

administration). On the basis of the observations made it was concluded that the potential for future cost reductions is significantly greater in some areas of the world than in others.

On the premise that the regulatory and competitive environment is the main vehicle for improved operating efficiency and lower transport costs, at least in those areas of the world where present cost levels are comparatively high, the group briefly discussed the current situation in this regard. It was generally felt that a continued trend towards more liberal regulation and greater competition could be expected in most parts of the world. While this trend would become much less pronounced in some areas where competition was already stiff, such as the North Atlantic, it could be expected to strengthen in other important areas.

The group finally looked into the role of fares in market development and the effectiveness of the present structure of promotional fares in generating traffic on an economical basis. The discussion of these matters was based on the results of extensive passenger surveys conducted by Boeing in the United States and Canada. One finding of these surveys was that where promotional fares were offered, the number of passengers diverted from paying the full fare to take advantage of a promotional fare was more than twice the number of passengers generated by the promotional fares. Furthermore, the diversion of full fare passengers would have been significantly greater if more seats had been available at the reduced fares. Another finding was that small fare reductions effectively generate additional traffic while larger reductions are comparatively less effective. Based on the survey results the conclusion had been drawn that the airlines are suffering from a proliferation of unsatisfactorily restrictive and unnecessarily generous discounts in many markets.

The deficiency of the present fare structure would have been even more striking had the scope of the surveys been extended beyond those who actually fly to cover also potential users of air transport. It was generally agreed that because of the excessive complexity of present day international fare structures, only a small fraction of potential air travellers may in fact be aware of the promotional fares available to them. In other words, airlines may in effect be offering their discount fares to a limited population and therefore have to apply greater discounts for a desired market response than would be necessary if the available fares were less confusing and could be advertised more effectively. The group suggested that this is a significant issue in relation to the continued development of airline travel and warrants additional research by airlines individually and collectively.

STRATEGIC EXTERNAL FORCES

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The session was attended by individuals with a variety of industry perspectives - airlines, manufacturers, the petroleum industry, government, academia, and aviation consulting. There was also a variety of geographic perspectives - from the United States, Canada and Europe.

The subjects covered in this session were

- a) The impact of changing external forces on fleet planning,
- b) Fuel prices,
- c) New market opportunities and societal forces,

- d) Limits to growth,
- e) Aviation technology,
- f) The impact of economic/business cycles,
- g) The "cost/yield/demand/profit dilemma".

Quite naturally, some of the topics covered overlapped with those of other sessions (e.g., Airline Passenger Forecasts and International Environment). Readers are encouraged to refer to the reports of the other sessions for comparative purposes.

The Impact of Changing External Forces on Fleet Planning

The group agreed that, with deregulation and the network type of route pattern such as exists in the United States, there is an inevitable tendency towards a decreasing average aircraft size. The increased competition under deregulation logically leads to increased frequency and that, in a limited growth environment, logically leads to smaller aircraft as carriers strive to achieve a break-even load factor. With a reduction in average aircraft size, unit costs are higher on a seat-mile basis, but lower on an aircraft-mile basis. The latter has increased in importance under U.S. deregulation as service frequency is a key factor in market presence. Possibly as a by-product of this deregulation induced trend, the aviation industry has started to question the long-held view that "bigger is better".

A computer simulation of a large airline system, using the total Canadian domestic market and assuming the airlines have comparable cost structures and are operating in a deregulated environment, showed the financial advantage of streamlining the network system through the use of smaller aircraft.

On international routes and in markets outside North America, there is a continued place for wide-bodied aircraft. With a limited number of gateways and limited frequency competition, the seat-mile cost advantage of a large aircraft favors its use - as long as market demand is sufficiently large.

A statistical comparison which dealt mainly with the trunk carriers, but also included some data on new entrants such as People Express, showed new carriers can operate with very low fares. There are long-run forces which will tend to narrow the cost structure gap between the older carriers and the new entrants. The question is how long it will take these forces to come into play.

As long as there are carriers going bankrupt, there will be aircraft available, for sale or lease, at distressed prices. As long as there are pilots, flight attendants, aircraft maintenance engineers, etc. being laid off, there will be people available who can be hired at low cost. But, as new aircraft have to be acquired and as employees gain seniority, there will be upward pressures on the costs of the new carriers. Looking at the other side of the present cost gap, there is great pressure now on the older carriers to reduce costs, and that is not only because of deregulation, but also because of the current economic environment. Labor costs are an obvious target. The employees' unions are, quite naturally, trying to resist these forces. However, if the choice really boils down to salary restraint or no job at all, the result is not difficult to predict. Thus, the session participants agreed that, over the long term, environmental forces will gradually narrow the cost structure gap.

