statistics. For example, rest and recuperation or "R&R" movements, may be an unidentified part of the published total traffic figures but separately identifiable in the unpublished data. Passenger statistics in some major Pacific markets were especially affected by this traffic during the 1960's. Failure to recognize that these passenger movements were only of a temporary nature could lead to conclusions of atypically high growth rates.

Other pitfalls which sometimes go unrecognized and unaccounted for include:

- Determination of traffic trends or averages from airport activity statistics which are affected by strikes, inauguration of service and the increase or decrease in operations at other nearby airports.

- Determination of trends in markets where former or current intrastate carrier operations make superficial analyses of CAB data very misleading. Until recently, carriers such as Pacific Southwest Airlines and Southwest did not report their O-D passengers to the CAB. Though CAB data may have shown several intrastate markets as having stable or declining passenger volumes, that may not have been correct. Total market traffic, including passengers carried by the intrastate carriers was in fact growing in most cases.

- Failure to remember that fares and special promotional programs play an important part in traffic analysis. The 1979 coupon program offered in several transcontinental markets by some carriers, but not others, is thought to have produced different carrier market shares than would have existed without those programs. Likewise, the $99 and $109 transcontinental fares in 1980 probably shifted to those routes some passengers who might have flown elsewhere and also generated traffic which otherwise might not have flown at all.

The preceding suggest the need to be aware of and, where necessary, adjust for these types of situations.

Future Data Requirements

With the sunset of CAB coming not too far in the future, the questions of what current data requirements should continue are being addressed. This topic is currently under discussion by several groups including carriers, the Air Transport Association, CAB, manufacturers, consultants and academic people, to name a few. The outcome is not yet clear and probably will not be for some time to come.

Some believe that in a truly deregulated industry, there should be, for example, no reporting requirements for passenger statistics on a market by market basis; that operating and related costs, and aircraft indices are basically privileged and private information -- the business of no one but the particular carrier itself. Others think that all or much of the current statistical information should continue, albeit reported to other governmental agencies or perhaps a non-governmental data collecting body after CAB sunsets.

Some of the CAB's programs, such as essential air services that will shift to other areas of the Federal government may require continued reporting of selected data. But, for many other statistics the solution is not readily apparent.

One point that should be remembered in this discussion is that reporting requirements should not be biased in favor of continuing current reports by established carriers to the exclusion of requiring comparable data by the newer carriers. The present level of traffic and service detail for reports such as service segment data, provide a wealth of market information to new or aspiring carriers which do not yet have to file comparable data themselves. Rather than allow this, would it not be preferable, and indeed, much more equitable, to reduce the present level of detail for carriers filing this information? If new carriers file summary information only, not on a flight-by-flight basis, should not existing carriers be allowed to reduce their reports to this level as well?

This reduction can probably be accomplished without sacrificing information which the Board, or other governmental groups, need in order to carry out their prescribed programs.

Conclusion

Forecasting in a deregulated industry has presented a new challenge to anyone involved with the airline industry. The necessity for more frequent analyses due to changing industry conditions is apparent. The need for variable type forecasting, for example, forecasts assuming more than one condition such as the number of flights and carriers in a market, is more evident now than in the past.

Management must plan -- for investment purposes, for aircraft acquisitions and retirements, for profitable operations. To do this it needs to know where it can best operate and how much its profit level will be. The rapidly changing environment in which airlines now function highlights the importance of accurate forecasting. Forecasting is not getting any easier but it is certainly more interesting, challenging and less predictable.

USES AND LIMITATIONS OF CAB TRAFFIC FLOW DATA PROGRAMS

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Summary

Traffic flow statistics have essential non-regulatory uses for the airline and aerospace industries and may be essential to whatever responsibilities and functions regarding air transport the United States government continues to exercise in the post-CAB era. U.S. data are also an essential ingredient of major international aviation statistics programs. Current CAB data programs are well-designed and efficient and the areas where improvements in traffic flow data are most needed in many cases are non-CAB data sources. Thus, there is a need not only to preserve those portions of the CAB traffic flow statistics that are considered to be essential but also to improve the traffic flow data originating from sources outside the CAB.

