

Aviation System Planning

Addressing Airport Infrastructure Needs

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As demand for air transportation continues to grow, it will become increasingly difficult to accommodate the resulting traffic levels without significantly expanding airport infrastructure. However, many larger airports are already constrained in their ability to expand, and surrounding communities often strongly resist the construction of additional runways. A growing number of metropolitan areas, therefore, will need to use secondary airports or even construct new airports. Trends in general aviation (GA) will pose new challenges to maintaining a viable system of GA airports, and the continuing shift toward making transportation investment decisions from an intermodal perspective will require increased attention to the broader context of airport development.

The current state and regional aviation system planning process attempts to coordinate the development of individual airports and to address larger system issues, including the relationship between air transportation and the rest of the transportation system. In practice, this coordination often leaves much to be desired:

- Individual airports pursue development agendas with little regard for the rest of the system;
- Agencies frequently prepare system plans without the resources to address increasingly complex issues;
- It is difficult to keep system plans updated to reflect changing situations and evolving airport development plans; and
- Capital investment decisions are not well linked to the system planning process.

As a result, the aviation system planning process must be strengthened, and coordination of system planning and development decisions at individual airports must be improved. This will require a better understanding of the issues that system planning must address and the value of improving the way they are addressed; it also will provide objective ways to measure both the effectiveness of system planning and the aviation system's performance in meeting user needs.

CURRENT ISSUES AND DIRECTIONS

Aviation system planning primarily takes place at the regional and state levels, and the National Plan of Integrated Airport Systems uses these state and regional plans to identify near-term development eligible for federal aid. There are several key issues that will have an impact on the future context of aviation system planning.

New Aircraft Types

New large aircraft (NLA) in the form of 600-passenger jets are likely to become a reality between 2005 and 2010, depending on when Asian economies recover from their current financial difficulties. NLA will be used in Asia to reduce congestion at major airports, as well as for links to Europe and the United States. In the United States, major airports have already begun to commit millions of dollars to upgrade the infrastructure to handle the NLA's wider wingspans and longer fuselages.

A few years later, 800-passenger jets are likely, with even larger aircraft possible by 2015 to 2020. Increasing numbers of NLA operations may complicate air traffic control by requiring greater separation between aircraft, reducing the hourly operation rates, although the number of seats per hour will probably increase. Landside facilities will experience sharper traffic peaks.

Regional jets will have two important effects. First, they will improve service in currently marginal markets and make many more city-pair combinations feasible, both operationally and economically. Second, airlines will be able to link midsize city-pairs with direct, nonstop regional jet service, bypassing the currently-used transfer hubs.

Regional jets might add to the airside congestion at larger airports, particularly at transfer hubs, because they generate additional traffic. But this problem might be offset by their use to provide direct service in markets that otherwise would be served only via hubs.

Funding

Airport Capacity

Airport capacity and funding will continue to constrain the expansion of air travel. New aircraft types, while stimulating the demand for air travel, also will require expensive improvements, especially for the major airports. Creative funding approaches, such as private venture capital, will be needed to supplement established financial sources. Airports will continue to raise as much of their revenues as possible from nonaeronautical sources, such as parking and retail operations or passenger facility charges.

Because of the funding required to provide adequate capacity at the nation's commercial service airports and the need to upgrade the national airspace system, federal funding for GA airports will be increasingly competitive. State and local governments will need to assume a larger role in the development of the GA system.

Aviation System Planning

The Airport and Airway Development Act of 1970 gave aviation system planning a major push through dedicated funding. But now funding specifically for system planning is no longer available, and federal involvement is concentrating on the development of the commercial aviation system. States and regions face a major challenge in continuing aviation system planning that effectively addresses the needs of both commercial and general aviation despite reduced federal support.

System Development Criteria and Project Priorities

The successful implementation of an aviation system plan requires an effective capital improvement program. This determines which of the many system needs are to be developed, in what time period, and with what funds. Better objective criteria and guidance are needed to help aviation planners balance competing system needs.