Research Topics

Potential research topics which were identified in the discussion of this portion of the session are as follows:

- What is the long-run impact of deregulation on airport congestion? With the tendency to downsize aircraft, there is a tendency towards increased movements at hub airports; but there is also an increased ability to use smaller airports for point-to-point service and reduce the number of connections and transits at the major hubs.
- What is the likelihood of higher user charges for general aviation, and what would be the implications? What is the fairest basis for cost allocation, and what is the fairest mechanism for cost recovery (e.g., user fees versus excise taxes).

Fuel Prices

Only a few years ago there was a strong consensus that fuel prices would increase at about 3 to 5 percent per year, in real terms, over the 1981-1991 period. But current conditions suggest that increases will be much lower, probably between 0 and 2 percent real and, in view of the recent price stability (even in current dollars), it follows that prices will increase at an average real rate in the order of 2 percent over the latter part of the decade. If this proves to be true, the existing narrow-body, medium range aircraft, such as the Boeing 727, will be around for at least a decade. There is, however, a risk for more stringent noise regulations. As the public gets used to the new quieter aircraft, like the 767 and DC-9 Super 80, they may become less tolerant of aircraft that were considered relatively quiet just a few years ago.

There is a risk that the fuel price forecast will be incorrect. In the view of the oil companies, jet fuel is currently underpriced by 10 to 12 percent. What they are saying, basically, is that the lack of demand has allowed the price to be ratcheted down a bit and, looking at the barrel and the products coming out of it, normal conditions would suggest that jet fuel prices should be higher than they presently are. What would happen if fuel prices increase significantly? Re-engining would become more attractive, but airframe life might make this nonviable, as the average aircraft age is increasing. The current period may be called "the age of the geriatric jet". Higher prices would also stimulate interest in development of even more fuel-efficient aircraft, such as the 150 passenger aircraft that has had a variety of names, like the "Delta 3". That program could be accelerated. Also, there would be renewed interest in substitute fuels, but with the long time frame involved, the effects would not be seen for quite some time.

What will happen if fuel prices decline? In theory, air fares and cargo rates will decline and demand will increase. However, tax adjustments would probably absorb all, or a great part, of any major price reduction as governments try to reduce their large deficits. What little is left, could well be consumed by the carriers, who have to increase their profitability. If fares do decline and demand increases, the existing excess capacity will be quickly consumed. It appears to be substantial today -- perhaps equivalent to four or five years' growth. However, if growth picked up, stimulated by lower prices, then the excess capacity would not last quite so long. In any case, depressed fuel prices would further dampen interest in technology development -- particularly in the United States.

The final subject of discussion on fuel prices was the Federal Aviation Administration's safety fuel studies, such as the anti-misting program. Several candidate fuel additives are being considered and crash testing with a B-707 is planned within the next 12 months. If requirements are adopted for fuel additives, there could be a 5 to 6 percent increase in jet fuel price. Also, engine and fuel pump modifications would likely be required for existing aircraft.

This discussion led to an addition to the list of potential research topics:

- What are the technical and economic implications of the imposition of a fuel anti-misting requirement?

New Market Opportunities for Societal Forces

The group agreed that the aviation industry is quite mature in the industrialized world. However, there are still geographical areas when air transportation is in its infancy. Obvious examples can be cited in South America, Asia and Africa. The key to the development of these markets is economic growth. Air transportation in underdeveloped countries is both dependent upon that economic growth and a significant contributor to it.

In the industrialized world, there are several new societal sub-markets developing. This is a function of demographics, life-styles, etc. As an example, there is an increased percentage of women air travellers, many of whom are travelling for business purposes. The session participants consider the increase in female business travellers to be largely a matter of substitution, as opposed to market stimulation. There is some stimulation, but essentially we are seeing women on business trips that would have been made by men a decade ago. Thus, in a macro sense, this is not a significant factor. There are larger macro implications in the leisure market. The increase in the number of two-income families has increased the potential for leisure air travel. Women are also playing a greater role in influencing mode choice and destination. In both business and leisure markets, the increasing numbers of women travellers is important in a micro sense, i.e. individual airline competition. A carrier can gain a competitive advantage by gearing its advertising to appeal more to women, by considering the inflight amenities desired by women such as easier to reach overhead bins and light meals, and by paying attention to such matters as equal treatment by cabin staff, sexual stereotyping in movies, etc.

Another subgroup is the youth and young adult. This is a generation which is acclimatized to air travel. They have grown up considering air travel to be part of their world. They are forming two-income families, they are having children later and fewer of them, and they are willing to work far from their place of birth. Thus, this age group has high potential for air travel.

Next, there is the over-65 subgroup. The size of this group is increasing significantly and they are becoming more affluent. They also have increasing interest in air travel, both in terms of vacation and visiting friends and relatives. The latter is stimulated by families spreading out geographically and then visiting each other through air travel, and by retirements in places far removed from the previous residence.

