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Small Aircraft Transportation Viability

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Small Aircraft Transportation Viability

In partial fulfillment of the requirements for the
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A Directed Project Report

By

Chad Schweinzger

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Committee Member	Approval Signature	Date
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ABSTRACT

This study focuses on the long-debated question of “fly or drive” by comparing the economic costs associated with the value of employee time. Driving, flying on small aircraft, and airline travel methods are compared. The top 31 Purdue Turbine Flight Operations (TFO) routes from January 1, 2009 to January 1, 2010 were used for analysis. Cirrus SR-20 and Embraer Phenom 100 aircraft were analyzed versus driving and airline travel when booked 3 days or two weeks in advance. The study concludes with a hypothetical university case study. With consideration taken to ensure use of accurate university figures, an economic decision-making tool is created, and a framework for future studies is formed. Results lend an insight to the importance of time and accurate measure of actual employee worth instead of productivity en route when deciding among certain modes of transportation. They also demonstrate the concept of practical use of university aircraft as a transportation tool for university employees.

SECTION 1. INTRODUCTION

This chapter sets forth the research question to be explored for this study. It details the reasoning and significance for the study, and concludes with associated definitions, assumptions, limitations, and delimitations.

1.1. Research Question

This research will investigate issues related to efficiency of employee travel at Purdue University. With the acquisition of a new fleet of aircraft, Purdue has opened the door for development of a University Small Aircraft Transportation System (SATS). This study will help to create an economic decision-making tool for the use of Purdue's aircraft to provide employee "lift". The research question that will be explored is: When considering the economic value of employee time, what is the financial benefit associated with utilizing small aircraft instead of a ground-based vehicle or airline transportation for Purdue University employees?

1.2. Scope

This project will incorporate a study of the cost implications created by utilizing Purdue University-owned aircraft to meet the travel needs of upper-level employees. The research will explore values of time and productivity using business aircraft for travel instead of an alternative mode, such as airline or automotive. As a part of the study, the researcher will establish a method for evaluating the cost of a particular employee's time, based on their salary, benefits, and associated university policies. The researcher will also establish a method to evaluate productivity for different modes of transportation. Using time-savings and productivity measurements for employees, the study will provide a way to quantify the economic value associated with direct travel.

This research evaluates three different methods of transportation: airline, automotive, and small aircraft. The business aircraft utilized for this study are the Cirrus SR-20 and Embraer Phenom 100 aircraft Purdue University has placed on order. The researcher will calculate the financial implications of a direct flight from Purdue University airport to the closest suitable airport at the destination. The economic cost of that trip will then be compared with the least expensive airline ticket and travel by automobile.

1.3. Significance

This research will add to the body of knowledge by creating an analytical tool for decision-making relating to upper-level employee travel. The results of the travel analysis done in this study will provide a method to evaluate aircraft utilization for financially-appropriate travel. Without this study, it would be more difficult to quantify the financial implications of travel on Purdue University Aircraft.

1.4. Definitions

Direct operating cost (DOC) – is equal to the sum of all consumables related to the direct operation of the aircraft in flight, such as fuel and oil. It also includes any associated maintenance costs, including inspection, replaceable or repairable parts, and overall replacement of the operating equipment (McGrath & Young, 2002).

Lifecycle costs (LCC) – are derived from an all-encompassing method that includes direct operating cost, but also adds additional associated costs. These include: ownership, operational, acquirement, and associated overhead costs (Travel$ense Business Travel Analysis Software (user's guide), 1999). LCC are taken from the rate at which aircraft costs are charged to users on a per hour basis.

Transportation costs – all productivity costs associated with:

- Travel from Purdue University (home base) to associated commercial airport.
- Average processing time at that departure airport for ticketing, baggage check, and security

- Time en-route (airborne, or on the ground for automobile transportation) (Travel$ense Business Travel Analysis Software (user's guide), 1999).

True cost – an individual's total salary, including benefits and bonus, divided by annual number of hours worked.

1.5. Assumptions

This study will be conducted assuming the following:

- Access to all costs associated with DOC and LCC methods are available to the researcher.
- Any specific data regarding the DOC or LCC methods that are not available will be taken from a generalized source reported by the manufacturer, or other similar operators.
- Travel$ense software operates per its manual and searches for the lowest cost fare for associated conditions.
- Travel$ense software is an appropriate instrument for measurement and all identified settings are appropriate for the operation at Purdue University
- All trips are completed in the same day they originate, if possible.
- The top 31 routes currently flown by Purdue University's Turbine Flight Operations faculty/student crews are tracked and available to the author.
- The hypothetical case study will assume one trip to each Statewide Technology location is made each month.
- The Statewide Technology locations are assumed to be: Anderson and Muncie, Columbus, Greensburg, Indianapolis, Kokomo, New Albany, Richmond, South Bend, and Vincennes.
- The top 31 route trips are assumed to depart Purdue University Airport at 9:00 am, therefore departing Indianapolis Airport as closely as possible to 9:00 am.
- All top 31 route trips will depart the location in order to return to Purdue by 5:00 pm, encompassing a normal business day of 9:00 am – 5:00 pm, if possible.
- Employee economic value data are available to the author.

1.6. Limitations

This study is also conducted with the following limitations:

- The study is conducted solely for the top 31 routes currently flown by Purdue University's Turbine Flight Operations faculty/student crews. These routes are flown from Purdue University Airport to their destination and back in the same day.
- 31 routes were chosen because there were 31 routes flown in the manner described above twice or more in the past year's flight data.
- It is recognized that not all of the top 31 route destinations have airline service, or would make logical sense to evaluate airline information, and will therefore only be compared with automotive transportation.
- The two aircraft that are to be analyzed are the Cirrus SR-20 and the Embraer Phenom 100, configured as specified when Purdue University purchased them

1.7. Delimitations

This study is conducted with the following delimitations acknowledged:

- It will not encompass more than the 31 associated routes.
- Leg dead time and leg taxi time will not be included as they cannot accurately be estimated and are subject to change based on air traffic control procedures and clearances.
- Time, distance, and productivity after the flight has landed at the destination will not be factored as meeting locations are not known to the author.
- The costs of lodging, meals and other miscellaneous travel expenditures will not be taken into consideration for this study.
- This study does not take into consideration the cost of the salary and benefits of flight crew members, as this is outside the scope of this study.

1.8. Summary

This section delineates the research question to be studied and its rationale. Relevant terms are defined, and the associated assumptions, limitations, and delimitations established.

