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THE STATE-OF-THE-ART IN AIR TRANSPORTATION DEMAND AND SYSTEMS ANALYSIS: A REPORT ON THE PROCEEDINGS OF A WORKSHOP SPONSORED BY THE CIVIL AERONAUTICS BOARD, DEPARTMENT OF TRANSPORTATION, AND NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (JUNE 1975)

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Introduction and Background

Forecasting air transportation demand has indeed become a complex and risky business in recent years, especially in view of unpredictable fuel prices, high inflation rates, a declining rate of aggregate population growth, and an uncertainty with respect to the regulatory structure in the aviation industry. Since the stakes are very high, the need for accurate forecasting and for a more complete understanding of the total system of air transportation continues to grow.

Past forecasting methods have become inadequate for at least two reasons. First, the trend extrapolation method of forecasting is no longer appropriate due to the significant changes in both the economic and the operating environments in recent years. Second, the more sophisticated econometric forecasting models are only as good as our understanding of the total air transportation system on the one hand, and the availability of data on the other. In light of these deficiencies, the dual needs for improving forecasting methods and for increasing the reliability of data are more critical now than ever before. In short, there is a compelling need to perform basic research to improve both the forecasting methods and the data in the aviation industry.

Among the various types of forecasts of aviation activity desired by the government agencies, the air carriers, the airframe and engine manufacturers, the airport authorities, and the financial community, one component that plays a critical role in long-range planning pertains to the future fleet requirements for the aviation industry. Forecast items needed with respect to future fleet requirements include types, configuration, ranges, and technologies of new aircraft so that the industry and government can coordinate their resources to

maximize the interests of the producers, regulators and consumers of future air service. The National Aeronautics and Space Administration (NASA), with its twin missions of both aeronautics and astronautics, has been focusing its attention on the aeronautics component in recent years. In this overall responsibility, the Systems Study Division of NASA-Ames Research Center has as one of its main objectives the development of a better understanding of the civil air transportation system in the United States, with emphasis placed on the proper and timely application of new technology. In order to fulfill this objective, the division has a critical need for projections of the growth of demand and for the determination of the role of technology in the future growth of air tranpsortation.

Before undertaking an extensive research effort in the area of air transportation demand analysis and forecasting, NASA-Ames attempted to solicit the views of the industry and other government agencies at a one day informal meeting in San Francisco in December 1974. The meeting was attended by about twenty experts from the carriers, airframe and engine manufacturers, U.S. Department of Transportation, universities and NASA. The goals of this mini-workshop were three-fold: the first objective was to determine the ways in which the NASA-Ames Systems Study Division could play a supportive role in this area; second, it was essential to receive an informal endorsement from the industry and other government agencies; and third, it was necessary to determine the direction for the proposed research. This meeting concluded with a general agreement on a definite need for future research, with the belief that not only could NASA-Ames play a supportive role but, more important, that it could play a catalytic role. However, due to the limited participation in this one-day meeting and the assistance that the proposed research could have provided to a wide variety of users, a more extensive workshop was proposed at

that time, possibly to be co-sponsored by other government agencies.

Subsequent to the December 1974 meeting, further discussions with the U.S. Civil Aeronautics Board (CAB) and the U.S. Department of Transportation (DOT) resulted in a three-day workshop co-sponsored by the CAB, DOT and NASA. The reasons for the joint sponsorship by the CAB and DOT reflected a desire from these agencies to participate in the search for methodologies and information on the long-range benefits, problems and issues of technological advances in aviation and to assist NASA in deploying its funds on these matters in the most productive and efficient ways. The overall objectives of this workshop were four-fold: first, to investigate the state-of-the-art in air transportation demand forecasting; second, to determine the needs of the various government agencies and the industry; third, to assess the possibility of long-term government sponsorship of basic research to improve the forecasting of air transportation activity; and fourth, to determine the most promising areas of research in air transportation and systems analysis. This workshop was organized by the Flight Transportation Laboratory of the Massachusetts Institute of Technology and the Transportation Center at Northwestern University and was held at the Mayflower Hotel in Washington, D.C. on June 2-4, 1975. The meeting was attended by one hundred experts, thirty-three of whom made extensive presentations. This report then is a summary of the highlights of the presentations delivered at the workshop, with appropriate interjections and editorial comments as perceived by its authors.

