

# Economic Impacts of Improving General Aviation Airports

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Every state and many communities face the issue of setting priorities for investments in airport facilities. This issue has received the most public attention regarding the regional economic importance of investments in major new commercial airport facilities but relatively little attention has been given to the role of general aviation (GA) facilities. As a result, the issue of investment priorities is particularly problematic for GA airport facilities because their contribution to local and state economies is not well understood. The state and local economic impacts of GA airports are defined and measured, and the benefits of improvements to those airports are assessed. General aviation today is briefly summarized, and the measurement of airport benefits is examined with particular attention to the different approaches for economic impact analysis. Results are presented from a survey of businesses that use GA, which focused on the relative importance of GA for those businesses. A basic model system for evaluating GA benefits, developed for the Massachusetts Aeronautics Commission, is presented.

General Aviation (GA) refers to private aircraft that are not used for scheduled air services (passenger or cargo) or for military uses. Typically GA aircraft are small, propeller- or jet-powered airplanes or helicopters that may be owned by individuals or by corporations. Aircraft available for charter services (air taxi) or flight training are included in the GA category as well.

Contrary to the popular view, flying private planes is far from just a recreational activity. Nationally, according to a survey by the Aircraft Owners and Pilots Association, it is estimated that at least 26 percent of the GA fleet is operated exclusively for business and that 60 percent is used at least partly for business purposes. Other key findings from prior studies are as follows:

- Nationally, an estimated 34,000 firms operate 68,000 private aircraft.
- Of the Fortune 500 list of largest publicly held U.S. corporations, 363 operate their own business aircraft (1).
- Business turboprops and business jets in North America now number over 10,000, and are growing at a pace of over 3 percent annually (2).
- More than two-thirds of all business aircraft trips make use of GA airports rather than commercial air terminals (3).

Nationally, the importance of corporate access to GA airports is increasing as manufacturing and other corporations decentralize. As noted by one executive:

In this day and age, if you don't have a good all-weather airport, you're substantially jeopardizing your ability to grow and attract business. The more we grow, the more of a problem it becomes to us. The more reason we have to travel around (4).

## MEASUREMENT OF AVIATION BENEFITS

GA facilities (and improvements to those facilities) can provide a range of potential benefits:

- **User Benefits.** Provide travel time and operating cost savings, as well as safety improvements, for travelers.
- **Economic Benefits.** Promote business expansion and attraction by generating jobs and business income and by providing necessary facilities to attract new businesses.

User benefits of an airport or airport improvement result in subsequent economic benefits for business expansion and attraction.

### User Benefits

Transportation system efficiency impacts from transportation projects are evaluated through user benefits. For any given transportation improvement, the aggregate economic value of time savings, out-of-pocket cost savings, and safety improvements for all travelers can be compared to current or base case conditions. User benefits associated with a project can then be compared to the costs involved and can also be used to compare the net benefits of alternative projects and for ordering projects by priority in statewide airport system plans. Such a process is actively used by the state of Wisconsin in its statewide Airport Benefit Cost computer system and also in FAA's Airport Data Analysis microcomputer program.

Application of benefit-cost analysis on the basis of transportation efficiency (user) impacts is a respected approach used in project evaluation for highways and seaports, as well as aviation facilities. However, it is increasingly being recognized that user benefits can understate the full economic benefits of a project, particularly when the proposal is a new facility or expansion of an existing facility that is motivated by its potential role as a catalyst for local economic development.

### Economic Benefits

Much confusion exists about how to measure economic impacts of GA airport facilities. In fact, different measures are appro-

priate depending on the policy questions, which may include the following:

- What is the value of an airport to the economy of its surrounding community or county area?
- What are the economic benefits of improving an airport, compared to the costs involved?

### Role in the Economy

Airport promotional literature often describes the airport's economic importance in terms of its involvement in many aspects of the local economy. Economic roles of an airport are determined by counting the value of sales, employment, and payroll of fixed-base operators, airport-related services, and all businesses that depend on or use the airport in some way or another. Thus, this method essentially gives credit by association and overstates the economic value of an airport by giving credit for all the business activity that ever uses the airport. Local airport proponents like this method because it can generate big numbers favoring airport improvements.