Introduction

It is important to take a good look at the Civil Aeronautics Board's major traffic flow statistics programs in terms of the critical decisions that will have to be made in the next two years regarding

their future. This paper will examine the ten percent ticket sample and the ER586 program in particular, taking a look at their users and their principal nonregulatory uses. The Transportation Systems Center is the multi-modal research and development arm of the Department of Transportation, located in Cambridge, Massachusetts, and over the last few years has been doing extensive work in aviation route statistics for the Office of the Secretary of Transportation, the Federal Aviation Administration, the Civil Aeronautics Board and others. It is from this vantage point that this paper will look at the users and the nonregulatory uses of these statistics, to see what conclusions might be drawn that would be relevant to the critical decisions that will have to be made.

Principal U.S. and International Programs

This discussion will begin with an examination of the traffic flow data resources available for international and major domestic route analysis to see how the traffic flow programs of the CAB relate to the overall picture of statistical resources available. Figure 1 examines these resources in terms of three overall categories: (1) U.S. traffic flow programs; (2) internationally produced traffic flow programs; and (3) related statistical programs which describe commodity and passenger origin and destination flows.

First, in terms of traffic flow programs produced within the U.S., five principal, comprehensive resources have been identified. The first of these

Figure 1. Summary of principal U.S. and international traffic flow data programs.

	PROGRAM	PROD. ORG.	SUMMARY OF CONTENT	LIMITATIONS
A. U.S. Traffic Flow Programs				
1.	10% Ticket Sample	CAB	Passenger O/D ticket sample, by direction for ticket and flight coupons. Number of passengers with connection points and destination.	-Only covers tickets involving U.S. carriers -International data restricted -No flight numbers or detail
2.	Service Segment Data (ER-586)	CAB	Flight data for U.S. carriers with detail by segment including enplaned passengers and cargo, also capacity data and load factors.	-Data base large and costly to use -Trip O/Ds not available -U.S. carriers only -All cargo service excluded
3.	Charter Data (Forms T-6 and 217)	CAB	Detailed data on charter groups giving passengers, cargo revenue by city pair. Includes foreign carriers.	-Covers only major city pairs in domestic market and does not include small aircraft
4.	U.S. International Air Travel Statistics	DOT/ INS	International on-flight passenger O/D data by flag of carrier and by citizenship category. Includes foreign carriers.	-Excludes most traffic to inland U.S. ports -Includes non-revenue passengers -Carrier and flight detail restricted
5.	Airline Schedule Data	OAG Inc. and others	City pair carrier schedule data, also fares, flight itinerary and aircraft data.	-Gives schedule information only -Expensive and detailed to have on computer
B. International Traffic Flow Programs				
*6.	On Flight O/D	ICAO	On-flight O/D by city pair with total for all carriers reported. Includes passenger, mail and freight data.	-Carrier data not available -Data often incomplete -Data old when published
*7.	Flight Stage Traffic Flow	ICAO	Flight segment traffic by city pair and carrier, including passenger, freight, mail, aircraft used and capacity data.	-No O/D data -Data old when published -Carriers often missing on routes
8.	Regional Route Statistics	IATA	Traffic and capacity by carrier for major international route groups.	-Some carriers not included -Precise O/D pair not given
C. Related Statistical Programs				
9.	U.S. Foreign Trade Data	Dept. Comm.	Commodity group O/D (country/ U.S. Customs District) by value and weight and mode.	-Specifics of shipper and transport not available -Carrier data highly restricted
10.	U.N. Trade Data	U.N.	Commodity group O/D (country to country) by value and weight.	-Mode not given -Data old when published -Incomplete data
11.	Passenger Survey Data	-IATA -D. Com. -PA of NY&NJ	Several sources. None is complete or satisfactory. Most surveys reveal sample of true O/Ds, trip purpose, number traveling together and socio-economic data about travelers.	-Usually small samples -Geographic coverage is limited -Data often restricted

*The U.S. carrier data for these programs is supplied by the CAB using the ER-586 data base.

is the ten percent ticket sample of the Civil Aeronautics Board. This is the principal U.S. passenger origin-destination (O-D) program, which is conducted by sampling the tickets and analyzing not only the origin and destination of the tickets, but the carrier and flight O-Ds on the individual coupons making up the ticket.

Second, the service segment data program of the Civil Aeronautics Board, commonly known as the ER 586 program, has been identified. This gives extensive data by flight segment for U.S. carrier flights, including passengers and cargo capacity offered, load factors, and other useful information. And as shown in Figure 1, some limitations of the various programs have also been identified. Next are the charter data programs of the Civil Aeronautics Board, Forms T6 and 217, which give detailed data on charter flights for passengers and cargo by city pair.

