

cargo data bases, primarily through leveraging existing sources. The panel members felt that FAA was the logical modal agency within the federal government to champion the need for comprehensive data bases and to oversee their formulation. In this regard, the panel acknowledged the range of information already amassed by federal agencies. The panel also recognized that new mandated data collection initiatives would not be popular with either the industry or federal budget organizations. Accordingly, the panel strongly suggested that efforts focus on optimizing the use of existing data bases and collection channels.

■ *Convene a forecasting forum to develop a consensus view and report.* The panel suggested that FAA follow an established practice in the economics field. Specifically, it was suggested that FAA regularly invite leading air cargo forecasters to a forum to discuss their findings, assumptions, and methods. The objective of this forum would be to develop a consensus view and forecast, which FAA could publish for industry use. It was hoped by the panel that this format would encourage the participation of a broad range of industry and airport forecasters, including organizations that do not routinely publish their forecasts.

■ *Consider undertaking air cargo forecasting at the macro level.* Similar to airport and private industry forecasts, the panel recognized that certain needs and uses for macro-level forecasts exist at the federal level which may not be fully addressed by current air cargo forecasts. The panel, therefore, suggested that FAA consider undertaking its own air cargo forecasting to meet these needs.

Summary

The air cargo panel at the 1997 workshop faced a unique mission to establish a framework for future discussions and to address a very specific question raised by FAA. The panel concluded that air cargo is an important part of the domestic and global distribution systems, with the use of air cargo growing annually.

The panel also recognized that the industry is still in its infancy, with many changes and challenges facing it as it undergoes the maturation process. These challenges include evolutions in the way goods move (e.g., belly cargo or in all-cargo aircraft); who moves the goods (e.g., integrators or forwarders); where the aircraft will go (e.g., full service airports or all-cargo airports); how the aircraft portion of the move is integrated with ground operations (e.g., intermodal systems); and how cargo is tracked and information is supplied to customers (e.g., electronic data interchange, tagging, and advanced information systems). The outcome of these trends will affect investment, policy, and operational decisions for both the public and private sectors.

Accordingly, good information and forecasts are important, and it appeared to the panel that FAA is the logical federal agency to spearhead efforts in this area. Equally important, since the industry is still evolving, is the need to continue discussions of air cargo on an ongoing basis as a means for identifying emerging trends and issues and assessing their implications.

AIRPORTS AND INFRASTRUCTURE

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Introduction

The workshop provided a forum for knowledgeable participants to exchange views on passenger traffic forecasts, equipment procurement forecasts and the expected development of the industry's supporting infrastructure. The Airport & Infrastructure panel focused on this final topic, and team essentially acted as futurists, discussing and analyzing social, cultural, political and technological trends and economic statistics to develop alternative future scenarios for the industry forecasts. In this role the panel sought to "think out of the box" and provide early identification of innovations over the next 10 years. Some of the issues considered included:

- Examining various global trends in commercialization and privatization of airports, air traffic control systems, and airlines and their impact on the U.S. scene, where these matters are handled differently.
- How will regional jets, newer larger aircraft, and telecommunications technologies affect airports and future demand forecasts?
- What is the 10-year impact of low-cost carriers on market demand?

Capacity as well as environmental constraints at airports are widely understood throughout the industry, but by discussing the context of these issues within the broader framework of aviation system elements the panel was able to identify some pathmarks to the future.

The size of the global aircraft fleet is going to double in the coming 20 years. With the United States possessing nearly one-half of the global fleet, sizable increases in passenger and cargo traffic as well as aircraft handling capacity will be needed in the airspace system and at airports in the future.

The panel recognized that FAA, passenger, cargo and aircraft activity, forecasts are essentially unconstrained with regard to future airport infrastructure limitations, beyond the extent that such infrastructure constraints have existed in the past. Specifically the panel reviewed the airport passenger demand forecasts and the aircraft activity at FAA facilities forecasts. The panel believed that the unconstrained growth projections by FAA are reasonable demand forecasts and are attainable if airports and related infrastructure, the supply-side of the equation, proves adequate to accommodate a near doubling of commercial passengers over the next 10 to 12 years. Demand is not uniform throughout the national system of airports however. Significantly different growth rates occurring at various airports create the potential for capacity constraint choke points within the system.

