Aircraft Selection—with Particular Reference to the Aer Lingus Selection of the BAC One-Eleven

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AIRLINE FLEET REPLACEMENTS

Over eighty per cent of the capital of the world's airlines is invested in aircraft and in the spare parts necessary for their maintenance It was the practice up to recent times to provide for the replacement of those aircraft at intervals of from five to ten years An aeroplane may have a life span of that length in the sense that it will continue to hold a leading place in its class, short range or long range, if it has the aerodynamic qualities and the generally accepted standard of comfort for passengers necessary to keep it commercially attractive, unchallenged by any serious rival, during that period

Conditions in the technical development of the aeroplane at the present time, especially the absence of any important improvements in design or in motive power and the uncertainty about the prospects for supersonic transport, as well as general economic considerations, tend to lengthen its useful life period Development costs also are now weighing more heavily on manufacturers of commercial aircraft and in turn on airline operators. The airlines consequently have begun to realise that the rate of replacement heretofore accepted has been imposing too great a strain on their resources There are several considerations that could shorten or extend the life of an aeroplane as a transport vehicle in the front rank They relate particularly to its competitive qualities, its reliability, size, speed and operating unit costs

It is not any physical defect in the aeroplanes themselves but pressure of competition stimulated by the enterprise of the manufacturers that has caused the airlines or some of them to replace their aircraft at a rate which encouraged excess production It not only encouraged excess production but because of the heavy capital charges which premature replacements involved it imposed a severe strain on the economy of the industry Air

fares and cargo rates are for the most part usually settled by agreement for the great majority of the airlines, that is for all those who belong to the International Air Transport Association, but abundant scope for competition is found in the quality of the service, the speed of the aircraft, the frequency of flights, the suitability of departure and arrival times, the reliability of the time-table, the degree of comfort offered to the passengers and the reputation generally of the organisation

There are few industries I believe whose members so frequently make decisions as critical to their survival, or at least to their solvency, as the airline operators in regard to the selection of aircraft The decision is critical because the initial cost represents so high a proportion of the total investment in the business Air transport companies regard this task of aircraft selection as particularly important also because public confidence which is indispensable to the successful conduct of their business is closely related to the reputation of the aircraft That reputation, the quality of performance and general reliability, becomes interwoven with the morale of the airline organisation through the reactions first of the flying staff and the maintenance engineers and then of the sales staff and the general body of employees It is gradually reflected in the attitude of sales agents and of the public

The public usually have no interest in the machines that produce the goods they purchase but they are very interested in the aeroplanes in which they fly Also, of course, confidence in its tools is an important element in the forces that help to sustain the vitality of a business organisation This is particularly true of air transport where the quality of the tool has a peculiar importance One finds that when a succession of aircraft from a particular manufacturer have proved their worth some of the world's leading airlines despite strong inducements elsewhere will continue time after time to go to that same manufacturer for the replenishment of their fleets It is true that they have not a very wide choice Without considering Russia there are less than a dozen manufacturers of commercial passenger transport planes in the world, the bulk of the production being in the United States

Prior to the introduction of the turbine system into the aircraft engine, that is, the system of the Viscount and the BAC One-Eleven, the development of the piston-type engine was directed mainly towards reducing the engine weight and increasing the power both for the benefit of the payload and for better performance generally Until the turbine arrived there had been no radical change in engine design for commercial aircraft. The improvements, as far as they went, enabled the aircraft manufacturers to offer to the airlines the prospect of higher speed, better control and lower running costs in new versions or models and those models, because of the eagerness to gain a competitive advantage by acquiring them, appeared at intervals which had the effect of curtailing the planned life-span of existing aircraft

We thus have had several models of many well-known designs like the Constellations and the various Douglas DCs, each offering some improvement on its predecessor—greater speed, more payload space, longer range,

better flying aids and usually the prospect of lower operating unit costs The British-built four-engined Comet was the pioneer of the commercial jets. It was the first aircraft with turbo-jet propulsion to go into commercial service It offered a speed of 460 miles an hour in 1952 when the fastest piston-engined aircraft were cruising at about 300 miles The first short-range passenger service turbo-jet aircraft, the twin-engined French Caravelle, appeared in 1959 Next in the short-range class came the Boeing 727 triple-engined turbo-jet at the end of 1963 and the British Trident triple-engined a few months later In less than ten years we had three new types of medium range aircraft capable of doing from 1,000 to nearly 2,000 miles full load, all with jet engines and the first—the Caravelle—in three or four models Their cost ranged from £1¼ million to nearly £2 million each The BAC One-Eleven costs about £1 million with major spares, it has a range of over 800 miles with full payload and a cruising speed of 550 The only twin-engined jet aircraft in commercial service at the present time, apart from those of Russian manufacture, are the French Caravelles Delivery of the British BAC One-Eleven has already commenced A third type of twin-engined jet, the Douglas DC-9, is expected in service in a year's time and a fourth, the Boeing 737, in 1967, followed by the Dutch F 28 a little later Although these aircraft are capable of flying at a range of from 800 to 2,000 miles, the distances over which they can be flown at their highest level of efficiency, that is with the maximem payload and the greatest economy in fuel consumption and maintenance, varies according to engine design and general aerodynamic characteristics.

The member airlines of the International Air Transport Association, ninety-three of them, who carry ninety per cent of the world's scheduled air traffic (not including Russia and China) had, according to the latest statistics, about 3,100 aircraft—passenger and freighter planes—in their operating fleets at the end of 1963. Those comprised 1,400 turbine-engined aircraft, 1,640 piston-engined and some helicopters The turbine-engined included nearly 800 jets like the Boeings, the DC-8s and the Caravelles, the balance being turbo-prop like the Britannias, the Viscounts and the Friendships. The piston-engined and probably the turbo-prop aircraft will have since fallen in number and the jets will have risen, but the total is unlikely to have changed appreciably Over two-thirds of that total of 3,100 aircraft were the products of four manufacturers, two in the U S A , one in France and one in Great Britain. Nearly 75% of the total were manufactured in the United States Four-engined longhaul aircraft accounted for 60% of the total and twin-engined shorthaul for 35% At that time (two years ago) only about 150 shorthaul turbo-jet aircraft of the BAC One-Eleven type were flying. They were practically all Caravelles Nearly 60% of the output, in tonne-kilometres flown, of the ninety-three members of the International Air Transport Association in 1963, was produced by U S carriers, nearly 20% by airlines whose headquarters are in Continental Europe and about 7% by British and Irish carriers.