Workshop Summary

The proceedings of the workshop were segmented into six sessions, each representing a specialized area of inquiry relevant to future aviation needs:

(1) The Role of Government Agencies on Aviation

(2) Issues of Concern to Airport Authorities

(3) Forecasting as Perceived by the Airline Companies

(4) The Activities of the Financial Community in the Airline Industry

(5) Issues in the Quantity and Quality in Air Transportation Data

(6) The Role of the Aircraft Manufacturers in the Forecasting Process

Panel (1)

The Government Agenicies Panel included Dr. Samuel L. Brown (CAB), Donald Farmer (Department of Justice), Jerome P. Mullin (NASA), John Schettino (Environmental Protection Agency) and Arthur L. Webster III (DOT). The purpose of this panel was to indicate the principal areas of future research needs in the aviation industry in general and the impact of goverment policy changes in aviation demand in particular and to suggest the relative roles that the government agencies should perform in promoting, financing and implementing these needs.

The first panelist, Dr. Brown, opened the workshop with a topic of great concern to the air carrier industry, the price elasticity of air travel demand. He presented a comprehensive account of 28 research studies on the elasticities of air transport conducted by the Board staff over the period 1959-1972. Price elasticities of demand for domestic air transport were derived from a wide range of regression models that used both time-series and cross-sectional data. Dr. Brown argued that, until better quality data became available, "... econometric studies are critically handicapped." He pleaded for the collection and tabulation of data for fares in city-pair markets, for segments

of the market demand (business and nonbusiness travel), and for the discretionary and necessitous portions of the non-business travel market. Without these additions to existing data sets, no improvements in the results of econometric modeling are likely. Furthermore, these empirical additions are critical for future air traffic forecasts because an accurate estimation of air traffic growth rates is a prime consideration by statute, not only in CAB policy decisions but also in industry planning.

In his presentation Mr. Webster analyzed the relatively wide variations in methodology used by the forecasters, as well as the very large variability in their forecasts. Forecasting methodologies range from professional judgement to sophisticated econometric models. As an example of this range, forecasts produced in 1965 of U.S. domestic revenue passenger miles displayed substantial variation in that the highest forecast for 1980 was 79 percent higher than the lowest forecast. With so much variation, the objective of forecasting should not be to predict the future, but rather to provide information which can be used to evaluate the impacts of our uncertainty about the future. Thus, it is more useful to produce plausibly high and low growth levels and then to evaluate the risks, the opportunities forgone, and the costs of erroneous decisions associated with these high and low levels of growth.

With respect to future improvement, Mr. Webster outlined eight specific areas where research could be directed. First, a distinction should be made between macro-forecasts such as revenue passenger miles, enplaned passengers, aircraft operations and aircraft fleet, and micro-forecasts such as passenger originations (O & D), peaking, and general aviation aircraft. Second, improvement in the availability and consistency of historical data regarding aviation

activity is needed. Third, methodologies have to be continuously improved. Fourth, there is a need for annual series of forecasts. Fifth, it is important to produce multimodal forecasts. Sixth, forecasters should use sensitivity analysis and develop forecast ranges. Seventh, improved documentation of forecasting activities is badly needed. And finally there is a critical need to develop methods which provide a better understanding of the interaction between the demand for and the supply of transportation.

Mr. Schettino also emphasized the need to assess the impact of various regulatory actions on demand forecasts. The Environmental Protection Agency (EPA) is engaged in a study of a comprehesive national program for aircraft/airport noise abatement to insure that the noise control options available to the aircraft manufacturers and operators, the airport operators, the Federal Government and other public authorities are implemented to protect the public health and welfare. More specifically, the EPA is currently preparing regulations to be proposed to the FAA for noise abatement flight procedures, noise source emissions, and airport noise. Several proposals have been or are being developed by the EPA: three covering flight procedures, five source control regulations and one airport regulations. There is a critical need to evaluate the impact of these proposals on the demand for air transportation. In particular, the evaluation procedures should include the impact of technology; for example, the proposed aircraft noise regulations currently being developed are limited by the available technology capability. Also, as air traffic demand increases, how will airport regulation alternatives inhibit future airport and airline growth with and without additional technology developments?

Another source of regulatory action stems from the Antitrust Division of

the U.S. Department of Justice, whose representative (Mr. Farmer) suggested that improved econometric models are necessary to study the important future research needs and issues of the airline industry, for example: the impact of entry on the rate of innovation; impacts of route integration; pricing flexibility; and general problems of demand forecasting for the whole commercial airline market.