The panel examined both positive and negative

supply side factors that FAA should consider, that may affect demand-side forecasts in the future. These include factors that could increase system costs due to overall air traffic control handling limitations, congestion delay costs, air traffic or airport capacity constraints, and the resultant higher yields.

The panel focused on infrastructure-related factors which are seen as potential threats to the continued growth of air passenger demand, and those factors which represent opportunities to relax any potential constraints to growth

Airports are faced with unprecedented growth and many are landlocked. Transportation system management options are frequently discussed. Evolutionary changes like e-tickets are occurring now. Other options include actions that airlines can take: spreading peaks pricing peak-hour flights higher using larger aircraft reallocating flights between airports, say from National to Dulles. But all of these options represent real costs to the system. Further could they be implemented to the degree required to stave off airport expansion and further development to some point beyond the forecast time horizon? Many panelists thought not.

Funding

If a doubling of air traffic demand is to be accommodated over the next decade, major infrastructure investment in the air traffic control system (ATC) and airports will continue to be required. Sources of funding for this infrastructure must be identified and assured. To accommodate the projected demand in a safe and efficient manner in the national system of airports, it is estimated that airport and infrastructure maintenance and expansion will require investments of between four and ten billion dollars annually. Currently the FAA Airport Improvement Program (AIP) provides a significant portion of these requirements. In an era of federal government cutbacks, and greater reliance on state and local government initiatives, the panel felt that future funding for airports might be severely limited.

The large airports where the majority of investment will be required are more viable economic entities than smaller airports, and the potential exists to exploit nonaeronautical revenue sources to assist in meeting funding needs. In addition to AIP entitlement funds, passenger facility charges (PFCs) and traditional revenue bond approaches to financing, other creative financing can be developed for financing aeronautical and nonaeronautical projects.

The situation is far graver for smaller airports where there are few potential nonaeronautical sources of revenue. To be maintained in the national airports system, small nonhub and general aviation airports are

more dependent on government support than larger airports. Any significant loss of government funding support for these airports will likely result in a significant constraint on the demand for aviation, particularly general aviation. FAA has already discontinued set-asides for reliever airports, a potential disservice to large hub operations. Yet, failure to maintain smaller airports will increase demand on larger airports to accommodate projected traffic.

Many small communities are unaware of the value of their airport to their local economy and may be unwilling to approve the necessary investment to maintain it. This is particularly true of privately owned public-use facilities whose owners determine that an airport is not the highest and best use of their property. Once an airport is lost, long lead times and the cost for new airport development severely limits any potential for a replacement facility. The panel had some concern that the elimination of AIP set-aside funding for system planning and reliever airports would negatively affect smaller facilities. The primary funding source for these airports is AIP discretionary funding. Funding cutbacks could lead to some contraction of airports in the national airport system.

If government funding is substantially reduced, FAA might have to reprioritize infrastructure funding and reinstate set-asides for small public-use airports (reliever airports) and system planning. Further, with reduced FAA funding, aeronautical revenues might have to be increased. This will increase the cost of air travel and potentially dampen demand. Systematic reviews should be undertaken by FAA in regard to the costs, benefits and other issues involved in an overall funding shift from FAA to airports, air carriers, and general aviation.

State block grants versus direct federal funding was also discussed. With both facilities development and system planning projects competing for limited state funds, system planning is less likely to be funded. It is important to establish priorities through system planning in order to maintain the national system of airports. In addition the quality of individual state airport organizations varies. Not all have comparable funding or commitment from the State government. As a result these agencies are not uniformly capable of administering funding programs. While state control of funding may continue as a pilot program, it is not a universal cure.

