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Final Report

**Development of a Web-Based Economic
Impact Calculator for
Small and Medium Size Airports**



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16. Abstract (Limit: 200 words) This report details the development of a Web-based economic impact calculator for Minnesota's Small and Medium Size, General Aviation airports. In this case, "economic impact" is defined as the result of expenditures or sales transactions between businesses or other entities that can be directly traced to the presence of an airport. The process involved site visits to 51 airports, meetings with airport managers, Fixed Base Operators (FBO), and Metropolitan council officials, as well as data collection of financials from airport sponsors and FBOs. After testing on the calculator was completed, it was transferred to the Mn/DOT Aeronautics server and can be found at http://dotapp1.dot.state.mn.us:8080/aeic/main.htm . We recommend, however, that a new effort be considered to obtain more detailed financials for FBOs as a way to improve calculator accuracy. Although the current model provides a good estimation of FBO expenditures, greater accuracy could be obtained with more data.			
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Development of a Web-Based Economic Impact Calculator for Small and Medium Size Airports

Final Report

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Executive Summary

This report details the process of developing an economic impact calculator that can be used by Minnesota's 136 General Aviation publicly sponsored airports, except for the three largest commercial service airports Minneapolis/St. Paul International, Duluth International, and Rochester International. The end product of the effort, a Web-based calculator is currently operational.

Airports serve numerous functions. The larger and better known are anchored by commercial scheduled air service. However, there are many more small and medium-size airports, most without any commercial scheduled air service, that provide essential services to rural communities. Apart from the most obvious services (i.e. general aviation) there can be many other economic activities taking place at these airports

Economic impact is the result of expenditures or sales transactions between businesses or other entities that can be directly traced to the presence of a particular facility, activity, or related services. Determining whether economic expenditures are due to the presence of an airport is the first step in estimating economic impact. The decision rule is to include a particular expenditure if it is due to the presence of the airport in question.

Economic impact consists of three parts: direct, indirect and induced impacts or effects. Direct impacts are the immediate, first round expenditures generated as firms expand production to supply the increased demand of an airport's or airport-related firm's goods and services. Indirect impacts are the intermediate sales as airports and related businesses buy inputs for their productive use. An example of this would include a Fixed Base Operator's (FBO) replenishing inventory (e.g. fuel), or hiring services (e.g. accountants). Finally, induced impacts come from increased household income as residents spend earnings in the local economy.

Data were collected from a variety of sources. A total of 51 airports, from all regions of the state, were personally visited by a member of the University study team. Airport managers, FBO businesses and other personnel were interviewed using an open-ended format. Other input was received from the Principal Investigators' attendance at the Minnesota Council of Airports annual symposium, from the Technical Advisory Panel (TAP) assembled to advise this study and from a mail/internet survey of airports and FBO businesses.

The Calculator produces economic impact values that should be considered as estimations and not exact figures. One of the most important issues affecting the accuracy of the economic impact estimates has to do with a relatively low response rate on the FBO survey. This survey was used to determine the operational equation used to calculate FBO and related entity expenditures. If an FBO is present at an airport it may be a significant contributor to regional economic impact. Therefore more data on FBO financials would produce more accurate economic impact values.

Although the model discussed in this report was developed to estimate economic impact of airport operations and activity it does not detail all the benefits airports provide. There are a number of non-quantifiable impacts that are significant. Foremost among them would be medical and life support airlift. There is no regular schedule from which this activity could be modeled and questions remain as to whether any local expenditures are associated with the activity. There is no question however, especially if you are the individual needing a medical airlift, that it is an essential service. Other services that may be of a sporadic and temporal nature may include fire suppression. What is most important is to recognize that these services require a system of regional airports to be useful and the present system of General Aviation airports in the state fills that need. Although there may be very little economic impact associated with these types of uses the value is much more than can be quantitatively determined.

It is recommended that a new effort to obtain more detailed financials for FBOs be considered as a way to improve calculator accuracy. It may be possible to use a variety of secondary and primary sources to accomplish this task. As FBO expenditures are a prime ingredient in economic impact analysis the model can be improved by further attention to this component. Although the model, as currently deployed, is considered to provide a good estimation of FBO expenditures greater accuracy can be obtained by more work on this feature of the calculator.

Chapter 1

Introduction

Airports serve numerous functions. The larger and better known are anchored by commercial scheduled air service. However, there are many more small and medium-size airports, most without any commercial scheduled air service, that provide essential services to rural communities. Apart from the most obvious services (i.e. general aviation) there can be many other economic activities taking place at these airports. All of the activities contribute to the economic impact generated by the airport. This report details the process of developing an economic impact calculator that can be used by Minnesota's 136 airports with the exception of the three largest commercial service airports Duluth International, Minneapolis and St. Paul International and Rochester International. The end product of the effort, a Web-based calculator, has been created.

Economic Impact

Before discussing the process used to develop the Web-based calculator, it is important to understand what is meant by economic impact. Economic impact is the result of expenditures or sales transactions between businesses or other entities that can be directly traced to the presence of a particular facility, activity, or related services. For example, airports are facilities that provide the conditions for air transportation to occur. Numerous services exist at airports that facilitate the activity air transportation. Transportation can consist of people or cargo.

Determining whether economic expenditures are due to the presence of an airport is the first step in estimating economic impact. The decision rule is to include a particular expenditure if it is due to the presence of the airport in question. Stated differently, if the expenditure would have taken place without an airport, then that expenditure is not included. The expenditure we are measuring is termed "final demand" and consists of purchases of goods and services sold for final consumption rather than an intermediate purchase for a good receiving further remanufacturing. When an expenditure is made, and it can be traced to the presence of the airport, that expenditure constitutes a sale to final demand.

It is occasionally a bit difficult to determine what counts as a legitimate expenditure and what doesn't. For example, at many state airports individuals are allowed to own hangars even though they are located on airport property. The hangar owner pays rent for the land and property tax on the value of the hangar. On the surface this appears to be an expenditure. Without the airport there would be no land to rent for hangars and no hangars to build. Yet this type of expense is in reality revenue to the airport owner. All the airports for which the economic impact calculator was developed have some form of public ownership. Public entities that own the airport receive land rents for hangar space and property tax based on the value of the hangar. Although some of this money goes directly to the public treasury and some may go directly for airport operations, in theory all the money collected by the public entity can be assumed to support the airport and its operations even if no direct "money trail" is apparent. Money is fungible and therefore there is almost no way to trace and link public revenue sources with particular public expenditures (i.e. airport operations). For the purpose of estimating the economic impact of an airport revenues are ignored and the amount of public expenditure on the airport becomes the key operational figure used. It is not that revenues are unimportant but

instead the assumption is that they are already taken into account and included in the amount of money spent by the public entity to support the airport. Economic impact is based on output (i.e. expenditures which are termed final demand) and should not be considered a measure of an airport's profitability or revenue. It is simply a measure of the economic activity, both in monetary terms and jobs, that is generated as a result of expenditures made due to the presence of an airport.

Economic impact consists of three parts: direct, indirect and induced impacts or effects. Direct impacts are the immediate, first round expenditures generated as firms expand production to supply the increased demand of an airport's or airport-related firm's goods and services. Indirect impacts are the intermediate sales as airports and related businesses buy inputs for their productive use. An example of this would include a Fixed Base Operator's replenishing inventory (e.g. fuel), or hiring services (e.g. accountants). Finally, induced impacts come from increased household income as employees spend earnings in the local economy. For example, if an FBO makes a profit as a result of efficient operations, the FBO owner may decide to purchase a new boat. This extra spending is only possible because of the initial direct expenditures resulting in a profit or income to the FBO. Likewise employees may make enough in wages that they have disposable income for discretionary purchases. If the wage earner decides to spend the extra money on a trip to Jamaica it would be due to the induced impact. However, because the trip spending occurs outside the region of airport location, it is not counted as impact. It is seen as a "leakage" out of the area. This holds regardless of whether the impact is indirect or induced. Only expenditures that take place in the region of study are included in the final economic impact estimate.

It is also possible to estimate the number of jobs that result from total expenditures. The economic impact calculator which was developed and deployed contains this feature.

In an attempt to summarize one can look at the economic impact estimates produced by the calculator as consisting of the total expenditures that take place in the region (county) and number of jobs created due to the presence of the airport. Without the airport the calculated expenditures and jobs would not exist in the region.

There were several steps in the process of designing the economic impact calculator. They were:

- I. Determine what type of economic activity takes place at Minnesota's airports
- II. Collect data from a sample of the most important contributors to economic impact
- III. Develop standards that could be applied to the various economic activities that were identified as existing at Minnesota's airports. Standards were developed from primary data collection and analysis as well as existing secondary data sources from studies conducted by the University of Minnesota Tourism Center.
- IV. Develop algorithms and select multipliers for use in calculating economic impact
- V. Design web site calculator
- VI. Test web site calculator
- VII. Deploy Calculator

A total of 51 airports, from all regions of the state, were personally visited by a member of the University study team. Airport managers, FBO operators and other personnel were interviewed using an open ended format. Other input was received from the Principal Investigators' attendance at the Minnesota Council of Airports and from the Technical Advisory Panel assembled to advise this study. Additionally financial data were collected from FOB businesses.

I. Determine Economic Activity

Public Ownership

All 134 of the airports, for which the calculator was designed, have some form of public ownership. Source of funding for annual operations may come from a county, city, state or federal government agency. At some airports public expenditures may be the sole source of economic impact. Public ownership is the only economic commonality for all the airports and therefore a screen in the Web based calculator is devoted to public ownership contributions.