SECTION 2. LITERATURE REVIEW

This chapter presents an overview of literature topics related to this study.

2.1. Introduction

Because this project explores the concept of a Small Aircraft Transportation System (SATS) and the cost of using small aircraft versus automotive or airline travel, it closely parallels a study done by McGrath and Young (2002) in Florida. The purpose of that study was to evaluate whether SATS could be an economically-viable source of transportation, an idea put forth by the National Aeronautics and Space Administration (NASA).

2.2. Background Information

SATS has a long history of governmental backing, dating back to 1989 when a government-industry-university workshop including the American Institute of Aeronautics and Astronautics (AIAA), General Aviation Manufacturers Association (GAMA), Federal Aviation Administration (FAA), and NASA was held to discuss the role of technology in revitalizing the general aviation industry in the United States (as cited in Durham, Holmes & Tarry, 2004). Since then, the vision of SATS has changed and been modified several times. It has evolved and impacted many different agencies, from NASA, to the Advanced General Aviation Transport Experiments (AGATE), to its current owner, the Joint Planning and Development Office (JPDO).

Although its ownership has changed a number of times, the SATS vision has remained fairly straight-forward: a point-to-point air transportation service that can operate competitively with airline transportation. The Commission on the Future of the U.S.

Aerospace Industry indicated that improvements in productivity of U.S. companies could be made if travel to any destination was available at any time (Durham et al., 2004).

In a report to the Transportation Research Board by the Committee for a Study of Public-Sector Requirements for a Small Aircraft Transportation System (2002), it was concluded that the SATS program was not justified. The committee stated that there was no need for a SATS system, and that the public demand for such a system did not exist. They did agree that further research into technological advancements was a valuable endeavor, but advised NASA to put the program on hold and reinvest resources to "more achievable goals" (Committee for a Study of Public-Sector Requirements for a Small Aircraft Transportation System, National Research Council, 2002, p. 115). This lengthy analysis of the SATS vision, and in particular, the pessimistic findings, slowly degraded the momentum behind SATS research. With a lack of backing, both monetarily and institutionally, the SATS program slowly fell to the wayside in the mid 2000s.

Negative perceptions of business aviation are not well-supported in all cases. In a study by NEXA Advisors, LLC (2009), 423 S&P 500 companies were analyzed. They were first divided into two categories: users (of business aviation) and non-users (those companies that do not use business aviation). After assigning the companies into these two groups, they were analyzed in the following categories: profitability, shareholder value, and asset utilization. Profitability was measured using a five-year compound annual growth rate. It also includes measures of revenue growth, earnings growth, earnings before interest and taxes, and earnings before interest, taxes, depreciation, and amortization. Shareholder value demonstrates "a linkage between a company's financial performance and the value ascribed to it by shareholders" (NEXA Advisors, LLC, 2009, p. 16). It analyzes total shareholder return, market value growth, and return on equity. Asset utilization includes measures of asset efficiency and return on assets. The NEXA study is different from previous similar studies because it measured changes in performance over time and applied weighting factors recognizing the size effect and

rapid growth sustainability. The study showed that among S&P 500 companies those who use business aviation have outperformed non-users financially, and in other non-financial measures. Of the 423 companies that remained in the S&P 500 from 2003 to 2007, 322 utilized business aircraft and 101 either rarely used business aviation or refrained from it all together. Earnings growth for the given time span, on average, were clearly skewed in favor of the business aviation users, displaying 19.4% growth compared to non-users who experienced only 12.9% growth. Users of business aviation also had a 19.5% average return on equity compared to a 16.2% return on equity for non-users. It should be taken into consideration that these companies might use business aviation because they can afford it. This is to say that it is possible the 322 companies use business aviation because they perform so well financially, and this possibility was recognized by NEXA in their study (NEXA Advisors, LLC, 2009).

It is also important to compare other, non-financial measurements among S&P 500 companies. The study showed that over 90% of the 50 most innovative companies, 25 best customer service companies, and 100 best brands on Business Week's lists, among others, were business aircraft users (Garvey, 2009). This study shows that, despite the negative connotation and bad name currently given to business aviation by the American public, organizations that utilize it appear to outperform non-users financially, and have gained the respect of consumers, leading to prestigious awards such as those listed above.

2.3. Previous Study

As previously noted, McGrath and Young (2002) conducted a cost study in which they used hypothetical SATS aircraft because aircraft compliant with the technological needs of a SATS aircraft did not yet exist. This study used software distributed by the National Business Aviation Association (NBAA) called Travel$ense to monitor costs and compare them for different modes of transportation to different locations (McGrath & Young, 2002).

Travel$ense employs user-defined assumptions about aircraft, passengers, and trip characteristics to compare business aircraft and airline transportation methods. It uses several different methods of valuing employee time, most of which are taken from the insurance industry, to help quantify the true trip costs associated with use of the different modes of transportation. The software also introduces the concept of productivity differences between business transportation and airline transportation methods, providing a way to quantify true trip costs for business flight departments (Travel$ense Business Travel Analysis Software (user's guide), 1999).

Using this software, McGrath and Young (2002) were able to use hypothetical assumptions for an envisioned SATS aircraft to analyze 68 city pairs in Florida. Their findings revealed that when considering time savings and productivity on an average trip length of 288 road miles or 231 air miles, use of their hypothetical SATS aircraft could produce significant savings. Even when the difference in productivity was ignored, simple time savings gained when using the hypothetical SATS aircraft alone was enough to provide a monetary savings (McGrath & Young, 2002).

In another study conducted by McGrath (2002), four different hypothetical SATS aircraft configurations were evaluated to determine optimal distance usage and costs. The four configurations resemble the current standard configurations: twin-engine turbofan, twin-engine turboprop, twin engine piston aircraft, and single-engine piston aircraft. Once optimal ranges were determined for each of the configurations, 50 potential city pairs were established that fit within the range of travel for that particular aircraft configuration. Cost comparisons were then analyzed for possible alternative modes of transportation. Again, value of time and productivity measures were introduced, and again, utilizing the hypothetical SATS aircraft. The study showed that SATS aircraft were competitive with any alternative transportation method (McGrath 2002).

2.4. Innovation

Durham, et al. (2004) discussed strategies for short-term and long-term technological development goals to suit the SATS model. The initial SATS technology only needed to support intercity transportation to and from underutilized airports that air carriers do not service. These cities would need to have a consumer base that would support transportation service at the small aircraft level. Currently, about 550 of the nation's more than 5,000 airports have scheduled air carrier service. About 90% of this travel is to and from 67 of the 550 served airports (Espinoza, Garcia, Goycoolea, Nemhauser & Savelsbergh, 2008). The recent decrease in frequency of flights to many of these airports has made it less convenient for business travelers. A decrease in possible flight times and flight locations may make it more difficult for business travelers to get where they want, when they want.