While Mr. Mullin also argued that demand was an ingredient of the forecasting process, he stressed the use of demand estimates in R and D policy and the importance of the latter in the planning for future aviation needs. Mr. Mullin gave two examples of how demand estimates might be used in R and D program planning. The first treated research aimed at new, more fuel efficient aircraft while the second example covered modifications to existing aircraft. Using a Hudson Institute research report's findings that the long run price of aviation fuel will decline, Mr. Mullin argued that an important future research need would be to examine a set of scenarios that relate aviation fuel consumption to shifts in the aircraft fleet mix and eventually to modifications in aircraft design. Herein is the best statement of the need to forecast accurately both the areas of determining appropriate program size as well as in setting specific project objectives. There is a critical need for moderate and long-term demand estimates in research and technology program planning.

Panel (2)

The second panel consisted of authorities and experts from various airport agencies that are responsible for the supervision and direction of aviation activies in their respective metropolitan areas. Some of the largest population

cities were represented by the speakers on this panel, including New York, Los Angeles, Chicago, and Atlanta. The participants on the airport authorities panel were the following: George P. Howard (PANY&NJ), John L. Graham (Los Angeles Department of Airports); Jack O'Reagan (Atlanta International Airport); and Paul D. Shaver (O'Hare International).

From the viewpoint of the airport authority, the importance of forecasting the demand for travel in conjunction with the impacts of socioeconomic, political and environmental issues hardly needs stressing. On account of the complexity of the forecasting problem, many sophisticated techniques of forecasting have been developed and used. The major benefits of these techniques have been restrained, however, largely because of difficulties with existing data used in the testing of various models. In George P. Howard's words: "If airports are to fully utilize the advanced techniques of forecasting and analysis, a program of integrating available data sources, along with the development of additional data sources would be highly desirable."

One of the more important empirical suggestions during the workshop was Mr. Howard's call for a periodic "national inflight survey", similar to the one undertaken by the Port Authority of New York/New Jersey's air passenger attributes, specific trip characteristics and other disaggregate factors significant to aviation. The data generated by this type of survey could be used to test a variety of new and potent demand models that already have been developed but as yet have not been verified. With the resulting calibration of these newer disaggregate, behavioral demand models with aviation data, rapid advances in the state of the art in demand forecasting would be forthcoming.

In addition, most airport hubs would benefit from the development of a

comprehensive and integrated data program. Airport authorities,in particular, need to be provided a flow of information on research areas that require practical and workable approaches. Some of the more critical areas, according to John L. Graham, are: the environmental factor, particularly noise problems around airports; ground access; and land use planning. Also, the development of local origin/destination (O/D) passenger surveys around major airports would be valuable. In particular, Paul Shaver suggested that a common format for a data bank for major domestic airports be developed to store operational, financial, and meteorological information.

Perhaps the most important task faced by an airport authority is that of planning. In most instances, day-to-day pressures occupy the energies of airport personnel to such an extent that very little time has been left for planning larger range aviation problems. Among many possible remedies to the situation, Jake O'Reagen recommended more "consultative review" miniworkshops in order to solicit industry views on various problems like forecasting demand and collecting data, with a special emphasis on the long-range aspects of aviation planning.

Panel (3)

In some ways no segment of the aviation industry is more important than that of the carriers. After all, it is they as a group who perform the daily functions of providing commercial air service to an increasingly sophisticated public. This panel, then, examined significant problems in aviation from the perspective of the carrier. The panel represented a broad spectrum of experts from the trunk, regional, commuter, supplemental and cargo air carriers. In particular the panel included Harry Lehr (United Air Lines), William H. Caldwell IV

(Flying Tiger Line), Jack Reiter (World Airways), Thomas S. Miles (National Air Transportation Associations, Inc.), Art Ford (Delta Airlines), and Thomas McGilvery (Allegheny Airlines).

The airline industry requirements for forecasting capabilities might be best summarized in the words of Harry Lehr: "The current economic conditions of the industry and the perishibility of our product (a seat unsold today cannot be inventoried) dictate a need for a forecasting methodology that is substantially closer to the level of developemnt of our other planning tools." Again, as in the other panels, similar pleas were heard here for more reliable and consistent data, for a basic understanding of air travel demand, and for better estimates of price elasticities. The fundamental economic need, on the basis of a common strain that evolved from the panel members' discussion was that a better understanding of the underlying behavioral traits for the forecasting of demand and other factors should be emphasized in order to monitor the intricate patterns of change that will occur in future aviation activities.

