of airline*

---

* Statistics indicate that, within wide limits, the size of the airline as such does not necessarily affect directly the level of operating costs although it may indirectly to the extent that it influences such factors as the size of aircraft operated.

C Route Structure (i.e. stage length, number of airports served, and traffic potential as determined by traffic rights)

a) actual payload available on a given aircraft after required fuel has been loaded

b) flight frequency (also depends to some extent on carrier decision)

c) block speed achieved

d) aircraft utilization (also depends to some extent on carrier decision)

D Decision of the Carrier (within the limits of government regulation, etc.)

a) extent and quality of services provided for the passenger in the air and on the ground

b) level of ticketing, sales and promotion activity

c) efficiency of general and administrative activity

d) method of providing insurance coverage

e) depreciation method

f) policy regarding aircraft rentals

g) aircraft configuration (allocation of load between cargo and different classes of passenger)

Formulae for forecasting direct unit aircraft operating costs

11. Many of these factors are taken into consideration in the formulae that have been developed by the Air Transport Association of America (ATA) and the Society of British Aerospace Companies (SBAC) for the forecasting of direct unit operating costs of new aircraft under a standard set of conditions. These formulae which are complex, requiring several pages of calculation, and based on arbitrary criteria, are widely used as a means for comparing operating economics of competitive aircraft and thereby to assist manufacturers in selling their new aircraft, and to assist airlines in selecting between different aircraft types and in planning the introduction of new aircraft into their systems, and in evolving specifications for desirable new aircraft.

Allocation of costs between passengers, cargo and mail

12. No generally acceptable formula has yet been developed for the allocation of cost between passengers, cargo and mail when these are carried on the same service. It might be suggested that such an allocation could be effected by first excluding those elements of cost that are directly associated with the carriage of passengers and then dividing the remainder equally between all types of load. The identification is possible of such clearly passenger costs as passenger service; ticketing sales and promotion; meals and steward services; the cost and weight penalty of seats, galleys, toilets, sound insulation and other passenger facilities; booking offices; and that part of insurance that covers passenger liability claims. The result of such an exercise does not have much practical meaning, however, since on mixed services cargo and mail ride on the back of the passenger service. The passenger traffic is essential if reasonably economic, frequent and extensive services are to be provided for the other categories of load. Without the passenger traffic, cargo and mail services could be provided only at greater cost, lower frequency and between fewer cities. On the other hand any improvement in passenger services in the sense of lower cost or greater frequency or extension of services benefits also the cargo and mail services.

13. Another obstacle to the allocation of costs on mixed services arises from the difficulty of determining in what proportions the capacity is available for passengers, cargo and mail. The capacity available for passengers can normally be determined precisely, but because of the relatively rigid configuration of aircraft the capacity available for cargo and mail varies with the passenger load factor. When this load factor approaches 100 per cent the space available for cargo and mail may not be fully utilized because of weight limitations. On the other hand when the passenger load factor approaches zero the weight capacity available may not be fully used for cargo and mail because of space limitations. It should be borne in mind, finally, that the difficulties cited in this paragraph and the preceding one apply only to mixed services and not to all-freight services which are steadily increasing in number.

II - TRENDS OF OPERATING COSTS AND RELATED FACTORS 1951 - 1964

Unit costs on international and domestic services

1. The global average operating cost figures for all services (international and domestic, scheduled and non-scheduled) of the airlines of ICAO Contracting States are given in Appendices 1, 2 and 3 for the years 1951 to 1964. Some of the trends apparent from these data are illustrated in Chart 3, and the changes in unit cost levels between 1951 and 1964 are shown in the following summary tables.

Operating cost per tonne-kilometre performed in US cents*

	1951		1964		% Change
International services	49.4¢		32.9¢		- 33%
(load factor)		(62.7%)		(55.9%)	
Domestic services	35.1¢		36.4¢		+ 4%
(load factor)		(62.5%)		(50.0%)	
All services	40.4¢		34.7¢		- 14%
(load factor)		(62.5%)		(52.8%)	

Operating cost per tonne-kilometre available in US cents

	1951	1964	% Change
International Services			
Direct	17.5	9.5	- 47%
Indirect	13.5	8.9	- 34%
Total	31.1	18.4	- 41%
Domestic Services			
Direct	12.6	10.6	- 16%
Indirect	9.4	7.6	- 19%
Total	22.0	18.2	- 17%
All Services			
Direct	14.3	10.1	- 29%
Indirect	10.9	8.2	- 25%
Total	25.2	18.3	- 27%

2. Considering first the cost of each unit of transport sold (tonne-kilometre performed), which is the figure that must be taken into account in relation to fares and rates, it may be seen that for all services combined the average cost fell from 40.4 cents in 1951 to 34.7 cents in 1964, a decline over the fourteen-year period of 14 per cent or about 1 per cent per year.* If the figures for international and domestic services are examined separately, however, a pronounced difference in trend appears. Thus on

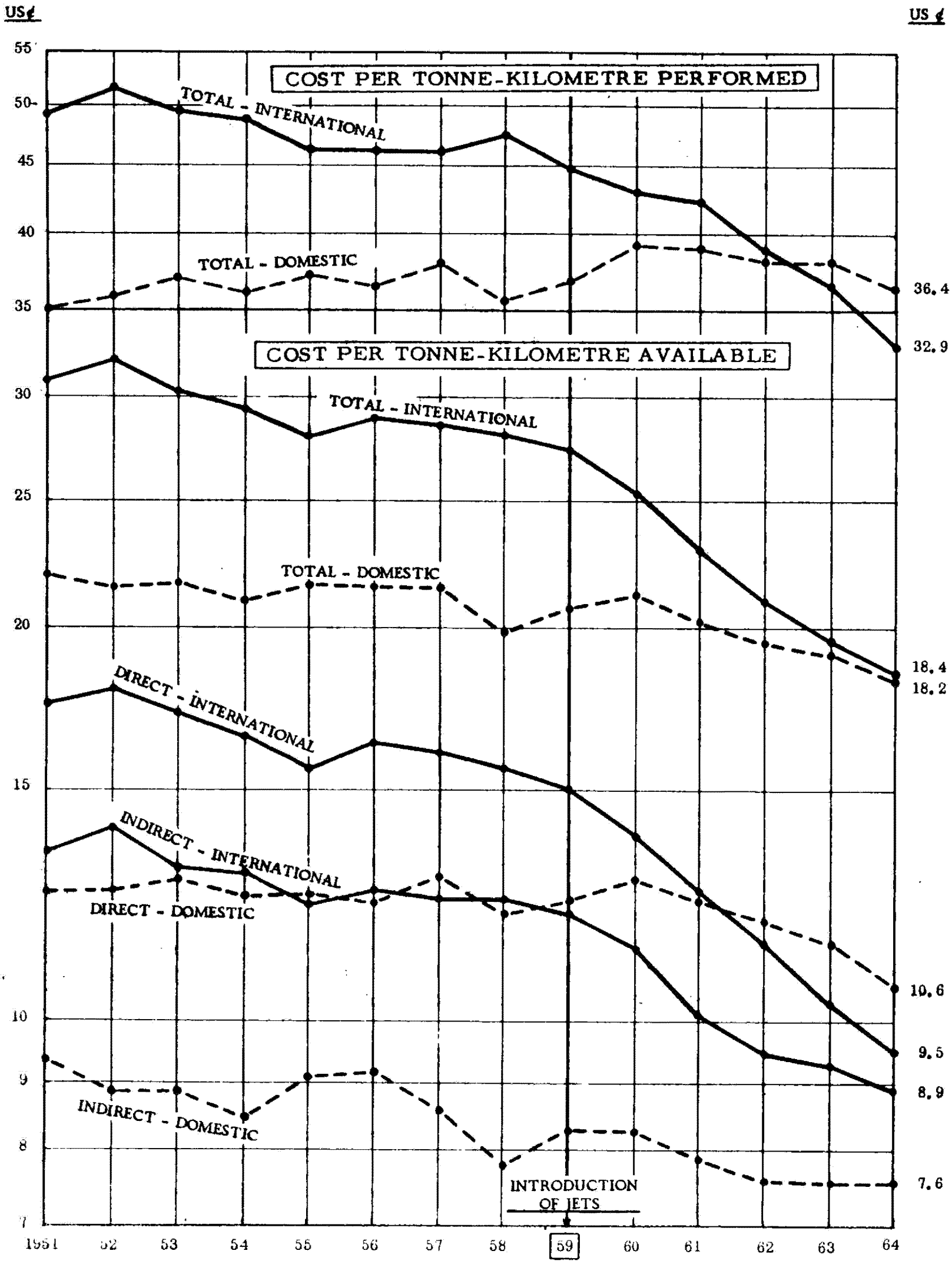
---

* Here, as elsewhere in this study, no attempt has been made to adjust cost figures to take account of the gradual reduction in the value of the US dollar due to inflation. Since other currencies have been converted into US dollars and cents at the current rate of exchange (as given in UN publications) there is however an automatic adjustment in those places where inflation has been sufficiently extreme to affect the exchange rate. If the above 1964 figures were expressed in US currency at 1951 values, cost reductions would be seen to be much greater.

CHART 3

UNIT OPERATING COST TRENDS: 1951 - 1964
Scheduled Airlines of ICAO Contracting States, Scheduled and Non-Scheduled Operations

International and Domestic Services



Notes: 1. For basic data see Appendices 1, 2 and 3.
2. This Chart has been drawn to a logarithmic scale to show rates of change.

international services the cost per tonne-kilometre performed fell from 49.4 cents in 1951 to 32.9 cents in 1964, a drop of 33 per cent, but on domestic services there was in the same period an increase of 4 per cent, from 35.1 cents to 36.4 cents. The relationship between these cost trends and the movements of average fares and rates may be suggested by reference to the data on operating revenues per tonne-kilometre performed for the same years. As might be expected it appears that unit revenues and costs exhibit similar trends. Thus as the cost per unit sold has risen slightly on domestic services so has the revenue rate, while on international services and all services combined the declines in unit cost are reflected in similar but less pronounced declines in revenue rates.

Operating revenues per tonne-kilometre performed
(in US cents)

	1951	1964	% Change
International services	47.2	35.8	- 24%
Domestic services	37.1	39.2	+ 5.7%
All services	40.9	37.5	- 8.3%

3. This Study, however, is not primarily concerned with the relationship between costs and fares, but rather with the factors that influence costs and for this purpose it is necessary to consider the production cost figure, that is the cost of producing a unit of air transport capacity irrespective of the proportion of this capacity that may be sold. The trends of cost per tonne-kilometre available while basically similar to those of cost per tonne-kilometre performed do show differences resulting from the effect of load factor on the latter. Thus the cost per tonne-kilometre available for all services combined fell from 25.2 cents in 1951 to 18.3 cents in 1964, a decline of 27 per cent -- about twice as great as the decline in cost per unit performed. The difference in the decline of costs per unit available from 1951 to 1964 on international and domestic services was considerable -- 41 per cent on the former against 17 per cent on the latter -- but not as great as in the case of cost per unit performed. The explanation for this differing behaviour of cost per unit available and performed is to be found, as suggested above, in the changes in load factor. In 1951 the load factor on both international and domestic services was just under 63 per cent, but by 1964 this figure had fallen about 7 points on international services, to 56 per cent, and nearly 13 points on domestic services, to 50 per cent.

4. One of the effects of these varying declines in cost has been that whereas the total cost per tonne-kilometre available was, in 1951, about 40 per cent higher on international than on domestic services, it had become, by 1964, approximately the same on both sectors -- just over 18 cents. If this total cost per unit available is divided into its direct and indirect elements it will be seen that the smallest decrease over the fourteen-year period 1951 to 1964 was in direct aircraft operating costs on domestic services -- about 16 per cent -- while the greatest decrease was in direct

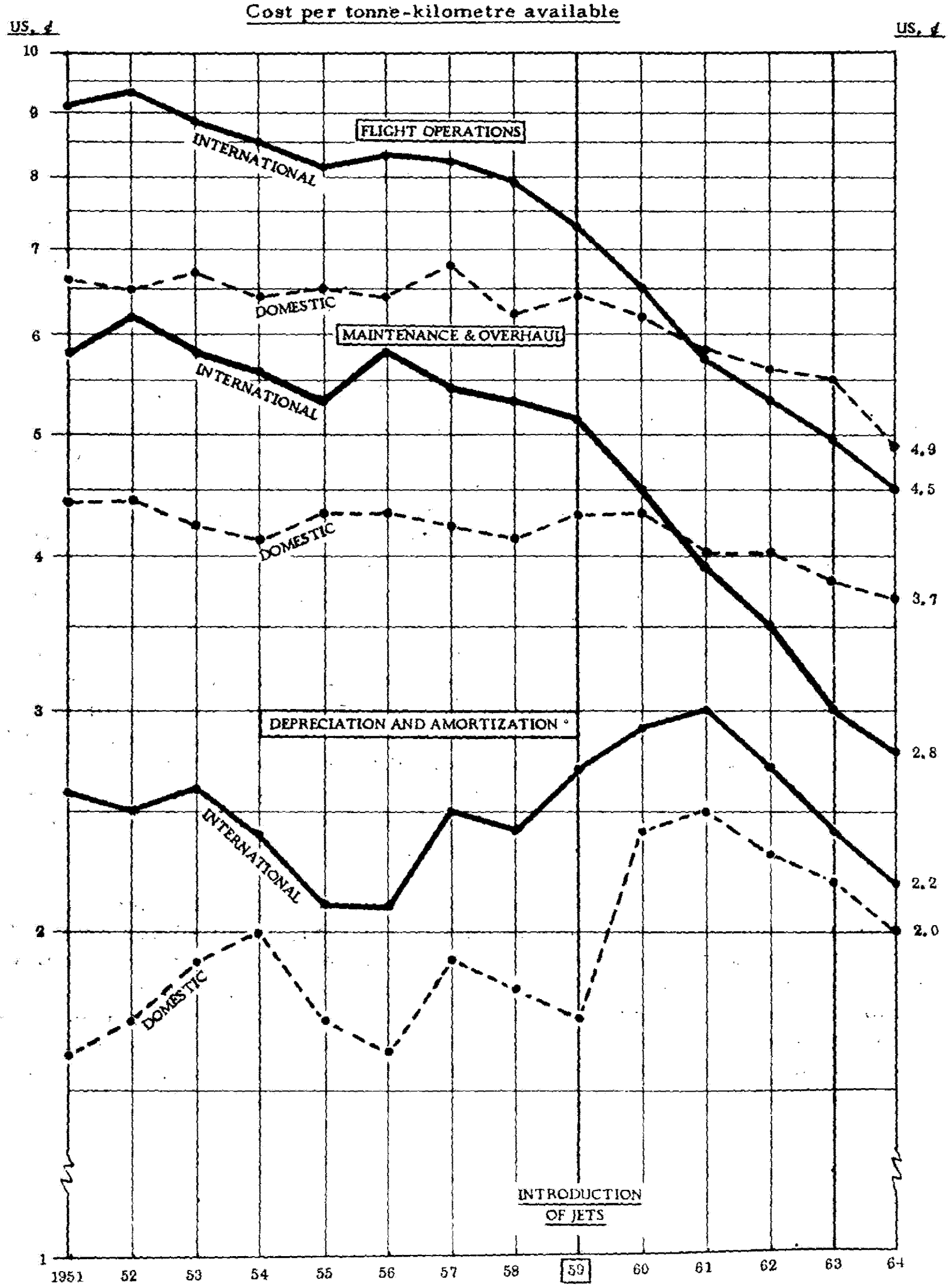
CHART 4

DIRECT UNIT OPERATING COST COMPONENT TRENDS: 1951 - 1964

Scheduled Airlines of ICAO Contracting States, Scheduled and Non-Scheduled Operations

International and Domestic Services

Cost per tonne-kilometre available



Notes: 1. For basic data see Appendices 2 and 3.
2. This Chart has been drawn to logarithmic scale to show rates of change.

* See Note in Appendix 9

costs on international services -- about 47 per cent. Furthermore it may be observed from Chart 3 that the rates of decrease in unit costs, both direct and indirect, show on international services, but not on domestic, a marked acceleration starting in 1959, the year in which the long range jet aircraft were introduced on these international services.

Elements of direct cost

5. The behaviour of the component elements of direct unit cost -- flight operations, maintenance and overhaul, and depreciation -- on international and domestic services from 1951 to 1964 is illustrated in Chart 4 on the basis of data given in Appendices 2 and 3. The figures for depreciation produce a somewhat erratic pattern, but from 1954 the movements on international and domestic services are roughly parallel. The rise after 1959 is attributable in part to a change in the method of statistical reporting adopted in 1960. (This problem is described in a Note in Appendix 9.)

6. The patterns produced by the cost figures for flight operations and maintenance and overhaul, on the other hand, are quite clear and much alike. In both cases the unit cost on domestic services shows a relatively limited decrease while on international services there is a considerable fall (from 9.1 to 4.5 cents for flight operations and from 5.8 to 2.8 cents for maintenance and overhaul) which brings international costs below the domestic level by 1961. Moreover, as in the case of international unit costs as a whole, the rate of decrease shows a noticeable acceleration after 1959.

Elements of indirect cost

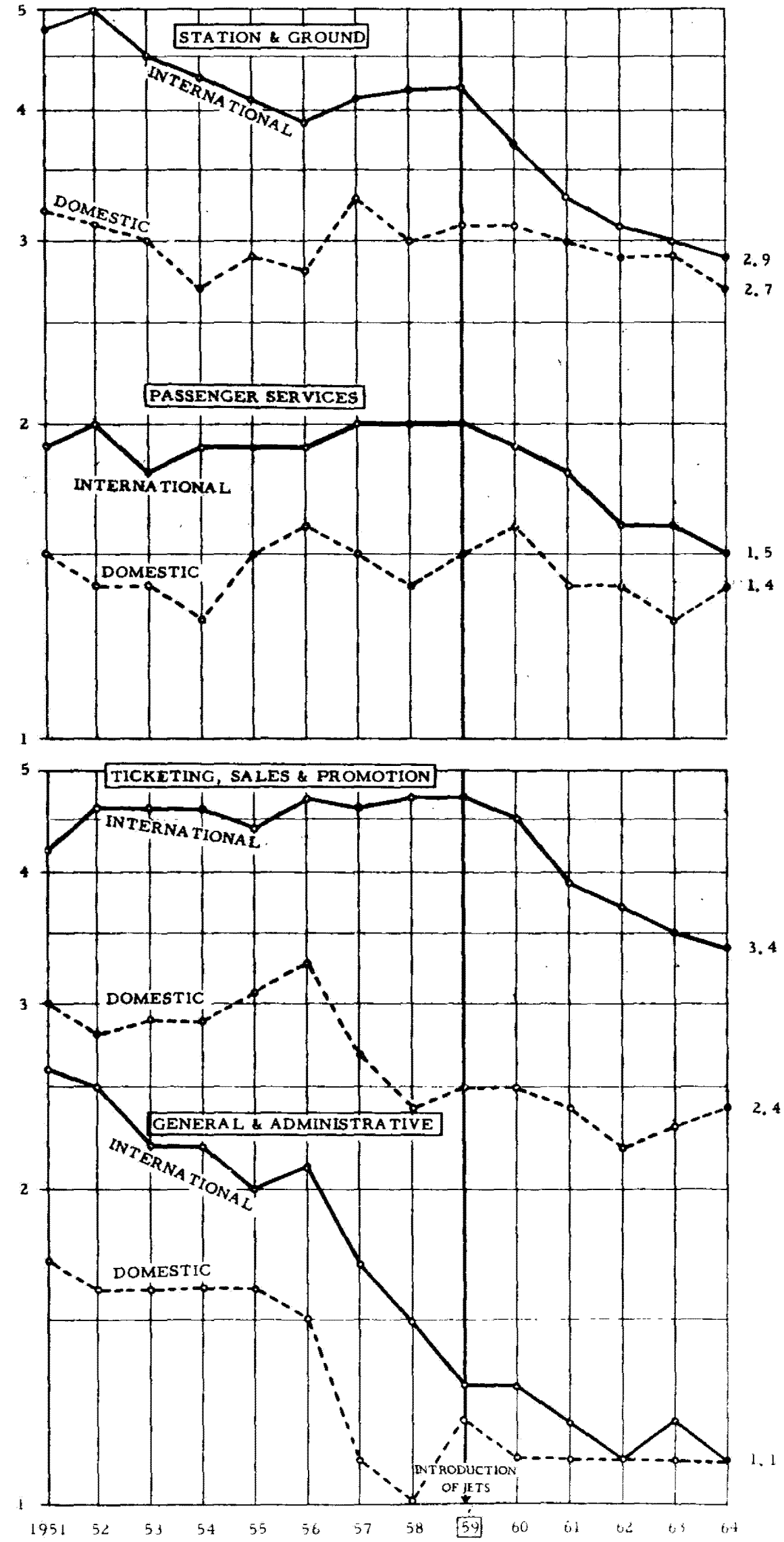
7. The trends exhibited by the component elements of indirect unit cost on international and domestic services from 1951 to 1964 are illustrated in Chart 5 on the basis of data given in Appendices 2 and 3. The implications are rather less clear than in the case of direct costs, but it may be observed that for all of the four main elements -- station and ground; passenger services; ticketing, sales and promotion; and general and administrative -- unit costs on domestic services show relatively moderate declines over the thirteen-year period but remain below the level of costs for the same item on international services. Regarding international services all of the elements of indirect cost show greater decreases than on domestic services and three -- station and ground; passenger services; and ticketing, sales and promotion -- show an accelerated rate of decrease from 1959. The fourth element -- general and administrative -- exhibits the greatest relative decline, but the rate appears roughly constant throughout the period. For comparative purposes the following table is given showing, for international and domestic services during the fourteen-year period 1951 to 1964, the percentage changes in the seven main items of cost on a unit basis.

CHART 5

INDIRECT UNIT OPERATING COST COMPONENT TRENDS; 1951 - 1964
Scheduled Airlines of ICAO Contracting States, Scheduled and Non-Scheduled Operations

International and Domestic Services

Cost per tonne-kilometre available



Notes: 1. For basic data see Appendices 2 and 3.
2. This Chart has been drawn to logarithmic scale to show rates of change

Percentage change in unit cost items: 1951 - 1964

Direct Cost	Domestic	International
Flight operations	- 26%	- 51%
Maintenance and overhaul	- 16%	- 52%
Depreciation	+ 25%	- 15%
Indirect Cost		
Station and ground	- 16%	- 40%
Passenger services	- 7%	- 21%
Ticketing, Sales and promotion	- 20%	- 19%
General and administrative	- 35%	- 58%

Changing relationship of the main cost items

8. As would be expected from the foregoing table there has, over the period under consideration, been some readjustment in importance relative to each other of the items of operating cost. The relevant data, in terms of percentage distribution, is given in Appendices 1, 2 and 3; and the situation on international services, where the change has been greatest, is illustrated in Chart 6. From the basic data it can be calculated that on international services the share of operating cost attributable to three items -- flight operations, maintenance and overhaul, and general and administrative -- fell, between 1951 and 1964, by a total of 10 percentage points, while the share attributable to the other four items -- depreciation, station and ground, passenger services, and ticketing sales and promotion -- rose by a corresponding amount.

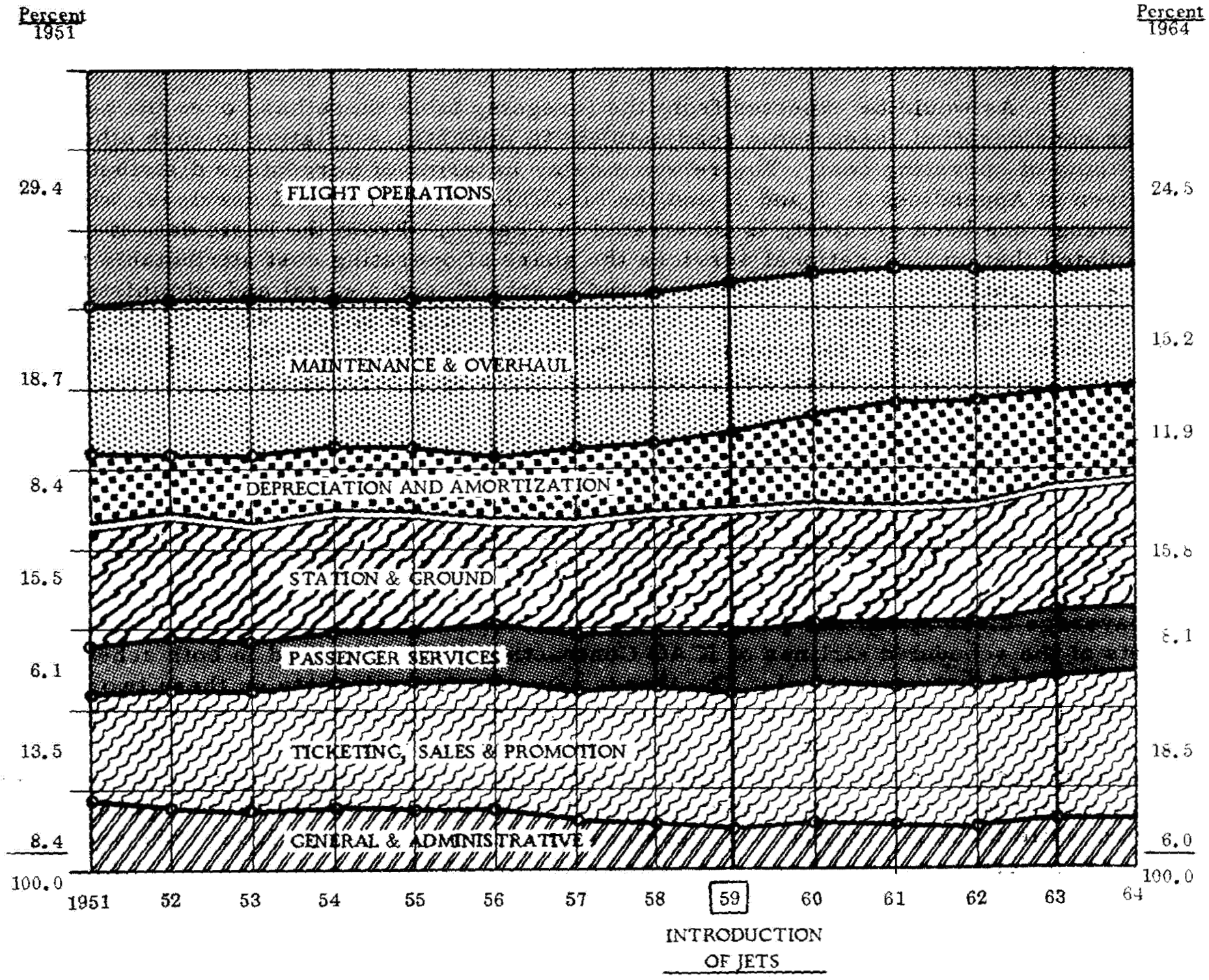
Aircraft speed and capacity trends

9. To find explanations for the global trends of unit operating costs that have been discussed it is helpful to examine the trends exhibited by some of the factors affecting these costs. Of these factors the most susceptible to analysis on the basis of data available to ICAO, and the most likely to show clear patterns of development are the average block speed and the average payload capacity available per aircraft in the fleets of the scheduled airlines of ICAO Contracting States (engaged in both scheduled and non-scheduled operations). The trends apparent from the data on these two factors are illustrated for international and domestic services separately in Chart 7. It may be seen immediately that while both block speed and aircraft payload capacity have increased each year from 1951 to 1964 on both international and domestic services the rates of increase on domestic services have been relatively moderate throughout the period while those on international services accelerated markedly from 1959 when the long range jets were introduced into service.

CHART 6

PERCENTAGE DISTRIBUTION OF OPERATING COST COMPONENTS: 1951 - 1964
Scheduled Airlines of ICAO Contracting States, Scheduled and Non-Scheduled Operations

International Services



Note: For basic data see Appendix 2

10. The actual figures for the first and last years of the period under consideration and for 1959 are given in the following tables.

Average block speed

(in kilometres per hour)

	1951	1959	1964
International services	320	385	545
Domestic services	275	325	395

Average payload capacity available per aircraft

(in tonnes)

	1951	1959	1964
International services	4.7	6.9	12.6
Domestic services	4.0	5.9	9.0

Regarding block speed it may be noted from these tables and Chart 7 that the margin in favour of international services remained fairly constant, at about 50-60 kilometres per hour, from 1951 to 1959, but between 1959 and 1964 increased about three times to 150 kilometres per hour. A similar pattern is visible for average aircraft payload capacity. Here the margin in favour of international services remained at about one tonne until 1959, but from then increased to nearly 4 tonnes in 1964.