In comparison, there are over 3,000 airports, public and private, with runways that are longer than 4,000 feet, which is more than long enough for service using small aircraft under the SATS model (Committee for a Study of Public-Sector Requirements for a Small Aircraft Transportation System, National Research Council, 2002). This helps to demonstrate that the original SATS intercity travel model should be expanded to reach to intrastate and interstate travel, due to the lack of service at many smaller airports and the reduction of city-to-city flight frequencies. With access to more than 3,000 airports, point-to-point travel greatly increases the ability of a consumer to travel more directly from one airport to a destination close to another airport accessible by small aircraft.

The long-term innovations required to create an economically-viable SATS aircraft were believed to be more technically-based. An increase in the level of automation to make small aircraft avionics rival those used by the airlines would be needed to simplify single-pilot operations. Also envisioned was the simplification of aircraft in general; from aircraft systems modifications to de-cluttering and ergonomically simplifying the cockpit. Simplified airspace and air traffic control functions would increase the ease with which everyday pilots could traverse the United States (Durham et al. 2004).

Besides advanced avionics and systems, the new aircraft visualized by McGrath and Young (2002) would need to be manufactured more efficiently to keep the cost of ownership down. Aircraft propulsion would facilitate the progress toward higher efficiency and speed, but would also need to be easily maintained to keep the cost of operation down. Advanced software and capabilities would need to be incorporated to increase productivity inside the aircraft from a user standpoint. An increase in ease of communication with other operators and controllers in the national airspace system would also be vital to create a more functional single-pilot capability. These aircraft would need to implement advanced weather detection and protection systems and would require precision guidance, enabling them to operate in less than ideal weather situations on precision instrument approaches.

As stated by Dunham, et al. (2004):

> The new generation of aircraft appears to be capable of providing economical, on-demand, point-to-point transportation service between the thousands of smaller communities with markets too limited in size to be served by scheduled air carriers using existing turboprops or regional jets. Smaller general aviation and regional airports could serve thousands of suburban, rural, and remote communities throughout the Nation, through these technological advancements. The safe, efficient utilization of smaller aircraft and smaller airports can make possible new levels of community accessibility and public mobility (p. 27).

Another major concern was coordinating all of the technological advances while keeping costs down and safety assurance in the forefront (Committee for a Study of Public-Sector Requirements for a Small Aircraft Transportation System, National Research Council, 2002). These concerns were valid, but the future is here. As McGrath (2002) stated, “paradigmatic change on SATS’ scale necessarily means interactions of technological, political, economic, socio-cultural, market, and other forces that are not fully understood by research communities” (McGrath, 2002, p. 174). This was to say that research should cease on SATS operations, but that it should be expanded and explored in a cross-disciplinary fashion.

These previous studies have demonstrated the slow progression of the SATS program. Most studies have been forced to assume technological advances that are unpredictable to help envision a hypothetical SATS aircraft for study. However, the SATS aircraft have now arrived. There are currently aircraft being produced that meet the criteria for a SATS aircraft, as stated previously. The Cirrus SR-20 and Embraer Phenom are two such aircraft. The technology that was assumed to be implemented in the future in previous studies is now available and has been ordered at Purdue University. The hypothetical costs used by McGrath and Young (2002) can now be better determined and applied to create an economical decision-making tool. Previous studies have had to estimate costs associated with improvements in equipment technology to make an acceptable SATS aircraft. They had to extrapolate these costs to create a method for estimating ownership and operating costs of a SATS aircraft. They could then use these costs to evaluate the economic viability of a SATS aircraft. Purdue University has ordered two different types of aircraft that meet the SATS technology specifications, and can be used to extract actual ownership and operating costs. This study will apply previous methodology used by McGrath and Young (2002) to create a framework for a decision-making tool, by utilizing real aircraft to better determine whether the SATS model is economically cost-effective.

2.5. Summary

This section has provided an overview of literature related to the topic to be studied. It has demonstrated the benefits of using existing SATS aircraft with the latest technology, instead of employing hypothetical aircraft figures.

SECTION 3. METHODOLOGY

This chapter will cover the research methods, framework, and analysis methods used in this study.

3.1. Research Framework

This study will provide a quantitative analysis of the cost of small aircraft transportation compared to the cost of transportation by airline and automobile, reflecting the models used by McGrath & Young (2002) in Florida. This study takes into account the value associated with time savings of direct point-to-point travel made possible through the use of small aircraft. In addition, productivity differences created by use of a business aircraft instead of an automobile or an airline will be explored. Direct Operating Cost (DOC) and Life Cycle Cost (LCC) methods will be compared against costs of airline and automobile travel, as defined. The DOC method will be analyzed because it is assumed that the aircraft in question may already be in use for flight training of some sort, and therefore, providing "lift" for university employees would be an added benefit. Consequently, the price of the flight will need to cover the added costs of operating the aircraft, thus the DOC. After all costs are determined, the economic value of employee time will be added back into the total cost to create a Real Trip Cost (RTC) value. The RTC value is compared for the top 31 routes flown by Purdue University's Turbine Flight Operations staff from January 1, 2009 to January 1, 2010. For comparison purposes, all trips for the three different travel methods will depart and return in the same day, if possible. Airline trips will be compared for scheduling both three days in advance and two weeks in advance. This will help compare the cost associated with scheduling meetings two weeks in advance as well as meetings that arise with only three days advanced notice. A separate baseline study will be conducted with en route productivity criteria set to 0% to help quantify the difference associated with productivity. All

associated fixed and variable costs used for DOC and LCC are taken from Purdue data. The DOC costs for the SR-20 and Phenom are $86.07 and $625.05, respectively. LCC costs for the SR-20 and Phenom are $180.00 and $1,600.00, respectively. These cost figures and route data were provided by the Director of Flight Operations, Aviation Technology Department, at Purdue University.

A hypothetical case study will be conducted using Statewide Technology locations. These locations are assumed to be visited once per month, departing at 9:00 am and leaving the location at 5:00 pm, assuming a full day visit.