COMMERCIAL AIRCRAFT PRODUCTION

The world's requirements in commercial aircraft (not including Russia and China) are being supplied now mainly by about eight manufacturers, four in the U S A , two in Continental Europe and two in Great Britain In the output of long-range, four-engined aircraft the U S manufacturers are predominant and among existing twin-engined aircraft the veteran DC-3s, although confined now to minor routes and services, are still by far the most numerous in operation

The close connection of civil aviation with military air power, as it seemed after World War II, and the diversion of resources to military requirements and the preoccupation of aircraft manufacturers with military needs hampered the growth of commercial air transport At the same time it relieved commercial air transport of a considerable burden of development costs and contributed to it a great deal in skill and experience Commercial air services across the Atlantic had only just commenced prior to World War II The development of the aeroplane, of its engine power and airframe, of its control and general performance was related largely to military needs and to the capacity of the national economy to satisfy them. Where military needs were large and pressing and where the necessary resources were available and utilised to meet them, the productive installations and the pool of experience and of scientific knowledge and technical skill on which the manufacturers of commercial aircraft were later able to draw were all the more extensive In this respect the American manufacturers, through Anglo-American war policy, had the advantage over the European

The building of large troop-carrying aeroplanes under the conditions of World War II and the successful search for tracking and detection devices and for better navigational and telecommunication aids laid the foundation for much of the progress in civil aviation that has since been made. The subsonic jet had several years of military service before being used for commercial purposes Developments in commercial aircraft construction still continue to be influenced directly by activities in the military field. An American military aircraft project for the building of what is called a heavy logistic transport capable of carrying 700 service passengers, or about 500 civilians, is attracting attention from the airlines at the present time Aircraft production for commercial use, with its heavy development costs, requires so much capital that to be profitable it must have a world-wide market especially now that the support which came from military needs is diminishing with the changing pattern of military planning

Practically all airlines operate mixed fleets of various aircraft types and sizes. Distances between take-off and landing points in the route network of an airline may differ so much that part of a network will be suitable economically for one type of aircraft and part for another The disadvantage of a fleet made up of several types with some maintenance staff, flight crews and engineers skilled in the upkeep of one type and some in that of another has to be weighed against the advantage, in a mixed fleet,

of being able to allocate the aircraft according to the routes for which they are best fitted by size and range In Britain commercial aircraft are designed primarily to meet the requirements of the national airlines but with an eye to world markets The requirements of the airlines throughout the world vary because of different route patterns, climatic conditions and the quality of ground facilities, but to tailor aircraft for any one of them would involve the risk of deviating too far from the average needs, thus diminishing the prospective market for aircraft sales

The choice of commercial air routes, assuming that traffic rights have been secured, is determined by the direction and volume of the movements of people travelling, there being no restriction beyond the presence of suitable route and ground facilities The distances to be flown, the number of people or the quantities of cargo to be carried, the most desirable frequency of service, the practice of competitors, considerations of safety and the limitations of current technology are the factors that influence the size of commercial aircraft The decisions of the most powerful carriers tend to set the pace for the general body, one endeavouring to out-do the other by acquiring something a little bigger and faster, only to find possibly from time to time, as carriers have learned to their cost, that the demand is lagging behind, that people are not travelling in the numbers expected or that cargo is not moving in the quantities assumed by a too optimistic forecast

The production plans of the aircraft manufacturers in relation to the commercial market are determined inevitably by the needs of the large air transport operators except possibly where government authorities intervene to promote projects such as those of the supersonics The route patterns of many large airlines contain stage lengths so varied and distributed that for the most economic operation they need different types of aircraft or at least different models or sizes with different ranges, so it is not uncommon for an airline to have half a dozen different aircraft types. The market for shorthaul aircraft, the kind used by Aer Lingus in its European network, is, therefore, world-wide and not confined to exclusively shorthaul carriers Nevertheless, it is primarily to these latter, the shorthaul carriers, that the manufacturers have to look for a market in newly designed shorthaul aircraft American manufacturers with their great resources and their large and diversified home demand have the advantage that they are catering for the world at large in catering for their domestic needs

There is not much difficulty in distinguishing what may be called a large from a small airline although over certain ranges it may not be so easy to say which is which. A carrier operating on inter-continental routes may employ more capital and get far more revenue but fewer passengers and have fewer employees than a carrier operating within a much smaller area Qantas, the Australian airline, for example, whose operations encircle the globe, has a capital of about £20 million, it carried 300,000 passengers last year and had a revenue of about £45 million Aer Lingus, that is the company which operates on the European network, with a capital of £5 million and with £7 million in revenue carried 900,000 passengers. It will

be evident that the smaller airlines individually can have little direct influence on the production plans of the aircraft manufacturers or on the design or aerodynamic characteristics of the aircraft they produce And in these matters although there are signs of change there seems to be no such identity of interest as would move either the smaller or the larger airlines to take initiatives as distinctive groups The smaller airlines in looking for aircraft to suit their needs must of necessity take the market as they find it But the aircraft designers take care to keep themselves aware generally of what the market is likely to accept

FLEET PLANNING

It is recognised now, I think, that no prudent businessman who has to compete seriously for markets can hope to get along successfully and avoid stumbling into trouble if he does not look well ahead, forecasting and planning and checking on his course from time to time and adjusting his plans and forecasts as conditions change Our estimates for capital and revenue in Aer Lingus enable us to chart our course forward over about seven years They diminish inevitably in detail and in precision in the later years but their relevance and value is maintained by regular revision One of the difficulties in this is that although the statistics supporting both the estimates and the actual operating results are available by aircraft type, route by route, and month by month, the causes of disparities between what is happening and what has been forecast are by no means always easy to identify However, as time passes it becomes clear at certain stages from the rate at which business is progressing, from a comparison of the actual results with the targets, from the shape of competition and from the general outlook that the aircraft fleet will have to be replaced or that it will have to be strengthened by additions approximating to a size and range which are necessarily determined by what is likely to be available and which are, therefore, to a large degree predictable

There are many influences that can bring about a situation in which it may be decided to consider enlarging the aircraft fleet or changing its composition. They may come in various forms and through various channels but mainly they reflect the pressures of competitive conditions The initiative may come from the management or the idea may originate in what one might call the market place at the scene of operations or close to it, that is at the point where an airline's services are being offered or delivered to the public against the challenge of its competitors That is where the voice of the passenger is heard Because of the very nature of the business, of its organisational structure and of the functional alignments in which it is conducted, it is from the impact of the views of those who are out in the field selling the product on the views of those who plan and set the sales targets and of those who must appraise and criticies the results—it is very often in the conflict of those people's reactions to the competitive conditions of the market that proposals for action affecting the size and composition of the aircraft fleet are likely to germinate I would cite in this connection the competitive conditions developing in the

early fifties which made it necessary for us to order the Viscounts although they had not then got beyond the assembly line Those were the forty-eight seater 700 series which we ordered in 1951 taking delivery in 1954 Again in 1955 with the immediate outlook none too bright we had to make provision for conditions that were likely to require more capacity a few years later so we ordered the larger Viscounts of sixty to sixty-five seats for delivery in 1957 and 1958 Those are the Viscounts we are now operating

When a decision is taken to improve the quality and capacity of the aircraft fleet by the acquisition of more modern aircraft a tentative estimate is made of the earliest date at which they are likely to be required and of the delivery programme, how the deliveries might be spread so as to avoid either shortage of capacity or excess Specific terms of reference are prepared for those who are to be given the responsibility of exploring the market, making a selection and advising on what course to take The current production programme of the leading commercial aircraft manufacturers throughout the world and their plans for the immediate future are already likely to be known The fleet planning or selection committee may have to set about their specific task two years or possibly three years ahead of the time when delivery is required In practice, there is in the airline, at certain points, a continuous scanning of the horizon so that when a formal selection process has to be set in motion a good deal of the evidence that is likely to be needed in the preliminary stages will already be near at hand This brings me to the consideration of a question to which various answers are given, that is the composition of the body to which the task of selection is to be entrusted and in particular the areas from which those who are to guide its deliberations should be chosen.

