

An Analysis of the Economic Impact of the Chattanooga Metropolitan Airport:

A Report to the Board of Directors of the
Chattanooga Metropolitan Airport Authority

Community Research Council

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Introduction and Methodology

The Chattanooga Metropolitan Airport Authority (CMAA) commissioned the Community Research Council (CRC) to conduct an overall assessment of the current economic impact of the Chattanooga Metropolitan Airport on the regional economy.

To develop this assessment, CRC engaged in a series of research tasks:

Literature Review

CRC conducted a review and assessment of relevant literature on the relationship between airport activity and economic development. This review is utilized to form the basis for the impact analysis.

Employment and Income Impact Analysis

CRC conducted an assessment of the regional economic effects resulting from airport-related activity. Impact estimates are derived from a regional input-output impact model using existing industry-to-industry and household to industry relationships.

Comparative Analysis

CRC conducted a multiple regression analysis of the relationship between air service and economic growth in mid-size cities to determine how increases (or decreases) in air services are related to changes in population, firm growth, income and employment in the selected comparison regions.

Location Factor Analysis

CRC conducted an assessment of location factors of firms that have recently invested, located or expanded operations in the Chattanooga region. This analysis is used to determine the relative importance of local air service in the decision-making processes of these firms.

For the purpose of developing the employment and income impact, this study primarily relied on a methodology developed by the Federal Aviation Administration (1992), which outlined impact estimate techniques and standardized methods of assessing the relationship among airport service and regional growth. These methods were employed when practical, when data was available, or in cases in which the suggested estimation technique was determined to be capable of yielding valid and reliable results.

Table 1. Impact Study Components Based on FAA Guidance

Study Component	Included	Comments
Impact Estimate, Airport and Related Operations	Yes	Input-Output Analysis
Impact Estimate, Transportation Cost Analysis	Yes	Alternate Market Cost Model
Enplanement/Economic Growth Association Assessment	Yes	Mid-Size County Framework
Impact Estimate, General Aviation	Yes	Based Aircraft/Employment Ratio
Impact Estimate, Airport-Related Visitor Spending	Yes	Scenario-Based Analysis

Summary of Findings

Our analysis suggests the Chattanooga Metropolitan Airport Generates **1,440 jobs** and **\$166,708,717 in local income and output** within the Chattanooga Region.

Table 2. Summary of Economic Impact

	Direct	Indirect	Induced	Total
Airport Operations				
Employment	640	174	202	1,016
Output	\$57,596,443	\$16,595,159	\$20,066,029	\$94,257,631
Income	\$22,444,283	\$6,050,040	\$6,296,467	\$34,780,790
Total	\$80,040,726	\$22,645,199	\$26,362,496	\$129,038,421
Visitors				
Employment	307	37	48	392
Output	\$15,635,569	\$4,096,557	\$4,763,976	\$24,496,102
Income	\$5,464,744	\$1,307,964	\$1,492,504	\$8,265,212
Total	\$21,100,313	\$5,404,521	\$6,256,480	\$32,761,314
General Aviation				
Employment	16	10	6	32
Output	\$2,466,844	\$861,118	\$585,909	\$3,913,871
Income	\$489,660	\$321,900	\$183,551	\$995,111
Total	\$2,956,504	\$1,183,018	\$769,460	\$4,908,982
Total Impact				
Employment	963	221	256	1,440
Output	\$75,698,856	\$21,552,834	\$25,415,914	\$122,667,604
Income	\$28,398,687	\$7,679,904	\$7,972,522	\$44,041,113
Grand Total	\$104,097,543	\$29,232,738	\$33,388,436	\$166,708,717

This impact includes \$129,038,421 in total impacts from airport operations, \$32,761,314 in total impacts derived from air passenger tourism, and \$4,908,982

in impacts resulting from general aviation activity. Additional economic benefits may also result from spending by visitors and business travelers arriving in Chattanooga using general aviation and through productivity savings due to reduced travel costs.

CRC's analysis of other midsize regions and airports finds that there is only a limited relationship between growth in enplanements and cargo at regional airports and growth in regional population, employment and wages. Passenger growth explains 10% of the change in regional population and wages and 14% of growth in regional employment. This finding is at variance with other studies that have identified a stronger relationship, though those studies have tended to focus on both larger airports and more populous regions.

CRC also found that air service at CMAA, given current levels of service, has not played a major role in the decisions of firms that have recently located, expanded, or invested in the region.

The Relationship Between Air Service and Regional Economic Development

Airports primarily generate economic impact through the operation of the airport itself. Airport employment depends on the volume of aviation activity at an airport, which is determined not only by the population of the region it serves, but also by the airport's air service function. The number of commercial flights and the mix of locations served by them defines whether the airport functions as an: (1) intercontinental gateway, (2) international (same continent) gateway, (3) regional transfer hub, (4) local origin/destination point, (5) specialized air cargo distribution center, or (6) overnight parcel hub.