Relationship between aircraft productivity and unit cost

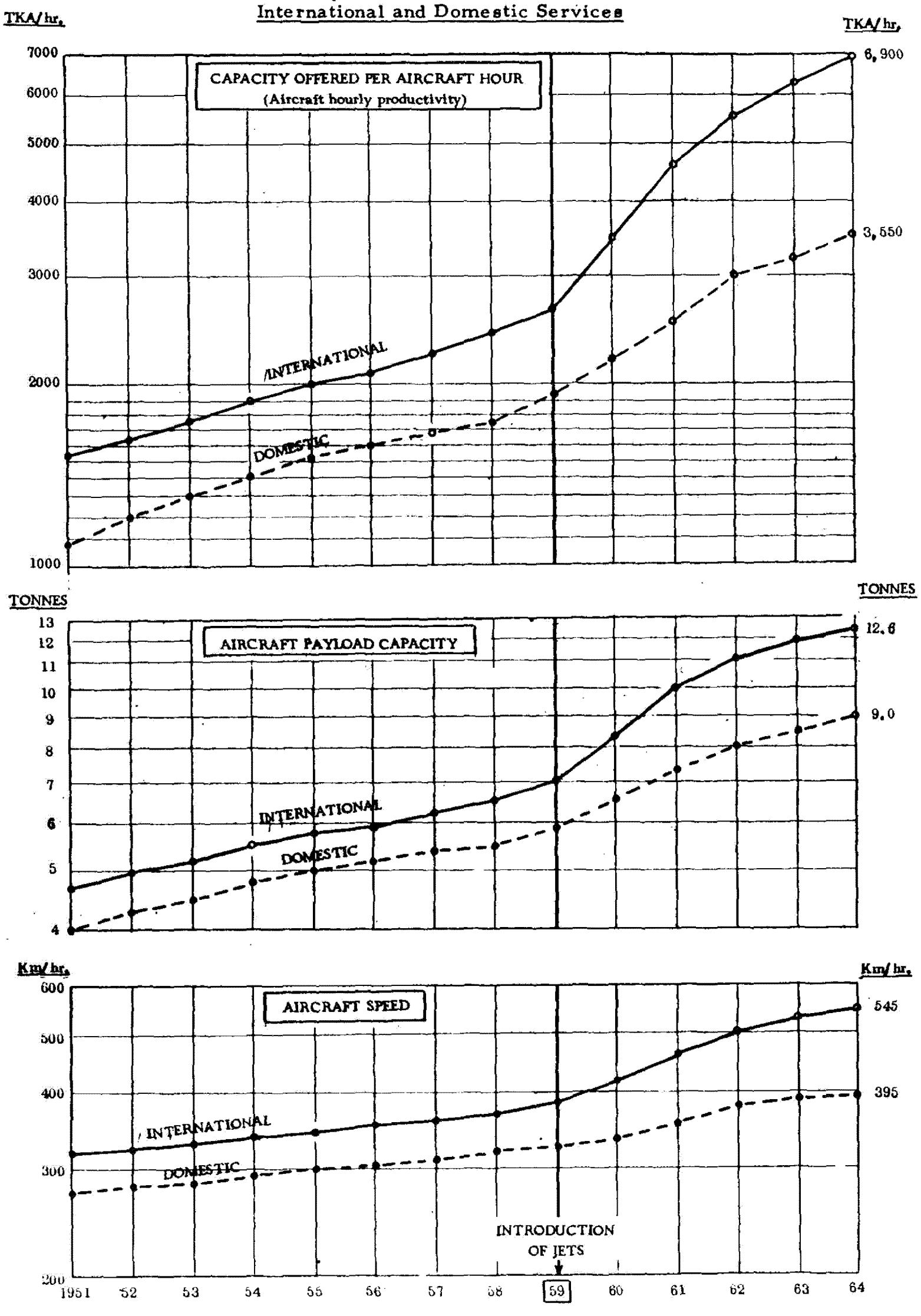
11. This evolution of aircraft characteristics on international services can also be shown in terms of a single factor by combining speed and payload capacity to obtain average aircraft productivity, expressed in terms of tonne-kilometres available per aircraft hour. Chart 1 illustrates the trend of aircraft productivity and also the clear inverse relationship between this factor and unit operating cost on international services. It may be seen that as productivity increases unit cost decreases and as the rate of productivity increase accelerates so the rate of unit cost decrease also accelerates in a reciprocal manner. The sharp upward turn in the trend lines for aircraft speed and capacity and resultant productivity is, of course, the consequence of the introduction into service in 1959 of the long range jet aircraft. These aircraft -- the various models of Boeing 707 and 720, Douglas DC-8, and Convair 880 and 990 -- have, on average, about twice the speed and twice the payload capacity, and therefore four times the productivity of the long range four-engine piston aircraft (see Chart 8). The impact of the long range jets showed first on international services because they are employed mainly on the long-haul routes which are predominantly international. Their effect on domestic services has been less pronounced because only a very few States -- Australia, Brazil, Canada and the United States -- have domestic routes long enough to support many such aircraft.

CHART 7

AVERAGE AIRCRAFT SPEED, PAYLOAD CAPACITY, AND CAPACITY OFFERED PER AIRCRAFT HOUR TRENDS: 1951 - 1964

Scheduled Airlines of ICAO Contracting States, Scheduled and Non-Scheduled Operations

International and Domestic Services



Note: This Chart has been drawn to logarithmic scale to show rates of change.

Summary

12. The more important of the trends noted in the foregoing paragraphs may be summarized as follows:

a) Over the period 1951 to 1964 the average cost of each tonne-kilometre of air transport sold by the airlines of ICAO Contracting States on all services (international and domestic; scheduled and non-scheduled) fell about 14 per cent from 40.4 to 34.7 cents. The decline, however, occurred wholly on the international services where this cost per tonne-kilometre performed fell about 33 per cent from 49.4 to 32.9 cents, while on the domestic services it rose slightly from 35.1 to 36.4 cents, thus leaving the domestic cost at a higher level than international.

b) During the same period the average cost of producing a tonne-kilometre of air transport capacity regardless of the proportion sold moved in a somewhat different way to the cost per unit sold owing to the decline in load factors which was almost twice as great on domestic as on international services. The cost per tonne-kilometre available fell 27 per cent, from 25.2 to 18.3 cents, this being the result largely of the behaviour of international costs which fell 41 per cent against 17 per cent on domestic services. As a consequence, by 1964, the cost per tonne-kilometre available was almost the same on international and domestic services -- just over 18 cents.

c) The 41 per cent decrease in cost per unit available on international services is attributable mainly to large decreases in two items which together account for almost half of the total cost figure: flight operations which fell 51 per cent, and maintenance and overhaul 52 per cent. As a result of these decreases the unit cost of both of these items on international services was, by 1964, below the domestic level, and since they are the chief components of direct aircraft operating cost. This figure also was, by 1964, lower on international than on domestic services.

d) The rates of decline in cost per unit available accelerated markedly from 1959 on international, but not on domestic services.

e) Average aircraft speed and payload capacity, and resultant productivity in terms of tonne-kilometres available per aircraft hour, increased each year from 1951, but particularly on international services showed an accelerated rate of increase from 1959. In the case of both speed and payload capacity the margin in favour of international services remained fairly steady from 1951 to 1959, but increased over three times between 1959 and 1964.

f) On international services there is a clear inverse relationship between the trends of aircraft productivity and total unit operating cost. As productivity increases, unit cost decreases, and the rates of change both accelerate from 1959.

13. The acceleration in the rate of increase in aircraft speed, payload capacity and productivity on international services starting in 1959 is clearly the result of the introduction into service in that year of the long range jet aircraft, chiefly Boeing 707's and Douglas DC-8's. These aircraft, employed mainly on international routes because of their optimum stage length, have about twice the speed, twice the payload capacity and four times the productivity of the long range piston-engine aircraft they replaced.

14. The simultaneous acceleration in the rate of decrease in unit operating costs on international services is also attributable to the appearance of these highly productive aircraft. The direct unit costs of various aircraft types will be dealt with in the next section, but it may be noted here that where the long range jets have been placed in service in quantity the increased speed, payload capacity, range, time between overhauls, and utilization of these aircraft have combined to reduce average unit costs at an accelerated rate.

15. One further consequence of the introduction of the low cost jets may be seen in the percentage distribution of costs on international compared to domestic services. In 1951 there was little difference between the two sectors, but by 1964, while there was still little difference in the proportion of costs attributable to the depreciation, station and ground, and general and administrative items, there was, on international services, an appreciably lower proportion of cost attributable to flight operations and maintenance and overhaul, and a higher proportion attributable to passenger services and ticketing sales and promotion.

III - DIRECT UNIT OPERATING COSTS FOR VARIOUS AIRCRAFT

Effect of aircraft performance characteristics on operating costs

1. In an examination of world air transport costs the aircraft may be considered as the common denominator. Of the primary determinants of cost referred to in Section I of this Study, economic environment varies from one country and region to another and route structure and carrier policy vary widely even for the carriers of one State, but there are a number of short, medium and long range civil transport aircraft that are in general use in ICAO Contracting States. The items of cost related directly to the characteristics of the aircraft in use, conventionally known as direct costs, are flight operations, maintenance and overhaul, and depreciation. The chief aircraft characteristics affecting the level of these items are payload capacity and speed, the size of crew, fuel and oil consumption, value and state of depreciation of the aircraft, and time required between overhauls. Of these the most significant are payload capacity and speed which together result in aircraft productivity.

Availability of data on aircraft performance characteristics

2. Statistical information on the direct unit operating costs associated with various aircraft types and on the actually experienced characteristics of these aircraft is not available on a world-wide basis. In fact such information has been obtained from only eight States and this generally not in comparable form. Comprehensive and comparable information covering a large volume of operations is available only for the United States and is contained in an annual publication of the Federal Aviation Agency entitled "Direct Operating Costs and Other Performance Characteristics of Transport Aircraft in Airline Service". The Analysis in this chapter is based on the data provided in the latest edition of this publication covering the year 1964. (Excerpts from these data are given in Appendix 4 on p. 51.) It is unfortunate that similar material is not available for the airlines of other States and for the aircraft not operated by the carriers of the United States. However, the material presented is of general interest since it does show the cost characteristics relative to each other of most of the aircraft in general use by the airlines of ICAO States. The average level of direct costs varies from region to region, but such information as is available suggests that the relationship between the different aircraft in terms of operating cost remains fairly constant.

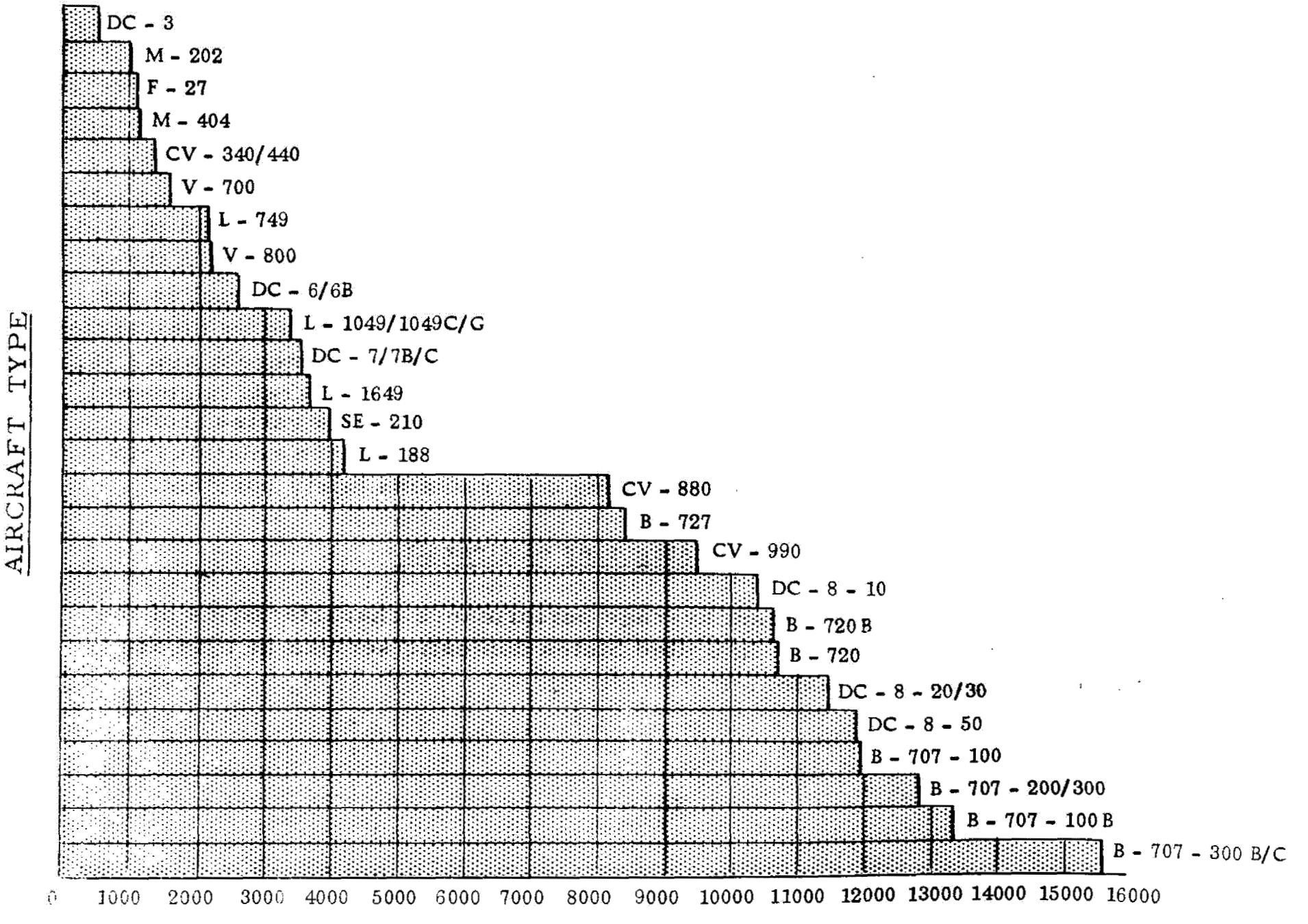
Performance characteristics of the main categories of aircraft

3. Some of the more significant average performance characteristics of the main categories of transport aircraft in United States domestic service in 1964 are given in the following summary table.

CHART 8

AVERAGE HOURLY PRODUCTIVITY OF SELECTED PASSENGER AIRCRAFT IN UNITED STATES DOMESTIC AIRLINE SERVICE - 1964

(Capacity offered per aircraft hour in tonne-kilometres available)



Note: For basic data see Appendix 4

Average performance characteristics by aircraft category
United States domestic service - 1964

Aircraft Category	Average No. in Service	Direct Unit Cost (¢/T. K.A.)	Average Payload Capacity (Seats)	(Tonnes)	Airborne Speed (K. P.H.)	Productivity (T.K.A./H)	Average Stage (km)	Utilization (H/Day)
	1	2	3	4	5	6	7	8
Passenger Aircraft								
2-Eng. Piston	338.6	17.3	35.6	3.4	272	925	161	6.3
2-Eng. Turbo-Prop	46.2	16.8	39.6	3.5	333	1,164	203	8.2
4-Eng. Piston	335.6	13.9	72.6	7.9	369	2,911	340	5.9
4-Eng. Turbo-Prop	172.8	13.4	70.0	7.6	452	3,434	385	7.8
2-Eng. Jet	20.0	17.7	63.9	6.9	583	4,021	620	6.7
3-Eng. Jet	41.9	8.1	92.7	11.2	753	8,430	915	6.9
4-Eng. Jet	295.7	7.3	115.0	14.7	751	11,041	1,265	10.0
Cargo Aircraft								
4-Eng. Piston	19.3	10.6	-	15.4	409	6,300	700	4.7
4-Eng. Jet	7.7	3.1	-	39.0	785	30,600	1,660	6.6
Helicopters								
Piston	6.8	154.0	9.7	1.0	128	128	23	1.5
Turbine	11.5	104.0	18.8	1.8	164	295	26	4.1

4. Passenger aircraft. - Considering first the data for the various categories of passenger aircraft it may be seen that as payload capacity (cols. 3 and 4) and speed (col. 5) and resulting productivity rise from category to category so, as might be expected, direct unit cost (col. 2) falls.* A further fact that emerges from the data is that productivity increases with average stage length (col. 7) which, like productivity, has an inverse relationship with unit cost. Average speed tends to increase with stage length and direct unit costs are thus reduced. Also increased average stage length means greater capacity per station served which tends to reduce indirect cost per tonne-kilometre.

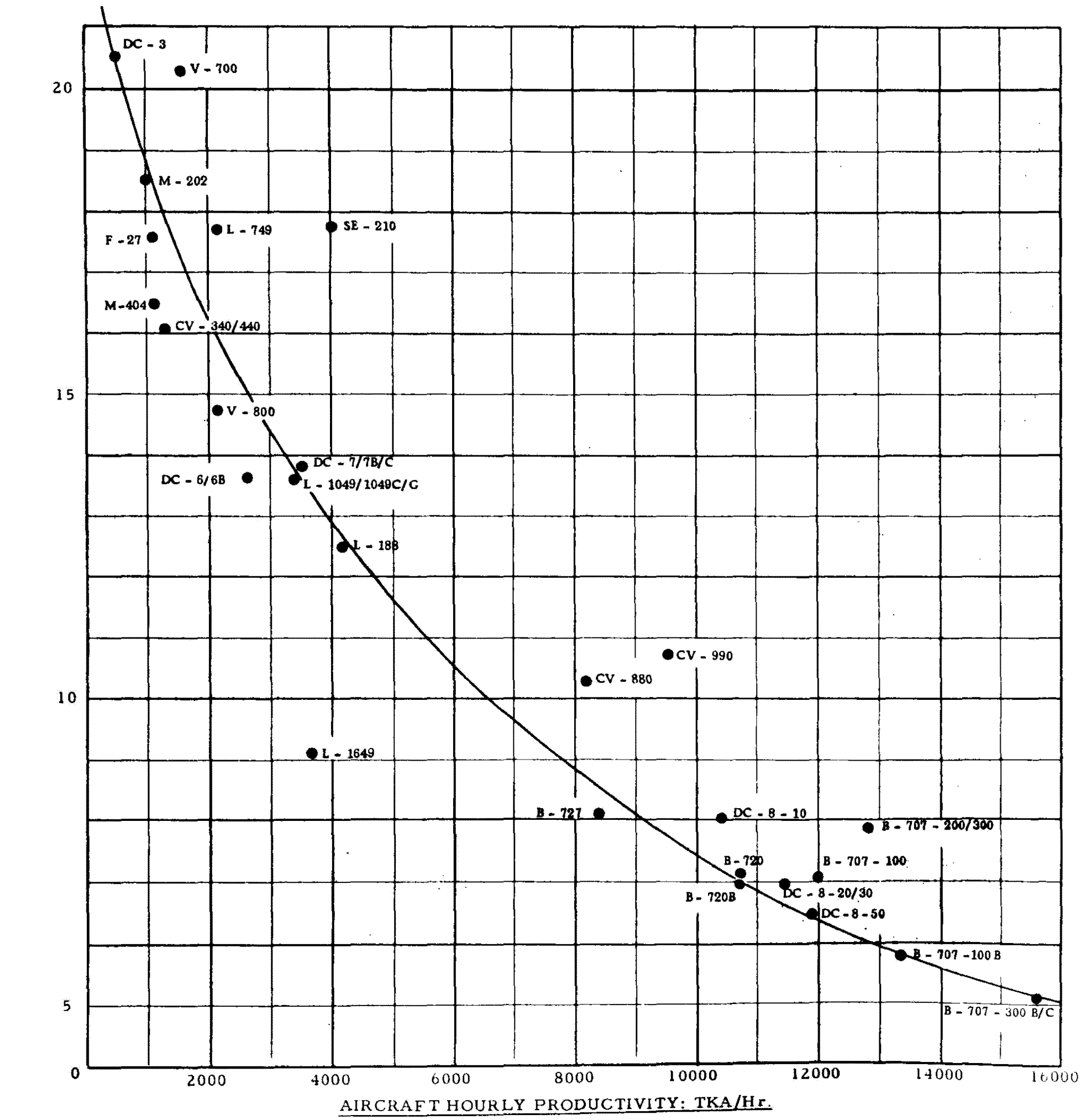
---

* Only the category of 2-engine jets does not conform to this pattern shown in column 2, but it should be noted as partial explanation that there are only twenty aircraft in this group all of non-United States manufacture which tends to increase the cost of maintenance and overhaul. Moreover although their average productivity is higher than that of the 4-engine piston and turbo-prop aircraft, their average payload capacity is appreciably lower. It may be that when statistics for the newer types in this category, such as the BAC-111, the B-737 and the DC-9, are available this anomally will disappear since although lighter they will have both greater payload capacity and greater speed.

CHART 9

HOURLY PRODUCTIVITY OF SELECTED AIRCRAFT TYPES RELATED TO DIRECT UNIT OPERATING COST PASSENGER AIRCRAFT IN UNITED STATES DOMESTIC AIRLINES SERVICE - 1964

(Tonne-kilometres available per hour and US cents per tonne-kilometre available)



5. Cargo aircraft. - The data on categories of cargo aircraft also shows the effect of productivity on direct unit cost. When an aircraft is arranged for the carriage of cargo rather than passengers the payload capacity of the aircraft is greatly increased by the absence of the various passenger facilities (seats, galleys, toilets, etc.). From the figures given it appears that the average capacity of the 4-engine piston aircraft is increased from 7.9 to 15.4 tonnes, that is almost doubled, while that of the 4-engine jets goes up from 14.7 to 39.0 tonnes, over two and a half times. It happens also that average stage length is increased by about 100 per cent for the 4-engine piston group and 30 per cent for the 4-engine jets with the consequence that airborne speed is increased by about 10 per cent for the former group and 5 per cent for the latter. Because of these increases in payload capacity and speed the average productivity of the cargo aircraft is between two and three times greater than that of the passenger versions. Direct unit costs for the cargo versions, in spite of lower utilization rates, are almost 25 per cent less in the case of the piston category and almost 60 per cent less for the jets. The very low direct cost of 3.1 cents per tonne-kilometre available achieved with the 4-engine cargo jets by United States domestic trunk carriers in 1964 suggests that as an increasing proportion of the world's air cargo is carried on all-cargo services in large jet aircraft it will be possible to reduce the average cargo rate from its 1964 level of 20.4 cents per tonne-kilometre performed. With these aircraft, if one assumes indirect costs are 50 per cent of direct and a 60 per cent load factor, the total cost per tonne-kilometre performed would be under 8 cents.

6. Helicopters. - Helicopters have been included in the table in paragraph 3 mainly to show that from the point of view of performance characteristics they are still far removed from fixed-wing aircraft. Unit costs, utilization, stage length, payload capacity and speed are of a completely different order of magnitude. For example the direct operating cost per tonne-kilometre available for turbine-engine helicopters in 1964 was 104 cents or six times the 16.8 cents achieved with 2-engine turbo-prop fixed-wing aircraft. However, with helicopters as with the fixed-wing types the inverse relationship between productivity and unit cost is apparent. Comparing the two categories the average productivity of the turbine helicopters is seen to be higher by about 130 per cent and the average direct unit cost lower by 33 per cent than those of the piston types.

Performance characteristics of various aircraft types

7. The direct cost and other performance characteristics dealt with in the foregoing paragraphs have been averages for the main categories of transport aircraft and as such have covered the wide variations found in the different types within each category. Statistics for the types of aircraft in domestic service in the United States in 1964 are given in Appendix 4. The productivity figures for these aircraft are illustrated in Chart 8 and are related to the direct unit cost figures in Chart 9. From Chart 8 it can be seen that there is a fairly steady progression in productivity from the DC-3 to the L-188 and again from the CV-880 to the B-707-300B/C, but that there is a sharp break between the 4-engine turbo-prop L-188 with an average of just over 4,000 tonne-kilometres available per hour and the 4-engine jet CV-880 with just over 8,000 tonne-kilometres per hour. The 4-engine jets range from this 8,000 to nearly 16,000 with the average for the group being just over 11,000 nearly four times as great as the average of 2,900 for the group of 4-engine piston aircraft which they replaced on most long-haul routes.

8. This sudden jump in productivity between 4-engine piston and 4-engine jet provides the explanation for the sudden acceleration in the rate of productivity increase on world international services (where apart from United States domestic services most of the long range jets are operated) illustrated in Chart 1 and referred to in Section II; and the relationship between direct unit cost and productivity illustrated in Chart 9 explains the acceleration in the rate of unit cost decrease also shown in Charts 1 and 3. Chart 9 demonstrates clearly that the fall in direct unit cost from the DC-3 to the B-707-300 B/C coincides with a steady rise in productivity. All but four or five of the twenty-six aircraft types in service are on or close to the approximately fitted line of regression.

9. Effect on depreciation.- In connection with this decline in direct cost per tonne-kilometre available as productivity rises it is interesting to note the relative importance of depreciation. Cost attributed to depreciation, of course, varies in an arbitrary manner depending on the period and rate of depreciation adopted. Moreover the unit cost of depreciation is affected by utilization which means that it is reduced in the case of the 4-engine jets where a high rate of utilization is achieved. However, apart from these factors the cost of depreciation is primarily determined by the age of the aircraft. As might be expected, therefore, depreciation accounts for the lowest percentage of direct cost in the case of the DC-3 -- about 2 per cent. For the whole group of 2 and 4-engine piston aircraft it is about 7 to 8 per cent; for the 2-engine turbo-props 13 per cent and for the other aircraft, the 4-engine turbo-props and the 2, 3 and 4-engine jets it varies from about 19 to 26 per cent.

10. Effect on flight operations and maintenance.- It is in the other elements of direct cost -- flight operations and maintenance and overhaul -- that the reductions occur as size and speed increase. More productivity can be achieved per crew member and per dollar of fuel cost and, in the case of the jets, the required time between overhauls is increased and maintenance cost thereby reduced because of the simplicity and reliability of the engines. Also regarding the jets it is important to observe the effect of the development of the turbofan engine. Compared to the older turbo-jet engine the turbofan achieves greater take-off and climb thrust, greater cruising speed, greater payload capacity and at the same time lower fuel consumption all of which characteristics lead to lower direct unit costs. On Chart 9 it can be seen that wherever a turbofan can be compared to the older turbo-jet version, that is the B-720 and the B-720B, the B-707-100 and the B-707-100B, the B-707-200/300 and the B-707-300 B/C, and the DC-8-10/20/30 and the DC-8-50, the turbofan version has the lower unit cost.

Future prospects for aircraft direct unit costs

11. 1965 to 1970.- For the near future, until about 1970 that is, such factors as the more wide spread use of the turbofan engine, development of laminar flow and boundary layer control techniques, lighter structures, and the appearance of stretched versions of existing types suggest that direct unit costs of the subsonic jets, and thereby the unit costs of the world's air transport fleet as a whole, may be reduced still further. Manufacturers of such new twin turbofan aircraft as the short and medium range Lear-40, F-28, BAC-111, B-737 and DC-9 claim that these aircraft will effectively reduce direct

unit costs for jets in their range group. In addition stretched versions of long range jets such as the Douglas DC-8-61/62/63 series now in production will bring direct unit cost below their present lowest level. The DC-8-61 and -63 will have a payload capacity about 66 per cent greater than the DC-8-50 which with the same speed should give them 66 per cent greater productivity.

12. After 1970.- For the 1970's there exists the possibility of very much larger subsonic jets such as the projected Boeing 747 and Douglas DC-10 with a capacity of the order of 500 seats instead of the 250 in the coming DC-8-61/63. These relatively large aircraft may be expected to bring direct unit costs still lower. Before these appear, however, supersonic transports may be placed in service. Two versions are being developed in ICAO States: the Anglo-French Concorde with a speed of Mach 2.2 and payload capacity of about 130 seats, expected to enter service in 1972; and the United States SST Project with a speed of Mach 2.7 to 3.0 and payload capacity of 150 to 220 seats, expected to enter service in 1974. There are too many new factors involved to allow reliable estimates to be made of their direct unit costs. Their capacity will be similar to that of present or soon-to-be-introduced subsonic jets, but their optimum cruising speed will of course be two or three times greater which should give them a correspondingly higher productivity. However their speed and the limitations that may result from engine noise and sonic boom may make them less flexible than subsonic jets in airline operation. If this proves to be so, low utilization rates may have an adverse effect on unit costs.