The approach to the problem will depend on the size and status of the airline and on the extent of its requirements and on the condition of aircraft production at a particular time It will depend largely on the power and influence of the airline In Britain either of the two national airlines may take the initiative prompted by the pressure of competition and, influenced by government policy, they may put proposals or specifications to British manufacturers From those proposals an acceptable design might emerge which either airline in due course would find attractive. Or it may be that the manufacturers take the initiative judging the time ripe to replenish the goodwill which an earlier success had gained for them as was the case with the Viscount and the BAC One-Eleven The task as it presents itself to us in Aer Lingus when a major change becomes necessary is to select an aeroplane usually from two or three types but possibly from half a dozen of which some may already be flying, some only on the production line and others perhaps not quite that far advanced

Very few airlines have the resources to enable them individually to order aircraft designed to suit their particular needs but in considering the prospects for some contemplated developments in design, in motive power or otherwise the aircraft manufacturers are likely to canvass, and will certainly be influenced by the views of the main operators in the field for which they are catering or of their more important supporters among

those already using their equipment That is a situation in which the smaller airlines have to make their choice from aircraft whose design and aerodynamic characteristics will have been decided upon without specific reference to them individually or collectively It is not uncommon for aircraft of the type or size, from which they may find it necessary to choose, to be still only at the drawing-board stage with the design and aerodynamic characteristics and general specification fully determined, but with nothing yet on the production line This, of course, could be true of airlines large or small The manufacturers may conduct a good deal of research at their own risk but they must be reasonably sure of a certain minimum sales for their product before they undertake production

For an aeroplane of a type already in service and still being produced the interval between placing an order with the manufacturers and getting delivery will depend, of course, on the state of production and demand but it could be about twelve months For an aeroplane that has only just got beyond the drawing-board stage the interval might be anywhere from two to three years Thus the investigations necessary before a selection can be made might have to start more than three years before the aircraft become available The timing of the delivery is very important because aircraft are far too costly to be left lying idle If, as is likely, additional flight crews are needed when a new type of aircraft is about to be introduced they have to be recruited and familiarised with the handling of it and so too for the maintenance staff That is part of a comprehensive and costly training programme which embraces several groups of employees including existing air crew members who have to undergo what are called conversion courses Furthermore, the successful introduction of a new type of aeroplane needs a considerable publicity campaign Any serious deviation from the agreed delivery dates would not only disrupt essential preparations of that kind but also the daily flying operations as planned and advertised It could cause a good deal of inconvenience to the airline and to the public

The design, size, range, weight, motive power, navigational systems and aerodynamic characteristics of the BAC One-Eleven were settled by the manufacturers from their experience and their knowledge of what the airlines throughout the world were most likely to want From such data the manufacturers were able to provide a broad assessment of the earning potential of the aeroplane But only the airlines interested in purchasing it would have had the means of reliably assessing its earning potential in the only context that had any real significance for them, that is in relation to their own history and experience, to their own routes, to their own pattern of operation, to their existing fleet and those of their competitors, to the general structure of their organisation, to the type, volume and diversity of the traffic they handle and in relation to their plans for the future

The fleet planning committee have to satisfy themselves as to which of the available types that appear generally to be suitable is most likely to offer the best means of extracting the highest return on the capital to be invested having regard to the kind of operation for which the aeroplane

is required They know that it must provide a service for the public in which the aeroplane itself will of course be intimately involved They must assume, I need hardly say, the utmost competence in those whose duty it will be to maintain and to operate the aeroplane and to provide the service generally which the public have a right to expect The aerodynamic qualities of the aircraft under investigation will have been determined by the designers and manufacturers but they will be critically examined by our engineers and carefully assessed in relation to our operations The problem essentially will then be to find out whether, and how far, in the services planned the operation of the aircraft is likely to be profitable and to strengthen the economy of the business as a whole The aeronautical potentialities of the aircraft will be examined and verified, comparing type with type, but in this exercise of aircraft selection the main objective will be to find out the economic potentialities of the aircraft in relation to the particular conditions under which it will be operating

Those are the considerations that should, I believe, dictate the composition of the body to be invested with the responsibility of recommending the type of aircraft to be acquired The design and aerodynamic qualities of the aircraft, I should explain, must be such as to satisfy the aeronautical authorities of the country of manufacture The aircraft must be certified by them for its airworthiness before it can be delivered for service It must also conform to the standards of the aeronautical authorities of the country in which the purchasing airline is based We, the prospective purchasers, must be satisfied with the layout of the passenger cabin and flight deck and with the instrumentation and flight systems and with the passenger amenities And although, as I have said, the design and the aeronautical potentialities of the aircraft are determined and fixed independently of us, our engineers must be satisfied that they suit our requirements The economic potentialities are not fixed or pre-determined and it is incidentally more difficult to forecast them than the technical performance That is why our economic planning function has a predominant place in our aircraft selection activities supported, as need be, but particularly for the purpose of specific investigations, by specialists from other areas of our organisation

Those who take part in the deliberations of the committee charged with the task of fleet planning or of advising on aircraft selection are drawn from several departments. One could not expect them to be free from professional prejudices The importance each may attach to particular aspects of the investigation and of the problems arising out of it is likely to be influenced by his background and occupation as engineer, flight captain, accountant, economist, production planner schedule controller or general administrator The methods of approach may be different but not necessarily opposed The interchange of ideas may be enlivened by various modes of interpretation, occasional conflict, a clash of interests related to specialised training and experience But those divergent attitudes have to be carefully harmonised to provide the synthesis from which we get the report and recommendations that form the basis of the company's decision.