Many areas of concern for future research needs were expressed by panel participants. Among the more important ones were the following: a benefit/cost analysis of the actual and relative contribution of the airline firms to the national economy (Caldwell); a methodology to quantify the motivational aspects of air travel demand (Lehr); a better integration of economic forecasts with improved estimates of demand elasticities (Reiter); the inclusion of commuter air carriers in the formal air transport system (Miles); an input/output model of specific sectors of the airline industry relative to air transportation in the aggregate (Ford); better knowledge of the demand for short-haul travel, especially for the air mode (McGilvery); and quantitative studies of the demand for air freight along with estimates of the impacts of technological

change on the logistical and distribution process (Caldwell).

The truly basic need is not for more complicated procedures and modeling techniques. Rather it is for the integration and extension of fundamental demand and technology models with carefully selected sets of available data. As Jack Reiter has said, the airlines principal need is for "understandable data and interpretation of that data in clear precise language."

Panel (4)

The Financial Community Panel included representatives from the banking aircraft leasing, brokerage, and financial institutional services industries. The Panel consisted of Harry E. Colwell III (Chase Manhattan Bank, N.A.), Harry A. Kimbriel, Jr. (Alliance One Institutional Services, Inc.), Dr. Julius Maltudis, Jr. (Salomon Brothers), Ted Schlegel (National Aircraft Leasing Co.), and Robert Simmons (First National City Bank).

From this panel discussion, one could easily appreciate the crucial role performed by the financial community in the development and sustenance of the airline industry. The large commitments by the nation's commercial banks and by other financial intermediaries have been instrumental in stimulating important innovations by the airline firms and manufacturers over the years. The decisions to finance (or not to finance) new equipment and facilities are based on many diffuse sources of data. The critical question for the future, however, pertains to: what additional information and analysis can the financial community use to more effectively serve the airlines and the nation's air transport system?

The answers again sound familiar: better estimates of price elasticity of demand; impacts of special fare plans; greater usage of demographic data;

capacity studies and load factor analysis; demand profiles on charter flights; estimates of "leading indicators" for the airline industry's impact of aircraft productivity on demand; and so on. Mr. Colwell's observation that the most important source of information lies in constant discussion "with people in the aerospace field" highlights the interactive need for knowledge of technological and demand forecasts by various government agencies and by firms. The need is all the more compelling if Mr. Simmons' prediction that in the 1957-1980 period 500 aircraft (costing $10.6 billion) will be delivered becomes true. A large portion of this cost (plus additional capital outlays for facilities) will be financed by the intermediaries, who also must have the capability of forecasting future changes in aviation and in the economy. As Mr. Kimbriel suggests, "good research can lead to a better understanding of the aviation industry and its ultimate economic role."

Mr. Kimbriel highlighted the need for research in four specific areas. First, there is a critical need for the development of a comprehensive national transportation policy. Here the universities can investigate the future strengths, weaknesses and other aspects of all modes of transportation. Second, there is a need for a long-range world and domestic environmental forecast with a focus on emerging population and sociological patterns, and demands of third world nations to participate more equitably in the use of resources and redistribution of wealth. Third, in the context of environmental projections, there is a need to forecast the technological outlook. In particular, what is the interaction between the needs and demands of society and technological developments? And fourth, there is a critical need to forecast the long-term capital requirements of the air carriers.

A particularly interesting feature of the airline industry in recent years has been the growth of leasing arrangements in financing the purchase of equipment. Here too, improvements in basic research are necessary for determining the world future growth trends and technology shifts. With this type of information

available, sound investment practices can be employed in selecting and financing equipment. According to Mr. Schlegel, one attractive alternative under this umbrella of investment options is leasing -- but this option also requires the same kind of forecasting accuracy as do other money and capital market instruments.

On a broader, more institutional scale, Dr. Maltudis suggests that research efforts examine very closely the possibilities of restructuring the airline industry. He believes that the major problems of the industry are those of overcompetition and overcapacity, both of which can be alleviated through prudent mergers and consolidation. In this case, research should be devoted to the forecasting of demand which would be used to eliminate wasteful competition rather than the current practices of adjusting the competitive structure of the route system. Even though the merits of airline merger research are not yet dramatically obvious, research into the individual components of demand and technology may alleviate some of the undesirable consequences of the overcompetition problem.