Another societal subgroup which is relevant to the aviation industry consists of handicapped travellers. Increased interest has arisen over the

last few years in services for the handicapped and in standards of service for people with various levels and types of disabilities. What are the architectural changes that are required. Consideration must be given to aisle width, washrooms, loading procedures, and so on. There are some basic questions because we can not even assume that the group that we refer to as the handicapped are homogeneous; nor can we easily know, if we are not handicapped, what kinds of improvements the handicapped require. In the discussion of this topic, there was a consensus that the aviation industry will, on its own, do more for the handicapped or government will impose standards. It was also agreed that the desires and legitimate requirements of the handicapped have not yet been sufficiently well-researched.

The research topic suggestions from this part of the session were:

- What are implications of changing societal patterns on the air transportation industry? This could focus on any or all of the sub-groups mentioned above. It could also incorporate the fact that the air mode has become a method of mass market transportation. Will there continue to be a mixture of fare classes on the same flight or will carriers tend to become more specialized?
- What are the appropriate standards of service for air travellers with various levels and types of disabilities?

Limits to Growth

On the subject of long term growth forecasts, the participants of this session were less optimistic than other groups and agreed that high growth rates, in the order of 7 to 10 percent per year, are no longer capable of being sustained. The rate has been quite volatile over the past three decades, but with a very strong downward trend. It averaged about 7 percent over the past ten years and, recently, has been less than 5 percent. An upturn is likely during the next few years as a result of the economic recovery, but, by the late 1990s, the annual rate will probably be back to 5 percent per annum, and lower in the more mature markets.

It is important to remember that "growth rate" is simply a convenient measuring-stick used by statisticians and forecasters. It is volumes of passengers, cargo and aircraft movements that require facilities, not percentage increases per se. Those volumes are still increasing rapidly in absolute terms. ICAO statistics show world revenue passenger kilometers at about 1100 billion (1.1×10^{12}) in 1982. It took almost 30 years for an increase of 1000 billion. Even with the lower growth rates discussed above, the next increment of that size will take only 13 years and the next one just 8 years. Thus, it is not suggested that the market has reached saturation; however, as the base grows, it becomes increasingly difficult to achieve a given percentage increase.

This same principle applies to the independent variables used in forecasting models. For example, growth rates for real income and GNP are declining, at least in the industrialized countries. Furthermore, there seems to be a declining trend in demand elasticity, with respect to both income and price. In the case of price, there appears to have been a very recent phenomenon in the United States of a significant increase in elasticity of demand. However, this is considered a temporary condition resulting from highly price sensitive passengers enter-

ing the market in response to very low fares. The discussion of this subject ended with a caution. The analyst must be very careful in recognizing the limitations of his/her data. This applies to the general statistical base on aviation activity as well as to analysis of demand elasticities.

The suggested research topics from this subject are:

- How large will the increase in aviation activity be over the very long term? More sensitivity analysis is required on the forecasts with respect to the implications for industry investment and capacity increment decisions.
- What are the current and probable future trends in elasticity of demand. To what degree must the market be subdivided to properly assess demand elasticity?

Aviation Technology

Deregulation, the softening of oil prices, the economic recession, and industry losses have all contributed to reduced interest in new aircraft. Thus, the average aircraft life is increasing. Nevertheless, there is still a need to replace "the geriatric jet". By keeping old aircraft longer, the replacement problem is pushed into the next decade, but it is not eliminated. There is already a tremendous bow wave of required aircraft replacements. It has been pushed back to the late 1980s or early 1990s, but it is still there. Eventually, those old aircraft will have to be replaced.

There will be an increasing trend toward greater use of non-ferrous metals in future aircraft. However the availability of these metals could be a problem. Consider cobalt for example. It is found primarily in the U.S.S.R., Asia and Africa. If an adequate supply of non-ferrous metals is not available to the manufacturers in North America and Western Europe, this aspect of technological development will be constrained.

The session participants all agreed that there will be a continuing downward trend (at least in real terms) in prices for avionics. This will make them more available for general aviation. However, there is also a trend toward more sophisticated system requirements which has the opposite effect on general aviation aircraft prices.

Major technological innovations such as a large prop-fan aircraft are likely at least a decade away. The incorporation of new technology over the next ten years will be evolutionary, rather than revolutionary. For example, increased use of composite materials, active controls, etc. will likely be through aircraft modifications and/or derivatives rather than completely new aircraft.