TRAFFIC FORECASTS

Where the interval from the date of ordering new aircraft to their going into service is two or three years, as it well may be, then economic forecasts for use in selecting the most suitable type of aircraft must span periods of seven to ten years ahead or have little value If to the usual uncertainties of economic conditions are added uncertainties about important technical issues forecasting can be very difficult The kind of technical uncertainty I refer to was experienced with the change from turbo-prop to pure jet aircraft about eight years ago and later with the change from the original jet engine to the fan-type engine which gave greater power and range with relatively less fuel consumption Now we have all the uncertainty and controversy connected with the production of supersonic transport for commercial use The seriousness of this kind of uncertainty is the difficulty it creates in forecasting the economic potential of subsonic aircraft whose future is likely to be affected by it

Members of the company's technical and economic planning staffs are engaged almost continuously studying problems connected with proposals for changes in the aircraft fleet, but when the conditions which I have already mentioned—traffic forecasts showing a shortage of capacity, technical improvements favouring competitors and the like—increase pressure to a point at which a major change in the composition of the fleet seems necessary then a special investigation is decided upon. The terms of reference must be comprehensive because any proposal involving a major change such as the acquisition of a new type of aircraft for service on an important group of routes would affect the use and economy of the existing fleet possibly throughout the entire route network for several years ahead. The fleet planning or aircraft selection committee in an investigation of this kind has inevitably a long-term planning function in that it must be able to say where and how, for several years ahead, the new aircraft will fit in and how the deployment and utilisation of the existing fleet will be affected The terms of reference will probably call for a specific recommendation on the aircraft that would best satisfy those requirements in the most economical and practical manner Certain assumptions regarding economic conditions generally and such things as future route patterns and fare structures are supplied in advance by way of guidance

A new aircraft type or model has invariably something special to offer. As with any other form of commercial innovation its success in stimulating public interest and attracting more business depends on the timing of its introduction. The penalty for aircraft that come late into service, late for the particular advantage they have to offer, can be very severe for the manufacturer and for the airlines committed to their use. Premature obsolescence resulting from errors of judgment in selecting aircraft or from the mis-timing of their introduction has been one of the main causes of heavy losses among the airlines When Aerlinte was considering how best in 1958 to break into the highly competitive North Atlantic route it was faced with the choice of leasing aircraft temporarily or of buying one or other of the types then leading the field in long-haul operations—the

Constellations, the Douglas DC-6s and 7s, the turbo-prop Britannias, for example The company decided to lease Constellations for the time being and to place an order for Boeing jets which first made their appearance on the North Atlantic late in 1958 Aerlinte's Boeings came into service in December 1960 The Constellations, the Douglas DC-6s and 7s and the Britannias were then rapidly receding into the background as aircraft that were still doing excellent work in their class but were no longer acceptable to the public in scheduled services on the main airways Even when deciding to purchase the Boeings for delivery in 1960 the company knew that the engine manufacturers had completed plans for the production of what is called the fan-type turbine which I have already mentioned This appeared very soon and provided an important addition to the engine power and to the range at proportionately less fuel cost Aerlinte's latest Boeings have the fan-type turbines, but under the conditions of 1958 weighing up the prospects on the North Atlantic as they appeared then, the company dared not risk any longer depending on leased aircraft while waiting for the fan-type turbine engines

The estimates of passenger and cargo traffic month by month and sector by sector prepared for the use of the fleet planning committee related to a route pattern on which the growth of traffic varies considerably The European network of Aer Lingus is an irregular pattern of short routes serving Dublin, Shannon, Cork and Belfast, penetrating into the more populous areas of Britain, and covering also some of the main centres of Continental Europe such as Paris, Rome, Brussels, Copenhagen, Amsterdam, Dusseldorf, Zurich, serving pilgrimage places like Lourdes, and Spanish tourist areas through Barcelona There is also a growing volume of charter work taking us to all parts of the globe We have to bear in mind in all fleet planning exercises that the routes to Great Britain account for nearly 80% of passengers carried on our scheduled services but more particularly that the Dublin to London route alone accounts for about 30%. From the viewpoint of economic operations, making the maximum use of staff and equipment, the route pattern of the European network is awkward, untidy and difficult, more so even than the route patterns of most other airlines Apart from any peculiarity of route pattern, what distinguishes the services most in relation to their economic operation is the shortness of the flight distances in the British sector where most of our traffic flows and the sharp contrast in traffic volume between what is commonly called the peak and the valley

In short flight distances the incidence of landings and departures, which are very costly operations, and of periods spent by the aircraft and crew on the ground is high and for that reason the flights have to be all the more carefully scheduled with regard both to timing and frequency These conditions by their impact on the earning potential affect the relative merits of the various aircraft types and as the significance of the impact will vary according to the design, size, weight and aerodynamic characteristics the performance of each type will have to be studied realistically by reference to a practical programme of operations route by route and sector by sector,

that is from each point of departure to the next landing point on each route.

Our average flight distance in the European network is about 230 miles What particularly distinguishes our operations, as I have already said, is the sharp seasonal rise and fall of traffic Of all international airlines we have probably the most unfavourable contrast in traffic extremes, peak and valley, with the result that in the busiest month of the summer we have to be equipped and geared to carry nearly five times as many passengers as in the quietest month of the winter The volume of traffic falls sharply in winter and our services are cut, but yet we must hold our stake in the market We must maintain the goodwill that has been built up, so there are limits to the cutting that we can do and these limits cannot be determined regionally but by reference to an examination of the traffic statistics route by route Winter services have to be provided even at a heavy loss It is, incidentally, during the winter months that major maintenance and overhaul work on the fleet is carried out, that crew training gets more fully into stride and that for many categories of staff their holidays become possible

The fleet-planning committee, in order to be able to form the best judgment of future prospects, must become thoroughly familiar with the fluctuations in traffic movements in recent years on every route likely to be affected by their recommendations But in order to estimate what capacity will be required, how many aircraft of any particular type, the conditions at and around the peak have to be given particular attention This relates more to the cross-Channel than to the Continental routes The summer peak traffic must be provided for but with such limitations as will yield the maximum gain for the year as a whole by avoiding too many idle planes or too much excess capacity in the winter It would be imprudent to build up an organisation geared to chase the peak, but to be prepared to satisfy the peak demand substantially is for us indispensable to a profitable operation for the year as a whole That means that all the statistics of traffic on which the aircraft selection committee base their judgments regarding the number of aircraft that may be needed must distinguish peak from valley conditions Air transport is not the only industry to find itself embarrassed from time to time by too much equipment, by a productive capacity too far in excess of the market demand for its products. Leasing aircraft to other airlines in winter makes an important contribution to the economics of our operations and is a factor in determining to what extent the peak demand can be satisfied The prospects for leasing and thereby improving the utilization of the fleet are enhanced by judicious fleet planning

Over two and three-quarter million people travelled by sea and air during the past twelve months between this country and Great Britain and the Continent The proportion by air was a little less than half of the total. More than two-thirds of those who travelled by air used Aer Lingus A distinguishing feature of the continental services is that while they carry less than ten per cent of the total passenger traffic of the European network they contribute about twenty-five per cent of the passenger revenue The

traffic is steadily growing and as air travel becomes more popular Ireland no longer appears to people on the European mainland as a remote place in the Atlantic The continental services are important also in relation to our trans-Atlantic operations because American travellers going to points in Europe like to be able to make their bookings with one carrier or preferably to be able to travel on the same system or at least in the hands of the same organisation throughout