### Economic Contribution

Economic contributions of an airport are measured by accounting for revenue received by businesses in the community as a result of the airport activity and is generally a more sophisticated measurement. Included are not only spending at the airport for landing and storage fees, fuel, and maintenance, but also spending at hotels, restaurants, and retail stores by travelers visiting the community because of the airport. Economic contribution further includes indirect and induced spending flowing to other businesses in the community as a result of the additional worker income and business orders. Economic contribution may be measured in terms of business sales, employment, and business activity generated by construction of airport improvements. One adjustment that should be (but is not always) made is to distinguish the actual share of revenue that stays as income for residents of the community from the share of revenue that flows out to suppliers or manufacturers located elsewhere.

Economic contribution does not count benefits for local businesses that depend on or use the airport except insofar as they spend money at the airport. If an airport improvement saves time and lowers cost for businesses or attracts new industry or tourism, no further benefit is recognized unless reflected in projections of local spending. However, this measure also counts local spending generated by an airport project regardless of whether it is newly generated air travel or merely travel shifted from a neighboring airport. For this reason, economic contribution may be used for summarizing the local economic impacts of an airport, but is not appropriate for ordering of statewide projects by priority.

### Net Economic Benefit

Net economic benefits are measured as income to residents generated as a result of maintaining or improving an airport

compared to a base case of not maintaining or improving that airport. This benefit measure has three components:

- Local income generated as a result of business expansion from increased direct user spending at the airport and in the community, as well as from indirect and induced business growth;
- Local income generated as a result of additional jobs because of new business attraction made possible by the airport improvements; and
- Additional value of user benefits (time and cost savings) associated with nonbusiness travel by local residents and existing visitors, who do not generate any increase in their spending because of those additional user benefits.

For statewide evaluation, any local income benefits associated with trips shifted from other airports in the state are rightfully excluded as merely intrastate distributional shifts. An input-output model would be used to identify and exclude that portion of spending that flows to out-of-state suppliers.

### ANALYSIS MODELS

Measuring economic benefits of GA airport projects is a major accounting process but a variety of microcomputer analysis tools are now emerging to aid the process. California's Economic Impact Model (5) provides a framework for assessing local impacts by measuring economic contribution and potential business attraction and includes a suggested survey of local airport users to provide additional data. Wisconsin's Airport Benefit-Cost Model (6) provides parallel accounting both of user benefits and of net economic benefits (compared to costs) from local and statewide points of view and also includes default statewide averages for valuation of user and local spending benefits. The Massachusetts Airport Impact Model (7) provides a method for estimating changes in airport business usage, economic contribution, and business attraction on the basis of characteristics of the airport improvements, its service area population, and the area's economic profile. Results from a Massachusetts survey and an impact model built on the results will be the focus of the following discussion.

### SURVEY OF BUSINESS USERS OF GENERAL AVIATION FACILITIES

The hardest part of evaluating economic impacts of airport projects is not estimating the local spending that is generated, but rather, assessing the additional impact of airport facilities on attracting new businesses or keeping existing businesses from leaving. Although many local and regional economic factors come into play, a basic understanding is needed of how different kinds of businesses currently depend on GA airport facilities for their existence, location, and expansion decision making. Such considerations can be addressed by the following questions:

- What kinds of businesses use GA? In what ways? How important is access to GA for those various types of businesses?

- What alternative options would be feasible for these businesses if the GA access were not maintained? To what extent would businesses shrink, relocate, or close?

- What role does current GA access play in business location and expansion plans? What role would future changes in GA access play in affecting future business location and expansion plans?

- What types of improvements can be made to airport facilities to enhance business use of GA? How can that support the economies of communities and the state?

These questions help to address the fundamental question of the regional economic consequences of changes in the availability and quality of GA airport facilities and services.

In order to better understand these matters, a survey was conducted by Cambridge Systematics for the Massachusetts Aeronautics Commission (8) of businesses owning or operating GA aircraft. Mailback surveys (Figure 1) were sent to all aircraft owners that were businesses or who voluntarily reported use of their aircraft for business purposes on their Massachusetts registration. Out of 3,000 registered owners in the state, approximately 1,000 aircraft owners fit these criteria and received the survey. Exactly 250 completed surveys were returned. Key findings are summarized in the following sections.