Panel (5)

The Air Transportation Data Panel was intended to provide viewpoints on data requirements from the perspectives of the Civil Aeronautics Board (CAB), the air carriers (especially in their international operations), trade associations, manufacturers, and the Department of Transportation (DOT). The panel included three Board personnel -- Jerold Coffee, James R. FitzGibbon, and Evans Wiley -- plus Richard D. Willy (Boeing Commercial Airplane Company), R. Lawrence Hughes (Pan American), Lee R. Howard (Air Transport Association), and Alan E. Pisarski (DOT).

The panelists representing the CAB discussed the wide variety of data collected and published by the Board for general use by the public. Mr. Coffee presented the general report information required of the air carriers by statute and the portions of this information which are maintained in computer data banks. Mr. FitzGibbon outlined the two largest statistical data processing systems in the CAB: the origin and destination survey of airline passenger traffic; and the traffic, capacity, and operating statistics program known as service segment data. Mr. Wiley then concentrated on future data and information requests that are being considered by the Board in order to further our understanding of airline operations. Perhaps the most important paper in this series of Board presentations, from the point of view of this workshop, was Mr. Wiley's discussion of future data needs. Since the board is the richest source of publicly available data on the domestic airline industry, it is imperative that future data requests by the CAB contribute to the verification of current and future modeling efforts in air transport demand and systems analysis.

Under the proclamation of the recent Domestic Passenger Fare Investigation (DPFI), the CAB needs revenue and traffic data for various categories of full-fare and discount-fare services in order to monitor the domestic fare level. Some specific future data requests pertain to: improved charter industry statistics; fuel data for the intrastate and commuter carriers; accounting data from the commuter carriers; standardized financial and traffic data from foreign flag carriers; cargo origin and destination surveys; and a continous survey of airline traffic that segments business and non-business travellers.

A good depiction of current data gaps was portrayed by Mr. Willy, who generally cautioned against creating new data bases without fully exploring

and utilizing currently available sets. Even so, some obvious data gaps do exist: first, there is the need for a demographic data set comparable with CAB traffic data -- a disaggregate set of information on who flies, how often, their incomes, ages, sex -- attributes necessary on which information should be available to test various types of currently available behavioral demand models; the second data gap results from the aggregation of statistics in the basic source files, which has the effect of disguising specific and random fluctuations of demand; and the third gap prevails in the general need to improve origin-destination information through a more thorough understanding of desirable service patterns.

The Air Transport Association (ATA) has participated with many airlines in generating additional sets of air transport data from a wide variety of sources. Among these sets is a recent analysis of "Aircraft Movement and Passenger Data: for the Largest 100 U.S. Airports". The comprehensive analysis was based on an average day in August 1973 and contains demand data that reflect: an hourly profile of all scheduled aircraft movements by aircraft type; an hourly profile of domestic flight data for the trunk and regional carriers; and numerous domestic city-pair data by airline. Additional air transport data are collected and published by the Department of Transportation, as Mr. Pisarski pointed out. Perhaps the most important need lies in the collection of international aviation data. DOT does provide a major source of international origin-destination information, although there are many problems associated with the tabulation of the data. Nevertheless, the challenge of "properly defining and accumulating appropriate (international) statistics," as Mr. Hughes argues, into a meaningful framework for analysis

and forecsting purposes is an absolute need at the present time.

Panel (6)

The final panel of the workshop focused on future research needs and requirements in the aviation industry as perceived by the manufacturers of aircraft in the United States. The views presented in this panel reflected those of the three major producers of airframe as well as those of two jet-engine manufacturers, General Electric, and Pratt and Whitney Aircraft. The panel included Yves Aureille (Douglas Aircraft Company), Roger Ulvestad (Lockheed Aircraft Company), Richard D. Willy (Boeing Commercial Aircraft Company), John D. Karraker (General Electric Company), and N. George Avram (Pratt and Whitney Aircraft).

From the viewpoints of the commercial airframe and jet engine business, the nature of the product by definition requires long range planning. An error in determining the potential markets for a given aircraft or for a given piece of large equipment, like a jet engine, can induce serious consequences in this important segment of the aviation industry. Clearly then, forecasting in the aggregate is recognized by the firms in this supplier segment of aviation as one of the important elements of profitability and perhaps even survival.