Fixed Base Operators

Next to Public Ownership the second most common contributor to airport economic impact is provided by Fixed Base Operators (FBOs). FBOs are commonly found at the states airports but as mentioned above not all airports have an FBO. An FBO is the mechanic/fuel stop/specialty service provider for general aviation.

Commercial Scheduled Air Service

A few airports in the state, besides those not included in this study (i.e. MSP, Rochester, Duluth International), support commercial scheduled air service. Economic impact for this type of activity is based on the number of passengers who fly into the airport but are not local residents plus the number of employees maintained at the airport by the airline company, plus the number of Transportation Security Administration officials and other government employees (e.g. Customs) stationed at the airport.

General Aviation Pilots and Other Overnight Visitors

General Aviation exists at all the airports in this state but it is not evenly distributed across the airports. The amount of economic impact generated by general aviation pilots depends on where they go and how long they stay. Some airports may cater to a few business people who use the airport for access to one of their stores or plants. Many times the business use is only on a daily basis and other times it may consist of an overnight. In addition to the occasional overnight use there are a few airports that attract a number of general aviation pilots for overnight stays because the airport provides access to recreation and second homes.

Retail Business

A few airports host retail businesses. Most of these businesses are aviation related such as car rental or travel agencies but some are less market specific such as restaurants and, in one case, a hair stylist. If a retail business is located at an airport then its performance is included in the economic impact estimates for that airport.

Business Use

How local businesses interact with the local airport producing quantifiable economic impact is a bit controversial. There are businesses that have a presence at the airport and some that require a direct connection to an airport in order to survive but their main business is not aviation related. In addition to FBOs and retail businesses a set of decision rules for determining the economic impact of “other” businesses were identified. They are:

- a. Freight transfer. Businesses that produce light and valuable products would make more use of a local airport than companies producing lower value and bulkier products. In order to determine the economic impact of businesses that use an airport for freight requires a few assumptions be accepted. The first is that the business of concern would not relocate its physical plant if the airport it currently uses were closed. Second, the business does not operate its own planes or does not perform its own maintenance on planes it does operate.
- b. Businesses that operate their own planes and perform their own maintenance regardless of whether an FBO is present. This is a more common business use of an airport. For some corporations the airport serves as a clients or partners first introduction to the business and the community in which it is located. This has resulted in a number of corporate strategies including contributions to enhance the airport’s look and functionality, development of private hangars and terminals to handle all business clients associated with the company. When a business operates in this manner it performs similar functions to an FBO and the economic impact is generated in a similar manner.
- c. Businesses located in the area that receive visits or visitors that arrive by plane. This appears to be common among the state’s airports. Because of the difficulties in determining whether business visitation is essential to the continued operation of the business and the fact that many other airports exist to provide access, although possibly not as convenient, plus the fact that much of the economic impact of this type of business use is already captured by another of the modeled activities it was determined not to attempt to calculate any economic impact associated with this type of business use of the airport.

Government and Other Non-Profit Use

A number of other business-like activities can be found at some of Minnesota’s airports. For example the National Guard may be a tenant at the airport. They maintain their own planes and have their own personnel. Other government agencies (e.g. US Forest Service) may use an airport as a base for seasonal work (e.g. fire fighting) and there may be other non-profit businesses located at an airport. These types of economic activities are treated, for the purpose of calculating economic impact, as separate businesses. If they perform their own maintenance operations and have their own employees then they are modeled separately from the other forms of economic activity identified above.

Other

It is impossible to capture all the types of business activity taking place at an airport. For example one year it may be necessary to purchase additional land for safety purposes. Expenditures related to running a business or airport that would not be considered “normal” can be assigned to the “Other” category.

II. Collect Data

Data were collected in a variety of ways. Much of the initial fact-finding was done through site visits with over 50 airports. Since all the airports for which this study was conducted have some form of public ownership a call for airport financials was issued. A total of 76 of the 134 airports for which financials were requested responded. Airport financials were analyzed with respect to the different categories of expenditures accounted for by airport sponsors. The other area requiring detailed information pertained to FBO expenditures. A questionnaire was developed and sent to the complete list of FBOs. There were 98 FBOs from which data were requested. A total 20 FBOs responded and sent financial information.

III. Standards

Whenever one model is applied to multiple sites spread out over a wide geographic area with varying degrees of economic activity from site to site it is necessary to develop a set of standards that can be applied while still maintaining a fair degree of accuracy. A variety of sources were used to develop the standards for this study.

A survey was used to collect data from FBOs so that a formula (i.e. the standard) could be developed based on actual FBO expenditure information. The final formula used for modeling FBO operations took the form:

$$Y(\text{expenditures}) = 10.90853 + fa (.040085) + fs (.1069578) + pa (.2601556) + N_{\text{plane}} (.1114583) \text{ where:}$$

fa = full time annual employees
fs = full time seasonal employees
pa = part time annual employees
N_{plane} = number of planes owned/operated by the FBO/Business

This equation accounts for almost 80% of the variance in the data obtained from FBOs. It was determined to be the best estimator of FBO expenditures possible given the amount of data available to build the equation.

The equation that applies to FBOs is a crucial standard for other economic activities that take place at the airport. The web site that was created to estimate economic impact has business, government and non-profit components. All of these types of economic activity are similar in nature to an FBO. Therefore we have applied the FBO equation (standard) to all similar types of economic activity that takes place at an airport but which can not be attributed to an FBO.

No standards are needed for estimating airline or TSA employees when actual numbers and salary estimates are easily available. However the economic impact attributed to airline passengers does require the use of standards. When non-residents fly into an airport they are considered tourists and all their spending, in the area, results in local economic impact. To

determine the extent of non resident spending and, therefore, economic impact requires the use of a different set of standards. The Tourism Center, University of Minnesota has been conducting visitor profile analyses for the last three years. Using the Tourism Center's visitor profile analyses, a set of standards was developed that apply to each airport in the state, included in this study. Once total enplanements (data that is required to be maintained) are determined that number is multiplied by the percentage of passengers who are considered local. The remaining percentage is considered the tourist number. This number, on an annual basis, is then multiplied by average length of stay and average expenditure per day for each tourist accessing the destination using the standards from the Tourism Center research. The result is the total annual visitor spending resulting from tourist access to the region through the use of scheduled commercial air service.

Described earlier, economic impact consists of more than simply how much money is spent directly by an FBO, tourists etc. As a result of the initial round of spending, often referred to as direct economic impact, other spending takes place. This is referred to as indirect and induced spending. The U.S. economy has been extensively studied and input/output tables exist for every county in the state. A widely used input-output model is IMPLAN (formerly called Impacts for PLANning). A feature available in IMPLAN is the capability of developing multipliers unique to each county and each economic sector in the county. These multipliers, necessary to estimate the indirect and induced impacts discussed earlier, provide the standards for which all the expenditure estimates are subjected in order to determine total economic impact for each category included on the website. Because of the design features of IMPLAN it was selected for use in this study.

IV. Develop Algorithms and Select Multipliers

Data obtained from FBOs was analyzed using multiple regression as the statistical technique. The resulting equation selected for this study is detailed above. Output from this equation was subjected to multipliers obtained from IMPLAN. Descriptive impact models were created for each of Minnesota's 87 counties. This resulted in a set of impact tables unique to the county for each economic sector existing in the county. Both gross output (expenditures) and employment multipliers were created.

V. Design Web Site Calculator

Once expenditure categories were determined a web site that would contain all the relevant information needed to calculate economic impact was developed. The architecture used for the web site consists of three parts. The first is the public screens. These screens contain all the web pages needed to collect user information for calculating economic impact. The second part, protected by a fire-wall, contains the algorithms and multipliers needed to calculate economic impact. This section of the web site cannot be manipulated and the information it contains is not available to the user. The third section consists of a Final Report, which is output with the calculated economic impact values imbedded in the report.

VI. Test Web Site Calculator

The web site, once constructed, was tested by a group of volunteers who attended a presentation made by the Principal Investigator in November of 2004 at the Center for Transportation Studies, University of Minnesota and MnDOT Aeronautics AirTAP Fall Forum. In addition, members of the TAP for this study were asked to test the workability of the site.

VII. Deploy Calculator

The Web Site Calculator was turned over to MnDOT Aeronautics for full deployment in late January 2005. It is listed as a special feature on the sidebar at: www.dot.state.mn.us/aero.

The Calculator produces economic impact values that should be considered as estimations and not exact figures. In the limitations section of the report some of the more salient issues for updating and refining the Calculator are discussed. The most important of those issues has to do with the relatively low response rate to the FBO survey. This survey was used to determine the operational equation used to calculate FBO and related entity expenditures. Any improvement that leads to a better expenditure estimation equation will surely improve the Calculator.

Although the model discussed in this report was developed to estimate economic impact of airport operations and activity it does not detail all the benefits airports provide. There are a number of non-quantifiable impacts that are significant. Foremost among them would be medical and life support airlift. There is no regular schedule from which this activity could be modeled and questions remain as to whether any local expenditures are associated with the activity. There is no question however, especially if you are the individual needing a medical airlift, that it is an essential service. Other services that may be of a sporadic and temporal nature may include fire suppression. What is most important is to recognize that these services require a network of regional airports to be useful and the present system of General Aviation airports in the state fills that need. Although there may be very little economic impact associated with these types of uses the value is much more than can be quantitatively determined.