Empirical studies confirm the common sense assumption that higher traffic results in economic effects of higher magnitude. Bruckner (2003) has found that a ten percent increase in passenger enplanements in a metro area results in a one percent increase in service employment, controlling for reverse causality. Button's (1999) study of 300 metropolitan areas similarly confirmed a positive relationship between the level of high-technology employment and airport size. Additionally, Green (2002) found that passenger boardings per capita and passenger originations per capita are "powerful predictors of population and employment growth" (p.18).

Activities immediately adjacent to commercial airports typically include services directly supporting operation of the airport, services for airline employees and passengers, and airport-related freight services. These types of activities are often located on adjacent land reserved for such uses. For each of these three types of activities, the employment level is directly proportional to the corresponding magnitude of the airport function as an aircraft servicing center, a passenger flight endpoint, or a freight origin or destination.

Indirect or second-round spending normally occurs within close proximity to the airport facility. Development in these areas can be classified as either "spin-off industries" or "attracted businesses. Spin-off industries include filling stations, lodging and housing for airport workers, and retail establishments that serve them. These activities grow directly with airport activity levels. Attracted businesses value location near an airport because of its air service and accessibility for visiting customers and employees coming by air. Activities are normally centered on high concentrations of air transport services, freight forwarding, warehousing and high-tech oriented businesses that produce products that have high value-to-weight ratio.

Airport activity can have several different types of effects on business activity in the rest of the metropolitan area or region, each of which must be appropriately handled in any accounting of overall regional impacts. Some business activities may shift away from elsewhere in the metropolitan area to relocate in the airport vicinity. This represents neither net growth nor net loss for the region as a whole. Some businesses may be attracted to locate in the metropolitan area, but not specifically in the airport vicinity, because of the improved quality of life and upgraded air service for the region. Some business growth occurs elsewhere in the metropolitan area as an indirect effect of net regional growth in airport-related businesses, as those businesses in turn increase demand for other local goods and services supplied to them. Other business growth occurs as an induced effect of the additional consumer spending by workers hired at airport-related businesses and their suppliers.

Perhaps most important for the Chattanooga airport, new activities may be attracted from outside of the area because of the access provided by enhanced air service. If a given airport offers a sufficient array of airline options, departure times and connections to major cities, this may help the region to attract: (a) regional or national corporate headquarters of large national and multi-national companies; (b) trade and merchandise centers marketing retail or industrial products; (c) service companies that are dependent on air service to reach their markets; and/or (d) airlines and related activities. Expansion of activities in the metropolitan area can occur for types of businesses that are users of airport services, suppliers to markets generated by the airport, or businesses that can take advantage of the local transport and other supporting infrastructure developed primarily to serve the airport. These are typically: (a) high-tech electronics and specialized equipment manufacturers, (b) communications companies, (c) warehouse and delivery services, and (d) a variety of specialized business services.

Prior Research Findings

One of the first empirical analyses of airport growth on metropolitan economies was conducted by Irwin and Kasarda (1991). The authors found that the rise of the airline industry and changes in the airline network through the 1970s and 1980s were important factors in the increased economic growth and competitiveness of urban areas well positioned within the network. Irwin and Kasarda point to Denver and Nashville as examples of smaller metropolitan areas that were integrated into the airline network, resulting in economic growth and increased prominence. A

study by Klier (2006) examining the flow of large public companies between the 50 largest metropolitan areas found that Nashville received the second highest share of new companies between 1990 and 2000. The integration of Nashville and other cities into the airline network “has led to differential access to foreign markets, introducing new dimensions of economic growth into the metropolitan system” (Irwin and Kasarda, 1991, p. 535).

Another study by Debbage and Delk (2001) examined the relationship between employment levels of administrative and auxiliary sector¹ employees and air passenger volume for the top 50 U.S. metropolitan airports between 1973 and 1996. The authors note that a significant proportion of U.S. airline passengers travel for business, supposing that business and airline activity are closely related. Citing research by Button and Taylor (2000), Debbage and Delk write that employees of information age industries are over 1.6 times more likely to fly than employees of other industries: A statistically significant relationship existed between airline service and economic development, especially for particular metropolitan areas that generate employment in knowledge-based sectors.

A study by Brueckner (2003) took a different approach in trying to explain the relationship between economic development and the airline industry by measuring levels of airline traffic. The study differed from earlier research in that it considered volume of traffic and employment by different industry sectors: goods-related employment² and service-related employment³ were the two sectors measured.