Private Airports in the State and Regional Systems

Privately owned airports traditionally have been excluded from public funding. Nonetheless, their role in meeting GA needs is being recognized increasingly as important, and it might be time to reconsider this policy.

Planning Issues

Demand Management

Through demand management, some regions have succeeded in attracting GA to airports that are less expensive to improve and that have the least environmental impacts. The demand management approach also might be relevant in addressing congestion at major commercial service airports. More studies are needed to document the effectiveness of demand management, and to develop guidelines so that this approach can be better understood.

Requirements for General Aviation Airports

Increasingly, access considerations are driving GA system planning. Which communities need their own airport and what types of airplanes should each airport handle? The airport planning literature and the Federal Aviation Administration (FAA) system planning guidance are largely silent on these issues. Analysis tools, improved methodologies, and sound criteria for system accessibility are needed.

Air Cargo

Air cargo continues to be overlooked in system planning. Air cargo development has been hampered by landside congestion, inadequate investment in modern facilities, limitations on the amount of cargo that can be carried on passenger aircraft, and nighttime curfews that restrict air-freight operations. As the economy grows, new cargo facilities with improved access will become a higher priority in system planning.

Landside Access

Airport ground access, facility development, and project funding will continue to be important challenges for aviation planners because of the complex institutional environment. Commercial service airports typically serve passengers and freight from a wide geographical area. Many local government jurisdictions and other agencies, including transit and rail authorities, environmental agencies, and transportation departments, have responsibilities that overlap and affect airport ground access. The appropriate future role of each mode must be defined, and connectivity between modes must be addressed.

AVIATION SYSTEM PLANNING—BEST PRACTICES

Aviation system planning is experiencing a shift in intergovernmental relationships, resulting in closer links with traditional transportation planning. The following aviation system planning studies represent the state of best practice in the United States and abroad.

Aviation System Planning in California

The California Aviation System Plan (CASP) is prepared by the California Department of Transportation (Caltrans) with the goal of developing and preserving a balanced system of airports responsive to the needs of the state. This process considers the interdependency

among airports, airspace, public demand for aviation facilities, and ground access to airports. It also takes into account the interactions of local, regional, state, and national aviation needs.

The CASP strategy follows a continuous system planning process that includes

1. Aviation elements of Regional Transportation Plans and Regional Aviation System Plans (RASPs); and
2. Interregional aviation system plans developed through partnerships coordinated by the Caltrans Aeronautics Program for regions outside the major metropolitan areas.

Annually, Aeronautics submits to FAA a five-year proposed list of planning projects, which serves as the basis for FAA's funding of aviation system planning in the state.

During the current CASP update, Caltrans obtained FAA system planning funds that were passed through to the Regional Transportation Planning Agencies (RTPAs) in central California to conduct continuous aviation system planning for the Central Valley region. Members of the RTPA Aviation System Planning Committee from the region helped Caltrans aviation planning staff develop the scope of work and budget for what was to become the Central California Aviation System Plan (CCASP).

To facilitate development of CCASP, Caltrans formed a Technical Advisory Committee, composed of RTPA staff and airport managers from the region and other aviation interests. This committee guided development of RASPs by each of the ten RTPAs involved. These plans included elements addressing the regional setting, aviation issues, existing airport facilities, policies and financial resources, system requirements, an action plan, and conclusions. When all ten RASPs were completed, Aeronautics staff worked with the CCASP committee to combine all of these plans into one CCASP.

Airport System Planning in Washington State

The Washington State Department of Transportation (WSDOT) Aviation Division and the Puget Sound Regional Council (PSRC) are building a cooperative planning program that includes coordinated efforts to address issues of mutual concern. These issues include data collection and analysis, pavement management, forecasting methods, policy development, land use encroachment, capital improvement programs, and aviation funding. The joint goal is to develop clear, concise information for regional decision makers and for the state legislature.