It was the competitive conditions on our Continental routes as well as the advantage to be gained by providing better support for the Atlantic route that gave rise to the need for jets But in considering what type of jet aircraft might best suit the Continent, it was necessary for reasons which I have already mentioned to examine the growth of traffic elsewhere, particularly on the London route, where the introduction of jet aircraft at a later stage would be unavoidable Traffic statistics, both passenger and cargo, for the ten years preceding the investigations of the fleet-planning committee, the years 1951/52 to 1960/61, were studied in the light of all that could be learned about significant economic conditions from year to year during that time It was a very unsettled period economically Trade was slackening everywhere after the Korean war boom Here and in Great Britain it was a period of austerity budgets and balance of payment problems

That was the background against which estimates of future annual traffic for ten years ahead were prepared The statistics showed the continuance of a slow diversion of travellers from sea to air that had been going on for some time We in our estimates now allowed for a stimulus to air traffic by the ultimate introduction of jets and for the increasing participation by BEA in cross-Channel traffic, and as a contingency we allowed for some encroachment by others The cross-Channel passenger traffic growth rates of Aer Lingus fluctuated widely in volume between 1951 and 1961 with increases varying from nil in 1953/54 to 29 7% in 1960/61 (our financial year is to the end of March) The average annual rate was 12 4% The committee assumed an annual average of 12 8% for the decade to 1971 On the Dublin/London route the annual average rate of growth between 1951 and 1961 was 11 6% The trend was upwards Here the committee assumed an annual average of 12 5% for the decade to 1971.

We have been competing with Viscount aircraft against jets, mainly Caravelles, on most of our continental routes for the past five years but the contest has gradually become more uneven because as the number of Caravelles and other jets increased, their attraction in speed, with no difference in fare, left the Viscount operators at a growing disadvantage. There has been no such competitive disability on the routes to Britain as there are no jets operating on them but in a few years time the position, at least in regard to London, may well be different The predominance of the Dublin/London route must influence all our fleet planning because it is the backbone of our European route system, it accounts for about 30% of the scheduled passenger traffic of the European network. That network

as a whole divides itself readily into three areas, the London route, the Continental routes and the British provincial routes

In order to get a realistic impression of the capabilities on the Dublin/London route of the various types of aircraft being studied the projected passenger traffic was fitted into a daily flight schedule not for the entire period, as that would have been too laborious, but for three years of the period This schedule of day and night flights was further restricted, without losing anything of its value, by taking only one direction, the busier direction, that is the direction having the greater number of passengers and flights each day The three years were not taken at random but in relation to factors which had some bearing on their relative value for the particular exercise, and on that basis they were not consecutive years The construction of an operating schedule for aircraft flights day and night, although a laborious task, was considered necessary in order to find out as reliably as possible the relative technical capabilities and economics of the various aircraft types on a route for which it was essential that the most modern of the company's shorthaul aircraft should ultimately be well suited regardless of what other routes they might serve

AIRCRAFT TYPES AND PERFORMANCE

The fleet-planning committee at an early stage collected from aircraft manufacturers all the information that could be got regarding aircraft available or likely to become available over the period of the investigation and which might answer to the general requirements of the airline For this purpose the Company's engineers prepared a detailed questionnaire which provided specifically for the conditions of our routes and which when fully answered by the manufacturers gave a very informative account of the structure, the systems, the capacity, range, speed and general performance actual or prospective of each type of aircraft Certain types were then excluded as obviously unsuitable, some because of age in design, others because of size or range, others perhaps for some feature which had given them an unsatisfactory history Although in an exercise of this kind the number of suitable types at any time available or becoming so in due course is likely to be small, possibly three or four, each of them might have several variants, but in all the committee could find as many as a dozen types or models, some of which, though likely *prima facie* to be unsuitable, it would probably not reject without formal consideration and comment, however brief, in its report

The information received from the aircraft manufacturers enabled the fleet-planning committee to prepare a comparative statement of the physical characteristics of the aircraft, their weight, cruising speed, range, passenger capacity, cargo capacity, propulsion systems and so on. The status of the manufacturers throughout the world, the number of well-known aircraft they had already successfully marketed, the quality of their after-sales services, what firm orders they held for newly-designed aircraft currently in production—all these matters had a serious bearing on the result of the committee's deliberations The committee started by con-

sidering all the available types of short to medium range jets, the Caravelles, in two or three models, the AVRO 761, the BAC One-Eleven, the Trident and the Boeing 727 Boeing aircraft of our transatlantic fleet were included so as to provide measurements that were useful for certain comparisons I should explain, perhaps, that the flight system and to a large extent the instrumentation and also the layout of the flight deck, all very important in relation to the performance of the aircraft, are matters for our pilots and engineers to consider and determine The interior configuration of the aircraft passenger cabin, the seating arrangements for example, and the location and number of galleys and toilets are also among the matters that must be agreed upon between the purchasing airline and the manufacturers The empty weight of the aircraft has a bearing on the payload it may carry, the number of passengers and the quantity of cargo, because while the major airports will take the largest aircraft fully loaded there are many airports where the payload is restricted by the length of the runways The loaded weight of the BAC One-Eleven, by way of example, is 75,000 lb , about 35 tons (at 2,000 lb to the ton), whereas that of the Trident is 115,000 lb or about 60 tons There is nothing to be gained by operating an aircraft whose running costs are attractively low if that advantage is lost through having to curtail its available capacity In a shorthaul route network like ours which includes several provincial airports some restriction on payload is quite common, but this would affect cargo rather than passengers although it could well affect both An airline, I need hardly say, like any other industrial undertaking must endeavour to utilize the potential of its equipment to a degree that will enable it to operate as economically as possible

From the data supplied by the manufacturers and from experience of our own operations the fleet-planning committee were able to estimate for each type of aircraft the amount of time that would have to be allocated periodically to maintenance and overhaul so as to comply with the company's regulations and with those of the national aeronautical authority, the Department of Transport and Power The timing and sequence of prescribed inspections and checks for maintenance purposes depends largely on the number of flying hours to be performed and it has a direct bearing, of course, on the availability for service and on the utilization of the aircraft It was also possible from the manufacturer's data to estimate flight times, that is the time taken for each flight and turn-round times, that is the time required for loading, unloading, refuelling, cleaning and so on at transit and terminal landing points. It would be impossible to prepare a reliable day-by-day flight schedule without allowing for these factors Their significance may be judged from the frequency of aircraft movements at the height of the season In August last year, for example, one or other of the company's aircraft on the European network landed or took off at Dublin Airport, on an average, 112 times per day and the movements between midnight and early morning would have been very few.