3.2. Testing Methodology

Travel$ense, a computer program available through the National Business Aviation Association (NBAA), will be used to compare the two modes of transportation (airline, and small aircraft). Travel$ense allows the user to define several variables associated with airline and business aircraft travel. It provides the user the ability to set up aircraft profiles matching those of actual use by the organization. It uses the website travelocity.com to access user-defined fares for airline travel and time associated with the given trip (Travel$ense Business Travel Analysis Software (user's guide), 1999). For this experiment, Travel$ense will be set to for the lowest possible fare from Indianapolis International Airport to the closest destination city, for comparison. Automotive and small aircraft travel will be assumed to depart from Purdue University's main campus in West Lafayette, Indiana.

Travel by automobile will be calculated on a separate spreadsheet using the same methods employed by Travel$ense. All automotive travel will be assumed to be at fifty-five miles per hour, and calculated using the shortest driving distance suggested by Google Maps (http://maps.google.com) driving directions. The cost of travel by automobile will be taken from the current Purdue personal vehicle travel reimbursement rate, which is $0.50 per mile (Purdue University Website, Privately Owned Vehicles

(POV), 2010). The author assumes the employee is capable of few work-related tasks while safely driving a vehicle (such as brainstorming, preparing, or limited phone conversation); therefore, the driving productivity level will be set at 10%, its default setting.

Travel$ense software has been available since 1999, and was the product of a consortium of flight departments across the country. The actual compilation and development was done by Personal Expertware of Redmond, WA. As stated in the Travel$ense manual (Travel$ense Business Travel Analysis Software (user's guide), 1999):

> It would be easy to dismiss these conclusions as biased, coming as they do from an Association representing business aircraft operators. The assumptions that form the results, however, are user-defined. Thus, Travel$ense's conclusions are as credible as you make them. Consequently, in the final analysis, Travel$ense is your tool… (p.1).

The Frequently Asked Questions section of the manual addresses the misconception that Travel$ense software will always show that business aircraft will be the best way to travel. Travel$ense states (Travel$ense Business Travel Analysis Software (user's guide), 1999):

> No, because business aircraft are not always the best way to travel, in a strict business sense. Travel$ense is a sophisticated, user-defined decision matrix that each company can customize using its own assumptions. Because the program is user-defined, using your assumptions, it can help justify tripling a flight department, or closing it. That is a sharp point on the argument that Travel$ense is not simply a program to make business aircraft look good. It is a program that tracks employee business travel productivity (p. 181).

There are six different user-defined categories that can be adjusted by the user in the Travel$ense software: Corporate, Cost, Times, Productivity, Airline, and Miscellaneous (Travel$ense Business Travel Analysis Software (user's guide), 1999).

3.2.1. Corporate Settings

The Corporate settings allow the user to define the hours of regular business and whether or not Saturday and Sunday travel will be permitted. Since Purdue University's Turbine Flight Operations aircraft regularly operate seven days a week, these are set to reflect Purdue's operation. However, these settings will be used as a default. The actual travel times are dictated by the passenger profile settings. Also included under corporate settings is the number of weeks worked per year. This will be set to 48 weeks per year, as that will be the assumed number of weeks a 12 month-appointment employee works.

3.2.2. Cost Settings

These settings will be used to reflect the cost of travel to and from the airport at which airline travel is to be started. For the purpose of commonality, one flat rate is assumed for all travel to and from Purdue University to the Indianapolis International Airport. It will reflect the rate associated with driving a personal vehicle round-trip and will be $65.00. Also included here will be the charge for one full day parking fee at Indianapolis Airport which is $9.00 (Indianapolis International Airport, Economy Parking, 2009). Personal car mileage rate is set at $0.50 per mile under the cost settings tab as well (Purdue University Website, Privately Owned Vehicles (POV), 2010). Other possible settings for hotel, meals, crew, and miscellaneous costs are outside of the scope of this study and will be disregarded.

3.2.3. Time Settings

This section allows users to define several drive-time settings that will be calculated and taken into consideration when final times are totaled for each mode of transportation. Drive times will be considered from the employee's office to the airport of departure. For small aircraft, travel will be made from Purdue University Airport, and the associated

drive time is set to 20 minutes for commonality purposes. The author assumes it is possible to get to the airport from any part of campus within 20 minutes. The drive time from Purdue University to Indianapolis International Airport, as determined from Google Maps (http://maps.google.com), will be set to 77 minutes. Drive time from the destination airport to the site of the meeting will not be taken into consideration for the top 31 routes, since data are not available on the exact location of the meeting. For the hypothetical case study, travel from the closest available airport having the minimum runway lengths prescribed for the given aircraft, to the state-wide location is calculated as drive time. Departure processing time is the time it takes to get passengers on the aircraft and will be set at 10 minutes for small aircraft. Departure processing time for airline travel will be 60 minutes, to reflect the Transportation Security Administration recommendation that passengers arrive 60-90 minutes before each flight (Indianapolis International Airport, 2009). Processing time upon arrival will be zero because no luggage would likely be checked when considering an out and back trip in the same day. Leg dead time is the time on either end of a flight considered completely unproductive. Examples of this are: finding your seat, stowing carry-on luggage, removing your jacket and getting situated. Although it can reasonably be assumed that the time waiting in line on the jet bridge and finding a seat on an airline aircraft is longer than on a business aircraft, it will be disregarded for this study, due to lack of information.

3.2.4. Productivity Settings

These settings are used to define different productivity percentages for different modes of transportation. As previously stated, drive-time productivity is set at the default setting of 10%. Processing time for both airline and small aircraft is set at an equal value of 20%, a default setting for business aircraft, but adding 10% productivity to the airline default setting for the purpose of commonality. In a 2009 poll conducted by Harris Interactive, 305 randomly-selected chief pilots, flight department managers and directors of flight departments were asked to distribute a questionnaire to passengers on their aircraft. Of this number, 289 completed the questionnaire and the results

revealed that participants spent 72% of the time on business aircraft on work-related effort, while only spending 31% of their time on work-related issues on commercial aircraft. In this survey work-related issues are defined as work-related meetings with company employees, individual work-related tasks, and/or work-related meetings with customers. Non-work-related activities were defined as non-work-related reading or entertainment, sleeping or resting, and/or other (Krane & Orkis, 2009). Although it is recognized the questionnaire could have been distributed unfairly, these productivity settings will be utilized as indicated, for business aircraft and airline productivity effects.

3.2.5. Airline Settings

These settings allow the user to define the earliest departure and latest return flights to be considered. The software will be left to its default settings of 6:00am to 11:00pm. If the software cannot find flights between these defined time settings, it will disregard them. Airline pricing mode settings and flight query mode settings will be left in the automatic mode, which is also considered the default mode. The software will be set to automatically retrieve the lowest airline fare under this setting.