The author notes the common supposition that poor airline service inhibits employment growth by limiting a metropolitan area’s ability to attract new businesses and grow existing businesses, which “may in turn impair the viability of...enterprise, especially in high-tech industries where exchange of information is critical” (p. 1455). Brueckner emphasizes the importance of good airline service by pointing out well-established research citing air travel’s impact on agglomeration economies, where poor service would limit agglomeration economies, thus hampering economic growth.⁴

The empirical findings of Brueckner’s study show an increase in passenger enplanements of 10 percent will result in approximately a 1 percent increase in employment. This finding applied only for service-related employment, as airline

¹ “The administrative and auxiliary sector primarily consists of workers engaged in activities such as management, research and development, financial services and supporting services such as accounting and data processing.” (Debbage and Delk, 2001, p. 159)

² Manufacturing, construction and mining. (Brueckner, 2003)

³ Wholesale and retail trade, FIRE (finance, insurance and real estate), services, government, transport and public utilities employment. (Brueckner, 2003)

⁴ “The term *economies of agglomeration* is used to describe the benefits that firms obtain when locating near each other. It is related to the idea of economies of scale and network effects in that the more related firms that are clustered together, the lower the cost of production. This is because firms have competing multiple suppliers, greater specialization of labor and greater ease of learning from other firms. Even when multiple firms in the same sectors (competitors) cluster, there may be advantages because that cluster attracts more suppliers and customers than a single firm could alone.” (LINFO, 2007)

traffic was found to have no impact on goods-related employment. It is important to note Brueckner's estimates were produced with a control for "reverse causality between employment and traffic" (p. 1467).

Another study by Green (2007) analyzed both passenger boardings per capita and passenger originations per capita to determine economic performance (measured in terms of population and employment growth). Both Green and Brueckner found that increased traffic at airports stimulate employment growth, both directly and indirectly. Green found that an increase in boarding per capita of one standard deviation resulted in increased employment growth of 8 percent. Green notes that the statistical significance of these findings are "sufficiently strong" (p. 110) and that they are consistent with the findings in Brueckner (2003).

Like Brueckner (2003), Green found no link between air traffic and economic development in regards to goods-related (manufacturing) employment. Green attempted to address the initial findings in Brueckner by measuring cargo activity. But with the results of this measure being insignificant, Green arrived at the same conclusion, supposing that the type of manufacturing-related economic development resulting from increased airline traffic has become more automated, resulting in fewer and lower paying jobs.

Prior research also suggests that air service could have an effect on business location decisions. A study by Karakaya and Canel (1998) examined the 84 fastest-growing businesses in New England and New York and 27 site selection criteria. The study grouped all of the selection criteria into six main factors. The accessibility factor,⁵ which included highways and airports, is ranked the third most important underlying location factor. When site selection criteria are ranked individually, the proximity to major airports ranks seventh and the proximity of local airports ranks 10th. Proximity to major highways ranked sixth on the list of criteria. De Noble and Galbraith (1992) found that proximity to an airport ranked 10th among specific site location criteria of U.S. high technology firms.

Air service could also affect foreign investment in a region. A study by Rodinelli, Johnson and Kasarda (1998) on changing forces of urban economic development stress the importance of American cities investing in "modern and efficient physical infrastructures—roads, bridges, highways, energy systems, telecommunications and airport and air cargo facilities—that facilitate international trade and investment" (p. 92). The authors note that modern air and logistical facilities are growing in importance in regards to the ability of a region to attract foreign investment. Another study by Coughlin, Terza and Arromdee (1991) on the location characteristics of foreign direct investment in the U.S. have found the number of airports to be statistically significant in regards to determining the likelihood of foreign direct investment. Finally, a study by Ulgado (1996) on the location characteristics of manufacturing investments in the U.S. by foreign firms reveals that foreign investors, specifically those from Japan and Germany, consider the

⁵ "Proximity to major US airports, highways, and availability to local airport..." (Karakaya and Canel 1998)

availability of transportation services significantly more important than do American investors.

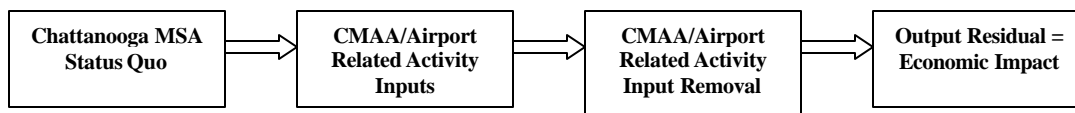
Current Economic Impact of Chattanooga Metropolitan Airport

General Methodology

The impact analysis for the Chattanooga Metropolitan Airport and related activity was conducted using an input-output modeling framework. Input-output modeling assumes that critical linkages exist between certain industries, so that changes in employment or output in one industry affects one or more linked industries within the regional economy. Households are also affected, as employees working at linked industries have an impact on consumption, which in turn affects the employment and output of additional industries. In this way, increased (or decreased) employment or output in one or more industries will “ripple” through the regional economy to create an aggregate economic impact on industries and households in the region. Input-Output modeling provides a means of estimating this effect.

For this analysis, a removed treatment design was used to determine regional impacts derived from CMAA operations and related activity. A status quo model of the Chattanooga region, defined as the Chattanooga Metropolitan Statistical Area (Dade, Walker, Catoosa, Sequatchie, Marion and Hamilton Counties), was derived using survey-based industry and household linkage data obtained from the IMPLAN Group, Inc.