There are two other major programs produced within the United States which are extensively used: (1) United States international air travel statistics series is produced by the Transportation Systems Center of DOT using the Immigration and Naturalization Service flight reports. It covers only on-flight passenger data for flights entering or leaving the United States. However, it does not provide comparable data for both U.S. and foreign carriers, by the citizen category of the air travelers; (2) the airline schedule data, such as that produced by Official Airline Guide, Inc., a private source. City pair fare schedules, also fare and flight itinerary data for both domestic and international flights are included.

Figure 1 also shows international traffic flow data statistics produced by international organizations and associations - the International Civil Aviation Organization, on-flight, origin-destination program, which gives on-flight origin-destination passenger and cargo and mail data by city pair in the form of totals; the ICAO flight stage, traffic flow data series, which gives flight segment detail by city pair or for individual carrier, including passengers, freight, and mail carried, and aircraft used, and the capacity offered. It should be noted that both of these ICAO programs obtain their information for United States carrier service from the CAB on the basis of a program compiling these statistics from the ER 586 data base.

Figure 1 also shows the regional route statistics program of the International Air Transport Association (IATA), which gives traffic and capacity data by carrier for the major international route groups. In summary, it should be noted that two of the major international aviation statistics programs depend on the statistics now produced by the CAB for much of their data, and it is quite dubious that these programs worldwide would be nearly as useful or could even survive without the carrier statistics provided by the United States.

Figure 1 also shows related statistical programs. These are international programs providing data on the freight commodities moved and the passengers traveling on international aviation service. The major commodity data source for the United States is the foreign trade data series published by the Department of Commerce from customs declaration data, giving detailed data on commodity group origin-destinations by country to U.S. customs district by value and weight of the air shipments. A related program is United Nations trade data, which is derived from similar sources for the entire world and gives commodity group origin destination data by value and weight for worldwide, international movements, unfortunately not identifying the mode of shipment.

Finally, Figure 1 lists the passenger survey data programs. These come from several sources but none is completed in its coverage IATA's coordinated passenger surveys, the Department of Commerce analysis of immigration and naturalization data on the alien declaration form, and the extensive inflight passenger surveys done about every five years by the Port Authority of New York and New Jersey. These sources give vital data about the passengers moving in international and sometimes domestic service, including the trip purpose, the number traveling together, socio-economic data about the travelers, etc.

What can be concluded from the major sources identified in Figure 1 about the role of CAB traffic flow statistics? First, the CAB programs are a vital ingredient of the statistics available on traffic flow movements of United States carriers. Second, they are also a vital ingredient in the worldwide picture of traffic flow movement, produced by the International Civil Aviation Organization.

Users and Uses of CAB Programs

Figure 2 provides examples of some principal uses of the various uses of CAB traffic flow statistics. It is not a comprehensive list of what is being done. While much of this information has been derived from direct experience with uses at the Transportation Systems Center (TSC), some of the material was developed from other users presenting papers at the International Aviation Data Symposium recently held at the TSC. This was a three-day symposium on international traffic flow statistics conducted at TSC and sponsored by the U.S. Department of Transportation Research and Special Programs Administration and the Office of the Secretary of Transportation.

First with respect to the uses by airlines, it should be noted that when an airline is looking at CAB traffic flow data, it is really looking for data on air markets which go well beyond what is available in the airline's own data base. These include traffic growth analysis and forecasting by route, carrier market share and competition analyses, capacity and frequency studies, yields analyses and cost revenue analyses. Now turning to uses by aircraft and component manufacturers, Figure 2 shows their needs for flow analysis by market and city pair, route segment traffic and service analysis, passenger O-D demand forecasting, aviation market shares of commodity O-D movements, and airline cargo commodity traffic analyses and forecasts. It is important to note here that, to support international sales, aircraft manufacturers also require detailed data for air markets which do not come into the United States, inasmuch as these are important markets for aircraft also.

In the airports area there are two directions of concern. One is the airport's concern about its own share of international air markets, such as the North Atlantic. For instance, the Logan Airport at Boston may be very concerned about its market share vis-a-vis New York or vis-a-vis inland ports, such as Chicago. The other concern is about traffic growth and the need for long-term planning to meet the demands which forecasted traffic will place on the airport. Often the very best data for these analyses come from the traffic flow statistics programs.