#### Breadth of Business Use of General Aviation

A wide variety of businesses own or use GA in Massachusetts, as shown in Figure 2. Services, including consultants, lawyers, doctors, and advertising firms, made up the largest group and represented over 35 percent of survey respondents. Manufacturing contributed another 19 percent of all business users and was dominated by computer, electronics, and machinery manufacturers. An additional 32 percent of the survey respondents were engaged in diverse industries such as wholesaling, retailing, construction, utilities, agriculture, and fishing. Finally, 14 percent were engaged in educational services or transportation services (primarily flight training or aircraft charter services).

Firms using GA in Massachusetts were found to be of all sizes. Although 60 percent had under 25 employees, many manufacturing firms surveyed employ over 2,000 workers.

The survey showed that GA is used by businesses in many different ways. Roughly 67 percent of the firms said they use GA to transport staff, visitors, or clients. Receiving supplies and shipping products accounted for 6 percent of the use, whereas aerial surveying accounted for 4 percent. Other uses were flight training (3 percent), other miscellaneous business uses (4 percent), and nonbusiness use (16 percent).

Not surprisingly, the way businesses used GA differed significantly by the type of business (see Table 1). For utilities, aerial surveying and delivering of products were the major uses of GA. Delivering products and receiving supplies were also particularly important uses for high-technology electronic equipment manufacturers, and for businesses engaged in wholesale trade. Aerial surveying was found to be an important use for businesses engaged in agriculture, real estate sales, and spotting schools of fish.

#### Importance of GA for Business

Many methods exist to assess benefits businesses receive from GA but one method uses a minimum estimate of the productivity and cost-saving benefits for businesses. Such benefits are measured in terms of what firms are willing to spend on GA in terms of capital and operating costs. If the premise is accepted that businesses typically decide to spend money on aircraft only when the value for the firm exceeds the cost of acquisition and operation, then the annual level of spending on GA represents a minimum estimate of its true economic benefit to business.

From the survey, average annual expenditures for GA aircraft was \$11,000 of operating expenses plus another \$13,000 of annual capital costs. Given an average business fleet of 1.7 aircraft, total spending on GA averaged \$40,000 per business.

Businesses were asked how they would respond if their base airport were no longer available for their use (see Figure 3 and Table 2). Overall, 66 percent of the firms reported that they would use the next closest airport or make fewer trips. Another 8 percent reported they would substitute another mode of transportation. Of particular concern, however, was the finding that 19 percent of the businesses reported they would relocate and 7 percent reported they would go out of business. Although the latter response may be an exaggeration of the true impact, it nevertheless highlighted the seriousness with which some businesses view their access to GA airport facilities. Also notable was that the incidence of reporting these impacts was highest (over 20 percent) for businesses engaged in agriculture, fishing, utilities, retail trade, finance, and real estate. Surveyed businesses that reported they would relocate or go out of business accounted for 8,050 employees and \$2.2 billion in sales. If these survey results are taken at face value, then the total statewide impact of GA access is even higher because the survey accounted for just 25 percent of all businesses using GA in the state.

Interestingly, these results are consistent with other survey questions that asked businesses about the relative importance of proximity to a GA airport in their original site selection decision. Approximately 23 percent of the businesses considered it an essential factor.

These survey findings are of interest because they highlighted the importance of GA airport facilities for the location decisions of some businesses. However, the findings also left many questions unanswered:

- Are stated intentions to relocate or close in response to such a hypothetical situation a good prediction of actual behavior?

- To what extent would businesses actually close or relocate in cases where GA airports were downgraded or closed?

- If businesses were to relocate, would it be to another community within the same state?

Businesses reporting they would not go out of business or move out of state were asked to estimate how much their sales volume would change and how much their transportation costs would change. Of the businesses that would not relocate or close, 40 percent reported they expected their sales volume to decrease with an estimated average loss in sales (including businesses that expected no decrease) of \$1 million (15 per-

1. What is your firm's primary product or service?

2. What size is your firm?

Number of people

Annual sales

3. Do you ever use general aviation aircraft for your business?

yes  no

If YES, skip to Question 4 and complete remainder of the survey.

If NO, answer question 3a and do not complete the survey.

Please be sure to return the survey form. Thank you.

3a. Have you ever considered using general aviation for your business?

yes  no If YES, why haven't you used it?