The overriding goal of this research was to produce a Web-based economic impact calculator that could be applied to most of the General Aviation airports in Minnesota. That goal was accomplished. As mentioned the approach used was diverse involving site visits, personal interviews, group feedback and primary data collection. In the chapters that follow other studies related to the subject at hand are reviewed. Further detail on the research design and methods for data collection are discussed, model limitations are addressed and a general discussion with conclusions is provided.

Chapter 2

Literature Review

There were many sources consulted to obtain information about airport operations and its relevance to economic impact. Some of the material collected and examined provided little information about economic impact but was more focused on a particular aspect of airport operations (e.g. revenue generation). However all the sources consulted were useful in helping investigators understand the many functions and activities taking place at General Aviation airports. Not all the literature sources consulted during the course of the study are discussed below. Only those directly relevant to airport economics are discussed in this section (for a complete list of sources consulted see the References).

A study conducted by the Pennsylvania Bureau of Aviation (The Center for Rural Pennsylvania, 2001) compared the economic impact of rural versus urban airports. They concluded that of the 134 public airports in the state 55 (41%) were found in rural areas. These rural airports generated \$31.5 million in payroll (1,650 jobs) compared to \$5.5 billion in payroll (286,500 jobs) for urban based airports in the state. Total economic impact from airport operations in the Pennsylvania study were estimated to be over \$12.5 billion with \$12.4 billion accounted for by the urban based airports.

Closer to home, a 1998 report prepared for the Metropolitan Council by the Airport Technology and Planning Group, Inc. examined the economic impact of aviation in the Twin Cities of Minneapolis/St. Paul, Minnesota. The focus of this study was on the impact of general aviation activity. For the seven reliever airports it was estimated that over \$132 million was spent on wages and other expenses for businesses operating out of the airports. Included in the economic impact estimates were spending generated by on-airport businesses and spending taking place by visitors that arrive via General Aviation. Methods used to collect data involved secondary sources and primary data collection from on-airport businesses and visitors. All expenditure estimates were then subjected to multiplier analysis using IMPLAN sector multipliers.

In 1999 Wilbur Smith and Associates completed a study titled “Minnesota Airports Economic Impact Study.” Various activities were measured including commercial scheduled air service operations, on-airport business operations, Fixed Base Operator operations, Corporate Flight Operations, and tourist use. Much of their use estimates were derived from interviews with airport tenants and managers. To calculate total economic impact the RIMS-II model (maintained by the U.S. Department of Commerce) was used to obtain sector multipliers. It should be noted that this study used five “regional” multipliers with each region consisting of multiple counties. Using enplanements, number of based aircraft, aircraft operations and runway length a regression equation was developed to estimate the economic impact for each airport. They specifically did not include any off-airport business operation expenses as it could not be definitively shown that the off-airport business operation owed its existence to the airport.

Martin Associates (2003) completed a study of the economic impact of the Seattle Seaport, Seattle-Tacoma International Airport and real estate tenants at the two ports. They concluded that 83,000 jobs were directly tied to the business activity generated by these two

ports. Similar to the other studies discussed above direct, indirect and induced impacts generating money and jobs were calculated using multiplier analysis.

When methodologies used in the above studies are examined it becomes obvious that although each uses a similar macro approach (i.e. calculating direct, indirect and induced through multiplier analysis) they also all use dissimilar micro-approaches. For example the Airport and Technology Group (1998) focused on wages and other expenses for businesses operating out of an airport. They also included expenses for tourists accessing a region through a particular airport. Sector multipliers were derived from IMPLAN, which is a county-based Input-Output System. By contrast, Wilbur Smith and Associates (1999) did not focus on wages as much as identifying the various types of business activity and associated expenditures. They also used a regression equation with four key independent variables. Their choice of multipliers was derived from the RIMS-II model, which does not supply county-based sector specific multipliers. Instead they relied on derived regional multipliers. It should also be mentioned that only two of the four independent variables can be accurately measured. Estimating enplanements not associated with commercial scheduled air service and total operations, as the investigators found out when conducting site visits, are no more than a best guess. Even though these figures, especially total operations, are available when subjected to tests that would reveal their relationship to economic impact no statistical significance could be found associated with these variables. Indeed it was concluded that they were less than useful and could prove misleading if actually used in the estimation of economic impact.

Any comparison between the above studies with respect to the study discussed in this document or even between themselves would not prove useful. The different methods used, choice of multiplier models, different variables employed etc render all the studies as “one-of-a-kind”. Although each of the studies cited above differ from each other in their methodological approach they did inform this study in developing a model for creating a web-based system and user needs when using that system. The model that was finally selected, detailed in the Research Methods section that follows, can be considered a hybrid where the best parts of the above studies were incorporated (e.g. use of county based sector multipliers provided by IMPLAN) and those that did not provide any clarity for estimating economic impact discarded. The discussion to follow will examine the process used for economic impact estimation in this study.

Chapter 3 Research Methods

There were several steps in the process of designing the economic impact calculator.

- I. Determine what type of economic activity takes place at Minnesota's airports
- II. Collect data from a sample of the most important contributors to economic impact
- III. Develop standards that could be applied to the various economic activities that were identified as existing at Minnesota's airports. Standards were developed from primary data collection and analysis as well as existing secondary data sources from studies conducted by the University of Minnesota Tourism Center.
- IV. Develop algorithms and select multipliers for use in calculating economic impact
- V. Design web site calculator
- VI. Test web site calculator
- VII. Deploy Calculator

Each of these steps is detailed below in separate sections. The entire project required 21 months to complete at a cost of \$156,000.

I. Determining Economic Activity

Before any economic modeling can begin a thorough understanding of the types of economic activity taking place at Minnesota's airports was required. This understanding was accomplished a number of ways. The Technical Advisory Panel (TAP) assembled for this study was very helpful in describing what different types of economic activities take place. A more direct approach was also undertaken. A total of 51 airports, from all regions of the state, were personally visited by a member of the University study team (Appendix A). Airport managers, FBO operators and other personnel were interviewed using an open-ended format. Other input was received from the Principal Investigators' attendance at the Minnesota Council of Airports (MCOA) annual meeting and in meetings with Metropolitan Airport Council (MAC) personnel.

After a number of airport visits it was apparent that, across the state, airports are operated differently yet maintain some common features. The differences in operation were primarily at the micro level. For example some FBOs bought their own fuel and paid the airport owner a flowage fee for use of the airports fuel farm. The flowage fee differed, in a few cases substantially, among the network of airports. Some FBOs offered transportation services (e.g. courtesy car) others did not. Some airports had a strong corporate presence (e.g. Marshall, Warroad) others did not have any business presence including an FBO (e.g. Bigfork). Hangar ownership covered the range from all privately owned to all publicly owned with many offering a mix of both types. Fees such as tie down or landing, if charged, were often waived if the pilot purchased fuel. In the southern part of the state airport land was frequently rented to farmers. In northern lake areas access to second homes and resorts was a primary attractor for General Aviation pilots.

Even with all the disparate types of economic activities taking place it was possible to find some common activity groupings that could account for the majority, if not all, of the economic impact generated by the airport. The following types of economic activity were found to be associated with the states airports:

1. Public Ownership

All 133 of the airports for which the calculator was designed have some form of public ownership. Source of funding for annual operations may come from a county, city, state or federal government agency. At some airports public expenditures may be the sole source of economic impact. Public ownership is the only economic commonality for all the airports and therefore a screen in the web-based calculator is devoted to public ownership contributions.

2. Fixed Base Operator

Next to Public Ownership the second most common contributor to airport economic impact is provided by Fixed Base Operators (FBOs). FBOs are commonly found at the states airports but as mentioned above not all airports have an FBO. An FBO is the mechanic/fuel stop/specialty service provider for general aviation. Most of them perform basic airplane service including annual certification and pumping fuel and some perform additional specialty services such as airplane renovation. Others may specialize in certain activities such as a flight school and not perform general maintenance activities.

Although there are many types of FBOs almost all the general aviation airports in the state house one full service FBO. Still with some airports not having an FBO presence the website screen that solicits information about FBO operations requires a voluntary check to be activated.

3. Commercial Scheduled Service

A few airports in the state, besides those not included in this study (i.e. MSP, Rochester, Duluth International), support commercial scheduled air service. Economic impact for this type of activity is based on the number of passengers who fly into the airport but are not local residents plus the number of employees maintained at the airport by the airline company, plus the number of Transportation Security Administration officials stationed at the airport. There is a separate box on the web site that can be checked if the airport in questions supports commercial scheduled air service.

4. General Aviations Pilots and Other Overnight Visitors

General Aviation exists at all the airports in this state but it is not evenly distributed across the airports. For example the six reliever airports in the Twin Cities plus South St. Paul are home to at least fifty percent of the registered general aviation aircraft in the state. The amount of economic impact generated by general aviation pilots depends on where they go and how long they stay. Some airports may cater to a few business people who use the airport for access to one of their stores or plants. Many times the business use is only on a daily business and other times it may consist of an overnight. In addition to the occasional overnight use there are a few airports that attract a number of general aviation pilots for overnight stays because the airport provides access to recreation and second homes. Regardless of the reason for an overnight if it occurs it has economic impact associated with

it. The screen that addresses overnight use by General Aviation pilots is voluntary and requires some knowledge of the actual overnight use that is taking place for the economic impact estimates to be valid.

5. Retail Business

A few airports host retail businesses. Most of these businesses are aviation related such as car rental or travel agencies but some are less market specific such as restaurants and, in one case, a hair stylist. If a retail business is located at an airport then its performance is included in the economic impact estimates for that airport. The Retail Business screen is voluntary. Most airports will not have to check the box indicating they have retail businesses.