Economic Impact Modeling Process



Inputs for the impact model were derived from a survey of tenants, service providers and air service carriers associated with CMAA. In cases in which data was unavailable, estimates were derived by the methods enumerated in detail within each relevant section of this study. Survey results and estimates were used to construct an industry-based framework of industry inputs related to CMAA operations, general aviation, and air passenger-based tourism.

Inputs derived from the survey were then removed from the model of the Chattanooga region to derive an estimate of how the regional economy would be structured in the absence of CMAA. The residual represents the total economic impact that CMAA exerts on the regional economy.

Airport Operations

Surveys were sent to 94 firms with operations at or near the airport. Telephone surveys were then administered to mail survey non-respondents. A total of 27 firms responded to the mail and telephone surveys, representing a 28.7% response rate. Employment and revenue data for an additional 17 firms was obtained through Dunn and Bradstreet firm data.

Many of the large, non-responding firms were in the package delivery/cargo industry. Output estimates for this industry were derived from industry standard freight revenue per pound estimates.⁶ Based on an air freight total of 15,311,544 pounds for 2006, total output for this industry was estimated to be \$14,239,735.

Certain data points were omitted where data could not be obtained or estimated. While such omissions in most cases cannot be avoided, it is likely that such omissions have resulted in an underestimation of impacts resulting from Chattanooga Metropolitan Airport operations, although the overall effect on aggregate impact estimates is likely minimal. For example, survey responses were not received from – nor were estimates available for – the following employers: Budget Rent-A-Car, Checker Cab, Mercury Cab, the National Weather Service and the National Forest Service.

Industry output represents changes in the amount of production, stated in monetary terms, resulting from changes in employment or output in one or more linked industries. Considering the effects of direct, indirect and induced output, total local output resulting from airport-related operations is \$129,038,421. Direct airport-related output is \$57,596,443. Indirect output from airport-related operations is \$16,595,159, while induced output is \$20,066,029.

Table 3. Economic Impact of Airport Operations

	Direct	Indirect	Induced	Total
Employment	640	174	202	1,016
Output	\$57,596,443	\$16,595,159	\$20,066,029	\$94,257,631
Income	\$22,444,283	\$6,050,040	\$6,296,467	\$34,780,790
Impact Total	\$80,040,726	\$22,645,199	\$26,362,496	\$129,038,421

Considering the effects of direct, indirect and induced employment, total local employment resulting from airport-related operations is 1,016 jobs. Direct employment is estimated to be 640 jobs. Indirect employment is estimated to be 174 jobs, while induced employment is estimated to be 202 jobs.

⁶ For example, Federal Express reported \$0.93 revenue per pound of cargo. This was used as the industry standard for all freight carriers at the airport. U.S. Securities and Exchange Commission, Form 8-K, Current Report – Federal Express Corporation, Commission File Number 1-15829, 2006.

Changes in regional income occur as a result of changes in employment or output in one or more linked industries within the region. Total direct, indirect and induced income effects resulting from airport related operations are \$34,780,790. The direct income effect is \$22,444,283. Indirect income resulting from airport-related operations is estimated to be \$6,050,040, while induced income is estimated at \$6,296,467.

Visitor Spending

The FAA (1992) suggests a methodology for assessing the importance of air service to regional visitor activity based on the ratio of arriving passengers to regional population. According to the FAA:

AP/POP is a rough measure of the extent to which an area attracts visitors, both business and pleasure.....If AP/POP is less than 1, the indirect impacts of the airport are likely to be negligible and should be ignored. This situation could be the result of heavy reliance by visitors and local travelers on a larger airport in a nearby metropolitan area (p.20).

For CMAA, the ratio in 2006 was .469, suggesting that the impact of air service on regional visitors could be negligible.

CRC explored an alternate methodology to measure the impact of visitor spending that was employed by the University of Memphis in its study of impacts derived from Memphis International Airport (2005).

The Memphis impact study employed the DB1B DOT/FAA Database, which is a 10% sample of all flight itineraries of passengers within the U.S. With this data, it is possible to determine the percentage of passengers boarding flights at Chattanooga Metropolitan Airport who began their journey there or at some other city. This method was employed to determine the number of annual visitors to the Chattanooga area that uses CMAA air services.

2006 DB1B data for Chattanooga Metropolitan Airports indicates that 73.5% of passengers boarding planes in Chattanooga were "round-trippers", meaning they started and ended their trips in Chattanooga (i.e. residents). The remainder, 26.5%, either took one-way trips out of town (reasoned to be a negligible amount) or originated their trips elsewhere and could be considered visitors to the area. If this proportion is applied to the 2006 enplanement data for Chattanooga Metropolitan Airport, the Chattanooga region is estimated to have 67,564 annual visitors as a result of air service.

CRC derived a per-visitor spending estimate of \$86 per day based on data on overall spending by visitors and annual visitor estimates for the region.⁷ Using this rate, an average air traveler would spend \$172 during a two-day visit to the region.