Variations in unit cost associated with a given aircraft type

13. In addition to the variations in the direct unit costs associated with different categories and types of aircraft in United States domestic operations that have been dealt with thus far it is necessary to consider the variations that occur in the costs associated with a particular aircraft. In Section I, paragraph 10, are listed the more important of the factors affecting the level of operating costs. These are grouped under four main headings in accordance with their primary source: (A) characteristics of the aircraft, (B) current economic environment, (C) route structure, and (D) decision of the carrier. The factors listed under (A) include such design characteristics as capacity and speed, crew size, fuel and oil consumption, value of aircraft, and required time between overhauls, and are considered as common to all aircraft of a given type. The factors listed under (B), (C) and (D), however, may lead to rather wide variations in the direct unit costs associated with one aircraft type under different operating conditions.

14. Current economic environment.- Arising from the current economic environment such factors as salary and wage levels, fuel and oil prices, level of aircraft rental fees, and charges for air navigation facilities may be expected to remain fairly uniform within any one country, but to vary internationally from region to region. On the other hand the level of demand for air transport capacity and the competitive situation in relation to other air carriers and to surface transport may vary both domestically and internationally. Such variations as do occur in these factors between States or within one State will clearly cause

variations in the level of direct operating cost associated with any particular aircraft type. Variations in salaries and wages will affect the cost of flight operations and maintenance and overhaul; variations in fuel and oil prices, and aircraft rental fees will modify the cost of flight operations; and variations in demand will affect scheduling and utilization and hence such items of direct unit cost as insurance and depreciation.

15. Route structure.- Factors arising from the route structure on which a given aircraft type is operated will also clearly affect its cost performance. The average stage length on which it is operated and the local air traffic control situation will affect its average block speed. Obviously the more holding over airports that is required the slower will be the speed, and because of the relative time needed for take-off, climb, descent and landing, the longer the stage length the greater the average speed. The actual volume of payload capacity available for allocation between the different classes of passenger and cargo may depend on the average stage length operated. Long-haul operations require a greater weight of fuel to be carried which may in extreme cases result in a reduction in payload capacity. Finally aircraft utilization depends to a large extent on the route structure. It is extremely difficult to achieve high utilization rates on short-haul operations or where traffic is light and frequency low.

16. Carrier decisions.- A number of the decisions that must be taken by the individual carrier will have an obvious effect on the level of direct unit operating costs. Such decisions will include those with respect to the type of flight equipment insurance coverage to be adopted, the depreciation method to be followed, policy concerning aircraft rentals, and the configuration selected for the aircraft. Configuration or allocation of load between the different classes of passenger and cargo determines the actual volume of payload capacity offered. Because the first class passenger requires more space and facilities, the total volume of payload capacity offered will be increased as the percentage of first class seats is reduced. Also, because passenger accommodation requires more facilities and space per pound of payload than cargo accommodation total payload capacity will be increased as passenger capacity is reduced, but so will revenue be reduced.

Summary

17. The main points made in this Section may be summarized as follows:

a) The direct unit operating costs associated with a particular aircraft type are determined in a primary sense by the characteristics of the aircraft itself, and in a secondary sense by the economic environment, the route structure and the decisions of the carrier which together define the nature of the operation for which an aircraft is used. The design characteristics, such as capacity, speed, crew size, fuel consumption, value of the aircraft, and time between overhauls, are common to all aircraft of a given type. The economic environment, route structure, and carrier decisions vary, however, between regions, routes and carriers and accordingly the direct unit costs associated with a particular aircraft will vary depending on operating factors (see Section I, paragraph 10 B, C and D).

b) The average performance characteristics of transport aircraft in United States domestic service in 1964 demonstrate the inverse relationship between direct unit cost and aircraft productivity.

c) For passenger aircraft there is a sharp break in progression between piston and turbo-prop types on the one hand, and 3 and 4-engine jets on the other in both productivity and direct unit cost, which fact explains the acceleration from 1959 on international services of the global rates of productivity increase and unit cost decrease referred to in Section II.

d) When 4-engine piston and jet aircraft are operated in cargo configuration their productivity is increased from two to three times and their direct unit costs are reduced about 25 and 60 per cent respectively. These low costs suggest that as the proportion of cargo moving on all-cargo flights increases the present level of cargo rates may be appreciably reduced.

e) The direct costs and other performance characteristics of helicopters are of a completely different order to those of fixed-wing aircraft. The costs are so high as to suggest that helicopters can be used for scheduled air services only when cost per journey is more significant than cost per kilometre or where the public interest justifies subsidy.

f) The increasing use of the turbofan engine which provides more power in relation to weight and fuel consumption, the development of laminar flow and boundary layer control techniques and of lighter structures, and the production of stretched versions of existing jet aircraft suggest that in the years up to 1970 direct unit costs for short, medium and long range jets will fall below their present level thus bringing down the global average of direct unit operating costs.

g) After 1970 much larger subsonic jets with perhaps 500 seats may be introduced, further reducing direct unit costs. Supersonic transports are also expected to appear, but lack of experience with a number of wholly new problems (sonic boom, high skin temperature, etc.) makes it difficult to estimate the direct operating costs to be associated with them with any degree of accuracy.

18. Direct unit operating costs associated with various aircraft types, which is the subject of this Chapter, have been examined on the basis of data available for United States domestic operations. The point has been made that the lowest direct unit costs are generally associated with the largest and fastest aircraft. It has been emphasized, however, that the level of these direct unit costs depends on operating conditions as well as on the characteristics of the aircraft. Large jet aircraft possess

the characteristics that make it possible to operate them at continually declining unit cost levels, but it must always be borne in mind that the operating cost potential of these as of all other aircraft can be fully realized only when they are operated in a favourable economic environment, on a suitable route structure, and with a reasonable degree of managerial efficiency.

19. Neglecting economic environment as being to a considerable extent beyond the control of the air transport industry, and assuming, for the purpose of this Study, a consistent degree of managerial efficiency, attention may be focussed on the importance of route structure as a determinant of the direct unit cost realized with a particular aircraft. The term route structure may be said to comprise the shape of the network, the length of the stages operated, the number of airports served and the traffic potential. While the lowest direct unit costs are achieved with large jets on long-haul routes with high traffic density, the realization of the operating cost potential of any aircraft depends on its being employed on a route structure that permits an economically satisfactory level of flight frequency, aircraft utilization, and load factor. Where the average stage length is short and particularly where traffic density is low this is difficult to achieve. The vicious circle then occurs where light traffic leads to poor levels of utilization and load factor, thence to high costs and back through high fares to light traffic. * Inevitably there must be many short-haul routes and, especially in the developing regions, many cases of low traffic density, but to the extent that it is desired to reduce direct unit costs to the greatest degree compatible with the provision of a satisfactory public service, it is necessary to examine route structures with a view to modifying them where possible, sometimes with the benefit of newly granted traffic rights, so as to increase average stage length and to maximize traffic density.

---

* In many countries governments, being interested in providing air services for small or remote communities, break this vicious circle either by direct subsidies or by arranging that carriers with profitable routes shall also operate on the unprofitable routes, a form of hidden subsidy that may result in less than optimum development of the profitable routes.

IV - AIRLINE UNIT OPERATING COSTS

Airline costs and related performance criteria

1. The individual airlines of ICAO States are the agents that use the aircraft discussed in Section III, within varying economic environments, on varying route structures, and with varying policies, to produce the global trends discussed in Section II. The world-wide averages for unit operating costs and related performance criteria are thus the products of a wide range of cost and performance levels achieved by the different airlines. Detailed, comparable and reliable statistical information is not available for all scheduled carriers of ICAO States, but in Appendices 5, 6, 7 and 7A, such material is presented for a selected group of 41 airlines whose operations are 25 per cent or more international, 80 per cent or more scheduled, and 60 per cent or more passenger. They fall into two groups: 23 having 90 per cent or more of their operations international, and the remaining 18 having 25 to 89 per cent international. For each of these airlines there are given: in Appendix 5, p. 53, costs per tonne-kilometre available under each of the seven main headings of direct and indirect cost, total cost per tonne-kilometre performed, the percentage distribution of these costs, and the overall weight load factor; in Appendix 6, p. 55, basic traffic, personnel and financial data; in Appendix 7, p. 57, performance criteria derived from the basic data in Appendix 6, and in Appendix 7A p. 59 airline rankings according to a number of the criteria given in Appendix 7. The relationships between a number of these performance criteria and unit operating costs are illustrated in Charts 10 to 18.

Performance criteria

2. As has been suggested, in Section I, the factors affecting airline operating costs may be divided into four main groups as they are related to the characteristics of the aircraft operated, economic environment, route structure or policy decisions of the carrier. To carry out a comparative analysis of the effects of these factors on the costs of a number of airlines it is necessary to have a set of standard performance criteria. The statistical information available does not permit the development of criteria that take into account, in any precise way, the factors related to economic environment or carrier policy decisions. It does, however, allow the development of a number of such criteria that reflect in various ways the factors related to aircraft characteristics and route structure. The performance criteria given in Appendices 7 and 7A and plotted against unit cost in Charts 10 to 18 for each of the airlines are as follows:

a) average payload capacity available per aircraft (Chart 10)
b) average aircraft speed (Chart 11)
c) average capacity offered per aircraft hour (Chart 12)
d) average aircraft utilization per day (Chart 13)
e) average capacity offered per aircraft day (Chart 14)
f) capacity offered per airline staff member (Chart 15)
g) average stage length (Chart 16)
h) capacity offered per flight (Chart 17)
i) capacity offered per station served (Chart 18)

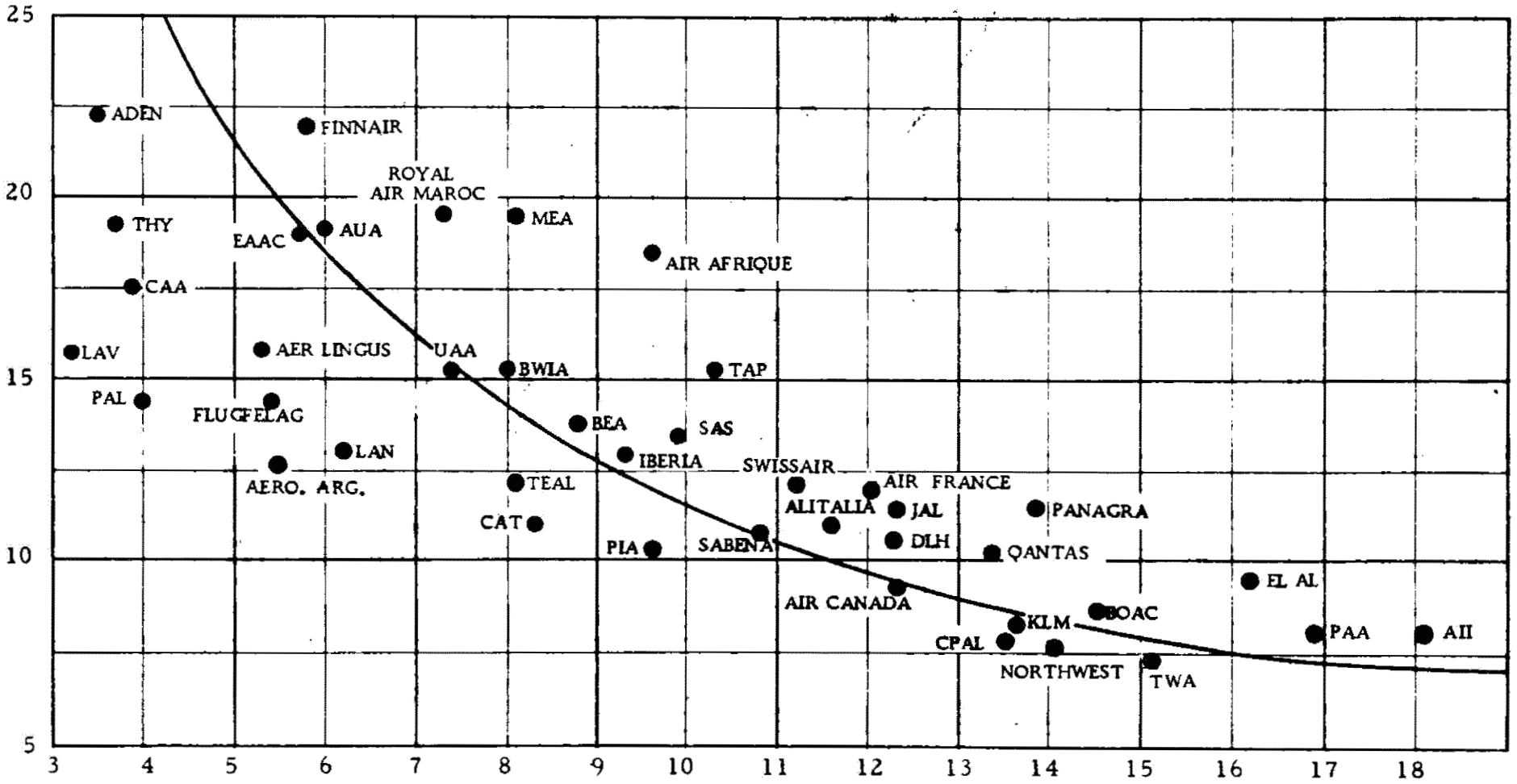
3. The first five of these performance criteria (that is payload capacity per aircraft, aircraft speed, daily aircraft utilization and capacity offered per aircraft hour and per aircraft day) measure factors that have a determining effect primarily on direct aircraft operating costs and accordingly are correlated, in Charts 10 to 14, with direct unit costs per tonne-kilometre available. The remaining four criteria (capacity offered per airline staff member, average stage length, and capacity offered per flight and per station served) reflect factors having a strong effect on indirect as well as on direct costs and are therefore correlated, in Charts 15 to 18, with total unit costs per tonne-kilometre available. The numerical values of the criteria themselves inevitably contain distortions. They relate, for example, to one year only -- 1964 -- which may in some cases be atypical. Moreover they are average figures calculated from basic data which unavoidably contain some degree of error. Nevertheless the correlations illustrated in the nine charts are clear and they are of value so long as it is realized that they show only general trends and relationships. In examining the charts it may be noted that in Appendix 7A all of the airlines analysed are ranked under each of the criteria. From the data presented in Appendix 7 a number of other interesting correlations may be plotted if desired.

4. Average aircraft payload capacity.- The first criterion, correlated to direct unit cost in Chart 10, is average payload capacity available per aircraft, expressed in tonnes. This criterion is the average weight capacity offered for all categories of load in all of the aircraft of each airline on all of its services. It reflects the payload characteristics of the aircraft operated, the configuration or allocation of capacity between the different classes of passenger and cargo, and to some extent the average stage length since for any particular aircraft as stage length is increased beyond a certain point payload may have to be sacrificed to fuel. Chart 10 shows that, in general, as average aircraft payload capacity increases direct unit cost falls. Further, it may be noted that 9 of the 10 airlines with the lowest direct unit cost (see Appendix 7A) appear among the 10 with the highest average payload capacity per aircraft.

CHART 10

AIRCRAFT PAYLOAD CAPACITY RELATED TO DIRECT UNIT OPERATING COST
41 Scheduled Airlines offering 25% or more of their capacity on International Services
All Services: International, Domestic, Scheduled, Non-Scheduled
1964

(The two sets of Statistics defining the points on this graph will be found in Appendix 7A)



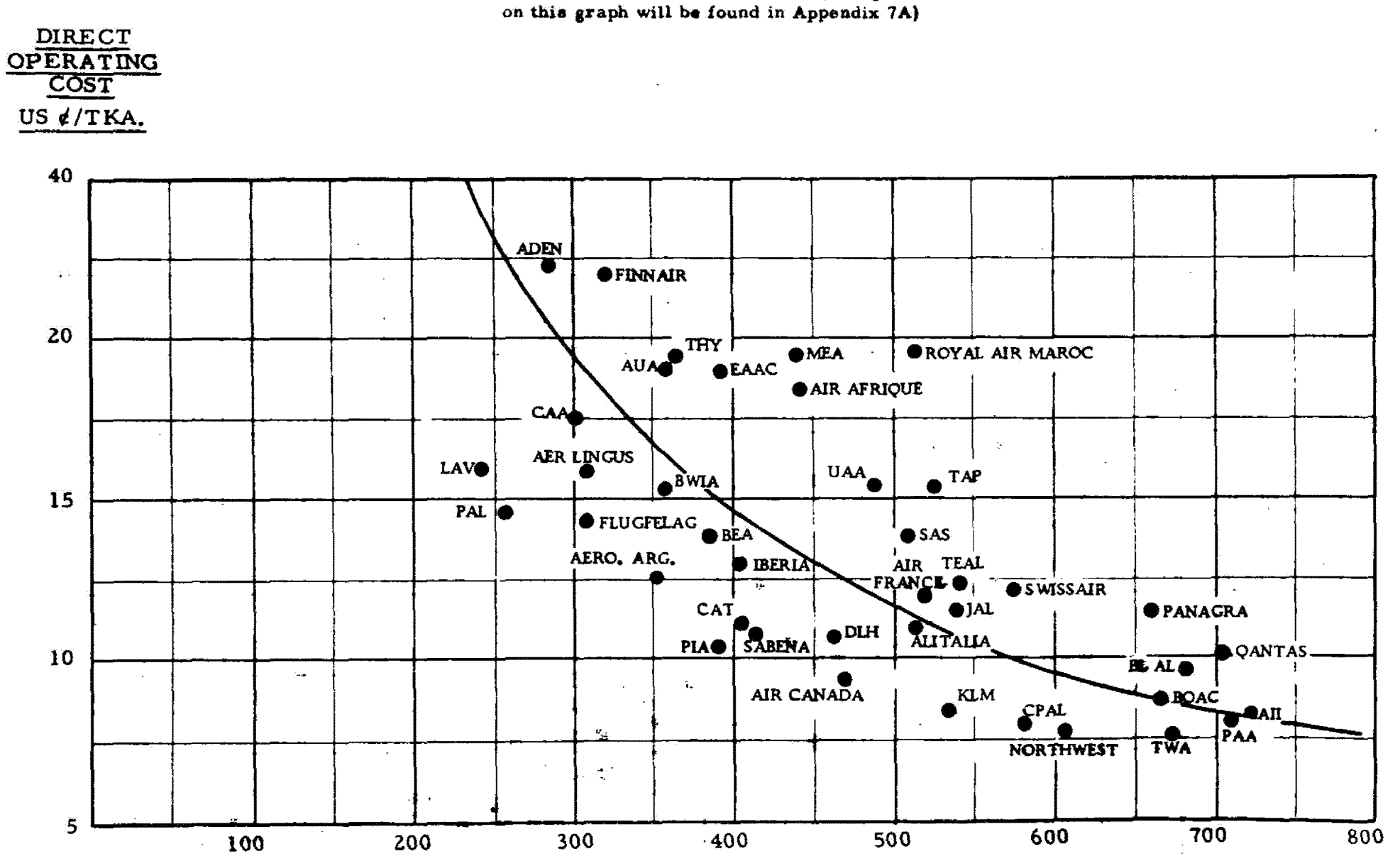
5. Average aircraft speed.- The average speed attained by each airline for all of its aircraft on all of its services is correlated with direct unit cost in Chart 11. This criterion reflects such aircraft characteristics as cruising speed, take-off and climb performance, and cruising altitude. It also reflects to a lesser extent the average stage length operated since average speed for a particular aircraft is reduced as stage length is reduced. From Chart 11 it may be seen that, in general, as average speed increases, direct unit cost decreases, and 8 of the 10 airlines with the lowest direct unit cost appear among the 10 with the highest average aircraft speed (see Appendix 7A).

CHART 11

AIRCRAFT SPEED RELATED TO DIRECT UNIT OPERATING COST

41 Scheduled Airlines offering 25% or more of their capacity on International Services
All Services: International, Domestic, Scheduled, Non-Scheduled
1964

(The two sets of Statistics defining the points on this graph will be found in Appendix 7A)



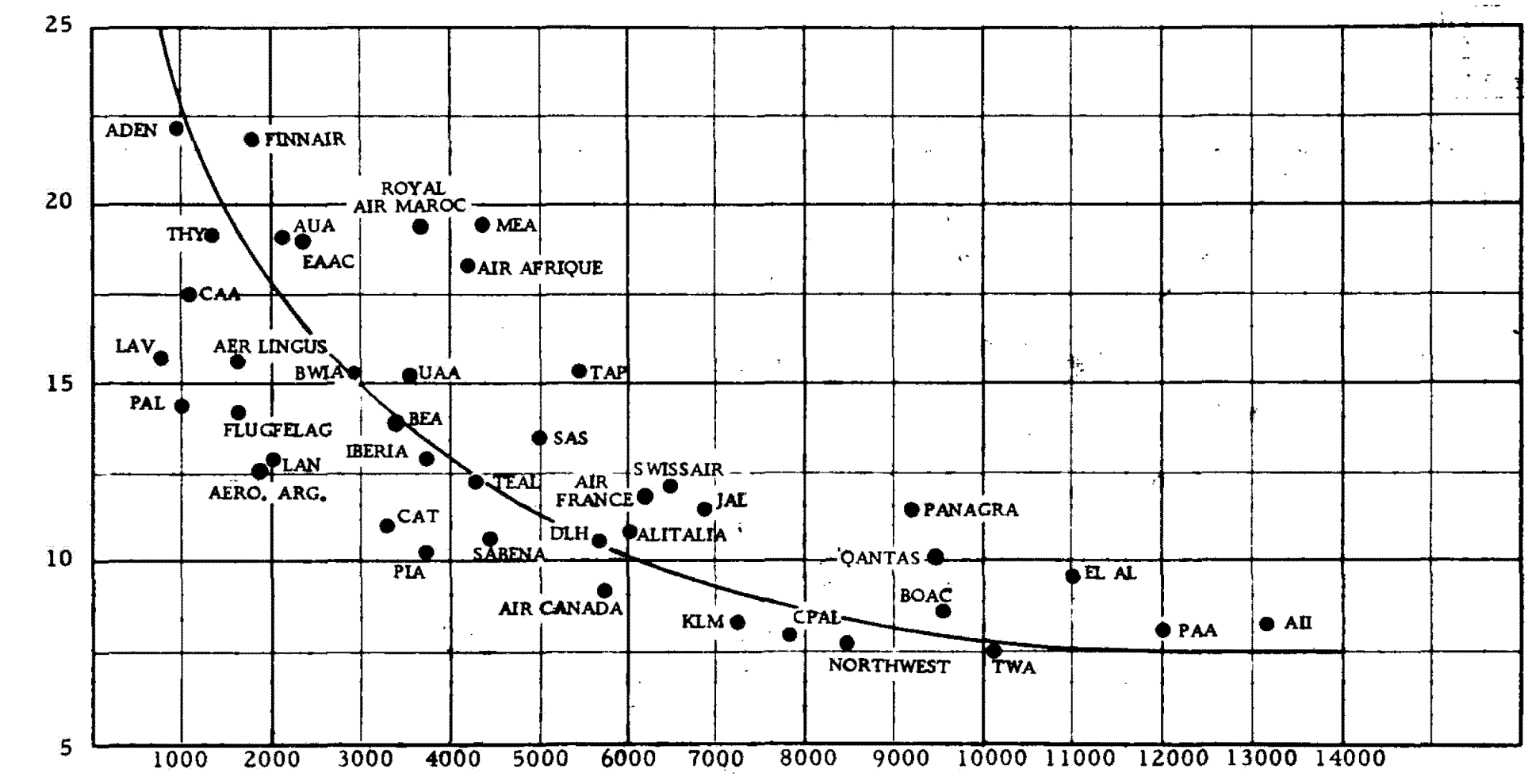
6. Capacity offered per aircraft hour (hourly aircraft productivity). - The average volume of air transport capacity offered per aircraft hour, expressed in tonne-kilometres available, combines the two criteria aircraft payload capacity and aircraft speed and takes into account all of the factors reflected by them. Chart 12 correlates this criterion with direct unit cost and as would be expected shows cost generally decreasing as hourly productivity rises, 9 of the 10 lowest direct unit cost airlines being among the 10 with the highest average hourly aircraft productivity (see Appendix 7A).

CHART 12

CAPACITY OFFERED PER AIRCRAFT HOUR RELATED TO DIRECT UNIT OPERATING COST

41 Scheduled Airlines offering 25% or more of their capacity on International Services
All Services: International, Domestic, Scheduled, Non-Schedules
1964

(The two sets of Statistics defining the points on this graph will be found in Appendix 7A)



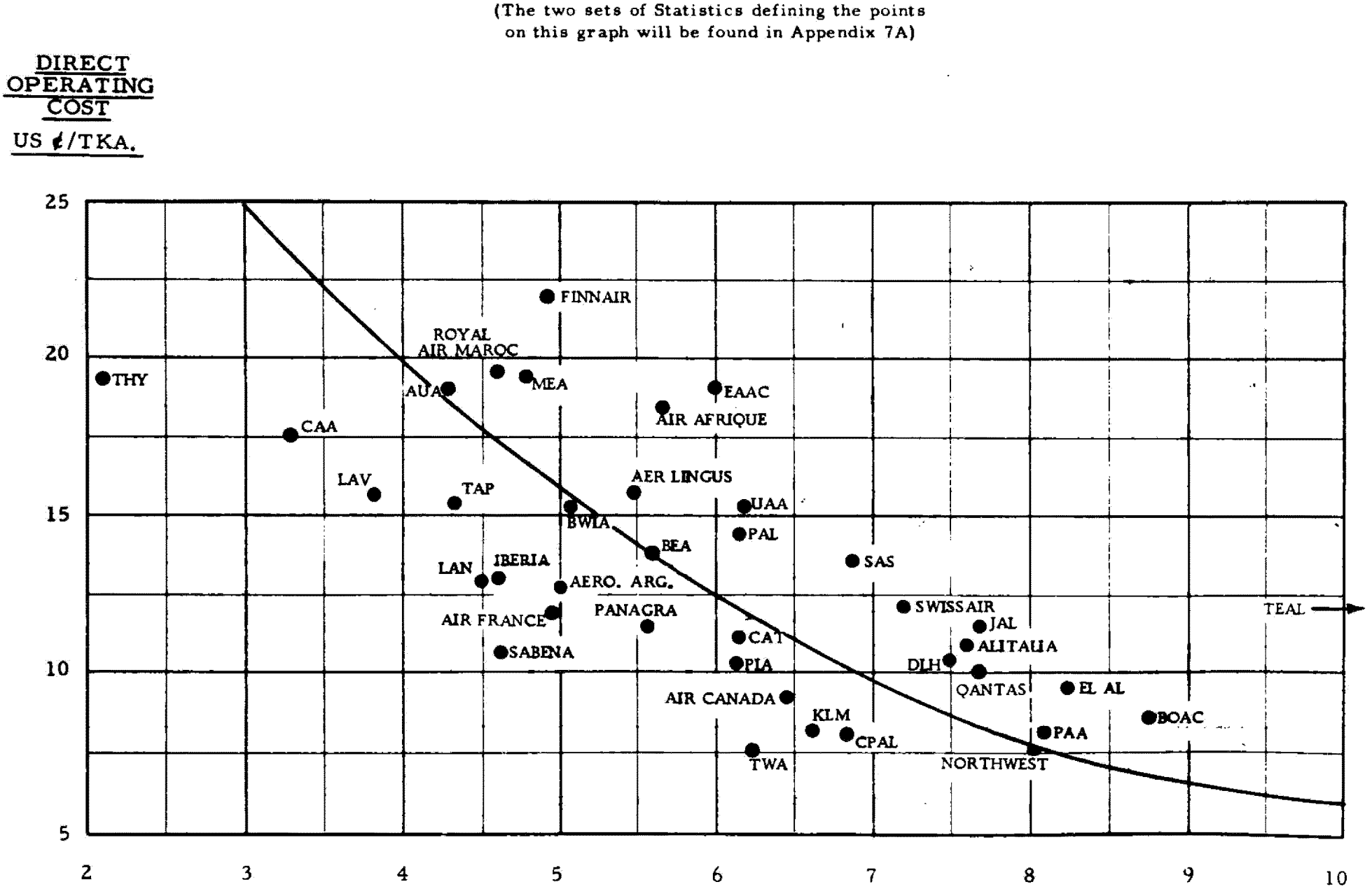
7. Daily aircraft utilization.- The average utilization of all of the aircraft in each airline's fleet expressed in hours per day is correlated with direct unit costs in Chart 13. Daily aircraft utilization, which affects such direct cost items as insurance, depreciation and crew cost reflects indirectly the nature of the route structure on which the carrier operates, utilization generally bearing a direct relationship to stage length, flight frequency and traffic density. Chart 13 again shows that as the criterion rises, in general, the direct unit cost falls. The correlation, however, is somewhat less close than in the previous cases. Only 5 of the 10 airlines with the lowest direct unit cost appear among the 10 with the highest average rates of daily utilization, but it should be noted that for one of the low cost airlines -- Air India International (AII) -- there are no utilization figures available (see Appendix 7A).