6. Business Use

How local businesses interact with the local airport producing quantifiable economic impact is a bit controversial. Already those businesses that happen to be located at an airport (i.e. Retail Business) have been identified and provided their own screen. In a similar way there is a screen for FBOs, which are also businesses located at the airport. However there are other businesses that have a presence at the airport and some that require a direct connection to an airport in order to survive but their main business is not aviation related. In developing decision rules for determining the economic impact of business use of an airport three different types of business activity were identified. They are:

- a. Freight transfer. Businesses that produce light and valuable products would make more use of a local airport than companies producing lower value and bulkier products. There is at least one example in Minnesota where this is the case. In order to determine the economic impact of businesses that use an airport for freight requires a few assumptions be accepted. The first is that the business of concern would not relocate its physical plant if the airport it currently uses were closed. Second, the business does not operate its own planes or does not perform its own maintenance on planes it does operate. Under the business use screen on the website there is a separate calculation devoted to businesses that use an airport for the distribution or receiving of freight.
- b. Businesses that operate their own planes and perform their own maintenance. This is a more common business use of an airport. There are a number of examples in Minnesota where a major corporation owns and operates its own hangars and performs its own maintenance regardless of whether an FBO is present. For some corporations the airport serves as a clients or partners first introduction to the business and the community in which it is located. This has resulted in a number of corporate strategies including contributions to enhance the airport's look and functionality, development of private hangars and terminals to handle all business clients associated with the company. When a business operates in this manner it performs similar functions to an FBO and the economic impact is generated in a similar manner.
- c. Businesses located in the area that receive visits or visitors that arrive by plane. This appears to be common among the state's airports but when pressed no airport manager felt they could accurately estimate the number of times this type of activity takes place. It is also not clear either from the published literature or from conversations with airport

personnel what would be the outcome if an airport was not easily available to the business operation. Additionally the economic impact associated with a day visit would be minimal. Any fuel expenditure would eventually be accounted for by FBO economic impact. If the business person were to spend an overnight the economic impact associated with that particular activity can be accounted for in the General Aviation Pilots and other Overnight Visitors screen. Because of the difficulties in determining whether business visitation is essential to the continued operation of the business and the fact that many other airports exist to provide access, although possibly not as convenient, plus the fact that much of the economic impact of this type of business use is already captured by another of the modeled activities it was determined not to attempt to calculate any economic impact associated with this type of business use of the airport. Therefore only the two categories of business use, identified in a and b above, are used to determine economic impact from business use of the airport.

7. Government and Other Non-Profit Use.

A number of other business-like activities can be found at some of Minnesota's airports. For example the National Guard may be a tenant at the airport. They maintain their own planes and have their own personnel. Other government agencies (e.g. US Forest Service) may use an airport as a base for seasonal work (e.g. fire fighting) and there may be other non-profit businesses located at an airport. These types of economic activities are treated, for the purpose of calculating economic impact, as separate businesses. If they perform their own maintenance operations and have their own employees then they are modeled separately from the other forms of economic activity identified above.

8. Other

It is impossible to capture all the types of business activity taking place at an airport. For example one year it may be necessary to purchase additional land for safety purposes. In a similar manner itinerant pesticide sprayers may seasonally use the airport as a base. They do not maintain their own aircraft or keep a hangar at the airport but they are running a business. Expenditures related to running the business that would not be considered "normal" can be assigned to the "Other" category. Normal purchases such as fuel are already covered when calculating an FBO's contribution and should not be entered on this screen.

II. Collect Data

Data were collected in a variety of ways. As mentioned much of the initial fact-finding was done through site visits with over 50 airports. These preliminary data allowed for the identification of two areas requiring more detailed analysis. The first was public sponsorship. Since all the airports for which this study was conducted have some form of public ownership a call for airport financials was issued. A total of 76 of the 134 airports for which financials were requested responded. Once collected, airport financials were analyzed with respect to the different categories of expenditures. It was then possible to construct the questions that would be needed to determine the economic impact of public sponsorship for airports.

The other area requiring detailed information pertained to FBO expenditures. FBOs are a common feature at Minnesota's airports and these businesses act in a similar manner to full service gas stations. That is they not only provide fuel services but many perform routine maintenance including airplane certification with some providing even more specialized services (e.g. aircraft renovation). In order to obtain information on FBO expenditures a questionnaire was developed and sent to the complete list of FBOs. The FBO contact list was obtained from MnDOT Aeronautics. There were 98 FBOs on that list. In total 20 FBOs responded to the surveys. Some of the responses were incomplete which rendered them only marginally helpful. The low level of responses obtained from the FBO survey affected the development of standards that could be applied to airports across the state. The problems associated with and solutions to deal with the low response rate will be detailed later in this report.

FBO data were analyzed to determine expected expenditures based on some easily determined input values. Originally it was hoped that expenditure data could be determined based on type of services performed by an FBO. There are many different types of services provided by the state's FBOs. Some of these services include flight schools (fixed wing and helicopter), charter air service, antique plane restoration among others. Unfortunately the low FBO response rate precluded any expenditure analysis by type of service. Instead the formula used to determine an FBO expenditures is based on number of employees (full, part time) working for the FBO plus the number of planes maintained by the FBO. The formula and its components will be detailed later in this report.

III. Standards

Whenever one model is applied to multiple sites spread out over a wide geographic area with varying degrees of economic activity from site to site it is necessary to develop a set of standards that can be applied while still maintaining a fair degree of accuracy. A variety of sources were used to develop the standards for this study. Standards are not necessary if complete information is already available about a particular economic activity that takes place at an airport. This is the case with public sponsorship of airports. Government funds used to support airport operations are part of the public record. Therefore it is possible to obtain the exact figure for public sponsorship money devoted to an airport as airport financials are part of the public record. In this case it is not necessary to develop any standards as actual expenditures are known and easily obtainable.

FBO operations are a different story. An FBO's expenditures are private information and there is no requirement that this information be shared with anyone other than the U.S. Internal Revenue Service. Therefore, the survey described in the preceding section was used to collect data from FBOs so that a formula (i.e. the standard) could be developed based on actual FBO expenditure information. Even with the relatively low response rate it was still possible to develop a predictive equation that could be applied across the range of airports and FBO operations in the state. The final formula used for modeling FBO operations took the form:

$Y(\text{expenditures}) = 10.90853 + fa (.040085) + fs (.1069578) + pa (.2601556) + N_{\text{plane}} (.1114583)$ where:
 fa = full time annual employees
 fs = full time seasonal employees
 pa = part time annual employees
 Nplane = number of planes owned/operated by the FBO/Business

This equation accounts for almost 80% of the variance in the data obtained from FBOs and was determined to be the best estimator of FBO expenditures possible given the amount of data available to build the equation. The four main components of the equation are the number of full time annual employees, the number of full time seasonal employees, the number of part time annual employees and the number of airplanes an FBO owns, rents or operates under license.

The equation that applies to FBOs is a crucial standard for other economic activities that take place at the airport. As detailed above, the web site that was created to estimate economic impact includes separate input screens for business, government and non-profit components. All of these types of economic activity are similar in nature to an FBO. That is they operate similar to an FBO but instead of being available to the public they are dedicated to the entity which created them. Nonetheless their expenditure patterns are similar to an FBO as they purchase similar products and have similar productivity measures meaning they all employ, essentially, the same number of people per unit of output. Therefore we have applied the FBO equation (standard) to all similar types of economic activity that takes place at an airport but which can not be attributed to an FBO.

Commercial scheduled air service is not a common feature at the majority of Minnesota's airports. Yet where it does occur it provides not only for market access. Commercial scheduled air service operations contribute to employment in the community and also provide non-resident access to the area's businesses and resources. The number of airline employees working at the airport, together with the number of Transportation Security Administration (TSA) employees stationed at the airport, are fairly easy numbers to determine. No standards are needed for estimating airline or TSA employees when actual numbers are easily available and can be entered on the commercial scheduled air service input screen. However the economic impact attributed to airline passengers does require the use of standards.

Not all airplane passengers are counted in economic impact estimation. Many of the passengers may be living in or near to the county where the airport they are using is located. Their expenditures, while home, do not constitute new money which can be attributed to the presence of an airport and therefore what residents spend is not considered as part of total airport derived economic impact. However, when non-residents fly into an airport they are considered tourists and all their spending in the area has an economic impact to the county. To determine the extent of non resident spending and therefore economic impact requires the use of a different set of standards. The Tourism Center, University of Minnesota has been conducting visitor profile analysis for the last three years. To date, eight different communities/regions in the state have been subjects of study. Part of what has been learned is that length of stay and expenditure patterns are different depending on where in the state the tourist decides to visit. Using the Tourism Center's visitor profile analysis, a set of standards was developed that apply to each

airport in the state, included in this study (Appendix B). Once total enplanements (data that is required to be maintained) are determined that number is multiplied by the percentage of passengers who are considered local. The remaining percentage is considered the tourist number. This number, on an annual basis, is then multiplied by average length of stay and average expenditure per day for each tourist accessing the destination, based on the Tourism Center research. The result is the total annual visitor spending resulting from tourist access to the region through the use of scheduled commercial air service.