Business travelers, however, might spend at a greater rate. For example, under federal per diem rates, a business traveler to Chattanooga may spend a total of \$129 per day.⁸

Table 4. Chattanooga Region Visitor Spending Estimates

Scenario	Visitors	Per Day Spending	Days	Per Trip Spending	Total Spending
General Visitor	67,564	\$86	1	\$86	\$5,810,504
	67,564	\$86	2	\$172	\$11,621,008
	67,564	\$86	3	\$258	\$17,431,512
	67,564	\$86	4	\$344	\$23,242,016
	67,564	\$86	5	\$430	\$29,052,520
	67,564	\$86	6	\$516	\$34,863,024
	67,564	\$86	7	\$602	\$40,673,528
	Business	67,564	\$129	1	\$129
67,564		\$129	2	\$258	\$17,431,512
67,564		\$129	3	\$387	\$26,147,268
67,564		\$129	4	\$516	\$34,863,024
67,564		\$129	5	\$645	\$43,578,780
67,564		\$129	6	\$774	\$52,294,536
67,564		\$129	7	\$903	\$61,010,292

Air service-related visitor expenditures impact the regional economy through successive rounds as spending on lodging, meals and incidental items occurs. If the spending behavior of the average tourist air passenger is modeled using the federal per diem rate for meals, incidentals and lodging, an aggregate annual air tourist count of 67,564 visiting Chattanooga for two-days/nights yields a total employment effect of **392 jobs**. This scenario would also yield a total output effect of \$24,496,102 and a total income effect of \$8,265,212, representing an aggregate monetary impact of **\$32,761,314**.

⁷ Data on total spending from the Tourism Institute and data on total visitors from the Chamber of Commerce. See, Tourism Institute, University of Tennessee – Knoxville, *2006 Hamilton County, Tennessee Economic Fact Sheet*, www.utk.edu/tourism and Chattanooga Area Chamber of Commerce, *Community Data and Locational Advantages*, www.chattanoogachamber.com/PDF_Files/2007_data_book.pdf.

⁸ General Services Administration, Office of Government-wide Policy, Attn: Travel Management Policy Division, www.gsa.gov.

Table 5. Visitor Impacts – Two Day, Per Diem Scenario

Impact	Direct	Indirect	Induced	Total
Employment	307	37	48	392
Output	\$15,635,569	\$4,096,557	\$4,763,976	\$24,496,102
Income	\$5,464,744	\$1,307,964	\$1,492,504	\$8,265,212
Total	\$21,100,313	\$5,404,521	\$6,256,480	\$32,761,314

General Aviation

CMAA had 114 based aircraft in 2007.⁹ Following FAA guidance on the recommended based aircraft-to-employment ratio for impact estimation purposes (one full-time employee per 7.2 aircraft), the direct impact of general aviation resulted in 16 full-time jobs, \$489,660 in income, and \$2,466,844 in output.

Table 6. CMAA Impacts – General Aviation Based Aircraft

Impact	Direct	Indirect	Induced	Total
Employment	16	10	6	32
Output	\$2,466,844	\$861,118	\$585,909	\$3,913,871
Income	\$489,660	\$321,900	\$183,551	\$995,111
Total	\$2,956,504	\$1,183,018	\$769,460	\$4,908,982

General aviation based aircraft activity also has implications for economic activity beyond direct airport operations. Indirect impacts from based aircraft are estimated to be ten jobs and \$1,183,018 in income and output, while induced impacts are estimated to be six jobs and \$769,460 in income and output. Total impacts on the Chattanooga region resulting from general aviation based at CMAA are 32 jobs and \$4,908,982 in income and output.

General Aircraft activity is also associated with additional spending to the extent that such aircraft carry visitors to the Chattanooga region. In 2007, Chattanooga Metropolitan Airport had 17,914 general aviation aircraft landings, of which 90% dispatched to the ramp area and deplaned.¹⁰ Accordingly, a total of 16,123 general aviation aircraft both landed and deplaned on the ramp in 2007.

While the exact number of passengers on each general aviation aircraft is not known, the Aircraft Owners and Pilots Association estimates an average of 2.5 passengers per aircraft.¹¹ Applying this ratio to general aviation aircraft to the landings/ramp deplanings in at CMAA in 2007 renders a passenger count of 40,307 passengers for the year. The following analysis proceeds on the supposition that each aircraft that both landed and deplaned at CMAA had 2.5 visitors to the Chattanooga area.

⁹ Chattanooga Metropolitan Airport Authority, Federal Aviation Administration Form 5010, 2007.

¹⁰ Data from Chattanooga Metropolitan Airport Authority, Jan. 31, 2008.

¹¹ Aircraft Owners and Pilots Association, Aviation Fact Card, 2006.