CHART 13

AIRCRAFT UTILIZATION PER DAY RELATED TO DIRECT UNIT OPERATING COST

38 Scheduled Airlines offering 25% or more of their capacity on International Services
All Services: International, Domestic, Scheduled, Non-Scheduled
1964

(The two sets of Statistics defining the points on this graph will be found in Appendix 7A)



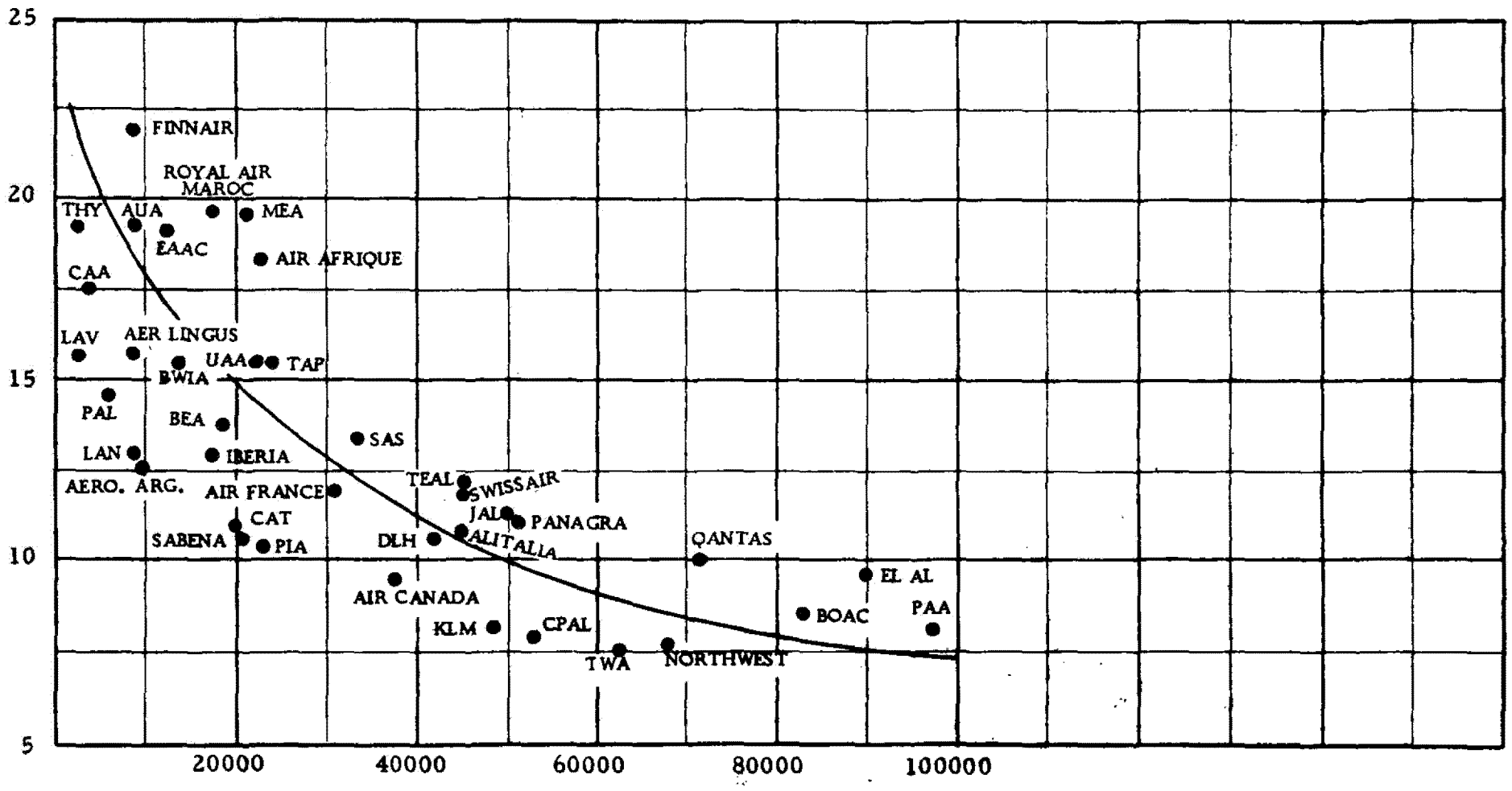
8. Capacity offered per aircraft day (daily aircraft productivity). - The average volume of air transport capacity offered by each aircraft each day, or daily aircraft productivity, expressed in tonne-kilometres available, takes into account all of the factors reflected in aircraft payload capacity, aircraft speed and aircraft utilization and as such is probably the most revealing indicator of direct unit cost. Chart 14 shows indeed that the decline in airline direct unit costs closely follows the rise in daily aircraft productivity. Of the 10 lowest direct unit cost airlines 8 appear among the 10 with the highest daily aircraft productivity, it being noted that for one of the low cost airlines -- Air India International (AII) -- there are no daily productivity figures (see Appendix 7A).

CHART 14

CAPACITY OFFERED PER AIRCRAFT DAY RELATED TO DIRECT UNIT OPERATING COST

38 Scheduled Airlines offering 25% or more of their capacity on International Services
All Services: International, Domestic, Scheduled, Non-Scheduled
1964

(The two sets of Statistics defining the points on this graph will be found in Appendix 7A)



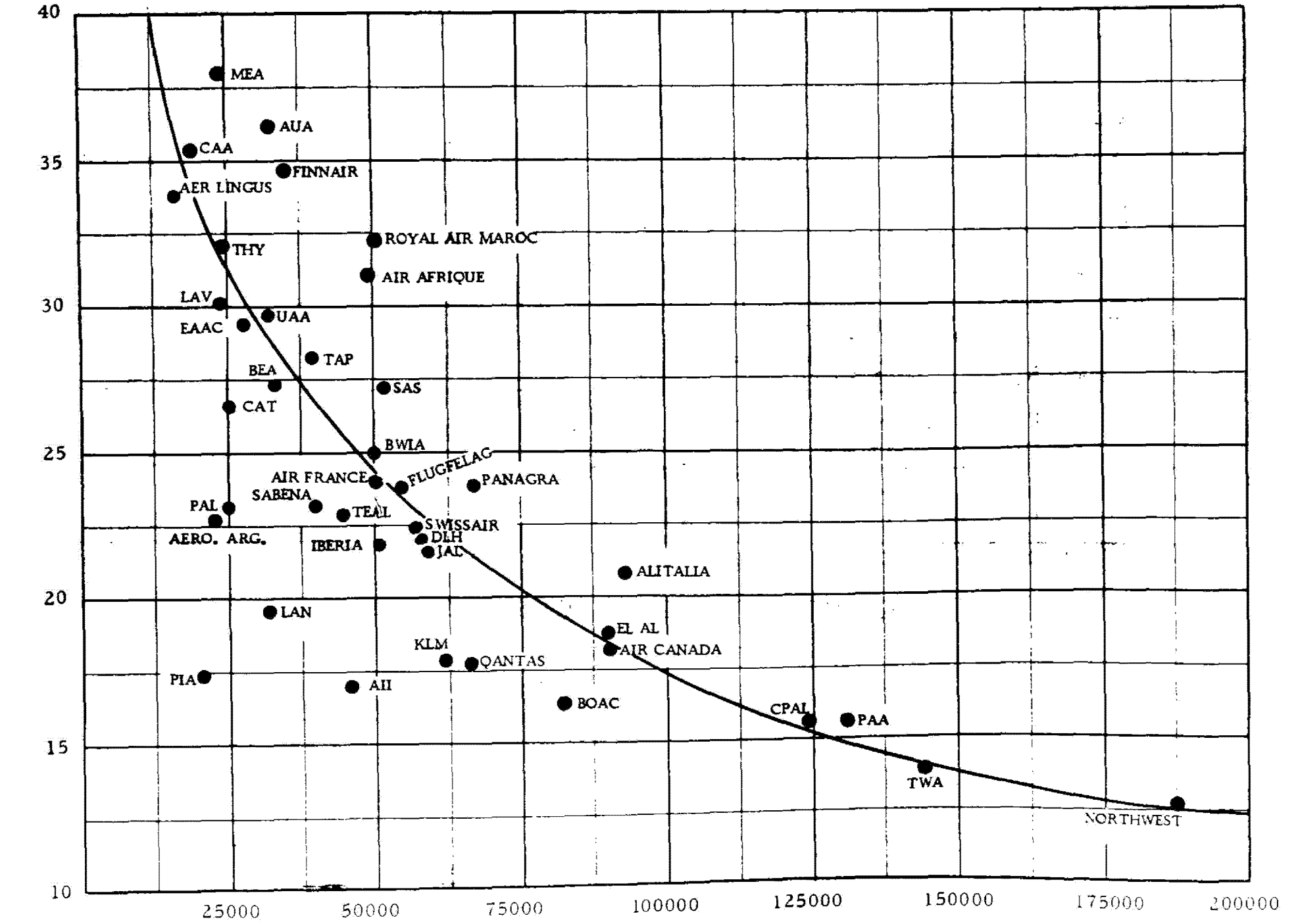
9. Capacity offered per airline staff member (staff productivity). - The volume of air transport capacity offered per airline staff member or staff productivity is correlated, in Chart 15, with total unit operating cost, both being expressed in tonne-kilometres available. (The correlation remains similar if the values are expressed in terms of tonne-kilometres performed.) This criterion of productivity per head, although widely used by management in the air transport industry as in other industries, must be regarded with the greatest care to avoid misunderstandings and erroneous conclusions. The difficulty arises chiefly because the staffs of some airlines perform for other airlines, on a contract basis, such tasks as aircraft maintenance, crew training, ticketing and handling. The statistics available do not adequately take such activities into account and accordingly staff productivity figures are distorted, downwards in the case of the airlines doing such work and upwards in the case of those for whom it is done. Nevertheless Chart 15 does show a correlation between unit cost and staff productivity which, when the above reservations are borne in mind, is of interest.

CHART 15

CAPACITY OFFERED PER AIRLINE STAFF MEMBER RELATED TO TOTAL UNIT OPERATING COST

40 Scheduled Airlines Offering 25% or more of their capacity on International Services
All Services: International, Domestic, Scheduled, Non-Scheduled
1964

(The two sets of Statistics defining the points on this graph will be found in Appendix 7A)



10. Stage length.- The total distance flown by a carrier, divided by the number of departures or flights operated, gives the average stage length flown by all aircraft in the fleet. In Chart 16 this criterion is correlated with total (direct plus indirect) unit costs for the group of airlines having 90 per cent or more of their operations on international services. Stage length, as has been pointed out, affects aircraft payload capacity, speed and utilization. It also affects those indirect unit costs that vary directly with the units of load handled, such as some parts of passenger service and ticketing costs: the longer the stage length the lower the unit cost. Chart 16 shows total unit costs generally decreasing as stage length increases. The correlation is not as close as in some of the previous cases, but 7 of the 10 airlines with the lowest total unit cost appear among the 10 with the longest average stage length.

CHART 16

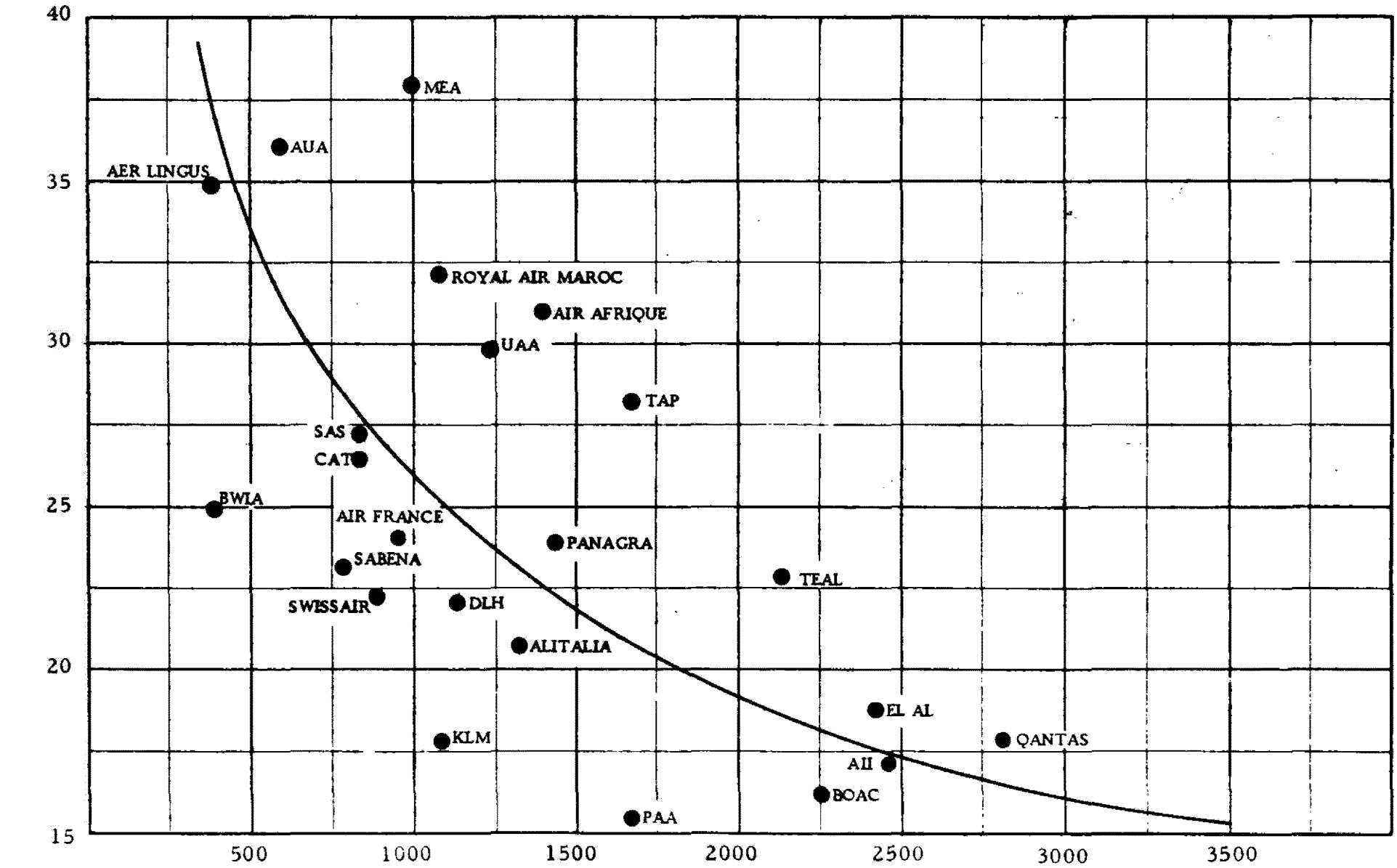
STAGE LENGTH RELATED TO TOTAL UNIT OPERATING COST

23 Scheduled Airlines offering 90% or more of their capacity on International Services

International Services only

1964

(The two sets of Statistics defining the points on this graph will be found in Appendix 7A)

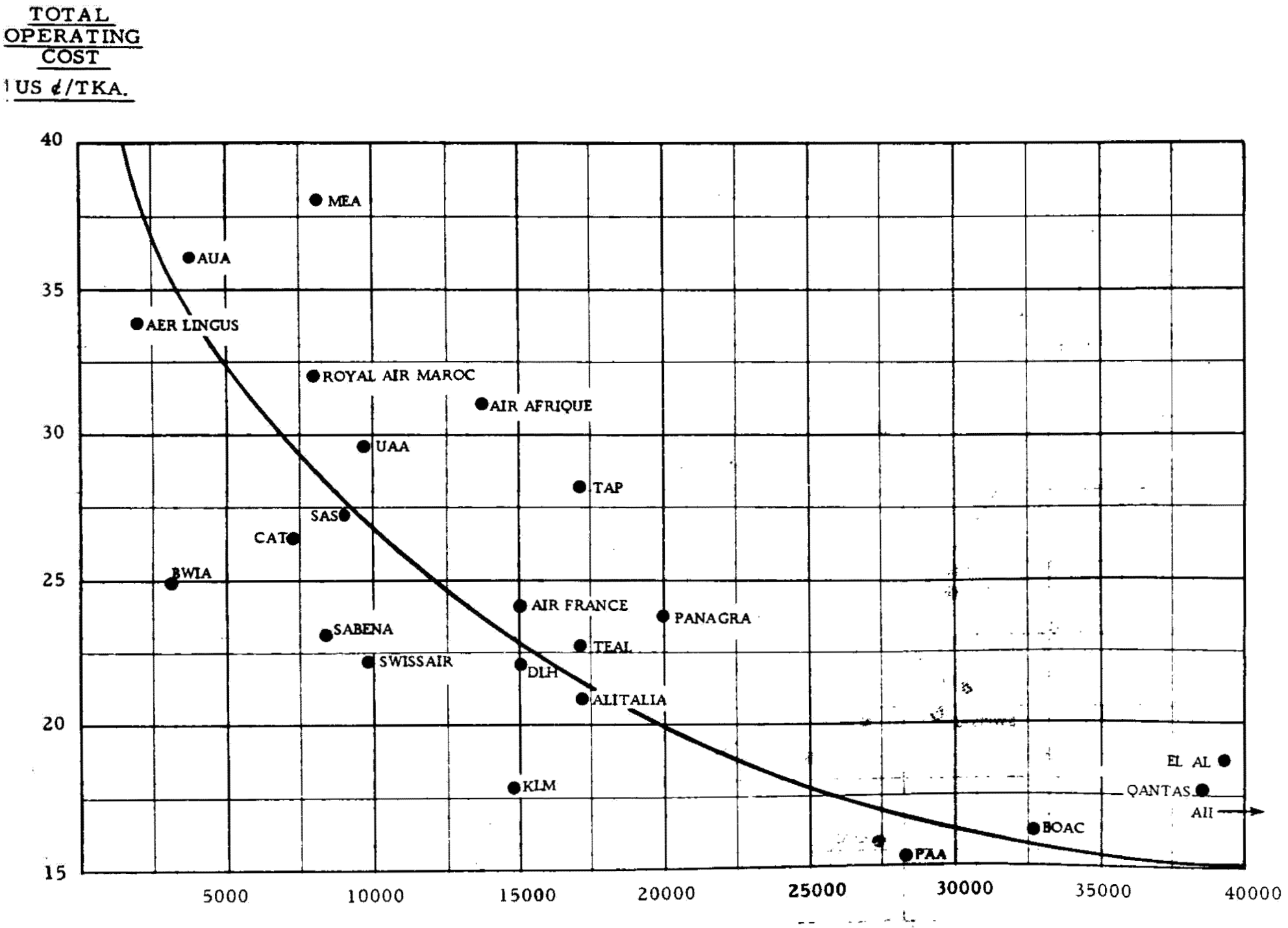


11. Capacity offered per flight. - In Chart 17 the volume of air transport capacity offered per flight or departure is correlated with total unit cost for the group of airlines with 90 per cent or more of their operations international. The criterion of capacity offered per flight is probably the most revealing indicator of total unit cost, its numerical value being susceptible to changes in such factors as the capacity of the aircraft, the total distance flown, the number of stages operated, the average stage length and the number of flights. Chart 17 clearly shows total unit cost decreasing as the value of the criterion rises, 8 of the 10 lowest unit cost airlines being among the 10 offering the greatest volume of capacity per flight.

CHART 17

CAPACITY OFFERED PER FLIGHT
RELATED TO TOTAL UNIT OPERATING COST
23 Scheduled Airlines offering 90% or more of their capacity on International Services
International Services only
1964

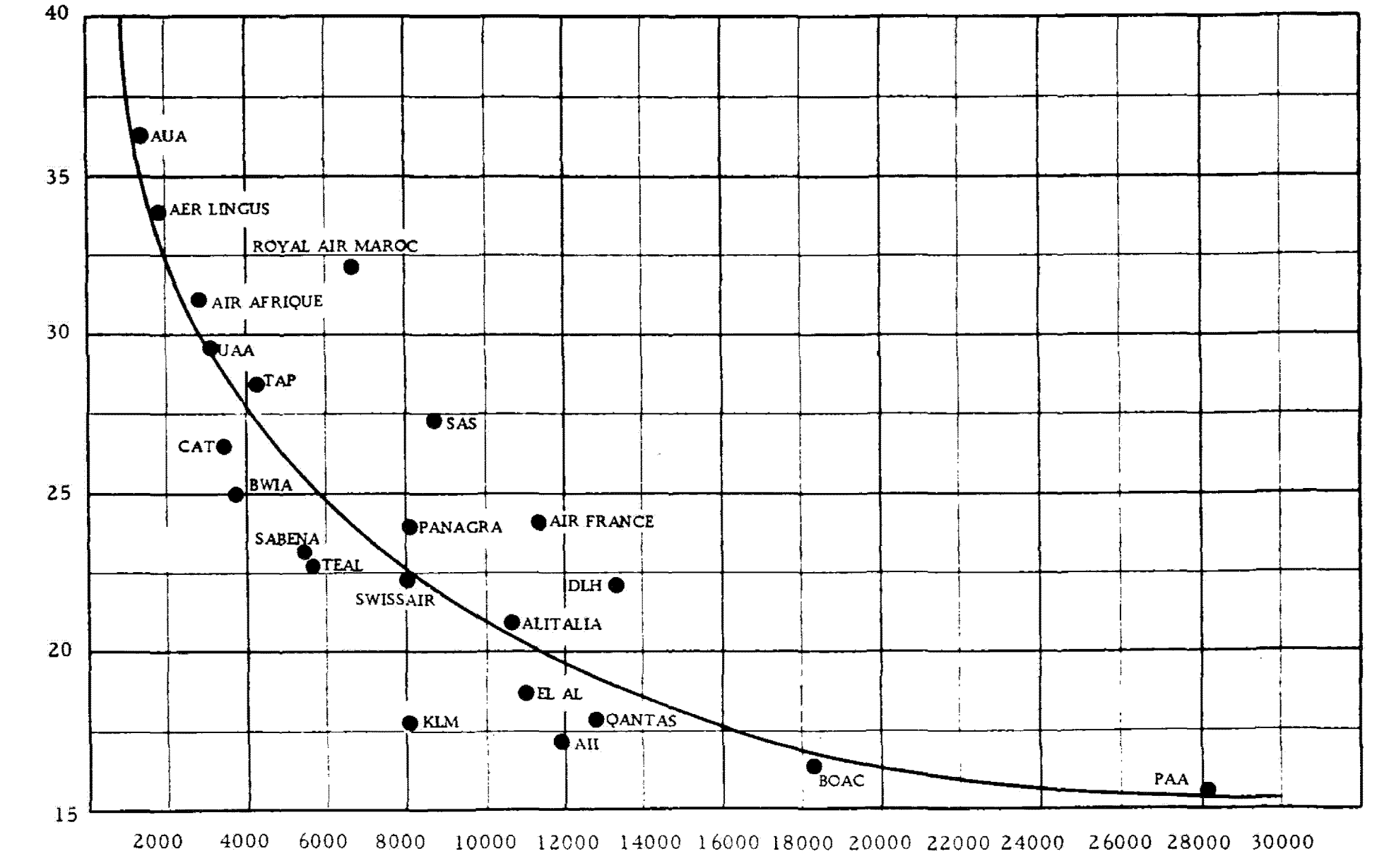
(The two sets of Statistics defining the points on this graph will be found in Appendix 7A)



12. Capacity offered per station served.- In Chart 18 the volume of air transport capacity offered per station or airport served is plotted against total unit cost, again for the group of airlines with 90 per cent or more of their operations international. Because of a limitation in the data available this criterion is calculated for scheduled services only. Capacity offered per station served, like capacity offered per flight, takes into account many of the factors influencing total unit cost, particularly those related to route structure such as the total distance flown and the number of stations, as well as the capacity of the aircraft. Again the correlation shows unit cost decreasing as the volume of capacity offered increases. Of the 10 airlines with the lowest total unit cost, 7 appear in Chart 18 among the 10 with the greatest volume of capacity offered per airport served.

CHART 18

CAPACITY OFFERED PER AIRPORT SERVED
RELATED TO TOTAL UNIT OPERATING COST
22 Scheduled Airlines ottering 90% or more of their capacity on International Services
International Services only
1964
(The two sets of Statistics defining the points
on this graph will be found in Appendix 7A)



Summary

13. In comparing airline unit operating costs attention has been given to a number of performance criteria, calculated from basic traffic and fleet statistical data, that take into account in varying degree some of the many factors determining cost levels. The criteria examined have been aircraft payload capacity, speed, and utilization, capacity offered per aircraft hour, per aircraft day and per airline staff member, stage length and the volume of air transport capacity offered per station served and per flight operated. In each case it has been noted that as the value of the criterion rose airline unit cost fell. Of the nine criteria studied the two most revealing appear to be:

a) Capacity offered per aircraft day (daily aircraft productivity) which takes account of aircraft payload capacity, speed and utilization and thus provides a good indication of direct unit cost level; and

b) Capacity offered per flight which reflects particularly the characteristics of the route structure operated and provides a good indication of both direct and indirect unit costs.

14. Examination of the correlations illustrated suggests that there is a tendency according to which those airlines that rank high in terms of one of the criteria rank high in all of them . Thus where an airline has a long average stage length it tends also to operate aircraft with high average payload capacity and speed. With reasonable traffic density its average aircraft utilization rate will probably be good and it follows that it will achieve a high level of hourly and daily aircraft productivity. Furthermore the capacity that it offers per flight and per station served will generally be at a relatively high level. In other words it appears that, assuming a similar degree of traffic density, the lowest unit costs, both direct and indirect, are generally achieved by the long-haul operators. On the other hand the short-haul operators tend to use smaller aircraft at lower speeds and generally to exhibit lower values for each of the criteria studied with the result that they tend to have higher unit costs. However, regional air services with relatively short average stage lengths may be as necessary and desirable in the public interest as are long-haul operations, and may have to be operated either at higher than average fares or at substantial deficits.

15. Recognizing that there is a need for short, medium and long-haul operations and that unit operating costs will tend to vary accordingly it may still be deduced from the data analysed in this section that in some cases the possibility may exist of reducing unit costs. The level of unit cost achieved by an airline must be considered in relation to the conditions of its operation. The public interest may require, for example, that air services be provided on route structures with very short stages or low traffic density with consequently high unit costs, and in such cases the government concerned may keep fares and rates at an acceptable level by the granting of subsidy. Assuming, however, that there is a general desire to lower unit costs to the greatest extent compatible with the requirements of the public, each airline may study its own operations and operating conditions with a view to the modification, where possible and desirable, of those factors that influence cost.