Described earlier, economic impact consists of more than simply how much money is spent directly by an FBO, tourists etc. As a result of this initial round of spending, often referred to as direct economic impact, other spending takes place. For a region the economic impact of the direct and resulting indirect and induced spending can be offset by the purchase of goods and services from out-of-region suppliers. This is referred to as leakage. The degree of this offset through leakage is dependent on the degree to which inputs can be supplied locally or must be imported from outside of the study region. For example if an FBO purchases a factory replacement part for a Cessna engine directly from the Cessna factory the amount of the expenditure is not considered as either indirect or induced spending for the region in which the airport and FBO are located. That is because the Cessna factory is not located in Minnesota and therefore any money sent to the Cessna factory is considered a leakage. In a similar manner if an employee of the TSA assigned to an airport in Minnesota spends part of his/her wages on a trip to Jamaica any money spent outside of the region in which the airport the TSA employee is assigned is considered a leakage. The amount of survey work required to determine the extent to which indirect, induced and leakage occurs in a region is a task beyond the scope of this study. Fortunately this task is accomplished through the use of regional averages, as the U.S. economy has been extensively studied and input/output tables exist for every county in the state. The widely used input-output model used in this work containing these data is IMPLAN. A feature available in IMPLAN is the capability of developing multipliers unique to each county and each economic sector in the county. These multipliers, necessary to estimate the indirect and induced impacts discussed earlier, provide the standards for which all the expenditure estimates are subjected in order to determine total economic impact for each category included on the website.

IV. Develop Algorithms and Select Multipliers

Data obtained from FBOs was analyzed using multiple regression as the statistical technique. All variables from the questionnaire were entered into the analysis. Initially data considered as outliers were removed from further analysis. The decision rule that guided this process was that any response more than three standard deviations from the mean was removed from further consideration. Because of the different scales for variable measurement all data were converted into a logarithmic expression. The operational equation resulting from this analysis was: $Y (\text{expenditures}) = 10.648 + fa (.8417) + fs (-1.3423) + pa (.4185) + N_{\text{plane}} (-/2702)$ where fa = full time annual, fs = full time seasonal, pa = part time annual, and N_{plane} = number of planes owned or maintained by the FBO/Business. This equation accounted for over 90% of the variance in the sample but it was based on only five cases. As will be explained when web site testing is discussed it was determined that the range of variables used in creating the equation was too narrow to accurately predict expenditures if input values differed from those that were used to create the model. After discovering this fatal flaw in the equation the excluded outlier values were then entered into the regression analysis. A total of 19 cases were then

considered and the resulting equation, mentioned in the previous section was output. This equation was also converted into a logarithmic expression and consisted of the following variables: full time annual, full time seasonal, part time annual and number of planes owned or maintained by the FBO. The reconfiguration of the equation, by adding in the outliers, reduced the predictive power and significance level of the full time annual variable. However, even with this reduction in predictive power, the equation chosen is the best that can be developed given the level of FBO response to the survey. More will be said about this later in the report.

As mentioned in the preceding section multipliers for estimating economic impact were obtained from IMPLAN. Descriptive impact models were created for each of Minnesota's 87 counties. This resulted in a set of impact tables unique to the county for each economic sector existing in the county. Both gross output (expenditures) and employment multipliers were created. The survey work with airports identified the nature of the business transactions that could be expected across the state associated with the airports. An important next step was to identify the appropriate IMPLAN (industrial classification) sector, and therefore multiplier, that would be assigned to each of the varied airport business activities. The first category, public ownership, is most associated with the air transportation sector. The appropriate multiplier for each county was then accepted for the public sponsorship category. This sector also includes the economic activities of FBO operations. Similarly, each appropriate county multiplier was applied to FBO expenditures. Other categories included in the web site for which air transportation sector multipliers were determined to be the most appropriate were: Commercial Scheduled Air Service, portions of business use, and Non-Profit or Government Operations. The businesses that ship freight use the truck transport sector. {Seems like something is missing from this sentence}

The Retail category has its own set of multipliers based on county retail performance. The sector used includes a collection of general merchandise operations.

Overnight visits to the area by General Aviation pilots and other visitors used expenditures based on the University of Minnesota Tourism Center visitor spending profiles described. Total spending was subjected to multipliers associated with the appropriate economic sector, such as lodging, food and beverage, gasoline stations, etc. For any other unanticipated expenditure associated with airport operations, an "Other" category was identified. As it is not possible to know what sector is involved and relate to any variety of sectors, a conservative low multiplier was created for both expenditures and jobs; this multiplier is the same for all counties. The next section will detail how each category's expenditures were calculated.

V. Design Web Site Calculator

Once expenditure categories were determined a web site that would contain all the relevant information needed to calculate economic impact was developed. Artemis Alliance was chosen as the vendor for software development. The architecture used for the web site consists of three parts. The first is the public screens. These screens contain all the web pages needed to collect user information for calculating economic impact. The second part, protected by a fire wall, contains the algorithms and multipliers needed to calculate economic impact. This section of the web site cannot be manipulated and the information it contains is not available to the user; this section of the site is referred to as the "black box." The third section consists of a Final Report, which is output with the calculated economic impact values imbedded in the report.

The first public screen contains a short introduction (Figure 3.1) with three different options for proceeding. The user may click on the icon “How it Works” (Figure 3.2) which describes what economic impact is and how the site works to estimate the economic impact generated by an airport. The user may also click on the icon “Getting Started” screen (Figure 3.3) which contains information about how the site has been structured including the type of information that is being requested. The third option is “Lets’ Go!” which takes the user to the first screen that collects information needed to calculate economic impact. This is the option preferred by those who are familiar with the site.

The first screen to collect user information (Figure 3.4) requests the name of the airport, county in which the airport is located and lists the different categories for which a separate screen has been developed. Each category can be checked or left blank with the exception of the Public Ownership category, which is always checked for reasons explained above. This screen is also set up to enter the number of different entities an airport has for each of the categories. For example if an airport has more than one FBO than that number can be entered on this screen and when FBO screens are presented there will be one screen that will come up automatically and need to be completed for each FBO that operates out of that airport.

Figure 3.1

Welcome to the Minnesota Department of Transportation Aeronautics Division Airport Economic Impact calculator home page.

The purpose of this site is to allow the user to estimate the economic impact of an airport in Minnesota. The only airports for which this site will not work are Duluth, Rochester and Minneapolis/St. Paul.

[How it Works](#) [Getting Started](#)

[Let's Go!](#)

This economic impact calculator was developed by William Gartner of the Department of Applied Economics and Daniel Erkkila of the North Central Research and Outreach Center, University of Minnesota. Financial support for its development was provided by the Center for Transportation Studies, University of Minnesota.

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Figure 3.2

How it Works:

Economic Impact is a measure of how much money and jobs are generated as result of a particular economic activity. In this case the economic activity is related to owning and operating an airport. Economic Impact is not a measure of an airports worth nor does it measure profit. Once public (i.e. airport sponsor) and private (e.g. Fixed Base Operator, Commercial Scheduled Air Service etc) activity is known these figures are subjected to certain formulas, which have been determined through data collection and analysis. These formulas estimate how much extra money is generated by the economic activity that is taking place and also the number of additional jobs created as a result of these initial expenditures. This additional economic activity is sometimes called the "multiplier effect". The size of the multiplier is determined by the economic activity existing in the county in which the airport in question is located. We have already entered this multiplier information into our data base so when you answer the questions that follow the program will automatically apply the formulas relevant to the county in which the airport is located.

When you have finished answering all the questions to determine an airport's economic impact click on the "Calculate" button. In a matter of seconds a final report will be generated showing the total dollar amount of the economic impact and the number of jobs that are directly and indirectly related to the airports operation. At any time you can go back and re-enter new values for any question, click "Calculate Economic Impact" again and a new report will be generated using these new values.

Figure 3.3

Getting Started:

A person familiar with the airport in question should be the one answering the questions on the next page. Even then some questions may require that additional information be obtained which might require a call or two. Read through the site to determine the information you will need. You will need to enter all the information in one session as the program is not designed to save any information you enter once you exit the site.

After you have entered the name of the airport and the county in which it is located you will be asked to describe the type of activity that takes place at the airport. Check all that apply. If a box is checked we will assume that particular activity does take place at your airport and a screen that asks questions about that activity will appear. If a box is not checked you will not be asked any questions about that activity and it will not appear as part of the economic impact measurement.

Note that the box for Public Ownership is already checked. All the airports in Minnesota for which this web site was developed have a form of public ownership either through direct sponsorship (i.e. municipality) or the Metropolitan Airports Commission (MAC) in the case of the reliever airports. You will need to work with someone who can provide the financials for the airport to answer the questions about public ownership. Since these documents are part of the public record it should not take more than one or two calls to obtain this information that is, if you do not already have it. You may also have to make a call or two to answer a few questions that appear on other screens. You can always insert a number based on "best guess" but when doubtful it is advisable to verify the accuracy of the information through a phone call. That is why it is important to familiarize yourself with the type of information requested before answering the questions. A Fixed Base Operator is defined, for the purposes of this calculator, as any business located at the airport which has as its primary activity some form of aviation. This would include flight schools, charter services, aircraft restoration, etc.

Figure 3.4

Basic Information

What is the name of the airport for which you wish to calculate economic impact?

In which county is this airport located?