3.2.6. Miscellaneous Settings

There are two important miscellaneous settings: time valuation method and percent value non-business hour travel. Time valuation is much debated and can have several different settings. This setting is a multiplier for an individual's true cost per hour (as defined), and is decided by the rate at which Purdue charges facilities and administration cost to outside organizations. The facilities and administration rate is 54%, meaning an additional 54% of the employee's true cost (salary plus benefits) is added to the total employee cost (Facilities and Administrative Cost Rate Agreement, 2009). Any other miscellaneous settings will be left at their default values.

Table 1. Top 31 Route Analysis Assumptions

	Driving	Small Aircraft	Airline
Drive to Departure Airport	N/A	20 minutes	77 minutes
Drive Productivity	10%	10%	10%
Cost to Drive	$0.50/mile	Variable (N/A)	$65.00 (130 miles)
Parking Cost	N/A	N/A	$9.00
Processing Time	N/A	10 minutes	60 minutes
Processing Productivity	N/A	20%	20%
En-route Productivity	10%	72%	31%
DOC	$0.50/mile	$86.07/hour	$625.05/hour
LCC	$0.50/mile	$180.00/hour	$1,600.00/hour

Table 2. Hypothetical Case Study Assumptions

	Driving	Small Aircraft
Processing (unproductive)	N/A	10 minutes
En-route Productivity	10%	72%
DOC	$0.50/mile	$86.07/hour
LCC	$0.50/mile	$180.00/hour

3.3. Aircraft Profiles

The aircraft profiles section allows the user to set up aircraft specifications such as minimum runway length, range, climb, cruise and descent speeds, and operating costs. Profiles for the Phenom 100 and SR-20 are listed in Table 3. Eight aircraft profiles were established to accommodate the differences between DOC and LCC and the difference between including productivity differences en-route and the zero percent baseline study. Information for these areas will be set to Purdue and manufacturer specifications per the Cirrus Aircraft Information Manual and the Embraer Phenom Flight Planning Guide. This information was discussed with the Director of Flight Operations for Purdue University and validated for accuracy.

Table 3. Aircraft Profiles

	Phenom 100	SR-20
Max Range	1,100 nm	575 nm
Minimum Runway	5,000 ft.	3,000 ft.
Climb Speed (1st 10 mins.)	200 kts.	95 kts.
Descent Speed (Last 15 mins.)	200 kts.	120 kts.
Short Trip Speed	250 kts. (<150 nm)	150 kts.
Long Trip Speed	390 kts.	150 kts.

3.4. Employee Settings

Travel$ense provides the user an option to add passengers and associated salary and benefit information for analysis. The researcher has taken the Turbine Flight Operations Primary User List and extracted the salary and benefit information for 33 listed employees of the University (TFO Usage Information (memorandum), 2009). From this information the researcher divided the 33 users into 3 categories; high, middle, and low, representing the average salary for the top third, middle third, and bottom third of authorized employees with publicly-available salaries. The high, middle, and low salary averages to be used are $301,654.55, $222,072.73, and $163,339.55 respectively (Purdue Salary Database 2009-10, 2009). The fringe benefit percentage for faculty and administrative employees earning over $105,000.00 per year was rounded to 37% for ease of calculation (actual value is 37.3%) and was then used to complete the salary and benefits component to the true employee cost (Budgeting Fringe Benefits for Sponsored Programs and Other Chargeable Accounts (memorandum), 2009). These salary and benefits figures were then divided by the total number of hours per year, based on 48 week per year, 40 hours per week work schedule, to arrive at a high, middle, and low hourly figure of $215.24, $158.46, and $116.55, respectively.

3.5. Hypothetical Case Study

The hypothetical case study will be evaluated between Purdue University and the nine other College of Technology locations throughout the state of Indiana. This will facilitate

simulating the use of University aircraft for travel to and from other University locations, creating a purposeful study of potential use. Because the locations are all inside the state, travel will be compared between SR-20 and vehicle travel modes only. This is due to the fact that it is highly unlikely travel via turbojet aircraft, such as the Phenom, will be cost-effective for such short distances. Since only two of the locations are served commercially, it was also determined not to compare airline travel for these routes. The College of Technology Statewide locations are: Anderson/Muncie, Columbus, Greensburg, Indianapolis, Kokomo, New Albany, Richmond, South Bend, and Vincennes (Purdue University College of Technology Statewide Website, 2010).

3.6. Data Analysis

Using previously-defined settings and routes, the author will conduct an analysis of all routes for both DOC and LCC methods. These values will be compared and conclusions drawn about which routes would benefit from small aircraft transportation, versus either airline or automobile transportation. The travel schedule associated with the hypothetical case study will be individually analyzed by the researcher as well.

3.7. Chapter Summary

This chapter summarizes the methodology for the study conducted for this research. Additionally, it defines all associated values for the software used to conduct the analysis.

SECTION 4. ANALYSIS AND FINDINGS

This chapter discusses the analysis and findings associated with the study described in the aforementioned sections. First, a hypothetical case study is explained, followed by an analysis of the top 31 routes for ease of discussion.

4.1. Hypothetical Case Study

In this section, the hypothetical case study is presented and the associated benefits when considering the economic value of employee time, are analyzed.

4.1.1. Driving Analysis

The hypothetical case study sets up a situation in which an employee departs from Purdue University Airport (for ease of analysis) and drives to one of the Statewide Technology locations for a meeting. The employee then departs later that same day to return to the University

All of the necessary data collected for the nine state-wide technology locations are entered into a spreadsheet (Appendix A). Distance and time are determined using Google Maps and contact address. Cost of the trip is determined by adding vehicle costs with employee time costs, shown here:

$$(Distance \times \$0.50) + (Drive\ Time \times Salary\ Level \times 1.54)$$

Productivity savings is calculated using the formula below.

$$(Drive\ Time \times 10\%) \times Salary\ Level\ \times 1.54$$

Total cost is calculated by adding the vehicle cost to the cost of the employee time and subtracting the employee productivity savings. The total cost is calculated for each salary level and for each of the nine locations.