16. Assuming, for the purpose of this Study, as was done in Section III (see paragraph 19), that the economic environment may not be subject to significant modification and that the airlines possess a similar degree of managerial skill, it is the factors related to route structure that must be examined most closely. If it should prove possible, perhaps through rearrangement of service patterns, or by co-operative agreements such as pooling, or newly granted traffic rights to augment the traffic potential of a route, or to increase the average stage length operated by an airline, this would tend to lead to an increase in aircraft utilization rates, load factor, and flight frequency and thus to the possibility of employment, on reasonable economic terms, of new, larger and faster aircraft with lower direct unit costs. To the extent that this is achieved it may be expected that the change of operating conditions will lead to reductions also in indirect unit costs.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDICES

APPENDIX 1

FINANCIAL TRENDS IN CIVIL AVIATION, 1951-1964
Scheduled Airlines of all ICAO Contracting States

ESTIMATES FOR DOMESTIC AND INTERNATIONAL SERVICES

DESCRIPTION	1951	1952	1953	1954	1955	1956	1957a/	1958	1959	1960b/	1961	1962	1963	1964
FINANCIAL DATA (In millions of United States Dollars)														
OPERATING REVENUES														
Scheduled Services														
Passenger	1 340	1 552	1 772	1 990	2 367	2 741	3 109	3 256	3 819	4 285	4 560	5 107	5 645	6 435
Cargo	215	237	258	280	341	376	404	406	462	497	541	598	675	772
Mail	156	169	175	183	190	209	215	216	240	265	287	317	341	352
Total Scheduled Services	1 711	1 958	2 205	2 453	2 898	3 326	3 728	3 878	4 521	5 045	5 388	6 022	6 661	7 559
Non-scheduled Services	58	46	45	51	62	82	136	150	151	185	295	341	304	375
Incidental	35	46	64	56	65	102	107	94	133	170	180	207	250	178
TOTAL OPERATING REVENUES	1 804	2 050	2 314	2 560	3 025	3 510	3 971	4 122	4 805	5 400	5 805	6 570	7 215	8 112
OPERATING EXPENSES														
Direct														
Flight Operations	528	609	694	753	873	1 005	1 219	1 226	1 368	1 481	1 599	1 756	1 863	1 935
Maintenance & Overhaul	344	413	448	487	574	699	771	812	933	1 032	1 092	1 205	1 217	1 333
Flight Equipment Depreciation b/	138	161	201	226	251	258	349	359	423	608	757	794	826	857
Total Direct Expenses	1 010	1 183	1 343	1 466	1 678	1 952	2 339	2 397	2 724	3 121	3 448	3 755	3 906	4 125
Indirect														
Station and Ground	266	307	330	346	408	452	606	614	705	785	873	970	1 047	1 157
Passenger Services	118	134	144	160	202	239	284	291	340	398	435	473	515	590
Ticketing, Sales and Promotion	243	281	329	369	443	537	565	585	678	785	848	925	1 016	1 178
General and Administrative	143	158	171	187	216	246	218	220	253	271	319	350	405	450
Total Indirect Expenses	770	880	974	1 062	1 269	1 474	1 673	1 710	1 976	2 237	2 473	2 718	2 983	3 375
TOTAL OPERATING EXPENSES	1 780	2 063	2 317	2 528	2 947	3 426	4 012	4 107	4 700	5 358	5 921	6 473	6 889	7 500
OPERATING RESULT	+24	-13	-3	+32	+78	+84	-41	+15	+105	+42	-118	+97	+326	+612
OPERATING REVENUES PER TONNE-KILOMETRE PERFORMED (In United States Cents)														
OPERATING REVENUES														
Scheduled Services														
Passenger	43.6	43.8	43.1	43.0	43.4	43.8	43.7	43.7	44.7	44.9	44.6	44.8	44.0	43.0
Cargo	23.4	23.9	24.6	25.1	25.6	24.9	24.4	24.4	24.0	22.9	21.8	20.3	20.6	19.7
Mail	66.7	66.0	63.4	56.5	50.1	50.8	48.9	46.0	45.8	43.3	39.7	39.4	39.8	38.8
Total Scheduled Services	40.5	40.8	40.6	40.4	40.4	40.7	40.4	40.5	41.9	41.0	40.1	39.8	39.3	38.2
Non-scheduled Services	32.6	36.2	32.2	31.9	32.1	21.2	23.0	24.1	20.1	24.9	21.1	20.9	21.2	20.3
AVERAGE c/	40.9	41.6	41.5	41.1	41.1	41.0	40.5	40.4	41.0	41.3	39.9	39.2	39.2	37.5
OPERATING EXPENSES PER TONNE-KILOMETRE AVAILABLE (In United States Cents)														
OPERATING EXPENSES														
Direct														
Flight Operations	7.5	7.5	7.4	7.1	7.0	7.0	7.2	6.9	6.7	6.3	5.8	5.5	5.2	4.7
Maintenance & Overhaul	4.9	5.1	4.8	4.6	4.6	4.8	4.5	4.6	4.6	4.4	4.0	3.7	3.4	3.3
Flight Equipment Depreciation b/	1.9	2.0	2.2	2.2	1.9	1.8	2.1	2.0	2.1	2.6	2.7	2.5	2.3	2.1
Total Direct Expenses	14.3	14.6	14.4	13.9	13.5	13.6	13.8	13.5	13.4	13.3	12.5	11.7	10.9	10.1
Indirect														
Station and Ground	3.8	3.8	3.6	3.3	3.3	3.2	3.5	3.5	3.5	3.4	3.1	3.0	2.9	2.8
Passenger Services	1.7	1.6	1.5	1.5	1.6	1.7	1.7	1.6	1.7	1.7	1.6	1.5	1.5	1.4
Ticketing, Sales and Promotion	3.4	3.5	3.5	3.5	3.6	3.8	3.3	3.3	3.3	3.3	3.1	2.9	2.9	2.9
General and Administrative	2.0	1.9	1.8	1.8	1.7	1.7	1.3	1.2	1.3	1.2	1.1	1.1	1.1	1.1
Total Indirect Expenses	10.9	10.8	10.4	10.1	10.2	10.4	9.8	9.6	9.8	9.6	8.9	8.5	8.4	8.2
TOTAL OPERATING EXPENSES	25.2	25.4	24.8	24.0	23.7	24.0	23.6	23.1	23.2	22.9	21.4	20.2	19.3	18.3
OPERATING EXPENSES PER TONNE-KILOMETRE PERFORMED (In United States Cents)														
TOTAL OPERATING EXPENSES	40.4	41.9	41.5	40.6	40.0	40.0	40.9	40.3	40.1	41.0	40.7	38.6	37.4	34.7
OVER-ALL LOAD FACTORS (In Percentages)														
LOAD FACTOR (All Services)	62.5	60.7	59.6	59.2	59.1	60.1	57.6	57.3	57.9	55.9	52.6	52.4	51.7	52.8
PASSENGER REVENUE PER PASSENGER-KILOMETRE (In United States Cents)														
SCHEDULED SERVICES	3.86	3.88	3.81	3.79	3.82	3.86	3.84	3.83	3.93	3.94	3.91	3.93	3.85	3.76
PERCENTAGE DISTRIBUTION OF FINANCIAL DATA (In Percentages)														
OPERATING REVENUES														
Scheduled Services														
Passenger	74.3	75.7	76.6	77.7	78.2	78.1	78.3	79.0	79.4	79.3	78.6	77.8	78.2	79.3
Cargo	11.9	11.6	11.1	10.9	11.3	10.7	10.2	9.9	9.6	9.2	9.3	9.1	9.4	9.5
Mail	8.7	8.3	7.6	7.2	6.3	6.0	5.4	5.2	5.0	4.9	4.9	4.8	4.7	4.4
Total Scheduled Services	94.9	95.6	95.3	[illegible]	95.8	94.8	93.9	94.1	94.0	93.4	92.8	91.7	92.3	93.2
Non-scheduled Services	3.2	2.2	1.9	2.0	2.0	2.3	3.4	3.6	3.2	3.4	4.0	5.2	4.2	4.6
Incidental	1.9	2.2	2.8	2.2	2.2	2.9	2.7	2.3	2.8	3.2	3.2	3.1	3.5	2.2
TOTAL OPERATING REVENUES	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
OPERATING EXPENSES														
Direct														
Flight Operations	29.7	29.5	30.0	29.8	29.6	29.3	30.4	29.9	29.1	27.6	27.0	27.1	27.0	25.8
Maintenance & Overhaul	19.3	20.0	19.3	19.3	19.5	20.1	19.2	19.8	19.9	19.3	18.4	18.6	17.7	17.8
Flight Equipment Depreciation b/	7.8	7.8	8.7	8.9	7.8	7.6	8.7	8.7	9.0	11.3	12.8	12.3	12.0	11.4
Total Direct Expenses	56.8	57.3	58.0	58.0	56.9	57.0	58.3	58.4	58.0	58.2	58.2	58.0	56.7	55.0
Indirect														
Station and Ground	14.9	14.9	14.2	13.7	13.9	13.2	15.1	14.9	15.0	14.7	14.8	15.0	15.2	15.5
Passenger Services	6.6	6.5	6.2	6.3	6.9	7.0	7.1	7.1	7.2	7.4	7.3	7.3	7.5	7.9
Ticketing, Sales and Promotion	13.6	13.6	14.2	14.6	15.0	15.6	14.1	14.2	14.4	14.6	14.3	14.3	14.7	15.6
General and Administrative	8.1	7.7	7.4	7.4	7.3	7.2	5.4	5.4	5.4	5.1	5.4	5.4	5.9	6.0
Total Indirect Expenses	43.2	42.7	42.0	42.0	43.1	43.0	41.7	41.6	42.0	41.8	41.8	42.0	43.3	45.0
TOTAL OPERATING EXPENSES	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: a/ On 1st January 1957, a new classification of Operating Expenses became effective in the United States, so that the figures shown for Station & Ground, Passenger Services, Ticketing, Sales & Promotion and General & Administrative expenses are not strictly comparable before and after this date

b/ Beginning 1960, in accordance with the changes made in ICAO's Air Transport Reporting Form "F" (Profit and Loss Statement), the expense item "Flight Equipment Depreciation" also includes "Ground Property and Equipment Depreciation", and "Amortization of Development and Pre-operating Costs", the latter being previously classified as a non-operating expense.

c/ Including Incidental Revenues.

ECONOMICS AND STATISTICS BRANCH (April 1966)

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX 2

FINANCIAL TRENDS IN CIVIL AVIATION, 1951-1964
Scheduled Airlines of all ICAO Contracting States
ESTIMATES FOR INTERNATIONAL SERVICES

DESCRIPTION	1951	1952	1953	1954	1955	1956	1957a/	1958	1959	1960b/	1961	1962	1963	1964
FINANCIAL DATA														
(In millions of United States Dollars)														
OPERATING REVENUES														
Scheduled Services														
Passenger	492	575	636	708	825	1 001	1 169	1 307	1 479	1 753	1 926	2 161	2 490	2 852
Cargo	84	95	104	124	138	165	186	204	237	269	316	347	400	449
Mail	98	104	106	111	118	125	133	145	155	167	187	205	228	254
Total Scheduled Services	674	774	846	943	1 081	1 291	1 488	1 656	1 871	2 189	2 429	2 713	3 118	3 535
Non-scheduled Services	28	28	30	37	41	58	74	92	95	128	161	215	192	261
Incidental	18	27	37	34	32	56	63	65	73	92	139	161	171	101
TOTAL OPERATING REVENUES	720	829	913	1 014	1 154	1 405	1 625	1 813	2 039	2 409	2 729	3 089	3 481	3 897
OPERATING EXPENSES														
Direct														
Flight Operations	221	258	279	306	342	404	476	535	558	621	724	789	826	878
Maintenance & Overhaul	141	172	184	201	224	282	314	359	389	430	495	521	506	546
Flight Equipment Depreciation b/	63	69	82	86	93	107	145	163	206	277	381	402	404	429
Total Direct Expenses	425	499	545	593	659	793	935	1 057	1 153	1 328	1 600	1 712	1 736	1 853
Indirect														
Station and Ground	117	139	142	155	173	190	238	284	321	354	419	462	506	566
Passenger Services	46	56	57	68	80	93	116	135	153	182	229	238	269	292
Ticketing, Sales & Promotion	102	128	146	166	186	229	267	318	359	430	495	551	590	663
General and Administrative	63	69	70	79	84	102	99	102	99	124	152	164	202	214
Total Indirect Expenses	328	392	415	468	523	614	720	839	932	1 090	1 295	1 415	1 567	1 735
TOTAL OPERATING EXPENSES	753	891	960	1 061	1 182	1 407	1 655	1 896	2 085	2 418	2 895	3 127	3 303	3 588
OPERATING RESULT	-33	-62	-47	-47	-28	-2	-30	-83	-46	-9	-166	-38	+178	+309
OPERATING REVENUES PER TONNE-KILOMETRE PERFORMED														
(In United States Cents)														
OPERATING REVENUES														
Scheduled Services														
Passenger	47.2	48.0	46.9	47.3	46.8	48.2	47.7	48.0	47.1	45.8	43.7	42.5	43.3	41.4
Cargo	27.7	28.5	30.0	30.5	29.5	28.8	29.1	29.4	28.3	26.3	24.8	22.6	22.6	20.9
Mail	90.7	86.7	80.9	68.9	61.5	61.9	60.2	58.5	55.4	48.8	43.4	42.3	43.4	42.9
Total Scheduled Services	48.4	48.9	45.8	45.7	44.6	45.3	44.9	45.2	44.0	42.2	39.8	38.2	38.8	36.9
Non-scheduled Services	40.6	40.0	33.3	36.6	35.6	30.7	27.6	29.4	24.0	30.9	22.4	23.0	19.5	19.9
AVERAGE c/	47.2	48.2	47.2	46.9	45.3	46.2	45.4	45.6	43.8	43.0	40.0	38.4	38.6	35.8
OPERATING EXPENSES PER TONNE-KILOMETRE AVAILABLE														
(In United States Cents)														
OPERATING EXPENSES														
Direct														
Flight Operations	9.1	9.3	8.8	8.5	8.1	8.3	8.2	7.9	7.3	6.5	5.7	5.3	4.9	4.5
Maintenance & Overhaul	5.8	6.2	5.8	5.6	5.3	5.8	5.4	5.3	5.1	4.5	3.9	3.5	3.0	2.8
Flight Equipment Depreciation b/	2.6	2.5	2.6	2.4	2.2	2.2	2.5	2.4	2.7	2.9	3.0	2.7	2.4	2.2
Total Direct Expenses	17.5	18.0	17.2	16.5	15.6	16.3	16.1	15.6	15.1	13.9	12.6	11.5	10.3	9.5
Indirect														
Station and Ground	4.8	5.0	4.5	4.3	4.1	3.9	4.1	4.2	4.2	3.7	3.3	3.1	3.0	2.9
Passenger Services	1.9	2.0	1.8	1.9	1.9	1.9	2.0	2.0	2.0	1.9	1.8	1.6	1.6	1.5
Ticketing, Sales and Promotion	4.2	4.6	4.6	4.6	4.4	4.7	4.6	4.7	4.7	4.5	3.9	3.7	3.5	3.4
General and Administrative	2.6	2.5	2.2	2.2	2.0	2.1	1.7	1.5	1.3	1.3	1.2	1.1	1.2	1.1
Total Indirect Expenses	13.5	14.1	13.1	13.0	12.4	12.6	12.4	12.4	12.2	11.4	10.2	9.5	9.3	8.9
TOTAL OPERATING EXPENSES	31.0	32.1	30.3	29.5	28.0	28.9	28.5	28.0	27.3	25.3	22.8	21.0	19.6	18.4
OPERATING EXPENSES PER TONNE-KILOMETRE PERFORMED														
(In United States Cents)														
TOTAL OPERATING EXPENSES	49.4	51.8	49.6	49.0	46.4	46.3	46.2	47.7	44.8	43.1	42.4	38.9	36.6	32.9
OVER-ALL LOAD FACTORS														
(In Percentages)														
LOAD FACTOR (All Services)	62.7	61.0	61.1	60.1	60.2	62.4	61.6	58.7	60.9	58.7	53.8	54.0	53.6	55.9
PASSENGER REVENUE PER PASSENGER-KILOMETRE														
(In United States Cents)														
SCHEDULED SERVICES	4.44	4.50	4.37	4.37	4.29	4.40	4.33	4.37	4.28	4.15	3.95	3.85	3.88	3.73
PERCENTAGE DISTRIBUTION OF FINANCIAL DATA														
(In Percentages)														
OPERATING REVENUES														
Scheduled Services														
Passenger	68.3	69.4	69.7	69.8	71.5	71.2	71.9	72.1	72.6	72.8	70.6	70.0	71.5	73.2
Cargo	11.7	11.5	11.4	12.2	12.0	11.8	11.4	11.2	11.6	11.2	11.6	11.2	11.5	11.5
Mail	13.6	12.5	11.6	11.0	10.2	8.9	8.2	8.0	7.6	6.9	6.8	6.6	6.6	6.0
Total Scheduled Services	93.6	93.4	92.7	93.0	93.7	91.9	91.5	91.3	91.8	90.9	89.0	87.8	89.6	90.7
Non-scheduled Services	3.9	3.4	3.3	3.6	3.5	4.1	4.6	5.1	4.6	5.3	5.9	7.0	5.5	6.7
Incidental	2.5	3.2	4.0	3.4	2.8	4.0	3.9	3.6	3.6	3.8	5.1	5.2	4.9	2.6
TOTAL OPERATING REVENUES	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
OPERATING EXPENSES														
Direct														
Flight Operations	29.4	29.0	29.1	28.8	28.9	28.7	28.8	28.2	26.8	25.7	25.0	25.2	25.0	24.5
Maintenance & Overhaul	18.7	19.3	19.2	18.9	19.0	20.0	19.0	18.9	18.7	17.8	17.1	16.7	15.3	15.2
Flight Equipment Depreciation b/	8.4	7.7	8.5	8.1	7.9	7.6	8.7	8.6	9.9	11.5	13.2	12.9	12.2	11.9
Total Direct Expenses	56.5	56.0	56.8	55.8	55.8	56.3	56.5	55.7	55.4	55.0	55.3	54.8	52.5	51.6
Indirect														
Station and Ground	15.5	15.6	14.8	14.6	14.6	13.5	14.4	15.0	15.4	14.6	14.5	14.8	15.3	15.6
Passenger Services	6.1	6.3	5.9	6.4	6.8	6.6	7.0	7.1	7.3	7.5	7.9	7.6	8.2	8.1
Ticketing, Sales and Promotion	13.5	14.4	15.2	15.7	15.7	16.3	16.1	16.8	17.2	17.8	17.1	17.6	17.9	18.5
General and Administrative	8.4	7.7	7.3	7.5	7.1	7.3	6.0	5.4	4.7	5.1	5.2	5.2	6.1	6.0
Total Indirect Expenses	43.5	44.0	43.2	44.2	44.2	43.7	43.5	44.3	44.6	45.0	44.7	45.2	47.5	48.4
TOTAL OPERATING EXPENSES	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: a/ On 1st January 1957, a new classification of Operating Expenses became effective in the United States so that the figures shown for Station & Ground, Passenger Services, Ticketing, Sales & Promotion and General & Administrative expenses are not strictly comparable before and after this date.

b/ Beginning 1960, in accordance with the changes made in ICAO's Air Transport Report Form "E" (Profit and Loss Statement), the expense item "Flight Equipment Depreciation" also includes "Ground Property and Equipment Depreciation", and "Amortization of Development and Pre-operating Costs", the latter being previously classified as a non-operating expense.

c/ Including Incidental Revenues.

ECONOMICS AND STATISTICS BRANCH (April 1960)

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX 3

FINANCIAL TRENDS IN CIVIL AVIATION, 1951-1964
Scheduled Airlines of all ICAO Contracting States

ESTIMATES FOR DOMESTIC SERVICES

DESCRIPTION	1951	1952	1953	1954	1955	1956	1957a/	1958	1959	1960b/	1961	1962	1963	1964
FINANCIAL DATA (In millions of United States Dollars)														
OPERATING REVENUES														
Scheduled Services														
Passenger	648	977	1 136	1 282	1 542	1 740	1 940	1 949	2 340	2 530	2 634	2 946	3 155	3 503
Cargo	131	142	154	156	205	211	218	202	225	228	225	251	275	325
Mail	58	65	69	72	72	84	82	71	85	98	100	112	113	116
Total Scheduled Services	1 037	1 184	1 359	1 510	1 817	2 035	2 240	2 222	2 650	2 856	2 959	3 309	3 543	4 024
Non-scheduled Services	30	18	15	14	21	24	62	58	56	57	74	126	112	114
Incidental	17	19	27	22	33	46	44	29	60	78	41	46	79	77
TOTAL OPERATING REVENUES	1 084	1 221	1 401	1 546	1 871	2 105	2 346	2 309	2 766	2 991	3 074	3 481	3 734	4 215
OPERATING EXPENSES														
Direct														
Flight Operations	307	351	415	447	531	601	743	691	810	860	875	967	1 037	1 057
Maintenance & Overhaul	203	241	264	286	350	407	457	453	544	602	597	684	711	787
Flight Equipment Depreciation b/	75	92	119	140	138	151	204	196	217	331	376	392	422	429
Total Direct Expenses	585	684	798	873	1 019	1 159	1 404	1 340	1 571	1 793	1 848	2 043	2 170	2 272
Indirect														
Station and Ground	149	168	188	191	235	263	368	330	384	431	454	508	541	591
Passenger Services	72	78	87	92	122	146	168	156	187	216	204	235	246	298
Ticketing, Sales and Promotion	141	153	183	205	257	307	298	267	319	353	353	374	426	515
General and Administrative	80	89	101	108	132	144	119	118	154	147	167	186	203	236
Total Indirect Expenses	442	488	559	594	746	860	953	871	1 044	1 147	1 178	1 303	1 416	1 640
TOTAL OPERATING EXPENSES	1 027	1 172	1 357	1 467	1 765	2 019	2 357	2 211	2 615	2 940	3 026	3 346	3 586	3 912
OPERATING RESULT	+57	+49	+44	+79	+106	+86	-11	+98	+151	+51	+48	+135	+148	+303
OPERATING REVENUES PER TONNE-KILOMETRE PERFORMED (In United States Cents)														
OPERATING REVENUES														
Scheduled Services														
Passenger	40.9	40.6	40.8	40.7	42.1	41.3	41.4	41.2	43.3	44.2	45.1	46.5	44.4	44.4
Cargo	21.3	21.3	22.4	22.4	24.4	23.1	22.0	20.7	20.6	19.8	18.6	18.1	18.3	18.2
Mail	47.2	47.1	47.2	43.9	40.4	42.2	39.0	32.3	35.1	36.0	34.0	35.0	34.0	32.7
Total Scheduled Services	36.9	36.9	37.6	37.6	38.8	38.2	38.0	37.4	39.3	40.0	40.3	41.2	39.6	39.4
Non-scheduled Services	27.3	21.6	31.3	22.6	28.8	12.1	19.1	18.7	15.7	17.4	18.8	18.1	24.7	21.2
AVERAGE c/	37.1	37.4	38.2	37.9	39.4	38.1	37.8	37.0	39.0	40.0	39.7	39.8	39.8	39.2
OPERATING EXPENSES PER TONNE-KILOMETRE AVAILABLE (In United States Cents)														
OPERATING EXPENSES														
Direct														
Flight Operations	6.6	6.5	6.7	6.4	6.5	6.4	6.8	6.2	6.4	6.2	5.8	5.6	5.5	4.9
Maintenance & Overhaul	4.4	4.4	4.2	4.1	4.3	4.3	4.2	4.1	4.3	4.3	4.0	4.0	3.8	3.7
Flight Equipment Depreciation b/	1.6	1.7	1.9	2.0	1.7	1.6	1.9	1.8	1.7	2.4	2.5	2.3	2.2	2.0
Total Direct Expenses	12.6	12.6	12.8	12.5	12.5	12.3	12.9	12.1	12.4	12.9	12.3	11.9	11.5	10.6
Indirect														
Station and Ground	3.2	3.1	3.0	2.7	2.9	2.8	3.3	3.0	3.1	3.1	3.0	2.9	2.9	2.7
Passenger Services	1.5	1.4	1.4	1.3	1.5	1.6	1.5	1.4	1.5	1.6	1.4	1.4	1.3	1.4
Ticketing, Sales and Promotion	3.0	2.8	2.9	2.9	3.1	3.3	2.7	2.4	2.5	2.5	2.4	2.2	2.3	2.4
General and Administrative	1.7	1.6	1.6	1.6	1.6	1.5	1.1	1.0	1.2	1.1	1.1	1.1	1.1	1.1
Total Indirect Expenses	9.4	8.9	8.9	8.5	9.1	9.2	8.6	7.8	8.3	8.3	7.9	7.6	7.6	7.6
TOTAL OPERATING EXPENSES	22.0	21.5	21.7	21.0	21.6	21.5	21.5	19.9	20.7	21.2	20.2	19.5	19.1	18.2
OPERATING EXPENSES PER TONNE-KILOMETRE PERFORMED (In United States Cents)														
TOTAL OPERATING EXPENSES	35.1	35.8	37.0	36.0	37.2	36.5	37.9	35.4	36.8	39.3	39.1	38.3	38.2	36.4
OVER-ALL LOAD FACTORS (In Percentages)														
LOAD FACTOR (All Services)	62.5	60.0	58.8	58.5	58.2	58.9	56.7	56.4	56.2	54.0	51.6	51.0	50.0	50.0
PASSENGER REVENUE PER PASSENGER-KILOMETRE (In United States Cents)														
SCHEDULED SERVICES	3.56	3.54	3.55	3.55	3.66	3.60	3.56	3.53	3.72	3.80	3.88	4.00	3.81	3.80
PERCENTAGE DISTRIBUTION OF FINANCIAL DATA (In Percentages)														
OPERATING REVENUES														
Scheduled Services														
Passenger	78.2	80.0	81.1	82.9	82.4	82.7	82.7	84.4	84.6	84.6	85.7	84.7	84.5	85.0
Cargo	12.1	11.6	11.0	10.1	10.8	10.0	9.3	8.7	8.1	7.6	7.3	7.2	7.4	7.7
Mail	5.4	5.3	4.9	4.7	3.9	4.0	3.5	3.1	3.1	3.3	3.3	3.2	3.0	2.8
Total Scheduled Services	95.7	96.9	97.0	97.7	97.1	96.7	95.5	96.2	95.8	95.5	96.3	95.1	94.9	95.5
Non-scheduled Services	2.8	1.5	1.1	0.9	1.1	1.1	2.6	2.5	2.0	1.9	2.4	3.6	3.0	2.7
Incidental	1.5	1.6	1.9	1.4	1.8	2.2	1.9	1.3	2.2	2.6	1.3	1.3	2.1	1.8
TOTAL OPERATING REVENUES	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
OPERATING EXPENSES														
Direct														
Flight Operations	29.9	29.9	30.6	30.5	30.1	29.8	31.5	31.3	31.0	29.2	28.9	28.9	28.9	27.0
Maintenance & Overhaul	19.8	20.5	19.5	19.5	19.8	20.2	19.4	20.5	20.8	20.5	19.7	20.4	19.8	20.1
Flight Equipment Depreciation b/	7.3	7.9	8.8	9.5	7.8	7.5	8.7	8.9	8.3	11.3	12.4	11.7	11.8	11.0
Total Direct Expenses	57.0	58.3	58.9	59.5	57.7	57.5	59.6	60.7	60.1	61.0	61.0	61.0	60.5	58.1
Indirect														
Station and Ground	14.5	14.3	13.8	13.0	13.3	13.0	15.6	14.9	14.7	14.7	15.0	15.2	15.1	15.2
Passenger Services	7.0	6.7	6.4	6.3	6.9	7.2	7.1	7.0	7.1	7.3	6.8	7.0	6.9	7.6
Ticketing, Sales and Promotion	13.7	13.1	13.5	13.8	14.6	15.2	12.6	12.1	12.2	12.0	11.7	11.2	11.9	13.2
General and Administrative	7.8	7.6	7.4	7.4	7.5	7.1	5.1	5.2	5.9	5.0	5.5	5.6	5.6	6.0
Total Indirect Expenses	43.0	41.7	41.1	40.5	42.3	42.5	40.4	39.3	39.9	39.0	39.0	39.0	39.5	41.9
TOTAL OPERATING EXPENSES	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: a/ On 1st January 1957, a new classification of Operating Expenses became effective in the United States, so that the figures shown for Station & Ground, Passenger Services, Ticketing, Sales & Promotion and General & Administrative expenses are not strictly comparable before and after this date.

b/ Beginning 1960, in accordance with the changes made in ICAO's Air Transport Reporting Form "F" (Profit and Loss Statement), the expense item "Flight Equipment Depreciation" also includes "Ground Property and Equipment Depreciation", and "Amortization of Development and Pre-operating Costs", the latter being previously classified as a non-operating expense.

c/ Including Incidental Revenues.