Nothing short of a scrutiny of the projected passenger movements day by day translated into a detailed operating programme, or rather into a

flight schedule, could be relied upon to reveal the relative merits of aircraft of different types and sizes on a busy route like that of Dublin/London This scrutiny showed that some of the types of aircraft being studied, while currently big enough, would be too small for the volume of traffic in a few years, they would need too many flights daily to cope with it, and that others were too big, they would have to fly too often with uneconomic payloads if the timetable were to be reasonably suitable for the travelling public and for competitive purposes Those types were therefore eliminated They offered no such special attractions as would recommend them for the Continental routes even if these routes were to be considered in isolation It was apparent in advance that the range of our European routes was too short and the traffic too small for our transatlantic Boeings, but their inclusion provided some interesting comparisons with the smaller jet types particularly in regard to the greater volume of traffic towards the end of the decade

OPERATING COSTS

The remaining aircraft types—British, French and American—had all been specifically designed for the same kind of short to medium-range operations, they had many characteristics in common and for that reason a satisfactory comparison of their respective merits needed a really close and critical analysis of their physical capabilities and of their operating costs in relation to the work and the working conditions for which they were required But some of these aircraft had not yet got far beyond the drawing-board stage and so there was the problem of finding operating costs for aircraft which had not yet flown, did not even exist except on paper The manufacturers' prognostications taken alone were of little value if only because they were based on assumptions not necessarily appropriate to our operations Certain costing formulae sponsored by the British aircraft industry and others sponsored by the industry in the United States were useful guides but in our study we preferred to lean heavily on our own experience with the Boeings and the Viscounts on our own routes and to make reasonable adjustments by reference to differences in design, in structure, in weight and in motive power Here we were concerned only with two groups of operating costs, what may be called the direct and the indirect, namely, fuel costs, cost of engine overhaul, cost of maintenance materials, maintenance labour, airport charges for landing and take-off, crew pay and expenses, passenger handling expenses, depreciation and insurance of aircraft

Operating expenditure of that kind is closely related to certain predetermined factors such as the capital cost of the aircraft, its gross weight, its size, motive power, and its rate of utilization. Such costs can therefore be estimated with no great difficulty and by using the same method of computation for each type of aircraft the resulting values can be regarded as reasonably sound for purposes of comparison They would not necessarily give reliable costings taken absolutely for any particular operation but for comparative purposes they do give, to an acceptable degree of accuracy in terms of operating cost, the relative positions of the different

aircraft types Practically all the other expenses of the business apart from the direct and indirect expenses which I have mentioned would remain unaffected by the type of aircraft that might be selected and it was therefore unnecessary to consider them I should say rather that they had to be considered only in so far as they entered into that category of expenditure which is inevitably associated with the successful introduction of new aircraft, expenditure on training and on development and promotional activities.

The estimated volume of traffic, passenger and cargo, and the rate at which it was expected to move for each type of aircraft, the speed, seating capacity, the airport turn-round times and the prescribed cycles for maintenance and overhaul were the data from which the day-to-day flight schedules were built up These taken with special reference to conditions at the height of the summer showed how many aircraft of each type would be required The summer traffic conditions, especially where there is keen competition from sea and rail transport, had to be viewed in the knowledge that shorthaul operations are not likely to be profitable unless the average annual amount of gross revenue per flight is high, that is to say, unless close on 70% of the seats offered are sold If air fares are to be kept down then the seat occupancy, or the proportion of payload space or output sold, must be all the higher, that is to say, the gross revenue per flight on average must be all the more It is difficult in shorthaul operations to get a good rate of utilization for aircraft and crew because the ratio of ground time to flight time is necessarily high and night flying is unattractive The utilization rate for aircraft and crew and so, of course, the output generally in longhaul air transport is usually substantially better than in shorthaul I am emphasising here the importance of what is called a high load factor in shorthaul operations

The movements of traffic on the cross-Channel provincial routes for the years 1951/52 to 1960/61 were studied in the same way as the Dublin/London traffic There were about a dozen such routes some recently opened and others of long standing Each was considered separately The average annual growth in passenger traffic for all of them combined during the ten years was 13% The projected growth for the following ten years had to allow for BEA's continued and possibly extended participation and for possible competition from other carriers either on those routes or in adjoining areas The committee had to form a judgment as to what additional routes were likely to be opened drawing off traffic perhaps from the existing routes and generating new traffic Both the short stage lengths, or flight distances, and the volume of traffic as projected left no doubt even without the need for a cost analysis, that on the provincial routes the turbo-prop aircraft, the Viscounts and Friendships, would have a clear advantage economically over the jets The problem then was by reference to the projected flow of traffic and flight frequencies and the expected demand for cargo and charter space, to estimate how far and in what numbers the Viscounts and Friendships respectively could best be used to serve the provincial routes to Great Britain and what bearing this would have on the strength and composition of the entire fleet.

The Continental routes differ from the cross-Channel in that they are mostly in sectors It is, therefore, more difficult to forecast the course of traffic Forecasting for, say, Dublin/Paris would by itself present no difficulty but it gets complicated when one takes a route like Dublin/Paris/Zurich/Rome There we have several sectors—Dublin/Rome, Dublin/Paris, Dublin/Zurich, Paris/Rome, Paris/Zurich and finally Zurich/Rome—six sectors in all with passengers for each Whatever regularity of passenger traffic there may have been between the terminal points Dublin and Rome, it would be difficult to detect any regularity on the intervening sectors. There was no such pattern in past years as would support a reliable forecast of sector traffic for the years ahead Some of the Continental routes moreover had not been long open What we did know was that even with the turbo-prop Viscounts competing with modern jets our traffic as a whole on those routes had been growing slowly but steadily and we were confident that given more modern equipment the growth could be accelerated. We were no less convinced, however, that despite the reputation of the Viscounts our prospects on the Continent and the valuable goodwill supporting them would wither away unless we were ready soon to match the jets of our competitors

There were certain factors which helped to limit, if not to simplify, the problem of determining the number and type of aircraft most suitable for operations on the Continent Operations abroad are in some instances subject to conditions which limit the frequency of services They may permit the foreign carrier to put down passengers but not to upload, or to upload only for journeys back to the carrier's home airport, or they may grant what is called fifth freedom rights permitting the carrier to take up and put down passengers without restriction save possibly as to the number of flights Where fifth freedom rights are given and the frequency of flights restricted as on some of our Continental routes the obvious choice would be a large aircraft if traffic were there in sufficient volume to ensure that too many seats would not go empty But large aircraft made for long journeys would be very uneconomical on short sectors unless full loads are carried and that would not be a practical proposition Another limiting factor on the frequency of flights where the traffic is thin is the minimum below which it would be foolish to expect to do business