Concerned about a trend of incompatible land use encroaching on airports, the state legislature amended the Washington State Growth Management Act (GMA) in 1996 to require cities and counties to protect airports. The provision called for the WSDOT Aviation Division to provide cities and counties with technical assistance, which led to the creation of the Airport Land Use Compatibility Program. The role of the program is advocacy and partnership. The WSDOT Aviation Division and the Washington State Department of Community, Trade, and Economic Development together support municipalities in amending their comprehensive plans and development regulations to allow for compatible land use development around airports.

In cooperation with WSDOT, PSRC is using its authority under GMA to require cities and counties in the region to document their efforts to avoid development of new incompatible land uses adjacent to public use airports. This requirement has caused local

planners to consider the technical aspects of planning around airports and has created a forum in which airport professionals and local planners can discuss the issues.

PSRC also is beginning to integrate airport development needs and airport surface access needs into the regional metropolitan transportation plan (MTP). The objectives for this program are threefold:

1. To document and consolidate regional airport funding needs;
2. To identify airport access needs; and
3. To provide a method for giving priority to projects that meet overall MTP goals and identified airport access needs.

One of nine policy focus areas used to develop PSRC's 1999 Transportation Improvement Program under the Transportation Equity Act for the 21st Century will give priority to projects that address local traffic impacts associated with the rapid growth of Seattle-Tacoma International Airport. The initiatives will seek to improve access to the airport, including highway and high-capacity transit projects and traffic-system management strategies.

European Approaches to Aviation System Planning

System planning requires a strategic view of the future, acknowledging uncertainty while making normative decisions. For example, the Dutch government undertook a set of studies to decide on the appropriate degree of development to allow at Amsterdam Schiphol airport. A set of economic scenarios was meshed into a set of air transport scenarios to give three possible future scenarios, recognizing the uncertain nature of the future context. The consequences for Schiphol traffic and for the based carrier, in terms of its ability to compete with other European hubs, were examined for each scenario. In addition, traffic models were used to assess the impact of different management policies on the scale and composition of the traffic. Decision makers could then respond to future growth, influencing the balance between economic and environmental impacts by adjusting the makeup of traffic to minimize environmental impacts and maximize economic benefits. The value of this approach was diluted by a political decision to limit capacity to a given level of passenger throughput rather than allowing the market to decide how to stay within defined noise limits; however, this capacity limit now has been lifted.

Downstream controversy can be avoidable through early public consultation, building consensus on how the issues are to be resolved. For example, for the new Oslo airport at Gardermoen, the terms of reference for the environmental impact assessment were established in advance. Effective involvement of the local community in regional airport development also requires guarantees of future control of impacts. To increase the likelihood of gaining permission to construct a second runway, Manchester International Airport in the United Kingdom agreed to the external monitoring of noise levels and of the quality of its own noise monitoring.

For politicians to support airport expansion, society itself must be convinced that more air travel is beneficial. Economic benefit analyses have fallen into discredit by failing to take a net rather than an absolute approach. To show the planning inquiry how a decision against approving Heathrow Terminal 5 (T5) might affect the overall economy, British Airways consultants estimated the percentage of increase in costs that this decision would cause for

each sector of the United Kingdom's industry. Although intending to demonstrate the additional costs of providing services without T5, this approach was more likely to convince a neutral observer of the value of additional air service than the more usual approach of counting jobs in an industry that only exists to support other economic activity.

DOCUMENTING THE VALUE OF AVIATION SYSTEM PLANNING

The need for aviation system planning is often believed to be self-evident—yet there are good reasons to document its value systematically. Recent changes in federal funding for aviation planning have eliminated the specific allowance for system planning, though FAA still can allot discretionary funds. System planning activities therefore must compete against other planning needs, such as airport master plans. FAA could benefit from guidance on the amount of funding appropriate for system planning. Moreover, there is the question of whether enough money is being spent on planning activities, considering the complexity of the issues and the recognition that aviation should be examined in the broader, multimodal context.