The federal government makes a number of special uses of these data. These include market share and capacity analyses for international ser-

Figure 2. Some principal uses of CAB traffic flow statistics.

Airlines	- Traffic growth analysis and forecasting by route - Carrier market share and competition analysis - Capacity - frequency studies - Yield analysis - Cost/revenue analysis
Aircraft and Component Manufacturers	- Traffic growth analysis by market and city pair - Airline route segment traffic and service analysis - Passenger O/D demand forecasting - Aviation market shares of commodity O/D movements - Airline cargo commodity traffic analysis and forecast - Fleet operations analysis
Airports	- Airport share of air markets - Airport traffic growth analysis and forecast by type of traffic
Federal Government (Not including CAB)	- Market potential and capacity analysis for international air services - Analyze issues on route competition, airline traffic, effects of mergers, etc. - Monitor air service levels to smaller communities for compliance with Airline Deregulation Act - Forecast air carrier activity for airports, routes and aircraft type for enroute traffic facilities, manpower and service planning (FAA) - Determine airport enplanements by type of traffic for Airport Development Aid Program fund allocations (FAA)
International Organizations	- Plan world-wide regional air navigation service requirements - Conduct world regional air transport and fares and rates studies - Obtain U.S. carrier traffic flow data for comprehensive world-wide traffic flow statistics

services, such as are performed by the DOT Office of the Secretary together with CAB in preparing for international bilateral negotiations; analysis of airline traffic and the effects of mergers; monitoring of air service levels to smaller communities in compliance with the Airline Deregulation Act; forecasting of air carrier activity for airports, routes, and traffic types for enroute facility planning for the Federal Aviation Administration; and determination of airport enplanements by type of traffic for airport development aid program fund allocations by the FAA.

With respect to use of data by international organizations, a principal example is the International Civil Aviation Organization (ICAO), which is engaged in planning worldwide, regional, air navigation service requirements and forecasting these requirements. It conducts regional air transportation analyses and studies and uses U.S. carrier traffic flow data as a part of its comprehensive, worldwide traffic flow statistics program.

This paper will now take a look at how these data are used, and some of the kinds of analyses conducted with CAB statistics. First let us consider the analyses in which a comparison and analysis of a single statistical traffic flow series are conducted. The requirements here, especially where carrier composition in a particular city pair market might be involved, are for completeness of reports. Data covering all of the carriers that have a significant share of the market in the system are required. This might suggest that mandatory reporting requirements are appropriate. Many times where extrapolations and long-term analysis are performed, a consistant data series over a number of years is needed so that forecasts can be made in a reliable and accurate manner.

There are also cases where the analysis involves the synthesis of traffic flow data from more than one statistical source. This is a very common procedure for in depth analyses on air markets and routes, because no one of the programs mentioned provides all of the data needed. The ten percent ticket sample does not give flight detail. The flight detail does not give passenger origins and destinations. The Transportation Systems Center air travel program does not give inland U.S. destinations for international flights. Thus a synthesis of the series to develop a complete profile of what is being studied often has to be developed. This suggests that no one particular traffic flow program could easily be retained and all others dropped, because the other programs tend to be complementary to one another.

Finally, analyses using traffic flow and other aviation statistical series involve a very wide range of users and it is necessary to look well beyond the aviation industry and the carriers in order to evaluate the overall requirement for these data. For instance, it is not unusual for banks, insurance companies and international organizations to use the traffic flow statistics along with the other data, and these uses often escape the purview of those concerned strictly with aviation.

Conclusions

The conclusions which follow are those of the author and do not represent official positions of the United States Department of Transportation.

1. Traffic flow statistics are essential for industry, including the aerospace industry, the airlines, and they may also be essential to the United States Government for those responsibilities and functions which will continue in the post-Civil Aeronautics Board era. This includes in the Department of Transportation the Federal Aviation Administration, the Office of the Secretary of Transportation, the Research and Special Projects Administration and others. This also could include the Department of Justice.

2. Deregulation does not reduce the nation's need for traffic flow statistics. Essentially, the major plans and decisions which govern the development and evolution of the air carrier and aerospace industries will have to be made whether CAB has a role to play in the decisions or not. In fact, one might contend that in the more competitive and open markets being created as a result of the Airline Deregulation Act, it will be more essential than ever for the carriers to have data on the total traffic flows, not only on routes on which they are

established, but on new routes which they may wish to explore as opportunities for expansion.