The fleet-planning committee were not, of course, without information regarding the performance of the Caravelles which had already throughout most of Europe been flying successfully for a few years Through our participation in the work of the European Air Research Bureau the committee were also well informed on the condition of European air transport generally They studied the traffic volume and growth and the flight frequencies on each of our Continental routes since operations began and they prepared flight schedules for the same three years that were used for the Dublin/London route as checkpoints for the ten years to the end of the decade The important problem was to find the cost of operating each type of aircraft at the frequencies which the flight scheduling exercise showed to be desirable The flight schedules here were not so much directly influenced by the volume of traffic as by our experience of the most

suitable days, times and flight frequencies for each route since it was started and by the timetables of our competitors and by the extent of our traffic rights and by our judgment as to how generally we could best exploit those rights Airport turn-round times, transit-stop times and maintenance times had to be calculated and allowed for in the usual way Those flight schedules made it possible to ascertain how many aircraft of each type would be required for the Continental services One did not have to go any further to be able to predict with some degree of assurance what types were likely to be uneconomical by reason of size

The state of the air cárgo traffic for several years past had also to be investigated and forecasts prepared similar to those for passengers though not in so much detail or with the same precision. Some of the aircraft considered were designed to give relatively more space to cargo than others, that is to say, a greater proportion of the available payload The committee aided by their terms of reference had to make certain assumptions regarding the extent to which cargo traffic would continue as in the past to be carried by all-cargo aircraft, that is, aircraft devoted entirely or mainly to cargo work as were the DC-3s for some time before being sold and as the Carvairs are now. For purposes of comparison it was sufficient to use current average cargo rates in calculating the revenue, just as for passenger revenue current average fares were used.

There was now available all the data necessary to give, for each of the three years chosen, the following information for each type of aircraft

(1) Number of passengers and quantity of cargo
(2) Number of aircraft of each type required to operate the schedules
(3) Number of round trips on each route (journeys out from, and back to, base)
(4) Number of block hours (i e hours from the start of taxying for take-off to the end of taxying after landing) to operate the schedules.
(5) Number of flight crews
(6) Operating revenue
(7) Operating expenditure—direct and indirect (landing charges, handling charges, crew pay and expenses, maintenance materials, maintenance labour, engine overhaul, passenger expenses, depreciation and insurance of aircraft).
(8) Surplus after direct and indirect expenses.
(9) Seat mile cost for direct and indirect expenses.
(10) Passenger mile cost for direct and indirect expenses
(11) Capacity ton mile cost for direct and indirect expenses.
(12) Aircraft mile cost for direct and indirect expenses.
(13) Block hour cost (see No. (4)) for direct and indirect expenses.
(14) Passenger load factor (i e. percentage of passenger miles to seat miles flown).
(15) Break even passenger load factor (i e passenger load factor at which revenue at (6) and expenditure at (7) would be equal).
(16) Aircraft utilization (average daily or yearly number of block hours per aircraft).

The committee thus had available all the indices by reference to which the economic potential of commercial aircraft is usually assessed

One of the recognised units of productivity in air transport is the *seat mile* (seating capacity multiplied by the distance flown), but this, like all the other yardsticks in the industry, has to be used cautiously There was no doubt from an examination of the surpluses and of other indices such as the seat mile costs and break even load factors that none of the aircraft types considered could be operated as economically as the Viscount There was equally no doubt that the continuance of successful operations on the Continent called for jets It was evident too that towards the end of the present decade the Viscounts, because of their size, would need too high a flight frequency to be able alone to cope with the traffic on the Dublin/ London route The larger aircraft among the jets showed seat mile costs that compared favourably with the smaller, but that was no use because on the Continental routes the estimated traffic growth was not enough to give an equally favourable *passenger mile* cost In other words, the passenger load factor, that is the average percentage of seats occupied per flight, in the larger aircraft would not be high enough A favourable seat-mile cost gives no advantage if too many seats are empty, that is if the proportion of ineffective production, or unsold units, is too high. The difficulty of course is that, like highly perishable commodities which cannot be preserved, what is unsold is lost, there is nothing that can be put into stock for later sale

In the same way an aircraft that shows a favourable operating cost per aircraft mile of flight must also have a payload capacity suitable to the volume and flow of traffic, neither too big nor too small The heavy losses incurred by certain carriers in recent years were the result largely of flying with too many empty seats Those losses were accompanied in some cases by impressively low output unit costs not because of a healthy economy of operation but because production encouraged by excess capacity too far outran the demand for seats Where the purpose is to see how economically an aircraft is operating one has to avoid looking at any of these indices in isolation The production cost has to be considered in association with the average seat occupancy per flight or the load factor, as it is called It should be remembered that we are dealing with scheduled airline operations where neither the route network nor the pattern of services is likely to undergo any major change and where a pool of operating indices, cost yardsticks and the like will have been built up and tested over the years.

When the traffic is predominantly passenger traffic and the aircraft are intended primarily for passenger operations, the seat-mile cost taken with the passenger load factor is more significant than the capacity-ton-mile taken with the overall load factor which combines passengers and cargo In comparing the earning potential of different aircraft we have the break-even load factor also as an important yardstick The break-even load factor represents the average seat occupancy per flight, at which the revenue will just match the expenditure. The break-even factor for purposes of comparison may be related to a particular group of expenditure

as it was in connection with the selection of the BAC One-Eleven where the fleet-planning committee confined their attention to the direct and indirect operating costs only and found for each aircraft type the load factor at which the revenue and expenditure would break even under operating conditions that were identical Yardsticks of this kind when used to compare one airline with another can be misleading because conditions are not identical and rarely have enough in common to be comparable

We now had, in the report of the fleet-planning committee, for each type of aircraft which they had studied, an economic assessment of its capabilities related first to our Continental operations and then, at a later stage, possibly with increased capacity and motive power, related to the Dublin/London route It was on the basis of that report and on the committee's finding that the management were able to recommend to the board of directors the purchase of the BAC One-Elevens

DISCUSSION

Mr McMahon I feel privileged to join with Mr FitzGerald in seconding this vote of thanks to Dr Dempsey for his penetrating and comprehensive analysis of the decision-making process of selecting aircraft.