What type of activity takes place at this airport (Check all that apply)

- Public Ownership
- Fixed Base Operator and other Aviation Businesses (if checked, how many?)
- Commercial Scheduled Air Service
- Retail Businesses Located at the Airport (if checked, how many?)
- Overnight use by GA Pilots and other Visitors
- Businesses that Ship Freight (if checked, how many?)
- Businesses that Own Hangars and Do Their Own Aircraft Maintenance (if checked, how many?)
- Non-Profit or Government Entities (e.g. Air National Guard. If checked, how many?)
- Other Expenses

Once the appropriate screens have been checked and the number of entities for each category listed the user clicks the “Next” button. This will take the user directly to the “Public Ownership” screen (Figure 3.5). There are three pieces of information that need to be entered on this screen. The first is the year for which the financials are being reported. The reason for this is to include the year in the final report for which economic impact is being calculated.

Additionally, a consumer price-indexing feature has been incorporated into the black box for each year from 1995 to 2003. This gives flexibility for users with data from differing years to standardize and express all economic impact estimates in present dollar figures. The next piece of information that is required is the total dollar figure provided by all government sources for yearly operation of the airport. These figures are subjected to county specific multipliers for the air transportation sector, which includes government expenditures for airport operations. The final piece of information requested is the amount of money spent for construction during the year for which the financials are being reported. Construction expenditures are usually not an every year expense, vary in size, and are related to a different set of multipliers than those used for normal airport maintenance and operation. Once the requested figures have been entered they are multiplied by the appropriate county-based, sector-specific IMPLAN output and employment multipliers to determine the economic impact of public ownership of the airport. If this is the only category that was checked the user can click “Calculate” and a final report detailing the economic impact of public ownership expenses is produced. However if other categories were checked the user will click “Next” and a new screen will appear with questions related to the next category that was checked.

Figure 3.5

Public Ownership

First determine who owns the airport. It may be county, city, combination of city and county, or the Metropolitan Airport Commission. Once you have determined airport ownership you will need to obtain a copy of the latest financials that relate to the airport. This may require a call to the city/county Treasurers Office. You want financials for the most recent year. If funds for operating the airport are derived from more than one source (e.g. city, county, revenues generated) add them all up and enter the total.

Year for which the financials are reported.

Add all the funds budgeted for maintaining and operating this airport in the year for which the financials are available and enter them here. DO NOT include capital improvements costs regardless of source. Enter amounts in whole dollars. For example, \$10,549.00 is entered as 10549.

How much was spent on capital improvements during the same year for which all the other financials are being reported. Do not report multiple year capital improvements expenses. Report only those that occurred during the same time period as for the above categories. Report all capital improvements expenses regardless of source (i.e. local, state, federal). Enter amounts in whole dollars. For example, \$10,549.00 is entered as 10549.

The next category relates to FBO expenditures (Figure 3.6). As mentioned above, four pieces of information need to be identified to calculate the economic impact of FBO operations. The number of full time annual, full time seasonal, part time annual plus the number of planes operated by the FBO are the data required for economic impact of FBO operations to be calculated. Once these figures are entered they are entered into the formula described above. The result is then subjected to county-specific IMPLAN multipliers for the air transportation sector. Resulting from this is the amount of money and jobs directly tied to FBO business operations at the airport. As mentioned a separate screen will appear for each FBO operation that was listed as operating out of the airport. In the final report the total of FBO impacts are listed together and reported as one sum.

The next category deals with commercial scheduled air service (Figure 3.7). There are four data requirements. The first two deal with tourist access through the airport. The user is asked to list the number of enplanements recorded at the airport during the last year. They are then asked to list the percentage of enplanements that are recorded by local residents. The remaining percentage is then multiplied by total enplanements to determine total non-resident access through the airport annually. The total of non-residents is then multiplied by standards for length of stay and amount of spending, per person, in a 24-hour period. These standards, as mentioned earlier, are taken from existing Tourism Center visitor profiles that were conducted for eight different destinations in the state. In order to apply the appropriate length of stay and 24 hour individual spending standards the state was carved into eight different regions. Each airport in a particular region uses the standards unique to that region. Counties that make up a particular region can be found in Appendix B. This process provides total tourist spending which is then

multiplied by specific county level multipliers from IMPLAN. The sectors related to tourist expenditures are lodging, food and beverage service, recreation and attractions, gasoline stations and general retail.

Figure 3.6

Fixed Base Operator (FBO) Page 1

How many full time all year employees does the FBO maintain?

How many full time seasonal employees does the FBO maintain?

How many part time all year employees does the FBO maintain?

How many planes does the FBO operate?

Figure 3.7

Commercial Scheduled Air Service

How many enplanements are recorded at this airport each year?

What percentage of those enplanements are local people (live within a 100 mile radius of the airport)?

How many full time employees does the airline providing the commercial scheduled air service maintain at the airport?

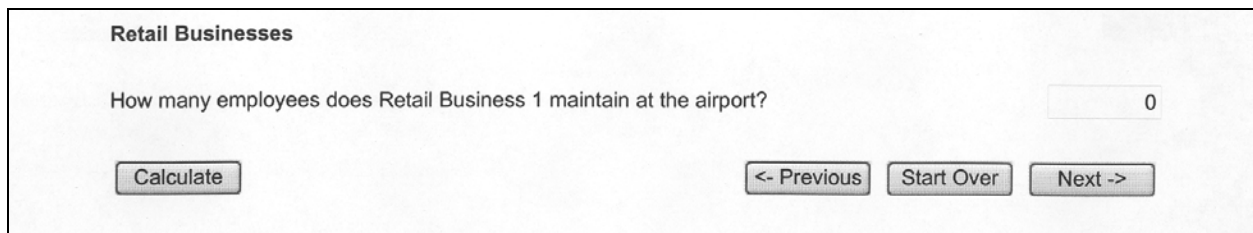
How many Transportation Safety Administration Employees are assigned to the airport?

The second part of the Commercial Scheduled Air Service is the number of employees maintained at the airport by both the airline providing the service and the Federal Governments Transportation Security Administration. U.S. Bureau of Labor Statistics and the Transportation Safety Administration websites provide data on the average wages of state commercial airline workers and TSA employees. Those averages, multiplied by numbers of employees, provide the necessary expenditure data for county impact analysis using the air transportation sector multipliers for determining the economic impact in dollars and jobs generated by the commercial

scheduled air service component operations. When tourist economic impacts are added in total economic impact of this category can be determined. This total is output in the final report.

The next category for analysis is Retail operations (Figure 3.8). There are a variety of retail operations found at Minnesota airports. The most common would be travel agencies and, especially at the airports with commercial scheduled air service, car rental outlets. However other types of retail businesses can be found at some airports. These businesses include restaurants and, in one case, a hair saloon. There is only one piece of information needed to determine economic impact of retail operations and that is the number of employees maintained by the business. Retail businesses have high multipliers associated with them because their customer-to-employee ratios are low, retail employees generally receive low wages/salaries and have low productivity coefficients associated with them. This is the nature of retail businesses worldwide and, with some exceptions, productivity measures remain depressed because the use of technology remains low for the customer/business interface. Therefore the higher multipliers associated with the retail sector will lead to larger economic impacts both in dollars generated in the community and jobs created. As a general rule, the more employees a business maintains per customer the larger the economic impact as wages are less likely to be affected by leakage (i.e. there is more in-community spending) than are hard goods required for inventory replacement. Once the number of employees has been entered, output per employee is calculated and then subjected to IMPLAN county specific retail multipliers to determine total dollar and job economic impact of retail business operations at the airport.

Figure 3.8



Retail Businesses

How many employees does Retail Business 1 maintain at the airport?

The next category “Overnight Use by GA Pilots and Other Visitors” (Figure 3.9) measures the impact from tourist accessing the region through the airport. This is separate from tourist impacts resulting from commercial scheduled air service but the calculations to reach economic impact are the same with one exception. There are two pieces of information required to make this category work. First is the amount of overnight use accounted for by GA pilots. The second is the number of tourists that access the region through the airport but not as pilots. Instead, these tourists use the services of charter operations that may use the airport as a base. Once the number of GA pilots has been entered that number is multiplied by visitor spending standards developed by the Tourism Center for eight regions in the state (see the explanation of this was done above in the commercial scheduled air service category). First the number of GA pilots spending the night is multiplied by average party size and then average length of stay and average spending per day. This provides total expenditures for GA pilots and their party. The number of tourists who use charter services to access the region where the airport is located is multiplied by average length of stay and average spent per day. The total of GA pilot and charter

tourist expenditures is further multiplied by IMPLAN county specific multipliers for the various sectors mentioned earlier that typify tourist spending to determine total economic impact of this category in both money and job terms.

Figure 3.9

Overnight Use by GA Pilots and other Visitors

Record all overnights regardless of purpose of visit (i.e. pleasure or business). Enter the number of yearly overnights recorded by GA pilots not based at the airport. If a plane comes in more than once count each time it spends an overnight.

How many other visitors come into the airport each year as part of a charter (e.g. fishing) or other recreational operation?

The next category, Businesses that Ship Freight (Figure 3.10), is one that will not apply to most of the states airports. However there are some airports that ship and receive freight for a local business. Usually this freight has a low weight to value ratio. It is not possible to determine if a business would relocate should the airport they are using close as business re-location is a very expensive proposition. However the need to use an airport for a business that ships freight is real. Therefore it was decided to estimate the cost saving of using one airport over another. Distance between the currently used airport versus one with similar facilities was used to determine the cost saving for the business currently using the airport to ship freight. The site user is requested to enter the number of times a particular business uses the airport each week and the distance in miles from the airport in use to an airport with similar facilities. Once these data are entered total miles saved from using the airport in question is calculated and multiplied by the government rate for mileage reimbursement, which was set at 40.5 cents per mile when the site was constructed. This figure is then multiplied by IMPLAN specific county multipliers associated with the sector track transportation to determine economic impact in dollars and jobs for this category.