3. Principal uses must be considered in determining the future of these data programs. The data need to be complete, should include all significant carriers on the traffic routes, need to be stable and of high quality, to permit sophisticated analytical use in forecasting. The traffic flow data need to be made readily available to a wide range of users from private industry to government, and hopefully preserving the excellent services now provided by the data venders.

4. U.S. data are essential for major international aviation statistics programs. Furthermore, the United States needs such information in order to maintain its leadership in aviation, both in terms of having the world's largest and most advanced air carriers and as the principal supplier of aircraft and other aerospace industry products to the world. These programs must continue and maintain a high quality, and this can only be done if the United States can provide the data needed for its own carriers and manufacturers. For marketing and designing of aerospace equipment, American industry needs to know what is going on in the traffic flows of other parts of the world and sometimes international statistics programs are the only source of these data in any consistent way.

The Civil Aeronautics Board programs as they now exist are well-designed and efficient and have produced reliable data. Some of the major gaps and limitations in traffic flow data resources in fact are in related non-CAB programs, particularly in the foreign trade data both of the United States and of the United Nations. Under the legislative authority of the Census Bureau, much of the detailed data needed to analyze air cargo markets cannot be made available to users, even though this could be done operationally without endangering its confidentiality. The United Nations data is subject to strict budgetary limitations and the problems of coordinating complex data series from well over a hundred countries make it very difficult to provide prompt and complete data; the U.N. does not have the resources needed to do a mode analysis on foreign trade data. The limitations on the passenger data are severe also. For example, the Immigration and Naturalization Service is no longer able to provide adequate data from its I-94 Alien Declaration Forms to give United States tourism and airline industries some very valuable data for marketing to foreign travelers. The United States Travel Service used to provide some very valuable information here, but its budget has been severely cut. Thus areas where data improvements are most needed in many cases are non-CAB data sources. Essentially there are two major problems: (1) there is a need to develop data resources that are now not adequately developed outside of the Civil Aeronautics Board, and (2), there is a need to preserve those portions of the CAB traffic flow statistics that are considered to be essential.

What the future of these data programs will be cannot now be foretold. Hopefully, through efforts like this conference of the TRB, an effective concensus can be worked out with government and industry, and that consensus can be presented to the Congress for action. Furthermore, let us hope that the users of these data programs will be closely involved in the major decisions for the post-CAB era.

FAA USES OF CAB DATA IN FORECASTING

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Summary

The airline industry data now collected by the Civil Aeronautics Board is an integral part of the analyses and forecasts made by FAA for budget, facility and manpower planning, industry surveillance and regulatory economic impact determinations. Air cargo provides a good example of the problems encountered in forecasting and analyses by the decline in availability of CAB data. The limited data now available from general aviation is another example of the minimum kinds of data that may be available for the air carriers in the future. Forecasting will become more difficult in the future but it will be performed.

Data describing the aviation industry and aviation traffic is used by the FAA as a basis for:

- Budget, facility and manpower planning;
- Industry surveillance; and
- Regulatory economic impact determination.

The airline industry data now collected by the CAB is an integral part for all three types of analyses. The forecast branch of the Office of Aviation Policy and Plans supports these analyses by providing the traffic and FAA workload projections they require.

The following is a brief review of the types of data FAA uses in generating its forecasts and identification of some of the issues which will have to be resolved as a result of CAB sunset.

FAA currently uses Form 41 data in its national and hub level forecasts. In doing the national forecasts the following data elements are used:

- Revenue passenger miles,
- Passenger enplanements,
- Average passenger trip length,
- Passenger load factors, and
- Passenger revenues.

These passenger data, when combined with data on the airline fleet, provides the historical data base which is utilized to project activity levels at FAA towered airports and at air route traffic control centers. Form 41 airline fleet data elements used in conjunction with the passenger data are:

- Airborne miles by equipment type,
- Hours flown by equipment type,
- Number of aircraft by type, and
- Fuel consumption.

Hub level forecasts -- forecasts of traffic at a number of airports within a limited geographical area -- are more dependent on O&D type data. That is, the trend in connecting airline passengers are as important at this level as are enplaning and deplaning passengers. This is true because connecting passenger traffic is a function of airline route structure and its growth is dependent on economic activity levels outside the hub, among other factors.

Special note should be taken of current cargo traffic reporting. It represents the first step in the decline of CAB data availability. The reported