Concern was also expressed about the dangers of some communities diverting aviation revenues to off-airport uses. Such diversion will increase the cost of aviation and decrease demand. It is vital that airport revenues stay on the airports and that investment dollars not be redirected to other activities.

Environmental Issues

Environmental issues, particularly opposition to aircraft noise, remains a serious threat to infrastructure development and thus to the unconstrained growth of aviation demand. Although the industry has made significant environmental gains in implementing noise abatement programs (e.g. engine retrofits and home insulation programs) and reducing runoff pollution at airports, public pressure will continue for further environmental remedies as activity levels continue to expand. Environmental opposition to industry growth presents an economic threat of escalating costs for the aviation consumers who indirectly must compensate for the costs of noise emission and runoff pollution programs. Environmental opposition, when successful, can result in outright prohibition of airport development. This results in increased cost of air travel as congestion grows, and as more expensive or less convenient alternate airport sites are developed.

Overall, environmental issues will continue to substantially delay airport capacity improvement projects that would help meet projected demand. Environmental issues impact all airports from the smallest general aviation to the largest commercial hub airport. The environmental concerns pose a major constraint on future expansion and growth. They loom as a primary threat to the future of the national airport system. Many federal environmental regulations are viewed as unfunded mandates by airport operators, further exacerbating the funding constraints discussed above.

General Aviation Issues

The projected growth of general aviation flying, as reflected in the current FAA forecasts, and the rebirth of the small piston engine manufacturing market, is a harbinger of an increased need for general aviation facilities. There may also be some new or revitalized smaller airports adjacent to communities resulting from industrial, commercial, and attendant general population dispersion in the United States.

With a shrinkage of small general aviation airports due to economic and development constraints—especially privately owned public-use airports (POPU) in the system—business and other general aviation aircraft will use larger airports, putting additional strain on capacity. Publicly owned airports are not decreasing in number and will have to pick up the resultant airport system deficiency. Reliever airports become even more important as this shift from privately owned public-use airports continues.

Business aircraft activity now accounts for a major new investment segment in the business aviation industry. The expanding practice of fractional

ownership allows more small business concerns to use private general aviation aircraft for their air travel in a cost-efficient way. This allows interested smaller business concerns ready access to sophisticated high-performance business aircraft through joint ownership. The growth of this program places additional requirements to provide upgraded facilities, particularly at smaller airports where accepting this new service means meeting the increased safety, security, and reliability needs of the industry.

Further information about fractional ownership and impacts on airports and infrastructure is contained in Appendix A.

In terms of FAA forecasting procedures, the panel noted that the 60-seat aircraft break in FAA forecast fields is no longer relevant. Commuter planes are becoming more like air carrier equipment, and air taxis are more akin to general aviation aircraft.

Airport Privatization

Internationally, the role of government in aviation is changing. In certain countries such as Canada, Mexico, and Australia, the government is getting out of the aviation business, including airports. The panel discussed the Canadian program, which is commercializing larger airports and privatizing smaller airports, as well as privatizing the air traffic control system. With primary reliance on user fees, this method of operating and maintaining the airport network seems to be working well in Canada. Under the Canadian program, the new operators, largely freed of public policy concerns, can adopt a businesslike approach to serving aviation demand. There has been a speed-up in decision making and in the overall ability of airports to respond more quickly to increases in demand. The new operators have worked to reduce airline user fees by developing non-aeronautical revenue sources. They have expanded their marketing staffs to attract new airline services. On the downside, profit-oriented airports can seek to optimize their financial position by delaying investment in airport infrastructure as long as possible.

The program works very well at major commercial facilities in Canada, but has yet to be proven at smaller airports. To what extent will airport privatization occur in the United States? The panel believes that state and local government ownership of airport facilities will continue. Those in favor of privatization see quicker decision making and faster implementation of capacity improvements at airports, but there is the specter of higher financing costs resulting from the generally higher cost of capital acquisition in the private sector. Privatized airports would not necessarily be tax exempt—adding another factor to a complicated formula.