Several technological issues relate to air safety. The anti-misting fuel program was already covered in the discussion of fuel prices. Other examples are collision avoidance and ground proximity warning systems. Some people argue that implementation of these, which is a form of technical regulation, is justified on the basis of safety. However, the argument has also been made that safety may be compromised by the elimination of economic regulation. Proponents of this view refer to ease of market entry and a tendency to cut corners in a competitive environment. The debate will probably continue for some time, therefore the following research topic is suggested:

- What would be the appropriate balance between the regulatory approach and the voluntary technology-based approach to further improve aviation safety?

The Impact of Economic/Business Cycles

Aviation is, and will continue to be, highly dependent upon economic conditions. There has been a recent increase in economic uncertainty. Business cycles have become more drastic as evidenced by increased volatility in cycle length and the depth of the recent recession. This has added to the risk-avoidance philosophy and, therefore, to the increased cost of capital. A contributing factor in the economic uncertainty is that external forces seem to be having a greater impact on domestic conditions. This is not just a U.S. phenomenon; it can be observed throughout the industrialized world.

The interplay of worldwide economic forces has a direct effect on currency valuation. Thus, there seems to be increased fluctuation in currency exchange rates. Some people claim that the effects of currency fluctuations on international air passenger volumes balance out. They argue that, as the dollar gets stronger and, say, the pound or mark gets weaker, all that happens is that there is a switch in the passenger origin split from east to west. This pattern is reversed when the exchange rates move in the opposite direction. The session participants did not agree with this theory. They believe that currency fluctuations have a ratcheting-down effect on international air passenger volumes. Consider an American resident who is planning a vacation in Europe. The decision making process is quite long, perhaps six to twelve months, or even longer. If the currency exchange rate becomes unfavorable during that period, he may well decide not to make the trip. But, his counterpart in Europe is not aware of the change yet; he is not involved in the decision making process because the rates were unfavorable to him a few months ago. Thus neither of them makes the trans-Atlantic journey. It follows that the interests of the aviation industry are best served by long cycles in exchange rate fluctuations. More rapid fluctuations will tend to exacerbate the problem of demand suppression.

COMMUTER INDUSTRY

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Five general forecast areas which the group determined were the most important for the commuter industry are:

- 1) Commuter industry traffic,
- 2) Financial capability of the industry,
- 3) Aircraft fleet,
- 4) Dynamics of the industry,
- 5) Airport facilities.

Traffic Growth

The first forecast developed was commuter industry passenger enplanements. In 1982 there were 18.5 million passengers boarded by the commuter airline industry. The forecast for 1992 is 40.2 million enplanements. This level would produce an average

annual growth rate of slightly less than 8.2 percent per year during the ten year period. The assumptions on which this forecast is based are:

- (1) The city pair markets now served by the commuter industry will grow at the same rate as the total air carrier industry rate of 4 percent per year for the ten year period;
- (2) The additional 4 percent per year growth will come from traffic gained from markets turned over to the commuter airlines by the other air carriers or traffic gained by reduced service by air carriers.

Although the replacement of air carrier service by commuters will produce significant growth for the commuter industry, it is not significant when compared to the total air carrier industry. In 1982 there were 237 commuter airline companies. These companies accounted for 1.2 percent of the total air carrier industry revenue passenger miles. The substantial growth during the ten year period, if obtained by the commuter industry, will produce approximately a 2.5 percent market share for the commuter industry by 1992.

The group concluded that in the case of traffic it was important to show that this would not be a fairly constant growth. Therefore, a five year forecast was also prepared. The 1987 forecast for commuter industry passenger enplanements is 29.2 million. This would produce a 9.7 percent average annual growth rate for the first five years and a 6.0 percent average annual growth rate for the remaining five years. This higher growth in the near term years is based on a higher growth rate for the near term general economy as it recovers from the recent recession.

Revenue passenger miles (RPMs) are forecast to increase from 2.6 billion in 1982 to 6.1 billion in 1992. This would produce a slightly higher growth rate for RPMs than for enplanements. This is based on increased average passenger trip lengths as commuter airlines gain additional markets from the air carriers.

Financial Environment

The second major area forecast was the expected financial environment for the commuter industry. It was determined that the sources of financial assistance would change during the ten year period. It was also established that when discussing financial sources two major areas must be examined. These major areas are financial sources for working capital and for financing new equipment. Today, the largest percentage of capital for the purchase of new equipment by the commuter carriers comes from the aircraft manufacturers. This assistance takes two forms. In each case the manufacturer finances its own aircraft sale. The manufacturer may charge the airline the established commercial interest rate or it may charge the airline a rate lower than the commercial interest rate in order to assure that it gains the sale from other manufacturer competitors. In many cases of sales to airlines in foreign countries the government of the manufacturer will assist the manufacturer in offering lower interest rates.

The second most important source are the various types of tax shelter leasing. The first is individual tax shelters, normally taking the form of limited partnerships. In this method a broker brings together a group of individual investors who through their joint investment in equipment gain the advantages of equipment tax shelter. The