Table 7. General Aviation Passenger Spending Estimates

Scenario	Visitors	Per Day Spending	Days	Per Trip Spending	Total Spending
General Visitor	40,307	\$86	1	\$86	\$3,466,402
	40,307	\$86	2	\$172	\$6,932,804
	40,307	\$86	3	\$258	\$10,399,206
	40,307	\$86	4	\$344	\$13,865,608
	40,307	\$86	5	\$430	\$17,332,010
	40,307	\$86	6	\$516	\$20,798,412
	40,307	\$86	7	\$602	\$24,264,814
Business	40,307	\$129	1	\$129	\$5,199,603
	40,307	\$129	2	\$258	\$10,399,206
	40,307	\$129	3	\$387	\$15,598,809
	40,307	\$129	4	\$516	\$20,798,412
	40,307	\$129	5	\$645	\$25,998,015
	40,307	\$129	6	\$774	\$31,197,618
	40,307	\$129	7	\$903	\$36,397,221

Assuming visitor and per diem spending estimated by the Tennessee Tourism Institute and the General Services Administration respectively, it is possible to derive daily spending estimates for both general visitors/tourists and business travelers. For instance, a business traveler spending two days/nights in Chattanooga is estimated to spend \$258. If all business travelers in 2007 averaged a stay of two days, the potential aggregate direct impact would be \$10,399,206.

If a general aviation business traveler staying in the Chattanooga region for two days/nights is used as a model for the average traveler of this type, total employment impact is estimated to be **234 jobs**.

Total economic benefit from general aviation visitor-related spending is estimated to be **\$19,544,581**. The total output effect is estimated to be \$14,613,762, while the total income effect is estimated to be \$4,930,819.

Table 8. General Aviation Visitor Impacts – Two Day, Per Diem Scenario

Impact	Direct	Indirect	Induced	Total
Employment	183	22	29	234
Income	\$3,260,129	\$780,299	\$890,391	\$4,930,819
Output	\$9,327,789	\$2,443,904	\$2,842,069	\$14,613,762
Total	\$12,587,918	\$3,224,203	\$3,732,460	\$19,544,581

Alternate Market Access - Travel Costs

It is possible that additional economic benefits may be gained by passengers who forego driving to the alternate markets of Nashville or Atlanta, which have airports that are both approximately 130 miles from Chattanooga (260 miles round-trip). Without CMAA, even more residents and businesses in the region would have to travel to other airports for air service.

Table 9. Alternate Market Driving and Time Cost

Driving Cost		Time Cost		Total Cost
Round Trip Distance (Miles)	260	Driving Time (Hours)	5	
Per Mile Cost	0.485	Average Hourly Wage	\$18.20	
Transportation Cost	\$126.10	Time Cost	\$91.00	\$217.10
Annual Enplanements	254,959	Annual Enplanements	254,959	
Aggregate Cost	\$32,150,330	Aggregate Cost	\$23,201,269	\$55,351,599

A 260-mile round trip would cost \$126.10 at the federal mileage reimbursement rates of 48.5 cents per mile. With annual enplanements of 246,893 in 2006, the aggregate potential benefit to the region for all passengers who utilized the Chattanooga Metropolitan Airport instead of either alternate market is \$32,150,330.

Driving to alternate markets also involves significant travel time costs. Assuming a five-hour travel time for a round trip journey to an alternate market and a per-hour cost of \$18.20 based on the average hourly wage for workers in Hamilton County, the travel time cost per passenger is \$91.00. Considering annual enplanements of 246,893, the aggregate potential benefit for passengers who utilized the Chattanooga Metropolitan Airport instead of either alternate market is \$23,201,269.

Assessing the Impact of Air Service Growth in Mid-Size Markets

Most of the studies that have examined the relationship between air service and economic development have focused on markets larger than Chattanooga. Since scale of operations affects total economic impact, this study examined air service in mid-size regions. To determine how changes in air service affect local economies that are similar in size to Chattanooga, CRC collected data for 129 counties in the U.S. with airports and with populations between 100,000 and 500,000 persons in the 2001 base year. For the years 2001-2005, CRC performed a regression analysis to determine the relationship between growth in passengers and growth in population, employment, the number of firms, and wages.

In treating growth in the number of passengers in the reference county as an independent variable, the assumption that growth in passengers has an effect on increases in population, employment, the number of firms, and wages (dependent variables) was tested.

Table 10. Regression Model:
Change in Passengers and Cargo by Population, Employment,
Firms and Wage, 2001 - 2005

	Regression Coefficient	Variance Explained	Significance (.05)
Passengers			
Population	.005	.102	Yes
Employment	.004	.144	Yes
Firms	.000	.040	No
Wage	-.001	.104	Yes
Cargo			
Population	-.009	.000	No
Employment	.024	.004	No
Firms	.001	.001	No
Wage	-.009	.013	No

These findings indicate that growth in the number of passengers explains 10% of the change in regional population and wages. Additionally, this data shows that growth in passengers explains 14% of growth in regional employment.