ECONOMICS AND STATISTICS BRANCH (April 1961)

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX 4

DIRECT OPERATING COSTS AND OTHER PERFORMANCE CHARACTERISTICS AIRCRAFT IN UNITED STATES DOMESTIC AIRLINE SERVICE - 1964

Class of certificated route air carriers — Aircraft Type	Direct Unit Cost	AVERAGES: Number of aircraft in service	Payload Capacity: Seats	Payload Capacity: Tonnes	Airborne speed	Productivity (Payload capacity x speed)	Stage length a/	Utilization (block time)
	¢/tka	no.	no.	no.	km/h	tka/h	km	h/day
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
DOMESTIC TRUNK AIRLINES								
Passenger aircraft								
DC-6/6B	13.72	165.5	68.1	7.4	359.7	2 662	325.7	6.8
DC-7/7B/C	13.82	79.4	78.5	8.9	396.8	3 549	378.0	6.0
L-749	17.70	32.9	56.5	6.2	345.7	2 143	319.9	4.2
L-1049/1049C/G	13.62	48.1	88.7	9.5	359.7	3 417	348.1	4.7
L-1649	9.12	9.7	91.0	9.5	388.1	3 696	962.3	0.6
Total 4-engine piston	13.98	335.6	72.6	7.9	368.5	2 911	335.7	5.9
V-700	20.32	45.5	45.6	4.3	370.8	1 593	305.3	6.7
V-800	14.71	11.0	55.2	5.1	426.6	2 176	382.7	9.1
L-188	12.47	116.3	77.6	8.7	480.9	4 184	409.9	8.1
Total 4-engine turboprop	13.39	172.8	70.0	7.6	451.9	3 434	384.0	7.8
SE-210	17.74	20.0	63.9	6.9	582.7	4 021	620.1	6.7
B-727	8.07	41.9	92.7	11.2	752.7	8 430	920.2	6.9
B-707-100	7.14	18.9	123.9	16.6	720.2	11 955	1 109.8	10.1
B-707-100B	5.84	41.1	124.5	16.8	794.7	13 351	1 854.2	10.3
B-707-200/300	6.96	4.8	125.6	17.1	751.2	12 846	1 161.3	8.8
B-707-300B/C	5.13	3.3	112.2	21.1	738.0	15 572	1 089.3	11.3
B-720	7.16	48.9	110.5	14.6	731.7	10 683	1 142.9	9.9
B-720B	6.99	49.2	111.4	14.2	751.9	10 677	1 150.0	10.6
DC-8-10	8.05	10.8	121.0	14.5	716.6	10 391	1 283.6	10.5
DC-8-20/30	6.99	27.8	123.7	15.1	758.0	11 446	1 429.2	11.5
DC-8-50	6.83	27.0	123.7	15.6	761.5	11 879	1 289.5	10.7
CV-880	10.29	44.9	93.8	11.0	745.4	8 199	1 053.8	8.8
CV-990	10.77	19.0	105.4	12.4	766.7	9 507	1 394.6	7.8
Total 4-engine jet	7.26	295.7	114.6	14.7	751.1	11 041	1 263.3	10.0
Cargo aircraft								
C-46	12.16	4.9	-	5.6	299.7	1 678	590.5	5.6
DC-7B	12.59	8.5	-	16.2	433.9	7 029	892.7	4.9
L-1049C	6.61	5.0	-	14.1	394.9	5 568	758.6	5.3
L-1649	10.74	5.8	-	15.1	381.6	5 762	391.2	4.0
Total 4-engine piston	10.62	19.3	-	15.3	409.2	6 261	698.8	4.7
B-707-300C	3.08	5.3	-	41.1	777.8	31 968	1 445.3	6.5
DC-8F	3.29	2.4	-	35.1	795.6	27 926	2 362.3	6.8
Total 4-engine jet	3.14	7.7	-	39.1	783.9	30 650	1 657.1	6.6

Class of certificated route air carriers — Aircraft Type	Direct Unit Cost	AVERAGES: Number of aircraft in service	Payload Capacity: Seats	Payload Capacity: Tonnes	Airborne speed	Productivity (Payload capacity x speed)	Stage length a/	Utilization (block time)
	¢/tka	no.	no.	no.	km/h	tka/h	km.	h/day
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
LOCAL SERVICE AIRLINES								
DC-3	20.48	156.3	23.8	2.1	239.0	502	139.2	5.8
CV-240	16.19	42.1	41.0	3.8	302.1	1 148	188.4	6.8
CV-340/440	16.03	66.2	46.0	4.4	307.5	1 353	179.3	7.3
M-202	18.54	15.1	38.9	3.6	285.5	1 028	167.2	5.4
M-404	16.48	58.9	40.5	4.0	281.8	1 127	159.3	6.3
Total 2-engine piston	17.33	338.6	35.6	3.4	272.0	925	160.8	6.3
F-27	17.59	44.3	38.9	3.4	327.0	1 112	196.8	8.2
CV-580	8.84	1.9	52.0	5.4	453.0	2 446	268.0	8.6
Total 2-engine turboprop	16.85	46.2	39.6	3.5	332.5	1 164	203.1	8.2
HELICOPTER AIRLINES								
B-47	814.10	0.8	-	0.3	95.9	29	b/	0.7
S-55	190.28	2.0	-	0.5	107.8	54	17.7	1.4
S-58	143.46	4.0	9.7	1.2	139.7	168	24.5	1.8
Total piston helicopters	155.66	6.8	9.7	1.0	128.4	128	22.7	1.5
S-61	75.76	4.2	22.5	2.2	172.2	379	37.0	4.8
S-62	92.02	3.3	9.0	0.7	142.9	100	19.2	5.1
V-107	164.10	4.0	24.8	2.3	177.7	409	24.0	2.7
Total turbine helicopters	105.01	11.5	18.8	1.8	163.3	294	35.7	4.1

Source of basic data:
United States Federal Aviation Agency (Office of Policy Development) study dated September 1965 entitled 'DIRECT OPERATING COSTS AND OTHER PERFORMANCE CHARACTERISTICS OF TRANSPORT AIRCRAFT IN AIRLINE SERVICE' Tables 1, 5, 11 and 15.
Col. 6: Col. 4 x Col. 5.
a/ For the 4th quarter of 1964.
b/ Not in scheduled service during the 4th quarter of 1964.

Conversion Factors:
1 statute mile = 1.6093 kilometres.
1 short ton = 0.9072 tonnes.
1 short ton-statute mile = 1.4600 tonne-kilometres.

ECONOMICS AND STATISTICS BRANCH (April 1966)

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX 5

DIRECT AND INDIRECT UNIT OPERATING EXPENSES - 1964
41 SELECTED INTERNATIONAL SCHEDULED PASSENGER AIRLINES a/
(All Services: International, Domestic, Scheduled, Non-Scheduled)

DESCRIPTION	AFRICA					EUROPE														
	YAOUNDE TREATY STATES b/	EAST AFRICA	MALAWI ZAMBIA & RHODESIA	MOROCCO	UNITED ARAB REPUBLIC	AUSTRIA	BELGIUM	FINLAND	FRANCE	GERMANY	ICELAND	IRELAND	ITALY	NETHERLANDS	PORTUGAL	SCANDINAVIA	SPAIN	SWITZERLAND	UNITED KINGDOM	
	AIR AFRIQUE	EAAC	CAA	ROYAL AIR MAROC	UAA	AUA	SABENA	FINNAIR	AIR FRANCE	DLH	FLUGFELAG	AER LINGUS	ALITALIA	KLM	TAP	SAS	IBERIA	SWISSAIR	BEA	BOAC
U.S. CENTS PER TONNE-KILOMETRE AVAILABLE																				
Direct																				
Flight Operations	12.5	9.6	8.7	10.4	8.2	7.3	5.5	8.9	5.5	5.0	7.2	7.0	5.3	4.3	8.8	6.4	6.1	5.0	5.3	4.1
Maintenance	3.2	5.5	6.3	5.4	6.1	5.9	3.3	5.8	3.3	3.0	5.9	6.2	3.2	2.0	3.1	4.3	3.9	3.7	4.0	2.3
Depreciation and Amortization	2.8	4.0	2.6	3.8	1.0	6.0	2.0	7.3	3.1	2.7	1.2	2.6	2.5	2.0	3.4	2.9	3.0	3.5	4.6	2.3
Total Direct	18.5	19.1	17.6	19.6	15.3	19.2	10.8	22.0	11.9	10.7	14.3	15.8	11.0	8.3	15.3	13.6	13.0	12.2	13.9	8.7
Indirect																				
Station and Other Ground Expenses	1.6	4.0	5.0	3.9	2.1	6.1	2.3	4.7	3.5	3.0	2.5	5.3	2.3	2.6	1.1	4.4	2.3	2.8	7.1	2.4
Passenger Services	0.8	2.0	1.7	1.8	1.2	2.5	2.5	2.7	2.2	2.0	1.6	3.0	2.0	1.0	0.7	1.9	1.6	1.7	1.7	1.4
Ticketing, Sales and Promotion	6.8	3.3	6.2	5.3	4.3	6.0	5.4	3.0	5.1	5.5	4.2	6.2	4.7	4.4	2.2	5.8	3.4	4.4	3.1	3.1
General and Administrative	3.3	0.9	4.9	1.0	1.7	2.3	0.6	2.3	1.1	1.0	1.2	3.6	0.9	1.1	9.0	1.6	1.6	1.2	2.1	0.8
Other Operating Expenses	0.1	-	-	0.6	5.1	0.1	1.6	-	0.2	-	-	-	-	0.5	-	-	-	-	c/ -0.7	0.0
Total Indirect	12.6	10.2	17.8	12.6	14.4	17.0	12.4	12.7	12.1	11.5	9.5	18.1	9.9	9.6	13.0	13.7	8.9	10.1	13.3	7.7
Grand Total Direct and Indirect	31.1	29.3	35.4	32.2	29.7	36.2	23.2	34.7	24.0	22.2	23.8	33.9	20.9	17.9	28.3	27.3	21.9	22.3	27.2	16.4
U.S. CENTS PER TONNE-KILOMETRE PERFORMED																				
Grand Total Direct and Indirect	47.6	52.0	55.3	47.5	61.8	68.8	40.0	67.6	42.4	36.9	41.8	49.5	39.9	32.2	46.9	47.1	40.0	42.0	45.8	31.7
PERCENTAGE DISTRIBUTION OF OPERATING EXPENSES (In Percentages)																				
Direct																				
Flight Operations	40.1	32.7	24.6	32.4	27.5	20.1	23.5	25.7	23.0	22.4	30.0	20.8	25.4	23.9	31.2	23.4	28.0	22.6	19.6	24.5
Maintenance	10.2	18.6	17.8	16.9	20.6	16.2	14.3	16.7	13.8	13.5	24.9	18.2	15.5	11.3	10.8	15.9	17.9	16.5	14.9	13.8
Depreciation & Amortization	8.9	13.8	7.3	11.8	3.5	16.5	8.9	21.1	12.9	12.4	5.1	7.5	11.8	11.2	12.1	10.5	13.6	15.8	17.0	14.2
Total Direct	59.2	65.1	49.7	61.1	51.6	52.8	46.7	63.5	49.7	48.3	60.0	46.5	52.7	46.4	54.1	49.8	59.5	54.9	51.5	52.5
Indirect																				
Station and Other Ground Expenses	5.1	13.6	14.2	12.0	7.2	17.0	9.9	13.6	14.6	13.3	10.6	15.6	11.1	14.3	3.7	16.2	10.4	12.7	26.1	14.8
Passenger Services	2.6	6.7	4.9	5.6	4.0	7.0	10.6	7.9	9.3	9.0	6.8	9.0	9.3	6.0	2.4	7.1	7.1	7.3	6.3	8.7
Ticketing, Sales and Promotion	22.0	11.4	17.4	16.3	14.5	16.7	23.4	8.6	21.2	24.9	17.7	18.3	22.4	24.5	7.9	21.2	15.6	19.6	11.3	18.9
General and Administrative	10.7	3.2	13.8	3.2	5.7	6.3	2.6	6.4	4.6	4.5	4.9	10.6	4.5	6.1	31.9	5.7	7.4	5.5	7.6	4.9
Other Operating Expenses	0.4	-	-	1.8	17.0	0.2	6.8	-	0.6	-	-	-	-	2.7	-	-	-	-	-2.8	0.2
Total Indirect	40.8	34.9	50.3	38.9	48.4	47.2	53.3	36.5	50.3	51.7	40.0	53.5	47.3	53.6	45.9	50.2	40.5	45.1	48.5	47.5
Grand Total Direct and Indirect	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
LOAD FACTORS (Percentages)																				
Load Factor - All Services	65.3	56.2	64.0	67.8	48.0	52.7	58.1	51.3	56.6	60.0	56.9	68.4	52.3	55.5	60.3	58.0	54.9	53.2	59.1	51.8

a/ Selection based on (1) availability and comparability of financial data; and (2) on operations being 25% or more international, 80% or more scheduled, and 60% or more passenger.
b/ Eleven States Signatories to the Yaoundé Treaty: Cameroon, Central African Rep., Chad, Congo (Brazzaville), Dahomey, Gabon, Ivory Coast, Mauritania, Niger, Senegal and Upper Volta.
c/ Capitalised introductory costs of the Trident to be charged to future years.

DIRECT AND INDIRECT UNIT OPERATING EXPENSES - 1964
41 SELECTED INTERNATIONAL SCHEDULED PASSENGER AIRLINES a/
(All Services: International, Domestic, Scheduled, Non-Scheduled)

DESCRIPTION	FAR EAST					LATIN AMERICA				MIDDLE EAST				NORTH AMERICA						OCEANIA	
	CHINA	INDIA	JAPAN	PAKISTAN	PHILIPPINES	ARGENTINA	CHILE	TRINIDAD & TOBAGO	VENEZUELA	ADEN	ISRAEL	LEBANON	TURKEY	CANADA		UNITED STATES				AUSTRALIA	NEW ZEALAND
	CAT	AII	JAL	PIA	PAL	AEROLINEAS ARGENTINAS	LAN	BWIA	LAV	ADEN	EL-AL	MEA	THY	AIR CANADA	CPAL	NORTHWEST	PAA	PANAGRA	TWA	QEA	TEAL
U.S. CENTS PER TONNE-KILOMETRE AVAILABLE																					
Direct																					
Flight Operations	7.6	3.9	5.0	3.6	6.6	6.5	8.0	11.2	7.1	14.8	3.8	9.4	9.1	3.2	5.1	3.9	4.0	5.3	3.9	3.9	5.8
Maintenance	3.4	2.3	2.9	3.6	4.9	4.4	3.7	3.6	7.0	6.7	2.8	6.5	5.6	3.6	2.3	2.1	2.6	4.8	2.3	3.1	3.9
Depreciation and Amortization.	0.1	2.1	3.7	3.1	3.0	1.7	1.4	0.5	1.7	0.8	3.0	3.6	4.6	2.5	0.6	1.8	1.6	1.5	1.4	3.1	2.6
Total Direct	11.1	8.3	11.6	10.3	14.5	12.6	13.1	15.3	15.8	22.3	9.6	19.5	19.3	9.3	8.0	7.8	8.2	11.6	7.6	10.1	12.3
Indirect																					
Station and Other Ground Expenses	4.5	1.4	2.2	2.8	2.0	1.8	1.6	4.3	5.5	3.8	2.2	5.8	3.0	3.8	2.5	1.7	2.5	3.6	2.3	2.2	2.4
Passenger Services	2.3	1.6	1.6	1.0	1.4	4.9	1.7	1.4	0.8	1.8	1.3	2.1	1.4	1.4	1.3	1.1	1.4	1.9	1.3	1.3	2.2
Ticketing, Sales and Promotion	7.4	5.1	4.3	1.9	3.2	1.7	2.1	2.7	4.0	2.8	4.1	5.6	1.0	2.9	3.2	1.6	2.7	4.6	2.1	3.2	4.0
General and Administrative	1.3	0.8	1.9	1.5	2.1	2.0	0.8	1.3	3.1	5.2	1.6	5.1	6.1	0.8	0.6	0.4	0.7	2.2	0.6	1.0	2.0
Other Operating Expenses	-	-	-	-	-	-	0.4	-	1.0	-	-	-	1.3	-	-	-	-	-	-	-	-
Total Indirect	15.5	8.9	10.0	7.2	8.7	10.4	6.6	9.7	14.4	13.6	9.2	18.6	12.8	8.9	7.6	4.8	7.4	12.3	6.3	7.7	10.6
Grand Total Direct and Indirect	26.6	17.2	21.6	17.5	23.2	23.0	19.7	25.0	30.2	35.9	18.8	38.1	32.1	18.2	15.6	12.6	15.6	23.9	13.9	17.8	22.9
U.S. CENTS PER TONNE-KILOMETRE PERFORMED																					
Grand Total Direct and Indirect	58.0	32.6	35.7	34.1	34.6	33.3	25.8	46.6	56.0	56.3	33.6	65.6	50.6	34.0	31.7	27.2	28.3	38.8	30.6	32.2	36.0
PERCENTAGE DISTRIBUTION OF OPERATING EXPENSES (In Percentages)																					
Direct																					
Flight Operations	28.6	22.7	23.0	20.6	28.5	28.4	40.4	44.8	23.4	41.3	20.1	24.6	28.4	17.8	32.8	30.5	25.5	22.1	28.4	22.0	25.3
Maintenance	12.7	13.5	13.5	20.6	21.0	19.1	18.7	14.2	23.0	18.7	14.7	17.0	17.3	20.1	14.4	16.8	16.7	19.9	16.8	17.3	16.9
Depreciation & Amortization	0.3	12.2	17.2	17.9	12.9	7.4	7.1	2.2	5.5	2.1	16.0	9.6	14.3	13.6	3.9	14.4	10.0	6.6	10.0	17.1	11.2
Total Direct	41.6	48.4	53.7	59.1	62.4	54.9	66.2	61.2	51.9	62.1	50.8	51.2	60.0	51.5	51.1	61.7	52.2	48.6	55.2	56.4	53.4
Indirect																					
Station and Other Ground Expenses	16.7	8.0	10.3	16.3	8.5	7.6	8.2	17.3	18.3	10.6	11.5	15.2	9.2	20.9	16.0	13.6	16.8	15.1	16.2	12.4	10.6
Passenger Services	8.9	9.1	7.3	5.7	6.2	21.3	8.6	5.6	2.8	5.0	7.1	5.5	4.4	7.7	8.6	9.0	9.0	7.8	9.4	7.5	9.8
Ticketing, Sales and Promotion	27.9	29.8	19.8	11.0	13.8	7.6	10.6	10.6	13.2	7.8	22.0	14.7	3.3	15.7	20.2	12.3	17.1	19.5	15.0	18.2	17.3
General and Administrative	4.9	4.7	8.9	7.9	9.1	8.6	4.1	5.3	10.4	14.5	8.6	13.4	19.0	4.2	4.1	3.4	4.9	9.0	4.2	5.5	8.9
Other Operating Expenses	-	-	-	-	-	-	2.3	-	3.4	-	-	-	4.1	-	-	-	-	-	-	-	-
Total Indirect	58.4	51.6	46.3	40.9	37.6	45.1	33.8	38.8	48.1	37.9	49.2	48.8	40.0	48.5	48.9	38.3	47.8	51.4	44.8	43.6	46.6
Grand Total Direct and Indirect	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
LOAD FACTORS (Percentages)																					
Load Factor - All Services	45.9	52.8	60.6	51.2	67.0	69.0	76.3	53.6	54.1	63.8	56.0	58.2	63.5	53.4	49.4	46.6	55.0	61.7	45.3	55.3	63.6

a/ Selection based on (1) availability and comparability of financial data; and (2) on operations being 25% or more international, 80% or more scheduled, and 60% or more passenger.

ECONOMICS AND STATISTICS BRANCH (April 1966)

APPENDIX A

BASIC AIR TRANSPORT DATA - 1964

A SELECTED [illegible] INTERNATIONAL SCHEDULED PASSENGER AIRLINES Ø

REGION / AIRLINE (Country)	PERSONNEL: TOTAL SERVICES (L&D) — Number of Airline Staff Members at Year-end	TRAFFIC: TOTAL SERVICES (INTERNATIONAL and DOMESTIC) SCHEDULED and NON-SCHEDULED FLIGHTS — Aircraft Kilometres Flown	Aircraft Departures (or Flights)	Aircraft Hours Flown	Tonne-Kilometres Available	Tonne-Kilometres Performed	Weight Load Factor	INTERNATIONAL OPERATIONS: SCHEDULED FLIGHTS ONLY — Number of International airports Served	Tonne-Kilometres Available	SCHEDULED and NON-SCHEDULED FLIGHTS — Aircraft Kilometres Flown	Aircraft Departures (or Flights)	Tonne-Kilometres Available	FINANCIAL: TOTAL SERVICES (INTER. & DOM.) SCHEDULED and NON-SCHEDULED FLIGHTS OPERATING EXPENSES — Direct	Indirect	Total	REGION / AIRLINE (Country)
	No.	(000's)	No.	No.	(000's)	(000's)	%	No.	(000's)	(000's)	No.	(000's)	U.S. Dollars (000's)			
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	
A. 23 AIRLINES WITH OPERATIONS 40% OR MORE INTERNATIONAL																
AFRICA																**AFRICA**
AIR AFRIQUE(Yaoundé Treaty States a/)	2 583	13 056	10 375*	29 441	125 456	82 232	65.5	40	114 536	11 949	8 475	116 702	23 065	15 913	38 978	AIR AFRIQUE(Yaoundé Treaty States a/)
ROYAL AIR MAROC (Morocco)	802	5 556	5 669	10 853	40 439	26 785	66.2	5	33 351	5 362	4 964	40 080	7 971	5 071	13 042	ROYAL AIR MAROC (Morocco)
? UAA (United Arab Republic)	3 951	16 801	17 382	34 482	124 627	58 127	46.6	34	106 180	14 491	11 638	113 967	16 252	15 282	31 534	? UAA (United Arab Republic)
EUROPE																**EUROPE**
AUA (Austria)	1 282	6 980	14 534	19 433	41 842	21 962	52.2	26	35 880	6 295	10 392	39 850	8 010	7 155	15 165	AUA (Austria)
SABENA (Belgium)	9 335	35 617	45 754	86 670	385 813	217 765	56.4	64	353 790	35 603	45 542	385 807	41 910	47 859	89 769	SABENA (Belgium)
AIR FRANCE (France)	24 030	100 783	102 734	193 911	1 215 285	682 450	56.2	98	1 098 918	90 524	75 660	1 134 781	145 139	147 020	292 159	AIR FRANCE (France)
DLH (Germany (Fed. Rep. of))	12 963	61 226	81 523	131 597	751 415	458 290	61.0	49	650 936	51 847	45 767	689 464	80 434	86 051	166 485	DLH (Germany (Fed. Rep. of))
? AER LINGUS (Ireland)	3 832	11 634	30 686	37 771	62 119	41 418	66.7	29	52 476	11 397	29 440	59 445	9 964	11 426	21 390	? AER LINGUS (Ireland)
ALITALIA (Italy)	8 637	68 814	76 950	133 687	801 313	415 421	51.8	67	711 737	55 369	41 773	718 091	88 125	79 170	167 295	ALITALIA (Italy)
? KLM (Netherlands)	14 500	66 215	62 140	124 223	901 955	475 927	52.8	103	831 449	66 011	61 172	900 943	76 961	88 779	165 740	? KLM (Netherlands)
TAP (Portugal)	2 134	8 177	6 043	15 552	84 092	50 822	60.4	19	79 839	7 799	4 675	80 474	12 843	10 918	23 761	TAP (Portugal)
? SAS (Scandinavia b/)	12 126	63 527	93 950	125 523	630 349	375 139	59.5	63	549 842	53 004	62 851	570 636	76 931	77 515	154 446	? SAS (Scandinavia b/)
SWISSAIR (Switzerland)	8 682	44 058	52 435	76 597	493 525	256 485	52.0	59	472 764	43 400	49 283	490 188	60 600	49 702	110 302	SWISSAIR (Switzerland)
? BOAC (United Kingdom)	? 19 887	113 242	50 010	170 503	1 632 307	830 735	50.9	81	1 479 369	113 242	50 010	1 632 307	144 885	130 798	275 681	? BOAC (United Kingdom)
FAR EAST																**FAR EAST**
? CAT (China (Rep. of))	? 1 288	4 009	8 689	9 922	33 139	14 757	44.5	8	27 773	3 375	4 027	29 687	3 632	5 098	8 730	? CAT (China (Rep. of))
? AII (India)	6 703	16 990	6 961	23 597	308 227	157 299	51.0	25	299 119	16 990	6 961	308 227	26 665	28 472	55 137	? AII (India)
LATIN AMERICA																**LATIN AMERICA**
BWIA (Trinidad & Tobago)	1 369	8 805	23 817	24 394	70 061	37 514	53.5	18	68 979	8 609	21 608	69 288	10 718	6 787	17 505	BWIA (Trinidad & Tobago)
MIDDLE EAST																**MIDDLE EAST**
? EL AL (Israel)	2 383	13 107	5 397	19 303	212 335	116 566	54.9	19	208 688	13 107	5 397	212 335	20 569	19 895	40 464	? EL AL (Israel)
MEA (Lebanon)	3 166	9 189	9 195	17 050	74 864	46 303	61.8	...	61 056	9 189	9 195	74 864	14 610	13 948	28 558	MEA (Lebanon)
NORTH AMERICA																**NORTH AMERICA**
PAA (United States)	26 530	204 874	123 036	287 792	3 457 298	1 900 549	55.0	117	3 290 843	204 389	122 118	3 449 385	281 346	257 423	538 769	PAA (United States)
PANAGRA (United States)	1 329	6 395	4 436	9 662	88 915	54 904	61.7	11	88 524	6 395	4 436	88 915	10 339	10 953	21 292	PANAGRA (United States)
OCEANIA																**OCEANIA**
? QANTAS (Australia)	8 036	38 819	13 711	55 300	522 031	286 267	54.8	39	496 454	38 582	13 560	520 895	56 445	43 632	100 077	? QANTAS (Australia)
? TEAL (New Zealand)	? 1 254	6 979	3 274	12 933	56 098	34 545	61.6	10	56 098	6 976	3 274	56 098	7 329	6 404	13 733	? TEAL (New Zealand)
B. 18 AIRLINES WITH OPERATIONS FROM 25% TO 89% INTERNATIONAL																
AFRICA																**AFRICA**
EAAC (East Africa g/)	2 727	12 814	24 401	32 485	73 938	41 719	56.4	14	58 561	7 740	4 372	58 881	13 431	7 201	20 632	EAAC (East Africa g/)
? CAA (Malawi, Zambia, Rhodesia)	? 1 333	6 401	16 274	21 278	25 281	15 857	62.7	12	9 130	1 877	2 067	9 130	4 574	4 619	9 193	? CAA (Malawi, Zambia, Rhodesia)
EUROPE																**EUROPE**
? FINNAIR (Finland)	1 887	11 897	34 361	37 024	68 423	34 273	50.1	24	43 295	6 620	10 921	45 949	15 407	8 857	24 264	? FINNAIR (Finland)
FLUGFELAG (Iceland)	312	3 119	6 605	10 104	16 852	8 935	53.0	7	11 953	2 145	1 862	13 513	2 409	1 603	4 012	FLUGFELAG (Iceland)
IBERIA (Spain)	6 518	35 563	47 843	88 258	330 786	185 022	55.3	44	238 298	21 998	14 703	245 457	43 182	29 382	72 564	IBERIA (Spain)
? BEA (United Kingdom)	? 18 011	66 712	135 820	172 193	587 951	341 720	58.1	58	415 975	48 923	78 700	422 247	88 522	83 570	172 092	? BEA (United Kingdom)
FAR EAST																**FAR EAST**
? JAL (Japan)	? 8 307	39 602	36 694	73 312	485 848	300 834	61.9	22	326 822	24 206	8 147	333 639	59 141	50 989	110 130	? JAL (Japan)
? PIA (Pakistan)	8 768	19 071	35 325	48 999	183 459	118 020	64.3	20	68 904	6 101	5 897	74 767	22 308	15 458	37 766	? PIA (Pakistan)
PAL (Philippines)	3 465	22 699	75 761	88 436	91 127	59 537	65.3	...	34 357	3 625	1 214	34 591	13 180	7 979	21 159	PAL (Philippines)
LATIN AMERICA																**LATIN AMERICA**
? AEROLINEAS ARGENTINAS (Argentina)	? 6 310	24 875	44 885	70 946	135 931	94 446	69.5	22	76 588	10 257	10 247	76 613	17 108	14 022	31 127	? AEROLINEAS ARGENTINAS (Argentina)
LAN (Chile)	2 361	12 074	21 966	37 394	74 848	57 095	76.3	7	24 681	3 370	2 409	24 681	9 781	4 990	14 771	LAN (Chile)
LAV (Venezuela)	1 208	9 027	36 402	37 078	29 317	15 339	52.3	...	4 267	1 433	1 982	7 474	4 606	4 261	8 867	LAV (Venezuela)
MIDDLE EAST																**MIDDLE EAST**
THY (Turkey)	1 293	8 453	19 860	23 245	31 504	18 881	59.9	12	6 079	2 635	3 017	11 233	6 063	4 047	10 110	THY (Turkey)
? ADEN (United Kingdom (Aden))	? 708	4 678	11 000	16 463	16 191	9 992	61.1	13	8 940	2 780	4 500*	11 131	3 536	2 161	5 697	? ADEN (United Kingdom (Aden))
NORTH AMERICA																**NORTH AMERICA**
AIR CANADA (Canada)	11 670	84 739	135 857	180 428	1 043 704	537 794	51.5	29	356 090	29 883	29 555	418 219	97 668	91 817	189 485	AIR CANADA (Canada)
CPAL (Canada)	2 668	24 613	22 132	42 457	331 188	166 864	50.4	21	232 604	16 723	5 022	248 812	26 497	25 306	51 803	CPAL (Canada)
NORTHWEST (United States)	6 598	89 279	122 461	147 961	1 250 656	582 886	46.6	10	351 412	24 095	10 453	442 548	97 767	60 703	158 470	NORTHWEST (United States)
TWA (United States)	24 600	234 568	203 339	348 781	3 530 669	1 599 211	45.3	24	906 449	49 992	19 291	958 586	269 976	219 475	489 451	TWA (United States)

NOTES:

ƒ Selection based on 1) availability and comparability of financial data ; and 2) on operations being 25% or more international, 90% or more scheduled, and 60% or more passenger.

a) AIR AFRIQUE a multi-national airline with headquarters in the IVORY COAST is operated by eleven States signatories to the Yaoundé Treaty namely: Cameroon, Central African Republic, Chad, Congo (Brazzaville), Dahomey, Gabon, Ivory Coast, Mauritania, Niger, Senegal, and Upper Volta.

b) Denmark, Norway, Sweden.

c) EAAC with headquarters in Kenya, performs operations for East Africa which is comprised of Kenya, the United Republic of Tanzania and Uganda.