4. Is your firm's aircraft (Check as many as apply)

- business owned
- owned personally
- leased
- chartered

If business owned, is the aircraft

- used exclusively by the business
- leased back to a FBO from a charter or rental
- used jointly with another business

5. What type(s) of aircraft do you use?

Make/Model	# of Aircraft
27	29
31	33
35	37
39	41
43	45
Total In fleet	27

6. How much does your firm spend for

aircraft operating expenses per year \$

aircraft capital costs per year \$ (lease payments, equipment purchases, depreciation, etc.)

7. What percent of your firm's total transportation costs are spent on general aviation?

%

8. In the future, does your firm plan to (Check as many as apply)

- increase the number of aircraft owned
- decrease the number of aircraft owned
- make no changes to the fleet
- upgrade the fleet

9. Estimate the TOTAL number of HOURS PER YEAR that your aircraft is used for BUSINESS purposes?

hours

10. What percent do these business trips represent of your aircraft's TOTAL tripmaking?

%

11. Estimate the PERCENT of total aircraft use attributable to transporting

- 75 % staff/executive transport
- 76 % visitors/clients
- 81 % suppliers/contractors
- 84 % receiving supplies (incoming)
- 87 % delivery of products (outgoing)
- 89 % aerial surveying
- 93 % non-business use
- 96 % other (specify)

100% Total

12. Where is your firm's aircraft based?

Massachusetts: → → Please specify airport name or code:

- Connecticut
- New Hampshire
- Vermont
- Maine
- other state (please specify)

13. What are the five primary airports that you fly to in MASSACHUSETTS, and approximately how often do you go to each?

Airport Name or Code	# of Times Per Year
1. 106	111
2. 114	113
3. 120	127
4. 128	138
5. 138	143

14. When you were selecting a site for your business, how important was proximity to a general aviation airport?

- not a consideration
- moderately important
- very important
- essential

15a. What would be your response IF your BASE AIRPORT were no longer available for your use? (Check as many as apply)

- substitute other modes, e.g., bus, truck, rail
- use next closest airport (specify)
- make fewer trips
- relocate business
- go out of business
- other (specify)

15b. How much do you think your business/ sales would change? (Estimate PERCENT CHANGE.)

- remain the same
- % higher
- % lower

15c. What would you expect your firm's transportation costs to be?

- remain the same
- % higher
- % lower

16a. What would be your response IF your most frequently used DESTINATION AIRPORT were no longer available for your use? (Check as many as apply)

- substitute other modes, e.g., bus, truck, rail
- use next closest airport (specify)
- make fewer trips
- relocate business
- go out of business
- other (specify)

16b. How much do you think your business/ sales would change? Estimate PERCENT CHANGE.

- remain the same
- % higher
- % lower

16c. What would you expect your firm's transportation costs to be?

- remain the same
- % higher
- % lower

17a. What is the most important improvement that needs to be made to general aviation airports? (e.g., runway, nav aids, services provided, etc.)

Kind of improvement: \_\_\_\_\_

Airport: \_\_\_\_\_

17b. How would this affect your business?

- % increase in sales
- % decrease in business costs

Please use the space below to elaborate on any of your answers or to describe an occasion on which your aircraft played a major role in your business.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

If we have any further questions, may we give you a call? All responses will be strictly confidential.

Contact Person: \_\_\_\_\_

Firm: \_\_\_\_\_

Telephone: \_\_\_\_\_

Thank you very much for your time and effort.

FIGURE 1 Survey instrument.



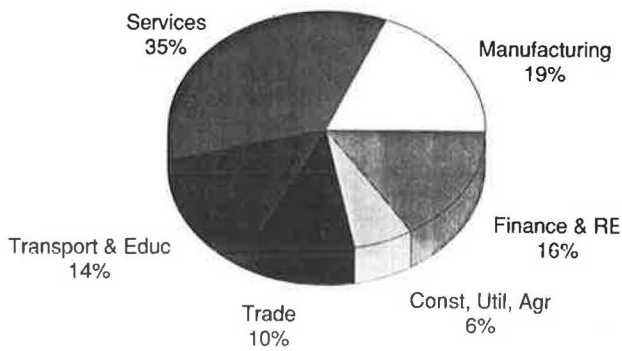


FIGURE 2 Business type of general aviation users.