Development programs at major airports easily could exceed \$1 billion, and the difference in annual operating and delay costs among alternatives to meet future capacity needs is often many millions of dollars. Failure to address all the issues adequately could lead to poor decisions, or at the least, to significant delays in implementing the selected system. The less thorough the evaluation of the alternatives, the stronger grounds opponents have for challenges—and the greater their chance of prevailing. Of equal concern is the delay in providing adequate capacity to meet the demand for air transportation. In too many metropolitan regions, airports are approaching capacity without any agreement on whether to expand—and if so, how—or to develop new airports—and if so, where.

Although the needs for future investment in airport infrastructure have been documented (*1*), the funding requirements for the planning studies necessary to implement these investments is not well understood. There is a pressing need for research to assess the cost-effectiveness of different levels of investment in system planning and to determine how to tailor the nature and scale of system planning studies to the issues being faced. Equally important is the need to assess the effectiveness of different system planning methods and techniques. Merely spending money on system planning is not enough if the planning process fails to resolve the issues of concern.

MEASURING THE PERFORMANCE OF THE AVIATION SYSTEM

The first section of this paper discussed some of the significant changes anticipated in the aviation system in the new millennium. Aviation system planners will need to predict and analyze the impacts of these changes, modify plans as necessary, and assess the actual impacts after the changes occur.

Individual states and the federal government have developed a range of metrics, data sources, and measurement approaches to evaluate aviation system performance. Following is a brief overview of performance measurement in aviation system planning and of the evolution necessary in approaches to measurement.

Managing Change Through the Performance Measurement and Improvement Cycle

Aviation system performance is usually managed in a cyclical process in which planners identify strategies for addressing expected changes, improvement opportunities, or aviation

system user needs and then predict their expected impacts on performance. Those predictions are used to determine which strategies to implement. After implementing the strategies, the performance of the system is measured and compared with the performance baseline and predictions. The results of those comparisons are then used to support future decisions and plans.

State, Regional, and Federal Aviation System Performance Measurement

The need for clearly defined goals, implementation strategies, and metrics is a common issue among state and federal transportation departments. For example, the Minnesota State Aviation System Plan has several goals, including

- 90 percent of the state population should be within 30 miles of a paved and lighted system airport, and
- 90 percent of the population should be no more than 60 minutes driving time from an airport with scheduled air service.

These attributes can be measured and can serve as yardsticks of system performance. Factual quantitative performance assessments are needed to support sound planning decisions, and the metrics must be selected specifically to support those decisions. Descriptions of some of the metrics used by the nation's airports, regions, and FAA follow.

Individual Airports

The federal government and individual states have developed a range of metrics to assess airport performance. FAA's *National Plan of Integrated Airport Systems* contains metrics for measuring airport capacity, safety, noise impacts, pavement condition, airport accessibility, and financial performance (2). Arizona's *1995 State Aviation Needs Study* defines three categories of performance metrics: facility, service level, and economic (3). The *Minnesota Aviation Performance Report* focuses on the safety, economics, and reliability aspects of performance (4).

It is important to recognize that each airport is embedded in a series of larger systems: the region, state, national airspace system, and global aviation system. Improvements at the airport level may not achieve the intended results if performance at a higher system level is not considered. For example, expanding airport capacity might not produce the intended benefits if congestion in surrounding airspace limits the number of operations.

Regions

The metrics used to measure the performance of regional systems of airports are often similar to those used for individual airports, but they can be supplemented with metrics that assess the system's performance in meeting user needs (5).

National Airspace System

FAA recently has developed a set of metrics for the safety, security, flexibility, predictability, and accessibility of the national airspace system, as well as for the delays experienced by NAS users (6,7). Specific metrics include the predictability of flight times, the elimination of air traffic control preferred routes, and the operation and availability of FAA equipment and services.

Performance Measurement Evolution

The metrics that planners currently use can be expected to evolve as demands on aviation systems change. Which metrics are emphasized, how they are calculated, and what target performance levels are established might require changes. To plan for changes in aviation systems and to measure and improve operational efficiency afterward, planners will need to review and revise their performance measurement approach periodically.

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