4.1.2. SR-20 Analysis

For the hypothetical case study it is assumed employees depart from Purdue University Airport so drive time costs and drive time productivity from campus to Purdue University Airport are ignored. Since there is no processing time to get in a car it is arbitrary to consider 10 minutes boarding the aircraft to be 20% productive so productivity will be disregarded for the small aircraft processing time. The flight departs Purdue University Airport and arrives at the closest available airport to the site being visited. The trip is then continued by driving from the destination airport to the site, in which all drive costs and productivity savings are still considered. The vehicle is considered to be rented at the destination airport at the rate of $27.00 plus $0.22 per mile, which is the car rental rate for Purdue University Transportation (Purdue University Physical Facilities Website, 2009). The same drive is then made back to the airport previously utilized, 10 minutes are spent boarding (processing time) the aircraft, and the aircraft departs to return to Purdue University Airport, where the trip concludes.

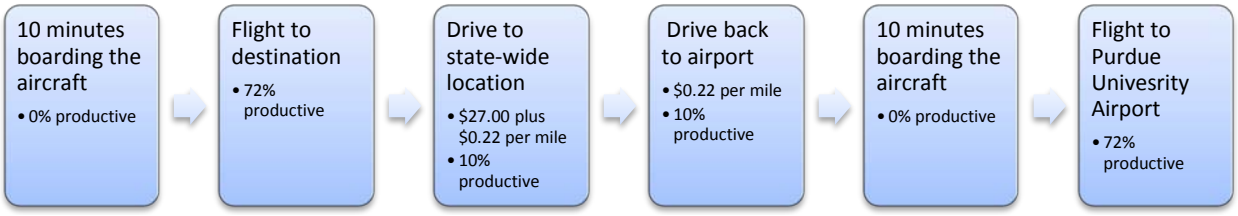

Figure 1. Hypothetical Flight Timeline

These flight times are used to determine the productive time en-route, DOC cost and LCC cost. Productive time is figured using 72% productivity while en-route, and total employee economic costs and productivity savings are calculated using the following formulas:

Cost of Employee Time

$$\big((Processing\ Time \times 2) + (Flight\ Time \times 2) + (2 \times Drive\ from\ destination\ to\ location\ time)\big) \times SalaryLevel \times 1.54$$

Productivity Savings

$$\big((2 \times Flight\ Time \times 72\%) + (2 \times Drive\ from\ destination\ \ to\ location\ time \times 10\%)\big) \times Salary\ Level \times 1.54$$

DOC and LCC costs are determined using hourly rates discussed earlier.

4.1.3. Findings

The data were tabulated, and associated savings are shown in Table 4.

Table 4. Hypothetical Case Study Findings

Name	Airport Used		DOC (w/ Productivity) Savings	DOC (w/o Productivity) Savings	LCC (w/ Productivity) Savings	LCC (w/o Productivity) Savings
Anderson and Muncie	KAID	H	$694.27	$439.70	$594.08	$339.51
Anderson and Muncie	KAID	M	$503.98	$316.57	$403.79	$216.38
Anderson and Muncie	KAID	L	$363.55	$225.70	$263.35	$125.51
Columbus	KCLU	H	$1,097.13	$778.91	$971.89	$653.67
Columbus	KCLU	M	$803.18	$568.92	$677.94	$443.68
Columbus	KCLU	L	$586.25	$413.94	$461.01	$288.70
Greensburg	I34	H	$1,142.10	$792.06	$1,004.34	$654.30
Greensburg	I34	M	$835.11	$577.42	$697.34	$439.65
Greensburg	I34	L	$608.54	$419.00	$470.77	$281.24
Indianapolis	I14	H	$548.99	$350.11	$470.72	$271.84
Indianapolis	I14	M	$397.64	$251.22	$319.36	$172.95
Indianapolis	I14	L	$285.94	$178.24	$207.66	$99.97
Kokomo	KOKK	H	$257.43	$74.45	$185.42	$2.44
Kokomo	KOKK	M	$177.99	$43.29	$105.98	-$28.72
Kokomo	KOKK	L	$119.37	$20.29	$47.35	-$51.72
New Albany	KJVY	H	$1,841.70	$1,547.35	$1,725.85	$1,431.50
New Albany	KJVY	M	$1,370.15	$1,153.46	$1,254.30	$1,037.61
New Albany	KJVY	L	$1,022.14	$862.76	$906.29	$746.91
Richmond	KRID	H	$1,175.77	$793.92	$1,025.49	$643.63
Richmond	KRID	M	$858.88	$577.76	$708.59	$427.48

Richmond	KRID	L	$625.01	$418.24	$474.72	$267.95
South Bend	KSBN	H	$1,154.65	$836.44	$1,029.41	$711.20
South Bend	KSBN	M	$847.54	$613.28	$722.30	$488.04
South Bend	KSBN	L	$620.89	$448.58	$495.65	$323.34
Vincennes	KLWV	H	$1,107.49	$725.64	$957.21	$575.35
Vincennes	KLWV	M	$807.49	$526.37	$657.20	$376.08
Vincennes	KLWV	L	$586.07	$379.31	$435.79	$229.02

For all three salary levels, all locations, both costing methods, and considering or not considering productivity, it is economically less expensive to use the SR-20 for all but one location. When considering LCC and 0% productivity while onboard the aircraft, it is less expensive to use the SR-20 than to drive to eight of the nine locations. Travel to the Kokomo location on the SR-20 is $2.44 less expensive if one considers the highest salary level but more expensive considering the middle or low salary level. It is important to note that the Kokomo location is located only 53.1 miles away via ground vehicle travel, and is the shortest distance from Purdue University out of all nine locations. Also, average total travel time savings to the nine locations is about two hours and fifty minutes by utilizing the SR-20 for transportation, versus a car. Comparing travel in a vehicle, where the employee is 10% productive en route, to the SR-20 using LCC and assuming the employee is 0% productive when onboard the aircraft, on average the high, middle, and low salary level savings per trip are $587.05, $397.02, and $256.77, respectively.

Neither DOC nor LCC methods account for compensation of crew members because Purdue University utilizes faculty members as instructor captains on their aircraft. That being said, adding up a hypothetical month of trips with a single lowest salary level employee traveling, the savings using the SR-20 would amount to $2,310.91. This month of trips totals approximately eleven hours and fourteen minutes of flight time, and equates to approximately $205.78 in savings per flight hour.

4.2. Top 31 Routes

This section describes the economic implications of travel to the top 31 destinations by vehicle, small aircraft, and airline. Table 1 and Table 2 (displayed on page 23) depict assumptions explained throughout this section.