Figure 3.10

Businesses that Ship Freight

On average how many trips per week does Business 1 make to the airport to ship or pick up freight?

How many miles is it from Business 1 to the NEXT nearest airport with similar facilities to Grand Marais airport?

The next category is also a type of business use described earlier in this report. This category consists of non-aviation related businesses that own or rent a hangar at the airport and maintain their own fleet of planes (Figure 3.11). Essentially they operate like a full service FBO but their services are restricted to the business and not available to the general public. Calculating the economic impact of this type of business operation is the same as calculating the economic impact of FBO businesses. Since these types of business operations perform the same services as an FBO the same algorithm applies and the same data gathering questions are asked. IMPLAN county specific multipliers for the air transportation sector are used to estimate the dollars and jobs economic impact.

Next in order is the Government or non-profit entities that may locate at and airport (Figure 3.12). Again since these types of operations own or rent their own hangar and do their own plane maintenance the process used to estimate economic impact is exactly the same used for the FBO and Business Use categories.

Figure 3.11

Businesses that Own Hangars and Do Their Own Aircraft Maintenance - Business 1

How many full time employees does this business maintain at the airport (do not include pilots)?

How many full time seasonal employees does this business maintain at the airport (do not include pilots)?

How many part time annual employees does this business maintain at the airport (do not include pilots)?

How many planes does this business maintain at the airport?

Figure 3.12

Non-Profit or Government Entities - Page 1

How many full time annual employees does this non-profit or government entity maintain at the airport (do not include pilots)?

How many full time seasonal employees does this non-profit or government entity maintain at the airport (do not include pilots)?

How many part time annual employees does this non-profit or government entity maintain at the airport (do not include pilots)?

How many planes does this non-profit or government entity maintain at the airport?

The last category of interest for the calculator is “Other” (Figure 3.13). As mentioned above this category is a catch all for what has not been entered elsewhere. Since this category is wide open we provide some detailed explanation of what should and should not be included when entering data. Also, as mentioned earlier, this category does not use IMPLAN county specific multipliers but instead uses a very conservative (low) multiplier for dollars and jobs which remain the same regardless of county location for the airport. The point is to at least allow the user to get “credit” for an economic enterprise that could not be anticipated or planned for in advance.

When the site user has completed entering data for all the categories checked a final report is produced (Figure 3.14). This report contains an explanation of economic impact along with the estimated economic impact in dollar and job terms for each of the categories for which data has been entered. It also contains a total economic impact estimate derived by summing all the separate category estimates.

Figure 3.13

Other

There may be some expenses that are not taken into account with the categories that have been provided for your use. Include those expenses in this 'Other' category. Examples of what might qualify would include wages for an agriculture sprayer who uses the airport as a base of operations while doing the spraying. Also the costs of the chemicals used to spray on the crops could be included if that expense occurred in the county in which the airport is located. The decision rule for using the 'Other' category is that whatever is paid must be an expense and not revenue. For example property taxes paid by those who own their own hangar is considered an airport revenue and not an airport expense and therefore should not be included in the total for this category. In the case of the agriculture sprayer, wages received for doing the work are an expense for the farmer paying for this service. In a similar manner the cost of the chemicals used for spraying are an expense for the farmer and would be included provided those chemicals were purchased in the county where the airport is located. Another example would be the acquisition of land by the airport authority. The cost of purchasing land would be considered an 'Other' expense. Before you use this 'Other' category, make sure the expenses do not fit into any other category.

What are the total expenses you wish to include in this category? Enter amounts in whole dollars. For example, \$10,549.00 is entered as 10549.

Indicate what these expenses are for.

Figure 3.14

Airport Economic Impact Calculator Report

This report has been prepared based on the answers you provided to the questions asked about the economic activity at Grand Marais airport for the year 2004.

It is important to remember as you read through this report that economic impact is not revenue or profit. It is a measure of the change or additional money and jobs that have been created as a result of the current economic activity taking place at the airport. This is what is called the "multiplier effect". Multipliers summarize and consist of direct, indirect and induced effects. Regarding your airport, a direct effect is the change in production of goods and/or services by an organization or business that would not have occurred if it were not for the existence of the airport. Indirect effects describe the changes in production by businesses that provide inputs to the directly affected airport industries or businesses. Finally, induced effects are the changes in area household spending patterns caused by changes in household income generated by the direct and indirect airport effects. In this report, the impacts are expressed in monetary and job terms and the totals shown for both are the sum of all the direct, indirect and induced effects. All impacts are measured at the county level in which the airport is located. The national and state data sets used for economic impact estimation are based on actual spending that takes place at the county level.

The findings below are set up such that total economic impact, that is the sum of all the economic activity that has been calculated, is displayed first. After that the economic impact related to the different types of economic activity, which you have identified as occurring at the airport, are displayed. This way you can see the contribution to total economic impact due to each one of the different types of economic activity that take place at the airport.

Total Economic Impact

The total economic impact of the activity reported at Grand Marais airport amounts to \$245,882.00 and 2.20 jobs county-wide in the year 2004.

VI. Test Web Site Calculator

The web site, once constructed, was tested by a group of volunteers who attended a presentation made by the P.I. in November of 2004 at the Center for Transportation Studies, University of Minnesota and MnDOT Aeronautics AirTAP (Airport Technical Assistance Program) Fall Forum. In addition members of the Technical Advisory Panel for this study were asked to test the workability of the site. The test revealed some editorial work that needed to be performed but more importantly it revealed a fatal flaw in the algorithm selected for use, as detailed above. After making the editorial changes and replacing the algorithm with one possessing less predictive power (i.e. lower level of variance explained) but more validity (stability) for input variables outside the range from which the algorithm was developed a second test was performed in January 2005. The same testers were used with MnDOT Aeronautics personnel and MCOA Board members added. No additional editorial work or other edits were required after this round of testing.

VII. Deploy Calculator

The Web Site Calculator was turned over to MnDOT Aeronautics for full deployment in late January 2005. It is listed as a special feature on the sidebar at: www.dot.state.mn.us/aero.

Chapter 4

Model Limitations

The deployed calculator was developed to estimate the economic impact of 133 General Aviation airports in the state of Minnesota. As detailed above, site visits and primary data collection were the primary means used to collect information about how airports in Minnesota function. What became obvious, especially from the site visits, is that many different activities take place among the system of airports in the state. However, even with the differences there was enough commonality to develop standards that apply to all the airports. Some of those standards, such as multipliers taken directly from IMPLAN, can be considered fairly solid as long as the appropriate sector is identified. The investigators on this study have full faith and confidence that the multipliers used were appropriate and accurate.

Another set of standards, regional length-of-stay and per-person, per-day expenditures, are appropriate but may not be as accurate. These standards were derived from destination visitor profile studies carried out by the University of Minnesota, Tourism Center. These studies cover all types of tourists, but primarily those who arrive at the destination in a private motor vehicle. Consequently, they may not accurately reflect length-of-stay and expenditure patterns for tourists who arrive by airplane. In the absence of any other data to fine tune these standards, the visitor profile data remain the best fit.

One of the features of the calculator is adjustment for inflation. Since financial data may be entered for any year of airport operation the Consumer Price Index (CPI) was used for adjustment. The CPI figures used cover the years 1995 -2004. Using this adjustment feature the economic impact estimates contained in the final report are expressed in 2004 dollar values. Over time these figures will remain in 2004 values although input values may be expressed in 2005, or later, nominal values. This issue is easily corrected if the web site standards are refreshed on a periodic basis. Two year intervals are recommended as the appropriate period for adjustment.

Similar to the CPI adjustment issue, the business freight feature of the calculator uses federal mileage reimbursement rates for 2004. As energy prices fluctuate this mileage rate may have to be adjusted. If energy costs are substantially higher or lower from one year to the next it would be advisable to change the mileage rate when other website maintenance is being performed.

The same must be said about the IMPLAN multipliers. IMPLAN reflects a static picture of a county's economic base existing in a particular year. Although most county-based sector multipliers change little from year to year the possibility for substantial change occurs when a county either gains or loses a major employer. Given that the statewide economic base does not change significantly on an annual basis IMPLAN multiplier adjustments can be done on a 3-5 year interval.

The most significant limitation of the developed calculator has to do with the operational equation used to determine expenditures from FBOs and other types of businesses that operate in

a similar manner to FBOs (i.e. businesses, government entities etc that have their own hangar and do their own aircraft maintenance). As mentioned earlier, if an FBO is present, it may be a significant contributor to regional economic impact. When data collection of FBO financials was initially undertaken it was hoped that data collected would yield enough information to determine expenditures based on types of service (e.g. aircraft renovation, flight school) provided. As detailed above, not enough questionnaires were returned to allow for this degree of model refinement. Therefore, regardless of FBO specialization, one general equation is used to determine the level of FBO expenditures for all. Related to this issue is the degree to which this equation accurately determines expenditure level. As mentioned above, the first equation employed accounted for slightly over 90% of the variance in expenditures when four variables were known. The four variables were number of full time annual employees, number of full time seasonal employees, number of part time annual employees, and number of planes maintained and operated. However, since only five data points were used to develop the equation it was highly unstable for values beyond the range of those used in its calculation. Therefore, a new equation was used that included the complete set of FBO questionnaire returns even if some data were considered “outliers” (i.e. defined as more than three standard deviations from the mean). This second equation was calculated from 19 data points and accounts for less of the variance around the range of expenditures than the previous equation but it is much more stable. The amount of variance explained by using this equation is 79.78%. The full time annual employee variable is no longer considered statistically significant thus reducing its predictive value. Nonetheless, the equation now employed in the calculator is the best that can be generated given the number of completed questionnaires returned for analysis.