The results using change in cargo volume as the independent variable are less convincing. None of the hypothesized relationships achieved significance at the .05 level. Cargo volume does not appear to be related to changes in the number of firms, population, employment or wages.

The limited relationship between passenger growth and employment, population and wage growth is born out by an analysis of both the fastest growing airports and the fastest growing regional economies examined through regression analysis.

Table 11. Top 20 Passenger Growth Rates – Midsize Airports, 2001 - 2005

County	Facility	Passengers	Employment	Wage	Firms	Pop.
Monterey	MONTEREY PENINSULA	388.1%	2.0%	13.7%	2.2%	4.7%
Shasta	REDDING MUNICIPAL	358.5%	3.9%	14.3%	4.4%	-0.9%
Newport News City	NEWPORT NEWS/ WILLIAMSBURG INENATIONAL	350.1%	5.3%	8.7%	8.4%	-0.3%
San Luis Obispo	SAN LUIS COUNTY REGIONAL	288.1%	4.2%	16.0%	10.3%	8.8%
Mesa	WALKER FIELD	243.9%	9.1%	15.3%	10.4%	6.7%
Collier	NAPLES MUNICIPAL	198.9%	17.0%	23.9%	20.7%	6.2%
Kanawha	YEAGER FIELD	174.4%	-3.8%	11.1%	-1.6%	-0.2%
Westmoreland	ARNOLD PALMER REGIONAL	157.2%	3.2%	11.4%	1.9%	0.7%
Santa Barbara	SANTA BARBARA MUNICIPAL	128.3%	4.1%	16.2%	2.1%	5.3%
Penobscot	BANGOR INTL	123.2%	1.0%	10.3%	2.2%	1.9%
Broome	GREATER BINGHAMTON/LINK FIELD	119.8%	-5.9%	6.0%	-0.3%	3.7%
Leon County	TALLAHASSEE REGIONAL	119.4%	1.5%	14.0%	11.7%	-2.8%
Cumberland	FAYETTEVILLE REGIONAL/ GRANNIS FIELD	118.5%	8.4%	14.0%	6.5%	4.7%
Deschutes	ROBERTS FIELD	112.2%	20.0%	15.2%	27.6%	5.6%
Lexington	COLUMBIA METROPOLITAN	105.2%	9.3%	10.7%	14.9%	9.5%
Genesee	BISHOP INTERNATIONAL	104.4%	-7.6%	5.5%	-2.4%	11.9%
Muskegon	MUSKEGON COUNTY	95.2%	1.1%	5.2%	1.4%	-2.4%
Greene	SPRINGFIELD-BRANSON NATIONAL	90.7%	6.0%	12.0%	6.1%	11.0%
Escambia	PENSACOLA REGIONAL	89.4%	3.4%	14.1%	5.7%	6.8%
Chittenden	BURLINGTON INERNATIONAL	88.0%	-1.4%	11.6%	4.6%	3.8%

After eliminating outliers, the 20 fastest growing airports between 2001 and 2005 had enplanement increases of 88% to 388.1%. Four of the 20 fastest growing enplanement airports – Columbia, S.C., Deschutes County, Oregon, Naples, Fla. and Mesa County, Col. – also had employment growth that placed their regions among the fastest growing among the sample, with increases in jobs of 9.1% to 20.0%. For example, Columbia's enplanements more than doubled – going from 353,588 to 725,590 -- as the region experienced a 9.3% increase in jobs, a 10.7% increase in wages, a 14.9% increase in firms and estimated population growth of 9.5%.

Nevertheless, despite significant increases in enplanements at their local airports, four regions actually lost jobs – Kanawha Co., W.V., Broome County, N.Y., Genesee County, Mich. and Burlington, Vt. For example, Bishop International's enplanements nearly doubled – going from 270,727 to 553,433 – as the region experienced a 7.6% decline in jobs. On average, the twenty fastest growing airports had regional job growth of 4.0%, wage growth of 12.4% and a 6.8% increase in firms.

On the other hand, all but one of the regions among those with the top 20 rates of job growth had increases in enplanements as well. For example, Mohave County, Arizona had a 25.5% increase in jobs and a 41.6% increase in passengers at the regional airport. Still, Brevard County had a 10.2% increase in jobs and a 13.5% decline at Melbourne International. On average, those regions with the fastest growth in employment had a 63.5% increase in enplanements.