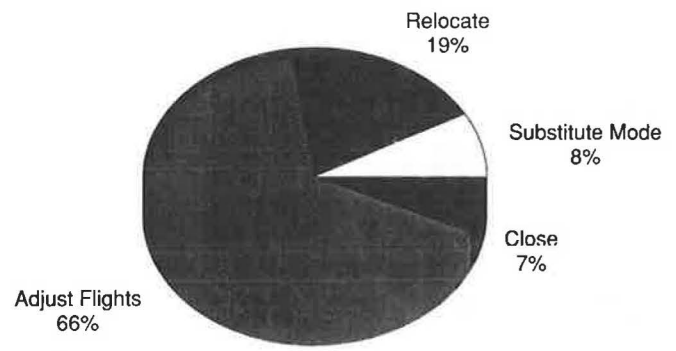


FIGURE 3 Responses to closing base airport.

TABLE 1 PERCENT OF EACH TRIP PURPOSE BY INDUSTRY (8)

Industry	Transporting Staff	Transporting Clients	Transporting Suppliers Contractors	Receiving Supplies	Delivering Products	Aerial Surveying	Other Than Business	Flight Training	Other
Agriculture	20	2	0	2	3	23	17	0	33
Construction	58	11	4	1	6	8	7	4	1
Miscellaneous manufacturing	70	16	4	0	3	0	8	0	0
Machinery manufacturing	60	8	2	1	6	1	21	1	0
Electronic equipment manufacturing	55	7	2	5	13	0	12	2	6
Transportation services	34	30	8	0	1	6	9	1	10
Utilities	23	8	7	2	17	24	9	0	10
Wholesale trade	54	10	1	12	11	0	13	0	0
Retail trade	71	4	0	2	0	0	13	0	9
Finance	71	15	2	0	2	2	7	0	0
Real estate	53	12	5	1	1	9	20	0	0
Services	53	10	1	2	2	4	22	2	5
Education	24	1	1	3	0	2	27	41	0
Average	53	12	2	2	4	4	17	3	4

TABLE 2 EXPECTED RESPONSE OF BUSINESSES LOSING BASE AIRPORT BY BUSINESS TYPE (8)

BUSINESS TYPE	RESPONSES TO LOSING DESTINATION AIRPORT				
	SUBSTITUTE OTHER MODES OF TRANSPORTATION	USE NEXT CLOSEST AIRPORT	MAKE FEWER TRIPS	RELOCATE BUSINESS	GO OUT OF BUSINESS
AGRICULTURE	0%	33%	0%	67%	0%
CONSTRUCTION	0	86	0	14	0
MISC. MANUFACTURING	7	79	7	0	7
MACHINERY MFG.	10	80	0	10	0
ELECTRONIC EQUIP. MFG.	7	64	14	14	0
TRANSPORTATION SERVICES	6	44	0	19	31
UTILITIES	20	60	0	20	0
WHOLESALE TRADE	8	67	8	8	8
RETAIL TRADE	22	44	0	22	11
FINANCE	0	73	0	27	0
REAL ESTATE	10	58	0	32	0
SERVICES	9	63	2	20	6
EDUCATION	0	50	10	20	20

cent). When asked about the effects on their transportation costs, over half reported that they expected their costs to increase with the average increase being 18 percent (\$30,000).

If these survey results are indicative of true impacts, then the results allow estimation of both the resulting change in business costs and the change in local business employment and sales. Alternatively, an economic simulation model of business competition (such as the REMI model) could be used to estimate how increases in GA-related transportation costs (compared to areas elsewhere) are likely to lead to decreases in local business activity.

Both quality and availability of GA airport facilities also affect nonlocal businesses that use those facilities. In the survey, businesses were also asked to report their expected response if their base airport were still available, but their most frequently used destination airport were no longer available for use. Responses to this question differed from those of the previous question about the loss of base airport access. Fewer businesses reported they would relocate, close, or use the next closest airport. However, a significantly greater proportion of the businesses reported that they would substitute other modes of transportation or make fewer trips. Of those businesses that reported they would not go out of business, the expected impacts on sales and transportation costs were similar to the expected impact of the base airport closing.