Sources: Col. 1: Fleet and Personnel Digest of Statistics No. 116, Series FP-No. 18 (and addenda).
Cols. 2-7, 9-12: Traffic Digest of Statistics No. 113, Series T-No. 23 (and addenda).
Col. 8: Traffic Flow (September 1964) Digest of Statistics No. 114, Series TF-No. 36.
Cols. 13-15: Financial Data Digest of Statistics No. 115, Series F-No. 18 (and addenda).

Symbols: * Estimated by ICAO ... Data not available
? 'Financial' year-end differs from calendar year-end; applicable also to 'personnel' for figures indicated in Col. 1.

All Traffic data are for the calendar year.

ECONOMICS AND STATISTICS BRANCH (April 1966)

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX 7

AIR TRANSPORT PERFORMANCE CRITERIA - 1964
41 SELECTED INTERNATIONAL SCHEDULED PASSENGER AIRLINES Ø

REGION / AIRLINE (Country)	International as percent of total tonne-kilometres available	TRAFFIC, FLEET and PERSONNEL — TOTAL SERVICES (INTERNATIONAL and DOMESTIC) — SCHEDULED and NON-SCHEDULED FLIGHTS: Payload capacity available per aircraft	Average aircraft speed	Average stage length	Average daily utilization per aircraft	Capacity offered per aircraft hour	Capacity offered per aircraft day	Capacity offered per flight	Capacity offered per airline staff member	Traffic carried per airline staff member	INTERNATIONAL OPERATIONS — SCHED & NON-SCHED FLIGHTS: Average stage length	Capacity offered per flight	SCHED. FLIGHTS: Capacity offered per airport served	FINANCIAL — TOTAL SERVICES (INT. & DOM.) — SCHEDULED and NON-SCHEDULED FLIGHTS — OPERATING EXPENSES PER TONNE-KILOMETRE — AVAILABLE: Direct	Indirect	Total	PERFORMED: Total	REGION / AIRLINE (Country)
	percent	tonnes	kmph	km	hrs: min	tkm	tkm	tkm	000 tkm	000 tkp	km	tkm	000 tkm	U.S. cents					
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	
A. 23 AIRLINES WITH OPERATIONS 90% OR MORE INTERNATIONAL																		
AFRICA																		**AFRICA**
AIR AFRIQUE(Yaoundé Treaty States a/)	93%	9.6	443	1 296*	5:39	4 261	23 563	12 452	49	32	1 410	13 770	2 863	18.5	12.6	31.1	47.6	AIR AFRIQUE(Yaoundé Treaty States a/)
ROYAL AIR MAROC (Morocco)	99	7.3	512	980	4:35	3 731	17 088	7 142	51	33	1 080	8 074	6 670	19.6	12.6	32.2	47.5	ROYAL AIR MAROC (Morocco)
Ø UAA (United Arab Republic)	91	7.4	487	934	6:09	3 616	22 238	6 934	32	15	1 245	9 795	3 123	15.3	14.4	29.7	61.8	Ø UAA (United Arab Republic)
EUROPE																		**EUROPE**
AUA (Austria)	95	6.0	359	480	4:16	2 153	9 193	2 879	33	17	606	3 835	1 380	19.2	17.0	36.2	68.8	AUA (Austria)
SABENA (Belgium)	100	10.8	411	778	4:37	4 452	20 568	8 432	41	23	782	8 471	5 528	10.8	12.4	23.2	40.0	SABENA (Belgium)
AIR FRANCE (France)	93	12.1	520	981	4:57	6 267	31 022	11 829	51	28	1 196	14 998	11 213	11.9	12.1	24.0	42.4	AIR FRANCE (France)
DLH (Germany (Fed. Rep. of))	92	12.3	465	751	7:27	5 710	42 540	9 217	58	35	1 135	15 085	13 284	10.7	11.5	22.2	36.9	DLH (Germany (Fed. Rep. of))
Ø AER LINGUS (Ireland)	96	5.3	308	379	5:27	1 645	8 965	2 024	16	11	387	2 019	1 810	15.8	18.1	33.9	49.5	Ø AER LINGUS (Ireland)
ALITALIA (Italy)	90	11.6	515	894	7:35	5 994	45 255	10 413	93	48	1 325	17 190	10 623	11.0	9.9	20.9	39.9	ALITALIA (Italy)
Ø KLM (Netherlands)	92	13.6	533	1 066	6:36	7 261	47 923	14 772	62	33	1 079	14 728	8 072	8.3	9.6	17.9	32.2	Ø KLM (Netherlands)
TAP (Portugal)	96	10.3	526	1 353	4:19	5 407	23 358	13 916	39	24	1 668	17 214	4 202	15.3	13.0	28.3	46.9	TAP (Portugal)
Ø SAS (Scandinavia b/)	91	9.9	506	676	6:51	5 022	34 401	6 709	52	31	843	9 079	8 728	13.6	13.7	27.3	47.1	Ø SAS (Scandinavia b/)
SWISSAIR (Switzerland)	99	11.2	575	840	7:10	6 443	46 196	9 412	57	30	881	9 946	8 013	12.2	10.1	22.3	42.0	SWISSAIR (Switzerland)
Ø BOAC (United Kingdom)	100	14.4	664	2 264	8:44	9 573	83 572	32 640	82	42	2 264	32 640	18 264	8.7	7.7	16.4	31.7	Ø BOAC (United Kingdom)
FAR EAST																		**FAR EAST**
Ø CAT (China (Rep. of))	90	8.3	404	461	6:07	3 340	20 441	3 814	26	11	838	7 372	3 472	11.1	15.5	26.6	58.0	Ø CAT (China (Rep. of))
Ø AII (India)	95	18.1	720	2 440	...	13 062	...	44 279	46	23	2 441	44 279	11 965	8.3	8.9	17.2	32.6	Ø AII (India)
LATIN AMERICA																		**LATIN AMERICA**
BWIA (Trinidad & Tobago)	99	8.0	361	370	5:04	2 872	14 561	2 942	51	27	398	3 207	3 852	15.3	9.7	25.0	46.6	BWIA (Trinidad & Tobago)
MIDDLE EAST																		**MIDDLE EAST**
Ø EL AL (Israel)	100	16.2	679	2 426	8:14	11 000	90 530	39 343	89	49	2 429	39 343	10 984	9.6	9.2	18.8	33.6	Ø EL AL (Israel)
MEA (Lebanon)	100	8.1	539	999	4:45	4 391	20 857	8 142	24	15	999	8 142	...	19.5	18.6	38.1	65.6	MEA (Lebanon)
NORTH AMERICA																		**NORTH AMERICA**
PAA (United States)	99.8	16.9	712	1 665	8:03	12 013	96 705	28 100	130	72	1 674	28 246	28 127	8.2	7.4	15.6	28.3	PAA (United States)
PANAGRA (United States)	100	13.9	662	1 441	5:34	9 203	51 261	20 044	67	41	1 441	20 044	8 048	11.6	12.3	23.9	38.8	PANAGRA (United States)
OCEANIA																		**OCEANIA**
Ø QANTAS (Australia)	99.8	13.4	702	2 851	7:40	9 440	72 405	38 074	65	36	2 845	38 414	12 730	10.1	7.7	17.8	32.2	Ø QANTAS (Australia)
Ø TEAL (New Zealand)	100	8.0	540	2 132	10:42	4 338	46 417	17 134	45	28	2 131	17 134	5 610	12.3	10.6	22.9	36.0	Ø TEAL (New Zealand)
B. 18 AIRLINES WITH OPERATIONS FROM 25% TO 89% INTERNATIONAL																		
AFRICA																		**AFRICA**
EAAC (East Africa c/)	80%	5.8	394	525	5:58	2 276	13 588	3 030	27	15	1 770	13 468	4 183	19.1	10.2	29.3	52.0	EAAC (East Africa c/)
Ø CAA (Malawi, Zambia, Rhodesia)	36	3.9	301	393	3:17	1 188	3 897	1 553	19	12	908	4 417	761	17.6	17.8	35.4	55.3	Ø CAA (Malawi, Zambia, Rhodesia)
EUROPE																		**EUROPE**
Ø FINNAIR (Finland)	67	5.8	321	346	4:54	1 848	9 055	1 991	36	18	606	4 207	1 804	22.0	12.7	34.7	67.6	Ø FINNAIR (Finland)
FLUGFELAG (Iceland)	80	5.4	309	472	...	1 668	...	2 551	54	29	1 152	7 257	1 708	14.3	9.5	23.8	41.8	FLUGFELAG (Iceland)
IBERIA (Spain)	74	9.3	403	743	4:35	3 748	17 166	6 914	51	28	1 496	16 694	5 416	13.0	8.9	21.9	40.0	IBERIA (Spain)
Ø BEA (United Kingdom)	72	8.8	387	491	5:35	3 414	19 050	4 329	33	19	622	5 365	7 172	13.9	13.3	27.2	45.8	Ø BEA (United Kingdom)
FAR EAST																		**FAR EAST**
Ø JAL (Japan)	69	12.3	540	1 079	7:39	6 627	50 697	13 241	58	36	2 971	40 952	14 856	11.6	10.0	21.6	35.7	Ø JAL (Japan)
Ø PIA (Pakistan)	41	9.6	389	540	6:07	3 744	22 913	5 193	21	13	1 055	12 679	3 440	10.3	7.2	17.5	34.1	Ø PIA (Pakistan)
PAL (Philippines)	38	4.0	257	300	6:08	1 050	6 314	1 203	26	17	2 984	28 495	...	14.5	8.7	23.2	34.6	PAL (Philippines)
LATIN AMERICA																		**LATIN AMERICA**
Ø AEROLINEAS ARGENTINAS (Argentina)	56	5.5	351	554	4:59	1 916	9 542	3 028	22	15	1 001	7 477	3 481	12.6	10.4	23.0	33.3	Ø AEROLINEAS ARGENTINAS (Argentina)
LAN (Chile)	33	6.2	323	550	4:31	2 002	9 049	3 407	32	24	1 399	10 245	3 526	13.1	6.6	19.7	25.8	LAN (Chile)
LAV (Venezuela)	25	3.2	243	248	3:50	791	3 050	805	24	13	723	3 771	...	15.8	14.4	30.2	56.0	LAV (Venezuela)
MIDDLE EAST																		**MIDDLE EAST**
THY (Turkey)	36	3.7	364	426	2:05	1 355	2 818	1 586	24	15	873	3 723	507	19.3	12.8	32.1	50.6	THY (Turkey)
Ø ADEN (United Kingdom (Aden))	69	3.5	284	425	5:34	982	...	1 472	...	...	618	2 474	688	22.3	13.6	35.9	56.3	Ø ADEN (United Kingdom (Aden))
NORTH AMERICA																		**NORTH AMERICA**
AIR CANADA (Canada)	40	12.3	470	624	6:27	5 785	37 313	7 682	89	46	1 011	14 151	12 279	9.3	8.9	18.2	34.0	AIR CANADA (Canada)
CPAL (Canada)	75	13.5	580	1 112	6:49	7 801	53 203	14 964	124	63	3 330	49 544	11 076	8.0	7.6	15.6	31.7	CPAL (Canada)
NORTHWEST (United States)	35	14.0	603	729	8:01	8 453	67 793	10 213	187	87	2 305	42 357	35 141	7.8	4.8	12.6	27.2	NORTHWEST (United States)
TWA (United States)	27	15.1	673	1 154	6:13	10 123	62 965	17 363	144	65	2 591	49 691	37 769	7.6	6.3	13.9	30.6	TWA (United States)
For graphic presentation of data see →			CHART 10	CHART 11		CHART 13	CHART 12	CHART 14		CHART 15		CHART 16	CHART 17	CHART 18					
Related to operating expense per tkm			Direct (Col. 14)	Direct (Col. 14)		Direct (Col. 14)	Direct (Col. 14)	Direct (Col. 14)		Total (Col. 16)		Total (Col. 16)	Total (Col. 16)	Total (Col. 16)					
Source of basic data: APPENDIX 6 column numbers →	(12÷5)x100	5 ÷ 2	2 ÷ 4	2 ÷ 3	estimated (see notes)	5 ÷ 4	calculated (see notes)	5 ÷ 3	5 ÷ 1	6 ÷ 1	10 ÷ 11	12 ÷ 11	9 ÷ 8	13 ÷ 5	14 ÷ 5	15 ÷ 5	15 ÷ 6	
														(s e e n o t e s)				

NOTES:

Ø Selection based on 1) availability and comparability of financial data ; and 2) on operations being 25% or more international, 80% or more scheduled, and 60% or more passenger.

a) AIR AFRIQUE a multi-national airline with headquarters in the IVORY COAST is operated by eleven States signatories to the Yaoundé Treaty namely: Cameroon, Central African Republic, Chad, Congo (Brazzaville), Dahomey, Gabon, Ivory Coast, Mauritania, Niger, Senegal, and Upper Volta.

b) Denmark, Norway, Sweden.

c) EAAC with headquarters in Kenya, performs operations for East Africa which is comprised of Kenya, the United Republic of Tanzania and Uganda.

Sources:
Col. 5: Fleet and Personnel Digest of Statistics No. 116, Series FP-No. 18 (and addenda)
Col. 7: Col. 5 x Col. 6 (column numbers as per APPENDIX 7)

Symbols:
* Estimated by ICAO
... Data not available
Ø Financial year-end differs from calendar year-end

For rank order of charted data see APPENDIX 7A

ECONOMICS AND STATISTICS BRANCH (April 1966)

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX 7A

AIR TRANSPORT PERFORMANCE CRITERIA - 1964
RANK ORDER OF 41 SELECTED INTERNATIONAL SCHEDULED PASSENGER AIRLINES ø

TRAFFIC, FLEET and PERSONNEL

TOTAL SERVICES (INTERNATIONAL and DOMESTIC)
SCHEDULED and NON-SCHEDULED FLIGHTS

Rank Number	Payload capacity available per aircraft		Average aircraft speed		Capacity offered per aircraft hour		Average daily utilization per aircraft		Capacity offered per aircraft day		Capacity offered per airline staff member		Rank Number
	Col. 1		Col. 2		Col. 3		Col. 4		Col. 5		Col. 6		
	Airlines	tonnes	Airlines	kmph	Airlines	tka	Airlines	hrs:min.	Airlines	tka	Airlines	000 tka	
1	AII	18.1	AII	720	AII	13 062	TEAL	10:42	PAA	96 705	NORTHWEST	187	1
2	PAA	16.9	PAA	712	PAA	12 013	BOAC	8:44	EL AL	90 530	TWA	144	2
3	EL AL	16.2	QANTAS	702	EL AL	11 000	EL AL	8:14	BOAC	83 572	PAA	130	3
4	TWA	15.1	EL AL	679	TWA	10 123	PAA	8:03	QANTAS	72 405	CPAL	124	4
5	BOAC	14.4	TWA	673	BOAC	9 573	NORTHWEST	8:01	NORTHWEST	67 793	ALITALIA	93	5
6	NORTHWEST	14.0	BOAC	664	QANTAS	9 440	QANTAS	7:40	TWA	62 965	AIR CANADA	[89	6
7	PANAGRA	13.9	PANAGRA	662	PANAGRA	9 203	JAL	7:39	CPAL	53 203	EL AL	[89	7
8	KLM	13.6	NORTHWEST	603	NORTHWEST	8 453	ALITALIA	7:35	PANAGRA	51 261	BOAC	82	8
9	CPAL	13.5	CPAL	580	CPAL	7 801	DLH	7:27	JAL	50 697	PANAGRA	67	9
10	QANTAS	13.4	SWISSAIR	575	KLM	7 261	SWISSAIR	7:10	KLM	47 923	QANTAS	65	10
11	AIR CANADA	[12.3	JAL	[540	JAL	6 627	SAS	6:51	TEAL	46 417	KLM	62	11
12	DLH	[12.3	TEAL	[540	SWISSAIR	6 443	CPAL	6:49	SWISSAIR	46 196	JAL	[58	12
13	JAL	[12.3	MEA	539	AIR FRANCE	6 267	KLM	6:36	ALITALIA	45 255	DLH	[58	13
14	AIR FRANCE	12.1	KLM	533	ALITALIA	5 994	AIR CANADA	6:27	DLH	42 540	SWISSAIR	57	14
15	ALITALIA	11.6	TAP	526	AIR CANADA	5 785	TWA	6:13	AIR CANADA	37 313	FLUGFELAG	54	15
16	SWISSAIR	11.2	AIR FRANCE	520	DLH	5 710	UAA	6:09	SAS	34 401	SAS	52	16
17	SABENA	10.8	ALITALIA	515	TAP	5 407	PAL	6:08	AIR FRANCE	31 022	BWIA	[51	17
18	TAP	10.3	ROYAL AIR MAROC	512	SAS	5 022	CAT	[6:07	AIR AFRIQUE	23 563	IBERIA	[51	18
19	SAS	9.9	SAS	506	SABENA	4 452	PIA	[6:07	TAP	23 358	AIR FRANCE	[51	19
20	PIA	[9.6	UAA	487	MEA	4 391	EAAC	5:58	PIA	22 913	ROYAL AIR MAROC	[51	20
21	AIR AFRIQUE	[9.6	AIR CANADA	470	TEAL	4 338	AIR AFRIQUE	5:39	UAA	22 238	AIR AFRIQUE	49	21
22	IBERIA	9.3	DLH	465	AIR AFRIQUE	4 261	BEA	5:35	MEA	20 857	AII	46	22
23	BEA	8.8	AIR AFRIQUE	443	IBERIA	3 748	PANAGRA	[5:34	SABENA	20 568	TEAL	45	23
24	CAT	8.3	SABENA	411	PIA	3 744	ADEN	[5:34	CAT	20 441	SABENA	41	24
25	MEA	8.1	CAT	404	ROYAL AIR MAROC	3 731	AER LINGUS	5:27	BEA	19 050	TAP	39	25
26	TEAL	[8.0	IBERIA	403	UAA	3 616	BWIA	5:04	IBERIA	17 166	FINNAIR	36	26
27	BWIA	[8.0	EAAC	394	BEA	3 414	AERO. ARGENTINAS	4:59	ROYAL AIR MAROC	17 088	BEA	[33	27
28	UAA	7.4	PIA	389	CAT	3 340	AIR FRANCE	4:57	BWIA	14 561	AUA	[33	28
29	ROYAL AIR MAROC	7.3	BEA	387	BWIA	2 872	FINNAIR	4:54	EAAC	13 588	LAN	[32	29
30	LAN	6.2	THY	364	EAAC	2 276	MEA	4:45	AERO. ARGENTINAS	9 542	UAA	[32	30
31	AUA	6.0	BWIA	361	AUA	2 153	SABENA	4:37	AUA	9 193	EAAC	27	31
32	EAAC	[5.8	AUA	359	LAN	2 002	ROYAL AIR MAROC	[4:35	FINNAIR	9 055	PAL	[26	32
33	FINNAIR	[5.8	AERO. ARGENTINAS	351	AERO. ARGENTINAS	1 916	IBERIA	[4:35	LAN	9 049	CAT	[26	33
34	AERO. ARGENTINAS	5.5	LAN	323	FINNAIR	1 848	LAN	4:31	AER LINGUS	8 965	THY	[24	34
35	FLUGFELAG	5.4	FINNAIR	321	FLUGFELAG	1 668	TAP	4:19	PAL	6 314	LAV	[24	35
36	AER LINGUS	5.3	FLUGFELAG	309	AER LINGUS	1 645	AUA	4:16	CAA	3 897	MEA	[24	36
37	PAL	4.0	AER LINGUS	308	THY	1 355	LAV	3:50	LAV	3 030	AERO. ARGENTINAS	22	37
38	CAA	3.9	CAA	301	CAA	1 188	CAA	3:17	THY	2 818	PIA	21	38
39	THY	3.7	ADEN	284	PAL	1 030	THY	2:05	AII	...	CAA	19	39
40	ADEN	3.5	PAL	257	ADEN	982	AII	...	FLUGFELAG	...	AER LINGUS	16	40
41	LAV	3.2	LAV	243	LAV	791	FLUGFELAG	...	ADEN	...	ADEN	...	41
	CHART 10		CHART 11		CHART 12		CHART 13		CHART 14		CHART 15		

See also APPENDIX 7

APPENDIX 7A (continued)

AIR TRANSPORT PERFORMANCE CRITERIA - 1964
RANK ORDER OF 41 SELECTED INTERNATIONAL SCHEDULED PASSENGER AIRLINES Ø

Rank Number	TRAFFIC and FLEET — INTERNATIONAL OPERATIONS — SCHEDULED and NON-SCHEDULED FLIGHTS: Average stage length — Col. 7		TRAFFIC and FLEET — INTERNATIONAL OPERATIONS — SCHEDULED and NON-SCHEDULED FLIGHTS: Capacity offered per flight — Col. 8		TRAFFIC and FLEET — INTERNATIONAL OPERATIONS — SCHEDULED FLIGHTS: Capacity offered per airport served — Col. 9		FINANCIAL — TOTAL SERVICES (INTERNATIONAL and DOMESTIC) — SCHEDULED and NON-SCHEDULED FLIGHTS — OPERATING EXPENSES PER TONNE-KILOMETRE — AVAILABLE — Direct — Col. 10		FINANCIAL — Indirect — Col. 11		FINANCIAL — Total — Col. 12		FINANCIAL — PERFORMED — Total — Col. 13		Rank Number
	Airlines	km	Airlines	tka	Airlines	000 tka	Airlines	US ¢	Airlines	US ¢	Airlines	US ¢	Airlines	US ¢	
1	CPAL	3 330	TWA	49 691	TWA	37 769	TWA	7.6	NORTHWEST	4.8	NORTHWEST	12.6	LAN	25.8	1
2	PAL	2 984	CPAL	49 544	NORTHWEST	35 141	NORTHWEST	7.8	TWA	6.3	TWA	13.9	NORTHWEST	27.2	2
3	JAL	2 971	AII	44 279	PAA	28 127	CPAL	8.0	LAN	6.6	CPAL	[15.6	PAA	28.3	3
4	QANTAS	2 845	NORTHWEST	42 337	BOAC	18 264	PAA	8.2	PIA	7.2	PAA	[15.6	TWA	30.6	4
5	TWA	2 591	JAL	40 952	JAL	14 856	AII	[8.3	PAA	7.4	BOAC	16.4	BOAC	[31.7	5
6	AII	2 441	EL AL	39 343	DLH	13 284	KLM	[8.3	CPAL	7.6	AII	17.2	CPAL	[31.7	6
7	EL AL	2 429	QANTAS	38 414	QANTAS	12 730	BOAC	8.7	BOAC	[7.7	PIA	17.5	KLM	[32.2	7
8	NORTHWEST	2 305	BOAC	32 640	AIR CANADA	12 279	AIR CANADA	9.3	QANTAS	[7.7	QANTAS	17.8	QANTAS	[32.2	8
9	BOAC	2 264	PAL	28 493	AII	11 965	EL AL	9.6	PAL	8.7	KLM	17.9	AII	32.6	9
10	TEAL	2 131	PAA	28 246	AIR FRANCE	11 213	QANTAS	10.1	AIR CANADA	[8.9	AIR CANADA	18.2	AERO. ARGENTINAS	33.3	10
11	EAAC	1 770	PANAGRA	20 044	CPAL	11 076	PIA	10.3	AII	[8.9	EL AL	18.8	EL AL	33.6	11
12	PAA	1 674	TAP	17 214	EL AL	10 984	DLH	10.7	IBERIA	[8.9	LAN	19.7	AIR CANADA	34.0	12
13	TAP	1 668	ALITALIA	17 190	ALITALIA	10 623	SABENA	10.8	EL AL	9.2	ALITALIA	20.9	PIA	34.1	13
14	IBERIA	1 496	TEAL	17 134	SAS	8 728	ALITALIA	11.0	FLUGFELAG	9.5	JAL	21.6	PAL	34.6	14
15	PANAGRA	1 441	IBERIA	16 694	KLM	8 072	CAT	11.1	KLM	9.6	IBERIA	21.9	JAL	35.7	15
16	AIR AFRIQUE	1 410	DLH	15 085	PANAGRA	8 048	JAL	[11.6	BWIA	9.7	DLH	22.2	TEAL	36.0	16
17	LAN	1 399	AIR FRANCE	14 998	SWISSAIR	8 013	PANAGRA	[11.6	ALITALIA	9.9	SWISSAIR	22.3	DLH	36.9	17
18	ALITALIA	1 325	KLM	14 728	BEA	7 172	AIR FRANCE	11.9	JAL	10.0	TEAL	22.9	PANAGRA	38.8	18
19	UAA	1 245	AIR CANADA	14 151	ROYAL AIR MAROC	6 670	SWISSAIR	12.2	SWISSAIR	10.1	AERO. ARGENTINAS	23.0	ALITALIA	39.9	19
20	AIR FRANCE	1 196	AIR AFRIQUE	13 770	TEAL	5 610	TEAL	12.3	EAAC	10.2	PAL	[23.2	IBERIA	[40.0	20
21	FLUGFELAG	1 152	EAAC	13 468	SABENA	5 528	AERO. ARGENTINAS	12.6	AERO. ARGENTINAS	10.4	SABENA	[23.2	SABENA	[40.0	21
22	DLH	1 135	PIA	12 679	IBERIA	5 416	IBERIA	13.0	TEAL	10.6	FLUGFELAG	23.8	FLUGFELAG	41.8	22
23	ROYAL AIR MAROC	1 080	LAN	10 245	TAP	4 202	LAN	13.1	DLH	11.5	PANAGRA	23.9	SWISSAIR	42.0	23
24	KLM	1 079	SWISSAIR	9 946	EAAC	4 183	SAS	13.6	AIR FRANCE	12.1	AIR FRANCE	24.0	AIR FRANCE	42.4	24
25	PIA	1 035	UAA	9 793	BWIA	3 832	BEA	13.9	PANAGRA	12.3	BWIA	25.0	BEA	45.8	25
26	AIR CANADA	1 011	SAS	9 079	LAN	3 526	FLUGFELAG	14.3	SABENA	12.4	CAT	26.6	BWIA	46.6	26
27	AERO. ARGENTINAS	1 001	SABENA	8 471	AERO. ARGENTINAS	3 481	PAL	14.5	AIR AFRIQUE	[12.6	BEA	27.2	TAP	46.9	27
28	MEA	999	MEA	8 142	CAT	3 472	BWIA	[15.3	ROYAL AIR MAROC	[12.6	SAS	27.3	SAS	47.1	28
29	CAA	908	ROYAL AIR MAROC	8 074	PIA	3 440	TAP	[15.3	FINNAIR	12.7	TAP	28.3	ROYAL AIR MAROC	47.5	29
30	SWISSAIR	881	AERO. ARGENTINAS	7 477	UAA	3 123	UAA	[15.3	THY	12.8	EAAC	29.3	AIR AFRIQUE	47.6	30
31	THY	873	CAT	7 372	AIR AFRIQUE	2 863	AER LINGUS	[15.8	TAP	13.0	UAA	29.7	AER LINGUS	49.5	31
32	SAS	843	FLUGFELAG	7 257	AER LINGUS	1 810	LAV	[15.8	BEA	13.3	LAV	30.2	THY	50.6	32
33	CAT	838	BEA	5 365	FINNAIR	1 804	CAA	17.6	ADEN	13.6	AIR AFRIQUE	31.1	EAAC	52.0	33
34	SABENA	782	CAA	4 417	FLUGFELAG	1 708	AIR AFRIQUE	18.5	SAS	13.7	THY	32.1	CAA	55.3	34
35	LAV	723	FINNAIR	4 207	AUA	1 380	EAAC	19.1	LAV	[14.4	ROYAL AIR MAROC	32.2	LAV	56.0	35
36	BEA	622	AUA	3 835	CAA	761	AUA	19.2	UAA	[14.4	AER LINGUS	33.9	ADEN	56.3	36
37	ADEN	618	LAV	3 771	ADEN	688	THY	19.3	CAT	15.5	FINNAIR	34.7	CAT	58.0	37
38	FINNAIR	606	THY	3 723	THY	507	MEA	19.5	AUA	17.0	CAA	35.4	UAA	61.8	38
39	AUA	606	BWIA	3 207	MEA	...	ROYAL AIR MAROC	19.6	CAA	17.8	ADEN	35.9	MEA	65.6	39
40	BWIA	398	ADEN	2 474	PAL	...	FINNAIR	22.0	AER LINGUS	18.1	AUA	36.2	FINNAIR	67.6	40
41	AER LINGUS	387	AER LINGUS	2 019	LAV	...	ADEN	22.3	MEA	18.6	MEA	38.1	AUA	68.8	41
	CHART 16		CHART 17		CHART 18		CHARTS 10,11,12,13,14				CHARTS 15,16,17,18				