The complexity of the problem is certainly formidable spanning not alone commercial and technical problems but also social and political factors Mr FitzGerald has referred to the problems of political intervention in aircraft selection in this country and mentioned that we have had only a couple of instances of direct government intervention in aircraft selection, the most important being in 1948 when the government rather than the air companies wished for the transatlantic services I think that we, in this country, can consider ourselves fortunate in not having an aircraft manufacturing industry to complicate this aircraft selection procedure B O A C in Britain has had rather difficult experiences with the government in Britain and from our point of view I think that we can consider ourselves fortunate in this aspect of our under-industrialisation Otherwise the "Buy Irish Campaign" would almost inevitably stretch to capital as well as consumer goods

All programming involves present decisions about future events and for this reason the assumptions on which the programming is based are probably the most important aspects of all this process. The range of uncertainties in aircraft choice is probably more diverse than in many other businesses The crucial assumption is that regarding the rate of traffic increase in the years ahead It would appear from Dr Dempsey's paper that whereas the measurable quantities were examined in intensive detail the less measurable aspects and less easily quantified parts of the exercise had not received the same degree of intensive scrutiny Mr FitzGerald's query regarding the possible margin of error and its accumulative effect over several years on the plans of the company is certainly a very valid one What would also be interesting is if Dr Dempsey could tell us whether in this exercise the company started with a percentage growth in traffic

in mind or alternatively if an absolute number was chosen at the end of the period and the cumulative growth rate in this backward method derived In the end the difficulty of trying to find out where dynamic management ends and over-optimism begins is ever present in the choosing of this growth rate but in the end some figure has got to be taken In forecasting the revenue position the difficulties of the Company are to some extent lessened by the fairly rigid fare structure occasioned by I.A T A. agreements

As Dr Dempsey has pointed out the safety regulations which any air company has to take before putting a plane in the air at all have in air transport economics a greater position of prominence than many other industries' safety precautions.

Dr. Dempsey in his paper has stressed the necessity of the international competitiveness of the industry and of the necessity of keeping up with other air companies in equipment However, there are certain dangers in following competition blindly. Certainly we must be competitive but there is the danger that the industry might be moving too quickly for the consumers' pocket We have in this industry the rather strange economic phenomenon where technological progress has had to be restrained in the interests of the consumer In our other industries the introduction of new processes and techniques has been considered a desirable event.

To return to the less measurable and more national costs of air transport I would like to ask Dr Dempsey whether in the consideration of the various costs involved in choosing the aircraft the social costs like increased noise have been taken into account Recently the London County Council has had to pay grants to people living near the Airport to seal the houses from the increased noise Certainly these are less susceptible to easy measurement than aspects of the costing system like load factor and fuel consumption but nevertheless they are a cost in the wider economic sense

At the risk of overburdening Dr Dempsey with questions I would pose a final question regarding the depreciation rates of the aircraft bought by the air companies The discussion regarding historical cost and replacement cost depreciation rates has been adequately thrashed out elsewhere and no doubt the air companies are well aware of the dispute In estimating the cost of the various types of aircraft would Dr Dempsey indicate the extent to which replacement cost is used as a basis for depreciation?

Again I would like to thank Dr Dempsey for his valuable paper to this Society tonight.

Mr. C. F. Smith spoke in appreciation of the able paper which had been read by Dr Dempsey. He said that it was interesting to observe that the principles governing decision-making in capital investment remained basically the same despite striking differences in the technological problems involved. In this context the Discounted Cash Flow technique now seemed to be accepted as the best modern practice and it would be interesting to know to what extent this contributed to the accuracy of the Aer Lingus aircraft selection process

The new computer which Aer Lingus had acquired should offer par-

ticular opportunities in correlating the statistical data for the different types of aircraft under consideration at any time

The paper did not advert to the factor of the National Balance of Payments in aircraft selection and Mr Smith asked if the possibility of sterling devaluation was an item to be considered in this context?

Miss Beere asked to be associated with the vote of thanks to Dr Dempsey She said that she had personal knowledge that Aer Lingus was the envy of many other air companies in that the decision as to type of aircraft was left to the discretion of the company and was not influenced by extraneous and non-commercial considerations This was as it should be The sound judgment that the company had displayed in the selection of aircraft had fully justified this policy At the same time, of course, the Company's expenditure on new equipment had to be kept as closely as practicable to the pattern established by the Second Programme for Economic Expansion

The traffic forecasts made by the air companies were of great value, not only in guiding their decisions about aircraft types but in various other connections They were used, for instance, in the Department's programming of airport requirements The careful work which went into the preparation of these estimates set a headline for others and she was glad to be able to pay tribute to the reliability of the company's forecasts She hoped that the acquisition of the Company's new computer would mean a reduction of laborious effort and even enable the opening up of new fields of research

Arising out of Miss Beere's query *Dr R. Johnston* (Economic Planning Department, Aer Lingus) referred to the use of the computer for evaluating growth rates He stated that programmes were being developed for analysis of historical data, and that the year-to-year variability of the growth factors on the various routes was also being studied. A set of point-to-point growth rates with standard deviations would emerge, suitable for application to smoothed base-year traffic statistics These growth-rates might be modified in the light of results from econometric analysis, should these be available, but it seemed reasonable to expect the same variability in the future as in the past The traffic would therefore be projected with an artificial variability superposed, generated by a pseudo-random number routine The final outcome would be a distribution of long-term traffic estimates, such that one could attribute probabilities to the estimated traffic being high or low by a stated amount Knowing the penalties for over or under-providing fleet, it will therefore be possible to use statistical decision theory to establish an optimum fleet investment strategy. The programmes are at present at the stage where growth rates and standard deviations can be evaluated, given the historical data, but the projection programme is not yet fully developed

Dr Geary The speaker arises with a pleasant sense of irresponsibility since he is quite incompetent to comment on the matter of Dr Dempsey's

paper He would, however, like to congratulate Dr Dempsey on the outstanding success of Aer Lingus to which success he has made an outstanding contribution Having said this, I would like to say that international air transport does not make economic sense In our primers on economics long ago, we read that more than one transport system cannot operate competitively between two points A and B. In international air transport, on the contrary, there are several air companies competing for traffic between important centres Many of us recall the halcyon days (of low fares) of unrestricted bus competition in Dublin and the speaker recalls that competition between White Star and Cunard, Cobh/New York, at the beginning of the century resulted in fares as low as £2 per head These happy times (for the passenger) could not and did not last for long. The economic law finds its validity in a consortium as regards fares standardised for services defined to the smallest absurd detail Many years ago I asked Dr Dempsey if Aer Lingus would be allowed by the consortium to serve Irish coffee on their transatlantic trips—this is the kind of definitional detail I referred to Why not go the whole hog towards a complete consortium with built-in safeguards as regards fares? There is not the smallest doubt that international air transport could be operated with far fewer of these incredibly expensive modern planes than is at present the case, and therefore, with a considerable reduction in the very high fares, because of better use of capacity, and a system of planes in reserve could be provided at convenient airports to obviate those irksome delays due to mechanical faults

It seems to me that the smaller international airlines are tied to the juggernaut of the few manufacturers of aircraft *They* decide that with supersonic planes we should be at our destination before we started It may well be that such expedition is needed by VIPs and businessmen with expense accounts The rest of us, I surmise the majority, even of businessmen, would be well content to cross the Atlantic comfortably in twelve hours The waste must be colossal in the too rapid obsolescence of perfectly efficient propeller planes I would ask Dr Dempsey why international air companies cannot retain these planes in useful service at lower tariffs than those used on jet and *a fortiori* supersonic planes