By combining the portion of business sales at risk of being lost because of a business closing, relocating, or sales contracting, a measure can be constructed for overall business sales vulnerability associated with the loss of base or primary destination airports. Results, presented in Table 3, show a wide variation in the portion of sales at risk. Overall, the average level of sales at risk of being lost was found to be approximately 40 percent of total business activity for the surveyed businesses. For a median-sized business, this is

equivalent to roughly \$1 million of sales at risk although the average (mean) sales at risk is \$30 million per business because of the existence of some large businesses in the survey. Either way, these figures for potentially lost sales dwarf the \$40,000 average annual spending per business on general aviation costs.

In any case, care must be taken to avoid double counting benefits. Benefits can be measured either in terms of the firm's estimate of its savings in cost of doing business (average of \$1 million per business), or in terms of the firm's estimate of local business sales at stake (average of \$1 to \$30 million per business), or in terms of the business expenditures associated with aircraft use (average of \$40,000 per business). Business expenditures for fuel, repair, storage, and fees in turn provide a major portion of the revenue of local fixed-base operators. To include this activity as an additional element of business benefit would, however, be double counting.

### PROCESS FRAMEWORK FOR ESTIMATING BUSINESS BENEFITS

One process framework for estimating benefits is the Massachusetts Airport Impact Model, which measures the economic benefit of GA airport projects as being the local worker income associated with that portion of business sales activity that depends on the continuation or improvement of a particular airport. For example, airport projects that may affect business use of an airport (and hence business sales activity) include

- Whether or not a runway is extended to accommodate corporate jets;

TABLE 3 PORTION OF BUSINESS SALES AT RISK (8)

SIC	INDUSTRY	
1-9	AGRICULTURE	67%
10-14	MINING	0%
15-19	CONSTRUCTION	21%
20-34,37-39	MANUFACTURING	13%
35	MACHINERY MFG.	12%
36	ELECTRICAL MFG.	19%
40-47	TRANSPORTATION SERVICES	57%
48-49	UTILITIES	20%
50-51	WHOLESALE	18%
52-59	RETAIL	36%
60-64,67	FINANCE	31%
65-66	REAL ESTATE	34%
70-81,83-89	SERVICES	33%
821-823	OTHER EDUCATION	0%
824-829	FLIGHT TRAINING/EDUC.	98%
90-99	GOVERNMENT	0%
AVERAGE WEIGHTED BY NUMBER OF AIRCRAFT		40.80%

Note: These figures represent the percentage of total business sales accounted by companies that claim they would relocate or go out of business if their base or primary/destination airport were to close, plus the reported loss to other companies that would not relocate or go out of business.

- Whether or not operating hours are extended and lighting is installed to allow night flying;
- Whether or not instrument landing systems or a crosswind runway is installed to allow operation in adverse weather conditions;
- Whether or not jet fuel and full maintenance services are provided; and
- Nature of user facilities and amenities.

Each of these considerations has the potential to encourage or prevent future business use of an airport.

The process of estimating business use of an airport, with and without improvements, is a multistep process. The key steps are discussed in the following paragraphs.

### Characteristics of Business Aircraft Ownership

From the survey, aircraft ownership, average fleet size, and mix of aircraft types all differed by the type of business. Table 4 presents these data in terms of the number and types of aircraft owned by businesses in each industry, expressed as a ratio per total statewide employment in that industry. As the economy of the state changes over time, employment in some industries will grow faster than in other industries and, as a result, the number of business aircraft and the mix of aircraft types will also change over time.

### Employment Profile and Forecast

State and federal sources provide forecasts of statewide employment growth (and decline) by industry (standard industrial classification groups) over the next decade and beyond. These forecasts reflect expectations of growth and decline in various industries as a result of shifts in the national

economy, shifts to foreign manufacturing in some industries, and changing technology.

### Potential Based Aircraft

Using the previous two steps together will allow estimates of the projected future number and mix of aircraft based in the state. The estimated potential for each airport depends on the specific employer profile forecast for its service area.

### Limitations on Aircraft Use and Additional Achievable Use

Business growth benefits from investments in GA airport facilities depend upon the adequacy of facilities provided and can be defined in terms of criteria such as

- Critical Aircraft Type—limitations on the type of aircraft that can use the airport (related to runway length and pavement);
- Lighting—limitations on use of the airport at night;
- Instrument Navigational Aids—limitations on use of the airport during low-visibility or inclement weather conditions; and
- Other Factors—availability of hangars and tie-downs, weather services, fuel, plowing in winter, restaurant, etc.