In conclusion, many functions in airport operations in the United States will be outsourced or privatized, but total commercialization and privatization as in Canada will not occur. Over 80 percent of airport workers are presently employed by private firms.

New Aircraft

Regional Jets

The large number of regional jets entering the commuter airline fleets and the orders for narrow body 150-seat aircraft by the major domestic carriers portend both positive and negative impacts on commercial air carrier airports. The introduction and use of these aircraft needs to be monitored by FAA as well as other segments of the aviation industry in terms of airport facility needs and overall demand forecasting.

The jury is out on the impact of RJs. The substitution of an RJ for a smaller commuter aircraft on a spoke route to a connecting hub airport would offer the promise of better utilization—passenger growth being accommodated with little or no increase in aircraft movements. However, replacing larger domestic air carrier aircraft in longer haul markets with RJs could require more frequencies into the hub airport to accommodate demand. Also, any new direct RJ-served point-to-point markets hub busters bypassing the connecting hub airport will mean new service requirements at smaller commercial airports.

Additionally, what will the fares be on RJs? Could they be higher than existing commuter services? While many panelists believe that the RJs will successfully divert some intercity travel from auto to air, it is too early to know how substantial this will become. If RJs result in reduced service frequencies to smaller communities, a plausible scenario on a variety of accounts, passengers could divert from air to autos to reach major hubs for their air travel connections. In considering RJ operations at airports, some necessary modifications to terminal facilities such as expensive modification of existing jetways to accommodate the five-foot door sill height on the RJs may limit their use. To add further concern and balance to the overall industry optimism for the RJs, if general aviation runways cannot accommodate RJs at major airports, RJs would of necessity have to shift to regular commercial service runways.

Generally the bottom line appears to be that new aircraft orders for narrow body aircraft will, for the most part, replace older narrow body aircraft with little increase in capacity. Hence increased frequencies will be required to meet increased future demand.

New Large Aircraft

The panel felt that the next generation of very large aircraft would primarily serve international markets and therefore will only slightly impact facilities at major U.S. gateway airports. Also, new large aircraft could continue the long-standing trend of boosting airport productivity by increasing aircraft size. It was noted, however, that these aircraft will probably find a market only in the largest international airports, particularly in Asia, and will bring their own costs in terms of requiring airport facilities to be modified to accommodate 600-seat aircraft. Designs for the new larger aircraft have raised concerns among air carriers and airports about taxiway-to-runway wing-tip to wing-tip clearances, limitations on adjacent gate use, and in the air, wake vortex and trailing distance separation in the air.

Technology-General

Considerable optimism was expressed that emerging aviation technology, particularly in the air traffic control field would continue to boost airport productivity and allow more to be done with less. Global positioning systems, tilt-rotor aircraft and improved telecommunications were cited as examples of potential technological advances which could be exploited.

FAA-induced delays, such as radar outage at a major hub and flow control, are evidence of the need for system improvements and timely introduction of new technologies. New advanced avionics holds promise for increasing airport capacity, somewhat relieving airport expansion requirements. How effectively the integration of these technologies is handled is critical to the impact on airport development and system cost.

A concern voiced by members of the airports panel was the ability of FAA to implement new technologies in a timely manner. To many, FAA appears to be financially and institutionally incapable of keeping pace with new technologies. The panel believed that there are technological opportunities available for capacity enhancements to assist in meeting unconstrained demand. Underfunding is an ongoing problem. Further the slow performance of FAA in replacing a 20-year old radar system raises the question of whether the agency would ever be in a position to turn over technology every 5 to 10 years. State DOTs cannot be expected to handle any of the development of these efficiency improvements.

Safety & Security Issues

The panel believed that short-term safety and security

issues will not significantly limit airport capacity, but could entail some further costs to the users of the system in implementing more extensive passenger security measures. Security costs include sophisticated new baggage/passenger screening equipment and the added inconvenience to passengers subjected to more lengthy and inconvenient security procedures. All of this will add to the cost of air travel and work against demand. Cargo and mail security protection costs can also be expected to increase.