It is recommended that a new effort to obtain more detailed financials for FBOs be considered as a way to improve calculator accuracy. It may be possible to use a variety of secondary and primary sources to accomplish this task. As FBO expenditures are a prime ingredient in economic impact analysis the model can be improved by further attention to this component. Although the model, as currently deployed, is considered to provide a good estimation of FBO expenditures, greater accuracy can be obtained by more work on this feature of the calculator.

The deployed calculator should be kept current. Updating the Consumer Price Index (CPI) is fairly easy and can be done in house. Every two years would be sufficient for this task. Updating county based multipliers is, however, a more substantial task. It would require someone with access to IMPLAN multipliers, select those multipliers related to the economic sectors employed in this research, and update each one on a county by county basis. Since the economic base of a region normally changes slowly, an exception being if a major new employer were to move into or exit a county, multiplier updates can be performed on a four to five year cycle.

Chapter 5

Discussion and Conclusion

This report details a twenty-one month effort to develop a web-based economic impact calculator for Minnesota's General Aviation airports with the exception of Minneapolis/St. Paul, Rochester, and Duluth International. The process involved site visits to 51 airports, meetings with airport managers, FBOs, Metropolitan Airport Council officials, and data collection of financials from airport sponsors and FBOs. The result was the creation of a website that queries users, over successive web pages, to determine their airport's economic impact based on the activities taking place at that airport. The different types of airport activities included in the web-based model were: Airport Sponsors, Fixed Base Operators, Commercial Scheduled Air Service, Businesses that ship freight out of an airport, Businesses that own or rent Hangars and perform airplane maintenance, Overnight use by General Aviation pilots and other Visitors, Retail Operations and "Other" expenditures. Each one of these categories, for which a separate screen on the web-based system is devoted, has one or more questions associated with it. The answers to these questions are then entered into an equation or are associated with certain "standards" that determine expected expenditures associated with that activity. Utilizing an input-output model at the county level (IMPLAN), expenditures are multiplied by sector specific economic impact multipliers that take into account direct, indirect and induced spending for the county in which the airport is located. The end result is the economic impact from each of the airport activities that exist at a particular airport. A final report is produced that reveals the economic impact related to a specific activity as well as a summary economic impact estimate of all activities.

Once the Calculator was developed it went through two tests using volunteer (managers) from Minnesota airports and MnDOT Aeronautics personnel. The first test revealed a major issue with the equation used to calculate FBO and related entity expenditure. It was then replaced with another equation that has a lower level of predictability but is more stable outside the range of variable inputs from which it was created. The second test revealed nothing that needed correction either from an editorial standpoint or with the new equation. It was then transferred to the MnDOT Aeronautics server and is fully deployed as of this writing. It can be found at: <http://dotapp1.dot.state.mn.us:8080/aeic/main.htm>.

The Calculator produces economic impact values that should be considered as estimations and not exact figures. In the limitations section of this report some of the more salient issues for updating and refining the Calculator are discussed. The most important of those issues has to do with the relatively low response rate to the FBO survey. This survey was used to determine the operational equation used to calculate FBO and related entity expenditures. Any improvement that leads to a better expenditure estimation equation will surely improve the Calculator. A combination of primary and secondary data sources may be used to collect more detailed information leading to a better predictive equation. Still the high level of variance in the sample accounted for (79.78%) by the expenditure estimation equation should provide fairly accurate estimates of total economic impact.

It has been suggested, by one of the investigators of this study in response to a question raised at a public forum, that the Calculator may be used to determine total economic impact of the General Aviation Airport system in the state of Minnesota provided the results for each airport are summed. This is only partially correct for mainly one reason. Economic impact is a geographically relative concept. Described earlier in relation to the use of IMPLAN multipliers in this study, impact comes from accounting for the productive, economic gains captured inside the defined region, i.e., county. When intermediate goods must be imported from a neighboring county, state or internationally to produce the final good or service, those expenditures are “lost” to the study area and benefit the region producing and shipping the intermediate good. By summing all 87 Minnesota county impact estimates independently determined in order to define a state total impact, the approach will always miss accounting for Minnesota intercounty transfers/sales of intermediate goods and services. This means that county multipliers for each sector are lower than multipliers derived when the state is the study region for the same sector due to this economic “leakage.” Therefore, a conservative bias will result from summing each airports economic impact, as determined by the Calculator.

Finally, although the model discussed in this report was developed to estimate economic impact of airport operations and activity it does not detail all the benefits airports provide. There are a number of non-quantifiable impacts that are significant. Foremost among them would be medical and life support airlift. There is no regular schedule from which this activity could be modeled and questions remain as to whether any local expenditures are associated with the activity. There is no question however, especially if you are the individual needing a medical airlift, that it is an essential service. Other services that may be of a sporadic and temporal nature may include fire suppression. What is most important is to recognize that these services require a network of regional airports to be useful and the present system of General Aviation airports in the state fills that need. Although there may be very little economic impact associated with these types of uses the value is much more than can be quantitatively determined.

The economic impact software now deployed required over 21 months of effort, over 50 airport visits, meetings with airport managers and administrative personnel, advice from a Technical Advisory Panel and close cooperation with MnDOT Aeronautics personnel to develop. The Investigators on this study feel that it is about as complete as one can make a software calculator meant to serve 133 General Aviation airports in Minnesota.

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APPENDIX A
Airports Visited

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Airports Visited

St. Cloud	Princeton
Cambridge	Winsted
Hutchinson	Litchfield
Hector	Willmar
Montevideo	Canby
Madison	Ortonville
Benson	Glenwood
Morris	Fairmont
Marshall	Owatonna
Lakeville	Faribault
Lake Elmo	St. Paul Downtown
Milaca	Red Wing
Waseca	Dodge Center
Airlake	Baudette
Winona	Brainerd
Thief River Falls	International Falls
Bemidji	Pine River
Park Rapids	Warroad
Little Fork	Big Fork
Detroit Lakes	Perham
South St. Paul	Granite Falls
Jackson	Worthington
Austin	Mankato
Grand Rapids	Anoka County/Blaine
Grand Marais	Duluth Sky Harbor
Lake Elmo	

APPENDIX B
Standards for Multiplier Application and Overnight Use

APPENDIX B
Standards for Multiplier Application and Overnight Use

COUNTY	Profile Zone	COUNTY	Profile Zone	COUNTY	Profile Zone
Lake of the Woods	1	Wilkin	5	Wabasha	7
Roseau	1	Aitkin	6	Washington	7
Kittson	2	Benton	6	Winona	7
Mahnomen	2	Carlton	6	Wright	7
Marshall	2	Crow Wing	6	Blue Earth	8
Norman	2	Kanabec	6	Brown	8
Pennington	2	Mille Lacs	6	Chippewa	8
Polk	2	Morrison	6	Cottonwood	8
Red Lake	2	Pine	6	Dodge	8
Beltrami	3	Todd	6	Faribault	8
Cass	3	Wadena	6	Fillmore	8
Clearwater	3	Anoka	7	Freeborn	8
Hubbard	3	Carver	7	Houston	8
Itasca	3	Chisago	7	Jackson	8
Koochiching	3	Dakota	7	Lincoln	8
Cook	4	Goodhue	7	Lyon	8
Lake	4	Hennepin	7	Martin	8
St. Louis	4	Isanti	7	Mower	8
Becker	5	Kandiyohi	7	Murray	8
Big Stone	5	Le Sueur	7	Nicollet	8
Clay	5	McLeod	7	Nobles	8
Douglas	5	Meeker	7	Pipestone	8
Grant	5	Olmsted	7	Redwood	8
Lac qui Parle	5	Ramsey	7	Renville	8
Otter Tail	5	Rice	7	Rock	8
Pope	5	Scott	7	Steele	8
Stevens	5	Sherburne	7	Waseca	8
Swift	5	Sibley	7	Watonwan	8
Traverse	5	Stearns	7	Yellow Medicine	8

Profile Zones

Spending	Lake of Woods = 1	Red River = 2	Itasca = 3	Ely = 4	Detroit Lakes = 5	Brainerd = 6	Shakopee = 7	Pipestone = 8
Lodging	\$62.86	\$31.19	\$37.27	\$28.66	\$33.10	\$23.51	\$21.66	\$16.98
Food & Beverage	\$41.66	\$27.65	\$13.85	\$15.27	\$12.27	\$16.99	\$11.56	\$12.06
Shopping	\$9.86	\$20.75	\$10.99	\$21.38	\$10.72	\$14.42	\$16.26	\$7.61
Transportation (Gas)	\$24.00	\$20.36	\$7.28	\$8.46	\$6.03	\$6.24	\$13.86	\$5.33
Groceries	\$14.00	\$18.22	\$5.64	\$5.90	\$3.70	\$5.97	\$0.85	\$1.67
Misc	\$1.71	\$1.44	\$3.58	\$2.28	\$1.82	\$3.58	\$2.53	\$1.58
Recreation & Attractions	\$9.58	\$10.58	\$3.23	\$8.89	\$2.72	\$8.26	\$12.47	\$2.40
# Trips /Year	6.1	5	2.6	1.7	3.4	4.8	2.9	1.3
Average Stay/Trip	3.8	4	4.8	9	6.4	5	1.6	1.9