Any airport project that increases the types of aircraft that can use the airport, or the time that the airport can be used, or the reliability for its usage, will encourage greater use of the airport and, hence, attract additional businesses and promote economic growth. Existing characteristics of an airport (with respect to these criteria) can be used to identify the existence of factors now limiting its use by business. Actual

TABLE 4 AIRCRAFT OWNED PER 1,000 TOTAL EMPLOYEES (8)

SIC	INDUSTRY	SINGLE	MULTI	JET	HELI	TOTAL
1-9	AGRICULTURE	0.80	0.00	0.00	0.00	0.00
10-14	MINING	0.00	0.00	0.00	0.00	0.00
15-19	CONSTRUCTION	0.18	0.09	0.00	0.05	0.32
20-34, 37-39	MANUFACTURING	0.10	0.02	0.01	0.00	0.13
35	MACHINERY MFG.	0.35	0.16	0.08	0.04	0.63
36	ELECTRICAL MFG.	0.41	0.17	0.03	0.00	0.61
40-47	TRANSPORTATION SERVICES	1.87	0.62	0.05	0.10	2.64
48-49	UTILITIES	0.16	0.16	0.00	0.08	0.41
50-51	WHOLESALE	0.35	0.06	0.00	0.00	0.41
52-59	RETAIL	0.08	0.01	0.00	0.00	0.09
60-64, 67	FINANCE	0.32	0.09	0.00	0.03	0.44
65-66	REAL ESTATE	2.31	1.08	0.15	0.00	3.55
70-81, 83-89	SERVICES	0.47	0.10	0.01	0.03	0.61
821-823	OTHER EDUCATION	0.00	0.00	0.00	0.00	0.00
824-829	FLIGHT TRAINING/EDUC.	34.02	1.79	0.00	0.00	35.81
90-99	GOVERNMENT	0.00	0.00	0.00	0.00	0.00
	TOTAL	0.36	0.09	0.01	0.02	0.48

Estimated 1987 employment by industry from Massachusetts Division of Employment Security; Massachusetts Industrial Employment Projected Changes 1984-1995.

Aircraft Owned per 1000 Total Employees is the ratio of the two above sets of figures.

or hypothetical airport improvement projects can then be defined in terms of whether they address some or all of the factors now limiting that business use.

### Business User Growth Impacts

It would be a clear oversimplification to credit a business startup, relocation, or expansion solely to the improvement of a nearby airport. Likewise, it would also be a clear oversimplification to blame a business failure, relocation, or contraction solely to the reduction in facilities or services of a nearby airport. Although access to GA is certainly an important factor in business location decisions and business sales, it is not the only factor. Usually, a combination of airport facilities with other business costs and competitive factors (such as availability and cost of labor and raw materials, and the nature of market competition) work together to encourage or discourage business growth. Therefore, the most appropriate ways to assess the effect of airports or changes in airports on business activity are in terms of the following measures:

- Associated Business Activity—additional business employment, payroll, and business sales generated by direct and indirect spending associated with the forecast of additional aircraft using the airport.
- At-Risk Business—portion of current employment, payroll, and sales volume of businesses using the airport that is at risk of being lost when their GA needs are not met, or gained when their GA needs are met.

### CONCLUSION: USE OF THE FRAMEWORK FOR ESTIMATING BUSINESS BENEFITS

In setting priorities for airport projects, a great many benefit and cost factors must be considered. Transportation efficiency benefits to users are one measurable factor. Additional impacts

on the economy because of potential business expansion and business attraction are other factors. There are, of course, other financial, environmental, and community impacts to be considered.

In addition to the specific economic benefits of airports to businesses, there are the less quantifiable benefits of the provision of access to the more remote regions of the state, the enhancement of mobility, and the ability to locate businesses where factors such as labor supply and resources are located. These quality-of-life aspects of GA airports make a more subtle, but nevertheless real, contribution to the quality of the business climate.

Not all benefits of airport improvements can yet be quantified. Further work is necessary to establish the transferability of results from the Massachusetts survey to other states. Further work is also needed to better understand the process of business relocations and business transportation changes resulting from changes in GA airport facilities and services. Nevertheless, the framework outlined was designed to demonstrate how impacts on the economy could be addressed.

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