See also APPENDIX 7

ORMANCE CRITERIA - 1964
TIONAL SCHEDULED PASSENGER AIRLINES Ø

F I N A N C I A L								Rank Number
TOTAL SERVICES (INTERNATIONAL and DOMESTIC)								
SCHEDULED and NON-SCHEDULED FLIGHTS								
OPERATING EXPENSES PER TONNE-KILOMETRE								
A V A I L A B L E						PERFORMED		
Direct		Indirect		Total		Total		
Col. 10		Col. 11		Col. 12		Col. 13		
lines	US ¢	Airlines	US ¢	Airlines	US ¢	Airlines	US ¢	
	7.6	NORTHWEST	4.8	NORTHWEST	12.6	LAN	25.8	1
ST	7.8	TWA	6.3	TWA	13.9	NORTHWEST	27.2	2
	8.0	LAN	6.6	CPAL	15.6	PAA	28.3	3
	8.2	PIA	7.2	PAA	15.6	TWA	30.6	4
	8.3	PAA	7.4	BOAC	16.4	BOAC	31.7	5
	8.3	CPAL	7.6	AII	17.2	CPAL	31.7	6
	8.7	BOAC	7.7	PIA	17.5	KLM	32.2	7
ADA	9.3	QANTAS	7.7	QANTAS	17.8	QANTAS	32.2	8
	9.6	PAL	8.7	KLM	17.9	AII	32.6	9
	10.1	AIR CANADA	8.9	AIR CANADA	18.2	AERO. ARGENTINAS	33.3	10
	10.3	AII	8.9	EL AL	18.8	EL AL	33.6	11
	10.7	IBERIA	8.9	LAN	19.7	AIR CANADA	34.0	12
	10.8	EL AL	9.2	ALITALIA	20.9	PIA	34.1	13
A	11.0	FLUGFELAG	9.5	JAL	21.6	PAL	34.6	14
	11.1	KLM	9.6	IBERIA	21.9	JAL	35.7	15
	11.6	BWIA	9.7	DLH	22.2	TEAL	36.0	16
	11.6	ALITALIA	9.9	SWISSAIR	22.3	DLH	36.9	17
NCE	11.9	JAL	10.0	TEAL	22.9	PANAGRA	38.8	18
R	12.2	SWISSAIR	10.1	AERO. ARGENTINAS	23.0	ALITALIA	39.9	19
	12.3	EAAC	10.2	PAL	23.2	IBERIA	40.0	20
RGENTINAS	12.6	AERO. ARGENTINAS	10.4	SABENA	23.2	SABENA	40.0	21
	13.0	TEAL	10.6	FLUGFELAG	23.8	FLUGFELAG	41.8	22
	13.1	DLH	11.5	PANAGRA	23.9	SWISSAIR	42.0	23
	13.6	AIR FRANCE	12.1	AIR FRANCE	24.0	AIR FRANCE	42.4	24
	13.9	PANAGRA	12.3	BWIA	25.0	BEA	45.8	25
AG	14.3	SABENA	12.4	CAT	26.6	BWIA	46.6	26
	14.5	AIR AFRIQUE	12.6	BEA	27.2	TAP	46.9	27
	15.3	ROYAL AIR MAROC	12.6	SAS	27.3	SAS	47.1	28
	15.3	FINNAIR	12.7	TAP	28.3	ROYAL AIR MAROC	47.5	29
	15.3	THY	12.8	EAAC	29.3	AIR AFRIQUE	47.6	30
GUS	15.8	TAP	13.0	UAA	29.7	AER LINGUS	49.5	31
	15.8	BEA	13.3	LAV	30.2	THY	50.6	32
	17.6	ADEN	13.6	AIR AFRIQUE	31.1	EAAC	52.0	33
IQUE .	18.5	SAS	13.7	THY	32.1	CAA	55.3	34
	19.1	LAV	14.4	ROYAL AIR MAROC	32.2	LAV	56.0	35
	19.2	UAA	14.4	AER LINGUS	33.9	ADEN	56.3	36
	19.3	CAT	15.5	FINNAIR	34.7	CAT	58.0	37
	19.5	AUA	17.0	CAA	35.4	UAA	61.8	38
IR MAROC	19.6	CAA	17.8	ADEN	35.9	MEA	65.6	39
	22.0	AER LINGUS	18.1	AUA	36.2	FINNAIR	67.6	40
	22.3	MEA	18.6	MEA	38.1	AUA	68.8	41
10,11,12,13,14				CHARTS 15,16,17,18				

FORM F

INSTRUCTIONS

Form to be filed by a State for each of its airlines engaged in the provision of scheduled "international" or "territorial" services.

This Form should be filed annually not later than **6 months** after the end of the year to which it refers.

NOTES

An airline provides "international" or "territorial" services if at least one service has a traffic stop in foreign territory or a flight stage passing for a relatively substantial distance over foreign territory or international waters.

Data are required in respect of the entire operations (international, territorial and domestic). Where practicable, an additional form is to be completed showing the operating revenues and expenses related, as closely as possible, to scheduled international and/or territorial services only, so that these financial data can be studied along with the traffic data for the year on the corresponding services as reported monthly on Forms A.

OPERATING REVENUES (Items 1 to 4):

1. Scheduled services:

Report under this heading revenues earned in services scheduled and performed according to a published time-table (or from services so regular or frequent as to constitute a recognizably systematic series), which are open to use by members of the public, including revenue earned from extra flights occasioned by overflow traffic from such scheduled services, and from preparatory revenue flights on planned scheduled services, sub-divided into Passenger, Excess baggage, Freight, express and diplomatic bags; Mail, as follows.

1.1 Passenger shall include the revenue from the transportation of passengers on scheduled flights, after the deduction of applicable discounts and rebates. It shall not include the value of passenger tickets sold in advance; the value of such tickets shall be carried forward until such time as the flight takes place or the value is refunded. Cancellation fees shall be included under item 3 "Incidental revenues".

Passenger revenue shall be credited with revenue upon the basis of published tariffs, excursion, other special fares and agreed inter-line pro-rates of through fares; and revenue from berth, compartment or other special accommodation furnished on the basis of fares or contracts for space occupied. It shall not include taxes on sales of passenger transportation.

Revenues from the sale of food and drinks not included in the price of the ticket shall be excluded and reported under item 3 "Incidental revenues".

Revenues from nominal service charges for persons traveling on a non-revenue basis (such as staff members) shall be excluded and reported under item 3 "Incidental revenues".

Passenger revenue shall not be charged with payments made for ground transportation, commission on sales or other expenses connected with passenger handling or interrupted flights. Such expenses shall be charged to appropriate expenditure accounts.

1.2 Excess Baggage shall include revenue arising from the transportation of passenger baggage in excess of the fixed free weight and fixed valuation allowance.

1.3 Freight shall include revenue, after deduction of applicable discounts and rebates on the basis of published tariffs and agreed inter-line pro-rates of through-tariffs.

Freight revenue shall also include "Express" revenue and revenue from the carriage of diplomatic bags.

Where the airline's staff has the privilege of sending personal consignments at reduced rates, such revenue shall be taken as normal freight revenue.

1.4 Mail shall include, payments received from the carriage of all domestic and foreign mail at prevailing rates, irrespective of the fact that such rates may be fixed in advance or in arrears.

Revenue from the use of Post Office aircraft, revenue from the use of special postal facilities in aircraft and current adjustments for revenues not billed but allowed shall be credited to mail revenue. Current adjustments for disallowed mail revenue shall be charged to this account, but fines and penalties imposed in connection with the carriage of mail shall be charged to appropriate expenditure accounts. Adjustments to mail pay for previous years shall be included under item 25.

2. Non-scheduled flights:

Shall include revenue derived from all flights performed for remuneration, including empty flights related thereto, other than those on scheduled services. This item shall include revenues from sales of the whole capacity of an aircraft where the responsibility for the performance of such transportation is that of the reporting carrier. This item shall also include revenues from inclusive tours other than those reported under scheduled services.

3. Incidental revenues:

Shall include net revenues (i.e., gross revenues less related direct expenses) from such sources as surface transportation; food services, service sales; commissions received on sales of transportation on other carriers, "no show" and cancellation fees; providing aircraft to other airlines or parties for operations under their control; property and other incidental net operating revenues which accrued to the airline from sources other than air transportation, any operating revenues which are not classifiable under items 1 and 2.

4. Total operating revenues:

The sum of items 1, 2 and 3.

OPERATING EXPENSES (Items 5 to 13):

5. Flight operations:

5.1 Flight crew salaries and expenses shall include pay and allowances, pensions, insurance, travelling and other similar expenses, including crew equipment costs. Pay, allowances and other related expenses of pursers, cabin attendants and passenger service personnel shall not be charged under this account, but included under "Passenger services" (item 9). Training costs shall not be included in this item (see 5.5 and 7.4).

5.2 Aircraft fuel and oil shall include non-refundable duties and taxes.

5.3 Flight equipment insurance and uninsured losses shall include: insurance against accidental damage to flight equipment while in flight and on the ground; insurance against liability occurring from operation of aircraft or, in case of non-insurance, the resulting expenses for which the airline is liable.

5.4 Rental of flight equipment shall include hire of aircraft and crews (see also note below re. "Aircraft not owned by the reporting airline").

5.5 Other flight expenses shall include expenses pertaining to in-flight operation and related stand by time of aircraft, which are not classifiable under items 5.1 to 5.4 inclusive. It shall also include the cost of training of flight crew, when separately identifiable, if this cost is not to be amortized over two or more years (see 7.4).

6. Maintenance and overhaul:

Shall include not only the cost of current maintenance of aircraft, engines, components and spares in an operative condition, but also the cost of repair and overhaul, including certificate of airworthiness overhaul where such is carried out under Government mandatory requirements.

Expenditure grouped under this account refers to the cost of engineering labour, not only hourly rated or costed labour, but engineering supervision, planning, inspection, etc., which can be determined as relating solely to engineering work on the particular type of aircraft, or to the particular unit within the airline's organization.

It shall include also the cost of materials used in maintaining the flight equipment in an operative condition. The cost can be determined according to the airline's internal methods.

Indirect expenditure arising under the above heading shall also be charged, whether by direct allocation or by pro-rating or apportionment. This will include items such as: pay of supervisory personnel at maintenance and overhaul shops; pay of engineers and other employees at the maintenance and overhaul shops, including stores and supplies personnel, accounting personnel, timekeepers, etc.; travel, training and other expenses of maintenance and overhaul employees; maintenance and insurance of equipment used at the maintenance and overhaul shops, where separately assessed; accommodation costs; office supplies and expenses, telephone and cable costs, transportation costs.

The cost of repair, overhaul and maintenance of the flight equipment by outside contractors and manufacturers, or by specialist units within the airline's organization, shall also be included.

If the airline's organization permits the separate cost of engineering staff at out-stations to be ascertained, then such costs may be included under the above account, or not, according to whether the airline decides that the engineering work carried out away from the engineering base is of such importance as to warrant the transfer of expenditure from out-stations to the engineering unit.

Where direct and related indirect maintenance of ground facilities cannot be segregated for inclusion under "Station and other ground expenses" it shall be included under this account.

If reserves are created for maintenance and overhaul, the reserve provisions shall be charged to this account, and the actual expenses incurred shall be offset against the reserves which have been provided.

7. Depreciation and amortization:

This item shall include depreciation and amortization charged to the current financial year (see also items 4.1, 5.1, 8.1, Balance Sheet, Form E). The amounts charged under this general heading shall be subdivided as follows:

7.1 Normal depreciation of flight equipment. The normal annual depreciation of assets included in item 4 of the Balance Sheet (Form E).

7.2 Normal depreciation of ground property and equipment. The normal annual depreciation of assets included in item 5 of the Balance Sheet (Form E).

NOTE

Normal depreciation of an asset shall be the proportion of the historical cost of the asset which is charged against the operating expenses in a particular year. The accrued normal depreciation of an asset shall never exceed the historical cost of that asset (see 7.3).

7.3 Extra depreciation (in excess of cost). If the airline decides to continue to charge an asset after the accrued normal depreciation has reached the same amount as the historical cost of this asset, the charge shall be reported under this operating expense item, which is supplementary to items 7.1 and 7.2.

7.4 Amortization of development and pre-operating cost. This item shall include charges for the amortization of capitalized development and pre-operating costs and other intangible assets applicable to the performance of air transportation. It shall include charges for the amortization of extraordinary training.

NOTE

The basis, rates and methods of depreciation used for arriving at the amounts reported for flight equipment under items 7.1 and 7.3 are requested in a separate statement.

8. Station and other ground expenses:

8.1 Landing and departure fees shall include, exclusively, fees levied against the airline for landings and departures of its aircraft.

8.2 Other expenses shall include such items as: housing, mooring, parking and picketing charges at all airports; pay, allowances and expenses of all station staff engaged in handling and servicing aircraft and load, including flight supervisors, dispatchers and ground radio operators; station accommodation costs; maintenance and insurance of airport facilities, where separately assessed; representation and traffic handling fees charged by third parties for handling the air services of the airline; station stores charges, including local duties on equipment, transportation, packing and materials, rental of stores, storekeepers' pay, allowances and expenses, etc.

The cost of providing services to third parties shall be credited to this account.

It shall also include the cost of training of ground personnel, when separately identifiable, if this cost is not to be amortized over two or more years (see item 7.4).

9. Passenger services:

Shall include: pay, allowances and expenses of cabin attendants and passenger service personnel, including pensions, uniforms, insurance, etc.; premiums for passenger liability insurance and passenger accident insurance paid by the airline, meals and accommodation, including costs of supplies and personal services furnished to passengers; expenses of handling passengers incurred because of interrupted flights, including hotels, meals, taxi fares and other expense items; costs of other services provided for passengers, such as pay, allowances and expenses of room reservation personnel, and all other services provided for the comfort of passengers in transit.

10. Ticketing, sales and promotion:

Shall include items such as: pay, allowances and related expenses of all staff engaged in ticketing, sales and promotion activities, accommodation costs, commissions on ticket sales, agency fees for outside services, advertising and publicity through various media and expenses related thereto.

11. General and administrative:

Shall include expenses incurred in performing the general and administrative functions of the airline and those expenses relating to matters of a general corporate nature, whether separately assessed or apportioned in conformity with the airline's accounting practices.

NOTE

Overhead costs directly related to operating expense items 5, 6, 8, 9 and 10 should be included in the expense items to which they are related and not in this item 11.

12. Other operating expenses:

Shall include operating expenses which cannot be assigned to items 5 through 11. The nature of such expenses should be specified.

13. Total operating expenses:

The sum of items 5 through 12.

14. Operating result:

The difference between item 4, "Total operating revenues" and item 13, "Total operating expenses".

NON-OPERATING REVENUES AND EXPENSES (Items 15 to 20).

15. Retirement of property and equipment:

Shall include the balance of gains and losses realized on sales, exchanges or retirement resulting from obsolescence, accident, etc., of flight equipment and other assets. Gain or loss on retirement is defined as the difference between the depreciated book value of the equipment at date of retirement and the value realized.

16. Interest:

Shall include the balance of receipts and payments (or accruals) on account of interest on long term and short-term notes receivable or payable, amortization of debt discount and expenses; amortization of premium on debt.

17. Payments from public funds not allocated elsewhere:

Shall include:

17.1 direct subsidies, and

17.2 other payments made by Government bodies, not accounted for elsewhere.

18. Affiliated companies:

Shall include the balance of all income from affiliated companies, and losses of affiliated companies reimbursed in cash or recorded as a valuation reserve against an investment. Affiliated companies are defined as companies controlled by the reporting airline.

19. Other non-operating items:

Shall include the balance of: dividend income, except from affiliated companies (item 18), profits and losses from non-operating property and equipment, from sales of securities owned; from foreign exchange transactions, from re sale of long term notes receivable, held in the airline's treasury, other income and expenditure of a non-operating nature.

20. Balance of non-operating items:

The net balance of items 15 through 19.

21. Profit or loss before income taxes:

The difference between item 14 "Operating result" and item 20 "Balance of non-operating items".

PROFIT OR LOSS (Items 22 to 26):

22. Income taxes:

Shall include: central or other governmental taxes; excess profits taxes; taxes on undistributed surplus; and other taxes imposed on net income.

23. Profit or loss after income taxes:

The difference between item 21 "Profit or loss before income taxes" and item 22 "Income taxes".

24. Unappropriated balance of profit or loss as shown on last year's balance sheet:

This item is self-explanatory. See identical item on the previous year's Form E (Balance Sheet).

25. Adjustments to current and previous years' results:

In the case of each adjustment the year to which it relates shall be stated and the nature of the adjustment shall be specified. Details may be given in the "Remarks" column or on a separate sheet, if necessary. Tax adjustments, adjustments to mail pay for previous years and adjustments such as that referred to in items 2 and 3 of the instructions to Form E (Balance Sheet) and under item 1.4 of this Form shall be included in this item.

26. Profit or loss available for distribution:

The net balance of item 23 "Profit or Loss after Income Taxes"; item 24 "Last Year's Unappropriated Balance of Profit or Loss"; and item 25 "Adjustment to Current and Previous Years' Results".

27. Appropriations:

28. Dividends:

Details may be given in the "Remarks" column or on a separate sheet if necessary.

29. Total distribution:

The sum of items 27 and 28.

30. Unappropriated balance of profit or loss as shown on this year's balance sheet:

The difference between item 26 and item 29, this amount should be identical to that reported in item 23 of the Current Year's Balance Sheet (Form E).

AIRCRAFT NOT OWNED BY THE REPORTING AIRLINE:

Revenues and expenses resulting from the operating of such aircraft should normally be reported by the airline which operates them and not by the owner of the aircraft. In certain circumstances, however, the terms of the lease or charter agreement may cause doubts as to the efficacy of this method of reporting, and in such cases the advice of ICAO should be sought.

APPENDIX 9

NOTE ON THE BREAKDOWN OF OPERATING COSTS INTO COMPONENT ACCOUNTS

Two important footnotes appearing below Appendices 1, 2 and 3 merit special consideration here:

a) On 1st January 1957, a new classification for Operating Expenses became effective in the United States, so that the figures shown for Indirect expenses (Station and Ground, Passenger Services, Ticketing, Sales & Promotion, and General and Administrative Expenses) are not strictly comparable before and after this date.

b) Beginning with 1960, a new revised ICAO Air Transport Reporting Form "F" was introduced, in which the expense account "Depreciation of Flight Equipment" was inserted into a larger expense category called "Depreciation and Amortization". This new account item included in addition, "Ground Property and Equipment Depreciation" (previously classified partly under "Maintenance and Overhaul" expenses, a direct expense account, and partly under "Station and Ground" expenses, an indirect expense account) and expenses for "Amortization of Development and Pre-Operating Costs" (previously classified as a non-operating item).

These changes in expense classifications make the detailed comparison of recent years with the past difficult, and subject to careful interpretation. In the first instance, the changes were entirely confined to the indirect expense category, but they nevertheless affect the allocation of expenses within this category. In the second instance, the direct expense category was increased by the amount of ground property and equipment depreciation that was formerly included under "Station and Ground Expenses", while the indirect expenses (and the total operating expenses as a result) were increased by amounts provided for "Amortization of Development and Pre-Operating Costs", previously classified as a non-operating expense. Neither of these changes was very large in itself, but their cumulation under the expense category for Depreciation and Amortization has made the total amounts reported under this heading rather difficult to compare with the amounts reported for "Flight Equipment Depreciation" in previous years. It will be specially important to keep this in mind when the charts in Chapter II are examined.

APPENDIX 10

NOTE ON ALLOCATION OF UNIT COSTS TO INTERNATIONAL AND DOMESTIC SERVICES

Operating Expenses are reported to ICAO for the scheduled airlines of its Contracting States, on Air Transport Reporting Form F, reproduced at Appendix 8. As a rule, the Forms F are filed covering the total international and domestic operations of the reporting airlines, but there are eleven United States airlines and one or two airlines of other States which regularly file with ICAO an additional Form F covering their international services separately. Furthermore, a number of airlines fly only or mostly on international services, so that their operations may be considered as representative of international services. These airlines provide the figures used as a basis in Chapters I and II of this study (and more particularly in Appendix 2) for estimating "international" costs, and it should be pointed out here that in some cases, the airline's own allocation of costs to international services may be based on certain arbitrary elements. On the whole, these airlines have operated approximately 70% of the World's tonne-kilometres performed in international services during the 14-year period 1951-1964, so that the Secretariat feels justified in considering their revenues and costs as truly representative of international operations. However, there are undoubtedly a number of smaller international airlines for which the average costs indicated in this study are not suitable, as the larger carriers tend to have a preponderant influence in averages of this kind.

APPENDIX 11

GLOSSARY OF TERMS USED IN THE STUDY

Note: The descriptions of terms given below are intended for use in connection with this Study only.

Aircraft productivity, (i) hourly productivity, the capacity offered per hour per aircraft, obtained by multiplying the payload capacity (tonnes) of the aircraft by its average airborne speed (kilometres per hour), expressed in tonne-kilometres available per hour; and (ii) daily productivity, obtained by multiplying the hourly productivity figure for the aircraft by its utilization (hours per day) expressed in tonne-kilometres available per day.

Aircraft utilization, the average number of revenue hours flown per aircraft per day, or the revenue hours flown per year divided by the number of aircraft days available, including days required for maintenance and overhaul, but not including days when the aircraft is not in service owing to accident, conversion, rental or government action.

Capacity offered, the quantity of air transport capacity produced and offered for sale, is obtained by multiplying aircraft payload capacity (tonnes, or number of passengers) by the distance flown (kilometres), and is expressed in terms of tonne-kilometres available or passenger-kilometres available.

Direct operating costs, those costs associated directly with the characteristics of the aircraft in question, including items 5 to 7 in the Instructions for Air Transport Reporting Form F (see Appendix 8), i.e., flight operations, maintenance and overhaul, and depreciation and amortization. (See Note on breakdown of operating costs in Appendix 9).

Domestic flight stage, a flight stage not classifiable as "international". (See Note on allocation of costs to international and domestic services in Appendix 10).

Indirect operating costs, operating costs other than direct, or those costs associated with sales, service and administration, including items 8 to 12 in the Instructions for Form F (see Appendix 8), i.e., station and ground costs; passenger services; ticketing, sales and promotion; general and administrative, and other operating costs.

International flight stage, a flight stage with one or both terminals in the territory of a State other than the one in which the airline is registered. (See Note on allocation of costs to international and domestic services in Appendix 10).

Operating costs, or operating expenses, the costs associated with the operation of an air service including items 5 to 13 in the Instructions for Air Transport Reporting Form F (see Appendix 8), but excluding the non-operating costs, items 15 to 20 on Form F.

Payload, the revenue load (passengers, baggage, cargo and mail) carried, expressed in terms of weight (tonnes) or numbers of passengers.

Payload capacity, the capacity available in an aircraft for the carriage of revenue load (passengers, baggage, cargo and mail), expressed in terms of weight (tonnes) or numbers of passengers.

Staff productivity, the capacity offered per airline employee per year, obtained by dividing the total quantity of capacity offered per year by the airline by the total number of personnel on the payroll of the airline, expressed as tonne-kilometres available per airline employee.

Traffic, the quantity of air transport sold, is obtained by multiplying payload carried (tonnes, or numbers of passengers) by the distance flown (kilometres), and is expressed in terms of tonne-kilometres performed or passenger-kilometres performed.

Unit operating costs, the cost of one unit of air transport produced or sold, obtained by dividing the total operating cost by the number of units of air transport produced or sold, and here expressed in United States cents per tonne- or passenger-kilometre available or performed.

- END -

ICAO TECHNICAL PUBLICATIONS

The following summary gives the status, and also describes in general terms the contents of the various series of technical publications issued by the International Civil Aviation Organization. It does not include specialized publications that do not fall specifically within one of the series, such as the ICAO Aeronautical Chart Catalogue *or the* Meteorological Tables for International Air Navigation.

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES are adopted by the Council in accordance with Articles 54, 37 and 90 of the Convention on International Civil Aviation and are designated, for convenience, as Annexes to the Convention. The uniform application by Contracting States of the specifications comprised in the International Standards is recognized as necessary for the safety or regularity of international air navigation while the uniform application of the specifications in the Recommended Practices is regarded as desirable in the interest of safety, regularity or efficiency of international air navigation. Knowledge of any differences between the national regulations or practices of a State and those established by an International Standard is essential to the safety or regularity of international air navigation. In the event of non-compliance with an International Standard, a State has, in fact, an obligation, under Article 38 of the Convention, to notify the Council of any differences. Knowledge of differences from Recommended Practices may also be important for the safety of air navigation and, although the Convention does not impose any obligation with regard thereto, the Council has invited Contracting States to notify such differences in addition to those relating to International Standards.

PROCEDURES FOR AIR NAVIGATION SERVICES (PANS) are approved by the Council for worldwide application. They comprise, for the most part, operating procedures regarded as not yet having attained a sufficient degree of maturity for adoption as International Standards and Recommended Practices, as well as material of a more permanent character which is considered too detailed for incorporation in an Annex, or is susceptible to frequent amendment, for which the processes of the Convention would be too cumbersome. As in the case of Recommended Practices, the Council has invited Contracting States to notify any differences between their national practices and the PANS when the knowledge of such differences is important for the safety of air navigation.

REGIONAL SUPPLEMENTARY PROCEDURES (SUPPS) have a status similar to that of PANS in that they are approved by the Council, but only for application in the respective regions. They are prepared in consolidated form, since certain of the procedures apply to overlapping regions or are common to two or more regions.

The following publications are prepared by authority of the Secretary General in accordance with the principles and policies approved by the Council.

ICAO FIELD MANUALS derive their status from the International Standards, Recommended Practices and PANS from which they are compiled. They are prepared primarily for the use of personnel engaged in operations in the field, as a service to those Contracting States who do not find it practicable, for various reasons, to prepare them for their own use.

TECHNICAL MANUALS provide guidance and information in amplification of the International Standards, Recommended Practices and PANS, the implementation of which they are designed to facilitate.

AIR NAVIGATION PLANS detail requirements for facilities and services for international air navigation in the respective ICAO Air Navigation Regions. They are prepared on the authority of the Secretary General on the basis of recommendations of regional air navigation meetings and of the Council action thereon. The plans are amended periodically to reflect changes in requirements and in the status of implementation of the recommended facilities and services.

ICAO CIRCULARS make available specialized information of interest to Contracting States. This includes studies on technical subjects as well as texts of Provisional Acceptable Means of Compliance.

EXTRACT FROM THE CATALOGUE

ICAO SALABLE PUBLICATIONS

The Technical, Economic and Social Consequences of the Introduction into Commercial Service of Supersonic Aircraft- A Preliminary Study.
(Doc 8087-C/925). August 1960. 124 pp. $1.25

The Economic Implications of the Introduction into Service of Long-Range Jet Aircraft.
(Doc 7894-C/907). June 1958. 66 pp. $1.25

Air Freight Study.
(Doc 8235-C/937). 1962. 117 pp. $2.00

Air Mail Study.
(Doc 8240-AT/716). April 1962. 37 pp. $0.50

Inclusive Tour Services in International Air Transport.
(Doc 8244-AT/717). 1962. 41 pp. $0.75

Aerial Work - A General Study of the Use of Civil Aviation for Aerial Work.
(Doc 8337-C/944). June 1963. 138 pp. $2.25

A Review of the Economic Situation of Air Transport
(Circular 73-AT/10). June 1965. 82 pp. $1.50

North Atlantic Traffic Forecasts (March 1966)
(Circular 76-AT/11). 1966. 33 pp. $0.75

N.B.—*Cash remittance should accompany each order.*
Catalogue sent free on request.

PRICE: U.S. $1.25
(or equivalent in other currencies)