While the research staffs of the aircraft manufacturers have produced some of the industry's more elaborate forecasting models, the companies are continually working for assistance in researching demand and technological features in aviation. Examples of this industry's capabilities to model air travel demand abound: Yves Aureille's distributed lag, simultaneous equation system model of the airline industry; Roger Ulvestad's regional model of air

travel demand; and Richard D. Willy's model of surplus seat management. Still, these models offer only partial answers to the myriad problems facing the industry today. Many areas of research opportunity will open up in the future for the systems analyst in air transportation to contribute to the fields of demand and technological forecasting. Three particularly troublesome areas of forecasting, as indicated by John D. Karraker, are: traffic on the non-U.S. market segments; volumes of air traffic between regions or cities; and aircraft retirements.

Changes in the air transportation environment in the future was the focus of a rather comprehensive discussion by N. George Avram. In considering the impacts of changed environments, Avram stressed the growing interdependence of the world economy and particularly the increased importance of foreign flag systems. Demand and technological forecasting thus becomes more intricate as the exogenous data base chages in its composition. On the one hand, changes in air passenger profiles need to be modeled and on the other, the rates of technological advances must be estimated. The knowledge of both these features (essentially, demand and technology) are crucial to the aircraft manufacturing and component industries so that they may adjust the production schedules and offer travelers the types of air service that will be desired. In addition to their own needs, the manufacturers need identical forms of information and modeling capabilities just as the airline firms and the governmental agencies do in order to assess the preferences to be expressed by air travelers in future years -- for fares, equipment, schedules, convenience and safety.

A central point mentioned by nearly every speaker was that, while forecasting is a difficult task, the ability to accurately provide both short-run and longer-run predictions of aviation phenomena is crucial to improving the planning process in the industry. For some experts realistic forecasts of macroeconomic variables such as aggregate revenue-passenger miles, total revenue and total expenditures were important. For others, accurate forecasts of microeconomic events such as specific origin-destination traffic, price elasticity of demand, and peak-hour movements were sought.

In particular, several recurring items pertaining to special issues highlighted the workshop. Among these, the more noteworthy ones involved the forecasting of demand (both passenger and cargo), improved data, capacity problems, and policy-oriented issues such as deregulation and the impact of new technology.

Demand

- More information and better forecasts are required to estimate the price elasticity of demand (for both passenger and cargo movements).
- More information is desired on the impacts of the special-fare plan packages presently in use.
- The largest unknown area of airline operations is cargo -- a situation which needs to be remedied in the future in view of the sizeable annual growth rates expected.
- More detailed demand models reflecting disaggregate, behavioral characteristics of both travelers and shippers need to be developed.

Data

- A more consistent pattern of data collected from the airline companies is desired. A major data gathering activity involving inflight surveys and the sharing of this information needs to be investigated.
- Generally more data of superior quality is needed, especially information on trip purpose and travel by fare type.
- Specific origin - destination (O-D) segment data should be collected, in particular for cargo operations.
- A variety of traffic, socio-economic and financial data for international passenger and cargo operations comparable to the U.S. domestic data sets should be generated.

Capacity Problems

- Solutions to the problems of excess capacity and excessive competition must be worked out in order to promote carrier (and industry) stability and profitability.
- Further research on the relationship between promotional fare packages and the levels of excess capacity is warranted.

Policy-Oriented Issues

- The implications of partial deregulation for the carriers are required.
- A national air transportation policy needs to be formulated for effective planning and for the appropriate use of econometric models in the forecasting process.
- The impacts of airline mergers on operating efficiency in the industry needs to be quantified.
- Research should be undertaken to determine the impact of technology on the aviation system.

- Research is required to provide an improved foundation for understanding the U.S. aviation system which would identify the role of NASA in aeronautical research and technology issues.

Conclusion

The general purpose of this workshop was not so much an effort to generate an exhaustive catalogue of possible areas for future university research but rather was an attempt to identify certain specific areas of research where academic institutions, working with federal and local government agencies, could provide important knowledge and systematic information that would enhance the air transport planning process. Time and time again, pleas were made for a better understanding of and improvement in demand and technological forecasting. From the perspectives of the panel participants, the payoffs associated with expenditures for this kind of research are enormous. The principal question remains, however, as to which goverment agencies can best provide their public service by funding such a program. On the basis of the reports generated by the workshop, it appears that the catalytic role played by the aerospace community for lunar research in the 1960s can be repeated in its application to the air transportation system in the 1980s. While other agencies, like DOT and CAB, are more constrained in the scope of projects that they can fund, cooperative research programs should be a cost-effective way to gain insights to and knowledge on the intricate matters of air transportation demand.

Transportation Demand and Systems Analaysis

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