Safety is taken as a given. The high standards of airport/aviation safety must continue and there are no major developments foreseen which would alter this commitment. However, the full impact of the TWA 800 accident and the Gore Commission recommendations, when implemented, will have additional impact. The inability of small commuter airports to meet new safety and security measures could eliminate some of these airports from the commercial air service network.

Terminal Area Forecast

A presentation on FAA Terminal Area Forecasts was provided to the Airports and Infrastructures panel. The graphics for the presentation are in Appendix C. The panel concluded that FAA forecast provides needed tools for planning future airport capacity to meet projected demand. However, input to the forecasts—specifically the quality of operations data as reported on FAA Form 5010, used annually to update all nontower airports flight information—raises questions. A number of options are offered to correct this:

- Develop an operations estimating algorithm to check reliability of reported data based on a more reliable known data base, such as based aircraft;
- Work with the National Association of State Aviation Officials to encourage more extensive use of sampling techniques to estimate non-tower counts that have been successful in a few states such as North Carolina;
- Eliminate actual and forecast estimates for small general aviation facilities and group them into estimated blocks of airports, e.g. 0 to 25,000 operations, then do a more detailed estimate as activity levels are significantly altered.

Regional Planning Issues

External threats to the aviation industry projections also exist, particularly with regard to critical urban planning issues. Competition for land is removing available development capacity potential for airports. For the

airport and the community it serves, planning protection is inadequate to preserve environmental gains achieved through investments in new technology.

Concern remains about the adequacy of the highway access system to keep pace with the projected development for air travel. If a balance is not retained between the capacity of the airside, terminal, and landside components, the bottleneck will shift to landside access and result in escalating costs for the air traveler through greater congestion. Unfortunately, these regional planning issues tend to go beyond the immediate control of the industry.

Land Use Issues

Of growing importance to airport capacity is airport landside and off-airport development costs. There will continue to be growing competition for land use in airport environs. Further and continuing investment in highway and sometimes transit access is required to accommodate travelers, airport workers, and cargo shipments. Airport development must be planned and implemented in the context of total transportation planning. The passenger is not interested in getting from airport X to airport Y, but in when he must leave his home/office and when he will arrive at his ultimate destination.

Air Cargo

In reviewing FAA forecasts the panel viewed airports as unified entities comprised of roadways, terminals, aprons, runways, and more, and serving air passengers, air cargo, commercial carriers and private operators. Although not stated directly, this view implies that passengers are the primary clients of airports. Nonetheless, air cargo is showing significant growth—particularly at major hubs—and carries with it special needs and services. The overnight aspect of air cargo movement creates special problems for airports as well as special opportunities. Daytime passenger flights carry cargo as well as luggage, but cargo volume is limited both by capacity and by the need for quick aircraft gate turn-around times.

Cargo adds bulk to the airports—in the size of the parcels, shipments, truck movements, and containerization. Containerization may demand more airport space if trends in intermodal cargo transfer spread beyond ships, rail, and trucks to the air mode as well. As airports look for better property utilization on their land-constrained sites, off-site but near the airport air cargo development becomes more desirable. It too has to compete with other land uses in the airport area. Good road linkages both to the airport and to the regional highway grid are a necessity for such off-

terminal sites.

The growth of cargo, and especially the demands of containerized intermodal cargo have to be carefully assessed by airport operators and by FAA in projecting future demand. A paper entitled *Freight Intermodal System* is contained in Appendix C and provides an introduction to the intermodal cargo concept.

Telecommunications Issues

Although outside the specific issue of airport and infrastructure planning, the panel believes that as younger people consider their future business options, some will choose the Internet over air travel. While reaching no conclusions on this subject, the panel notes that the issue of telecommunications as an alternative to air travel is real and should be monitored closely for its impact on future forecasts. The impact of telecommunications technology and the ability of this population to maximize use of this technology may affect the frequency of business travel, especially as costs increase.