4.2.1. Driving Analysis

The driving analysis for the top 31 routes is designed identically to that used previously in the hypothetical case study of the Statewide Technology locations. Since the available data do not include the location of the actual meeting, all vehicle travel is to the destination airport indicated by the previous year's TFO data for Purdue University. Important to note is that, due to drive time, an employee could not effectively drive to Atlanta, GA, Washington, DC, Clemson, SC, or Naples, FL, have a meeting, and drive back in the same day.

4.2.2. Small Aircraft Analysis

The small aircraft analysis is very similar to the analysis done for the hypothetical case study. One difference is there are two aircraft being analyzed, the SR-20 and the Phenom 100. The other differences are related to transportation to Purdue University Airport and processing time. For this comparison, there are 20 minutes of non-productive driving time included for an employee transporting themselves from anywhere on campus to Purdue University Airport for both small aircraft. Also, during the 10 minutes of processing time associated with boarding the aircraft, it is assumed that the employee is able to be 20% productive. These two short time periods represent a small amount of productivity savings, less than $44.00 for small aircraft compared to less than $218.00 for airline, but they are considered for equality purposes. If an employee is considered productive while driving to Indianapolis International Airport and while in processing, then they should be considered productive while driving to Purdue University Airport and in processing.

Productivity en-route is now calculated for three segments: driving, processing, and en-route. The method by which they are calculated remains the same, but different productivity levels for the different segments are used.

When considering 0% productivity onboard the aircraft, as is done for the baseline study, productivity savings associated with driving and processing are still included for both small aircraft and airline transportation.

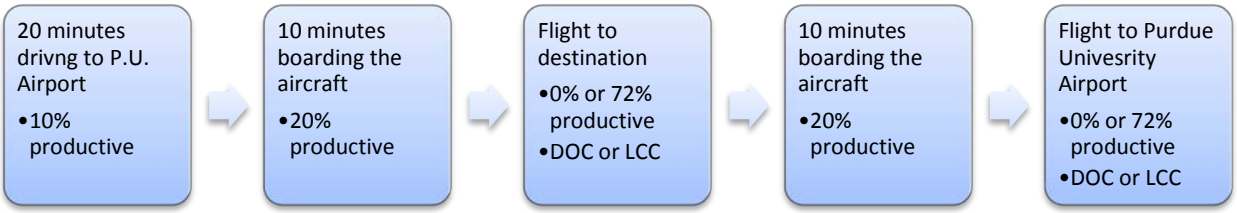

Figure 2. Small Aircraft Flight Timeline

A typical trip, shown in Figure 2, would consist of 20 minutes of productive transportation time from anywhere on Purdue's campus to the airport, followed by 10 minutes of productive processing time. Next, the flight time for the SR-20 or Phenom 100 en-route travel time occurs. The flight time is either considered productive time or non-productive time, depending on calculation of baseline (0% productive en route) or actual (72% productive en route). It is assumed that the leg ends upon arrival at the destination airport. The second leg consists of another 10 minutes of productive processing time, followed again by either the productive or unproductive SR-20 or Phenom 100 flight time. The second leg is assumed to end upon reaching Purdue University airport. All flight times are calculated by Travel$ense according to the proper aircraft profile.

One would not consider, or likely be allowed, to fly an SR-20 into major airports like Chicago O'Hare, Minneapolis, Midway or Washington Dulles. Also, the trip to Naples, FL could not be made without making a fuel stop, and for the purpose of this study, these airports are considered a highly unlikely use of the SR-20.

4.2.3. Airline Analysis

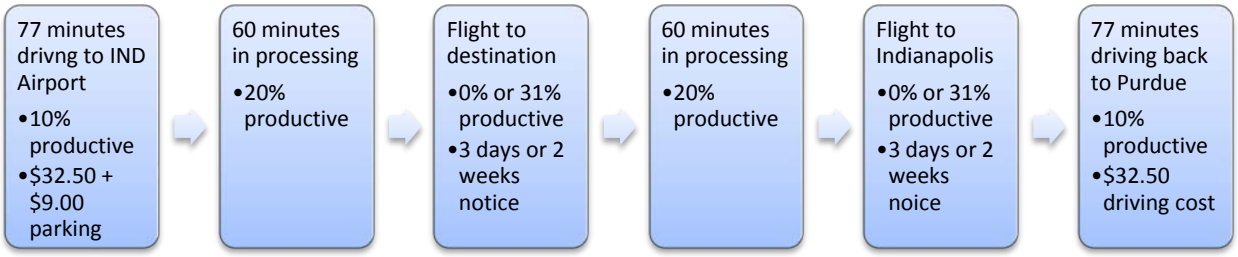

Figure 3. Airline Route Timeline

There are many differences when considering airline travel. One main similarity is the drive and processing time procedures. A timeline of events is depicted in Figure 3. First, the trip begins with 77 minutes of 10% productive drive time, followed by 60 minutes of 20% productive processing time. Again, the drive and processing times are considered productive, and the economic savings is calculated even when considering 0% productivity while on board the aircraft. Associated with this drive are a $9.00 parking fee and $32.50 in vehicle cost (representing half of the $65.00 round trip vehicle cost), and then, like the small aircraft, the trip time is added in. All trip times and ticket costs are tabulated using Travel$ense software, which generates available flight information according to user inputs from Travelocity (Travel$ense Business Travel Analysis Software (user's guide), 1999). This time is either valued at 0% productivity or at 31% productivity. Although it is likely that some flights have connections in other cities, the entire length of time traveling by airline is considered to be either 31% productive or 0% productive. Over half of the destinations in the top 31 routes did not have regularly-scheduled commercial service at the time the airline fares were extracted from the software. The leg ends at the destination airport, except for those that were not commercially-served, where the leg ends at the nearest commercially-served airport. The return leg begins with 60 minutes of productive processing, followed by the return flight time, and then a 77 minute drive home, which costs $32.50 in vehicle fees. The return leg ends when reaching Purdue University.

Two categories of airline airfares and flight times are analyzed. The first category assumes a meeting is planned three business days in advance to represent a meeting scheduled suddenly. All airline fares were extracted in one session on Thursday, March 4, 2010 in order to guard against availability and price changes, meaning the meeting, and therefore flights, were scheduled on March 9, 2010. The second category assumes there is two weeks' notice before the meeting, meaning the flight was to be on March 18, 2010. This is done to explore any difference in notification time that might be reflected in an increase in airline ticket price, but not affect the travel cost by small aircraft. This difference is found to be $82.68, and insignificant to the overall study.