Table 12. Top 20 Employment Growth Rates – Midsize Airports, 2001 - 2005

City	Facility	Passengers	Employment	Wage	Firms	Pop
Mohave County	LAUGHLIN/BULLHEAD INTERNATIONAL	41.6%	25.5%	13.4%	20.2%	1.3%
Deschutes County	ROBERTS FIELD	112.2%	20.0%	15.2%	27.6%	5.6%
Benton County	NW ARKANSAS REGIONAL	66.9%	20.0%	14.1%	28.5%	8.3%
Collier County	NAPLES MUNICIPAL	198.9%	17.0%	23.9%	20.7%	6.2%
Seminole County	ORLANDO SANFORD INTERNATIONAL	36.8%	15.6%	16.2%	20.8%	4.6%
Bay County	PANAMA CITY-BAY COUNTY INTERNATIONAL	50.8%	15.6%	20.7%	10.8%	1.3%
Webb County	LAREDO INTENATIONAL	19.8%	15.0%	13.6%	11.3%	-0.7%
Rankin County	JACKSON-EVERS INTL	21.0%	14.3%	11.8%	21.1%	4.8%
Whatcom County	BELLINGHAM INTERNATIONAL	42.3%	14.3%	12.3%	12.8%	2.2%
Volusia County	DAYTONA BEACH INTERNATIONAL	20.5%	14.1%	14.8%	19.8%	3.0%
Horry County	MYRTLE BEACH INTERNATIONAL	15.2%	12.8%	10.9%	14.9%	3.1%
Blount County	MC GHEE TYSON	69.7%	11.1%	9.2%	7.1%	10.0%
Jackson County	ROGUE VALLEY INTERNATIONAL	69.2%	11.1%	12.0%	14.0%	0.0%
Brevard County	MELBOURNE INTERNATIONAL	-13.5%	10.2%	16.7%	18.6%	-1.2%
Midland County	MIDLAND INTERNATIONAL	2.1%	10.2%	16.1%	1.4%	0.0%
Cass County	HECTOR INTERNATIONAL	45.1%	9.8%	16.1%	9.8%	1.3%
Charleston County	CHARLESTON AFB/INTERNATIONAL	77.4%	9.5%	18.2%	11.3%	2.2%
Lexington County	COLUMBIA METROPOLITAN	105.2%	9.3%	10.7%	14.9%	9.5%
Yellowstone County	BILLINGS LOGAN INTERNATIONAL	45.0%	9.2%	15.1%	6.0%	2.2%
Mesa County	WALKER FIELD	243.9%	9.1%	15.3%	10.4%	6.7%

Impact of Air Service on Recent Firm Locations in the Chattanooga Region

To assess the economic development impact of existing air service in Chattanooga, CRC – based on information from the Chattanooga Area Chamber of Commerce – contacted 37 firms that have either located, expended operations, or made an investment (through development projects) over the past three years. This list included firms in a variety of industries including manufacturing, real estate development, telecommunications, retail, and hotel/restaurant development.

Of the 37 firms contacted, eleven agreed to confidential interviews covering the history and nature of the activities that the firm conducts in the Chattanooga area, specific factors that led to the decision to locate, expand or invest in the area, and the importance of the Chattanooga Metropolitan Airport and its air service in the decision to locate, expand or invest in the area.

Representatives of each of the firms were able to rank a series of factors that led to their investment in the region. For a majority of the firms interviewed, the principals had personal ties to Chattanooga and were willing to incur incremental costs related to operating in a smaller market (as opposed to Atlanta or Nashville) to remain in the area. These costs were associated with the purchase of local goods and services as well as increased costs for air travel. Increased costs for air travel were incurred either by utilizing Chattanooga Metropolitan Airport or by driving to Nashville or Atlanta to take advantage of routes that were more direct and/or flexible in terms of timing.

A number of respondents indicated that the livability of the area, in terms of quality of life and the recent development in the downtown area, was a factor in the decision to locate or remain in the Chattanooga area. In the absence of Chattanooga's recent resurgence in this regard, a small number of respondents indicated that it was possible that relocation or expansion within another nearby market was possible.

The importance of local air service as a location factor was generally ranked by respondents in the range of 10th to 15th among all factors. Several firms indicated that air service was not considered as a factor in the decision to locate or expand in the Chattanooga area. The importance ascribed to air service varied by the type of industry in which the respondent was engaged. Development companies generally assigned a high relative importance to proximity to the air service provided by the Chattanooga Metropolitan Airport, although proximity to the interstate system was in all cases viewed as more important than proximity to air service.

Proximity to the interstate system was viewed as important by firms involved in development (primarily manufacturing facility development) and manufacturing firms. In general, firms engaged in knowledge-based activity ascribed a lower level of importance to the availability of local air service.

Table 13. Summary Ranking –
Business Location Factors

Location Factor	Ranking
Personal Attachment to Area	1
Quality of Life	2
Recent Development	3
Available Workforce	4
Commercial/Retail Density	5
Workforce Demeanor	6
Proximity to Interstate	7
Regional Centrality	8
Industry Specialization	9
Land/Site Availability	10

Firms with a large proportion of sales-related travel assigned a high importance to air travel, although a number of such firms indicated the lack of direct routes and the current price points for air service in Chattanooga usually cause sales representatives to drive to the nearby markets of Atlanta and Nashville to board cheaper, more flexible and direct routes to their destinations.

Tourism-related firms indicated a location strategy that favors agglomeration in either tourist-related activity or high-density commercial and retail development, and therefore did not ascribe a high importance to local air service.

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