On one hand the panel saw conducting business on the Internet as a factor reducing demand—business can be conducted on a computer. On the other hand such communication could also generate increased demand for face-to-face contact. Likewise, last-minute air ticket purchases at reduced costs are already a reality on the Internet. This will both fill airline seats and add traffic.

Powerful, user-friendly communication technology tools will be available for computer literate and computer-comfortable managers. The panel cannot quantify how these dynamics may affect the need for routine business travel. Airport infrastructure planners and airlines should consider the future in the context of advancements in communications technology. The airlines have already recognized its importance to certain segments of the traveling public, by providing special amenities including phone, modem, and fax capabilities. In order to encourage the continued use of air transportation, airports can also develop and market facilities, including business centers, to meet travelers' needs. Entire packages of air-hotel-land transportation must be assembled into single purchase packages to meet the specialized needs of specific segments of the passenger population.

Conclusions

Passenger demand is a function of the economy and the cost of air travel. The panel concluded that there would continue to be a strong demand for air transportation over the next decade.

The general conclusion reached by the panel was that over the short run (the next five years) airports are

not likely to pose a serious constraint on the realization of FAA demand forecasts. However, increasing airport costs—both out-of-pocket and delay-related—could represent a larger share of air carrier costs, and these are generally reflected in the yield assumptions that FAA has issued in the forecasts.

With short planning horizons, long lead times for approval/implementation of airport projects, limited funding resources, and lumpy investments (where projects are funded incrementally) capacity constraints will occur. This will result in higher costs to the industry either in increased user fees or aircraft delays. However, the panel concluded that airports and airlines should cooperate more closely to facilitate passenger and cargo processing and thereby improve customer service.

Over a longer term, it is not clear whether the current airport infrastructure can accommodate the forecasted doubling of aviation demand without severe strain. There are few signals that capacity problems are emerging, but the onset of significant delays occurs very rapidly at individual sites as the system approaches capacity.

In spite of environmental and land use issues, approximately one-third of the 30 largest U.S. airports have new runways in planning or under construction. According to FAA, the current delivery schedule is one runway per year. Given limited AIP funding levels, this delivery rate was considered optimistic by some panelists. It was the panel's feeling that this pace is too slow and could threaten the FAA forecast. Because of the long lead times involved, additional infrastructure projects need to be started now to keep pace with growth. If additional capacity cannot be achieved, costs will rise and some diversion to automobiles or new telecommunications options can be expected.

It was also noted that, following the construction of Denver International Airport, no new U.S. airports have been planned. More attention will likely need to be paid to the aviation infrastructure question in future workshops.

Advanced technology, improved efficiency of airport operations, and the potential increase in size and productivity of new aircraft will offer some relief for accommodating increased passenger demand without airport expansion. Considering the current status of the national system of airports and the estimated costs of new investments required for airport and infrastructure maintenance and development, the panel suggested that FAA carefully review the costs implied by the unconstrained traffic forecast and the resulting potential impact on demand.

Whatever the outcome of specific issues, the panel recognized that airports must be viewed as a system—serving passengers, cargo and aircraft activity—rather than as individual airports. This is critical to understanding airport problems. Airports, rather than ATC, will likely be the cause of system

constraints.

FLEETS AND MANUFACTURERS

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Introduction

The discussions of the Fleets and Manufacturers panel consisted of three parts. First, the entire panel met with panels on Domestic Air Carriers, International Airlines, and Regional and Commuter Airlines. (The report of this joint activity is the first article in this panel discussion series.) Second, a review of the forecasts submitted by each participant prior to the formal conference was compared with a consensus set of figures derived from the data. Third, discussions were held about the forecasting issues identified as key issues and those that were difficult to assess. Additional consideration was given to the issues raised in the joint meeting to determine the points of view expressed by the airline panels.