There were 15 routes identified that were not served commercially. Table 4 is a list of the top 31 route airports that were not served commercially, their substitute airport and distance between them. Other outside costs, such as hotel and lost productivity time, are not accounted for in the study, but could be considered in the evaluation of the options. Also not considered in this study, is the reduction in schedule flexibility caused by having meeting times controlled by airline schedules. Some airline flights considered only allowed for a very short time on site. There may be other available flights, but when queried on March 4, 2010 the fares from the software reflected these notable issues.

Table 5. Top 31 Airports Not Commercially Served

Airport	Substitute	Distance (miles)
Ohio State (OSU)	KCMH	11
Clark County (JVY)	KSDF	14
Lawrenceville (LWV)	KEVV	51
Gary (GYY)	KMDW	21
Willow Run (YIP)	KDTW	9
Chicago Executive (PWK	KORD	9
Porter County (VPZ)	KSBN	39
Naples (APF)	KRSW	27
Warsaw (ASW)	KSBN	39
Cincinnati (LUK)	KCVG	13
French Lick (FRH)	KSDF	54
Iowa City (IOW)	KCID	19
Butler County (HAO)	KCVG	24
Greenville (GCY)	KTRI	30
DeKalb-Peachtree (PDK)	KATL	17

4.2.4. Findings

Due to the quantity of information analyzed, Appendix B contains a complete comparison of associated costs and savings. However, notable findings and aggregate results are highlighted here. Figure 4 shows a comparison of transportation costs for the high salary level, considering productivity and using LCC for small aircraft.

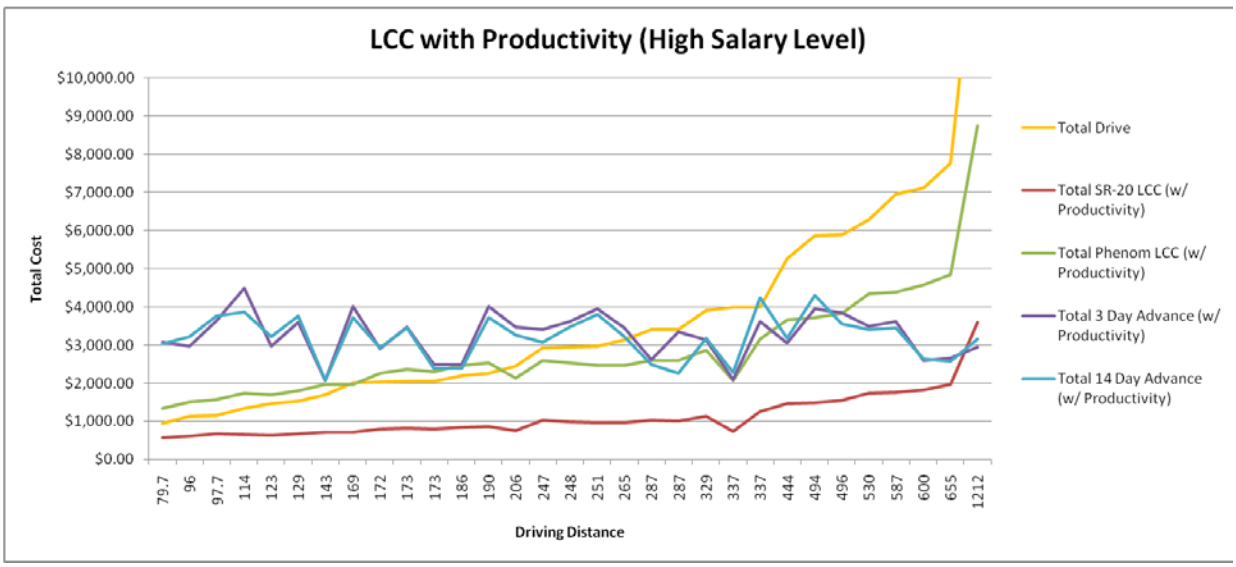

Figure 4. Total LCC Comparison

Figure 5 shows total DOC costs with productivity included for the high salary level.

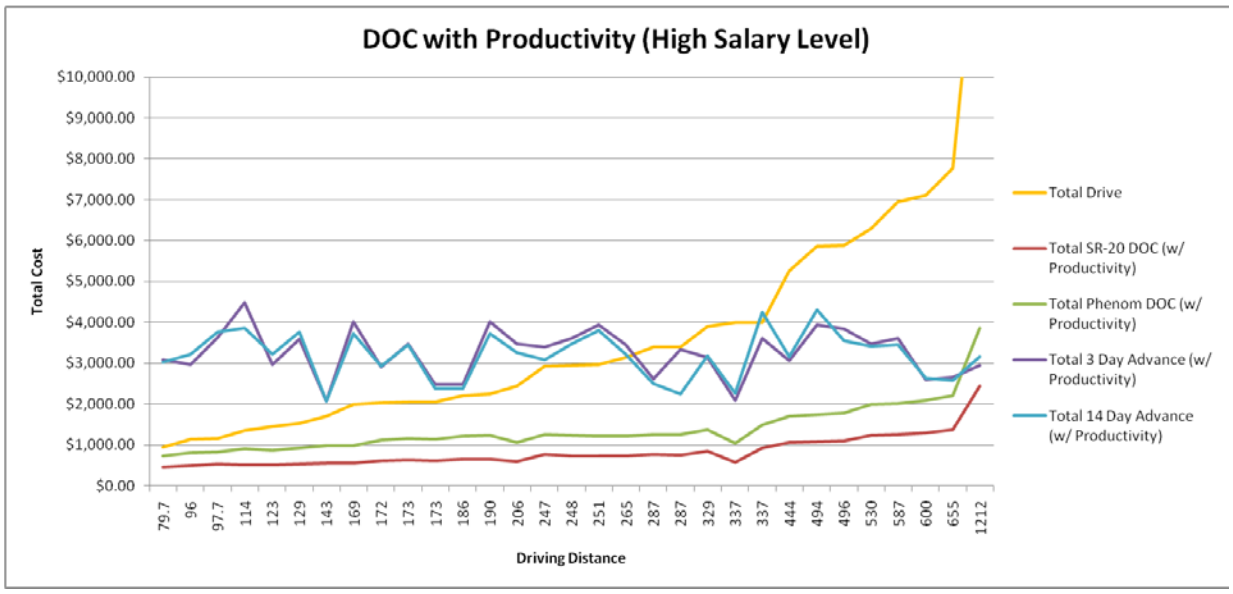

Figure 5. Total DOC Comparison

Figure 4 shows all airports arranged in order of driving distance and associated high salary level economic costs for both small aircraft and both airline settings including productivity. From this graph it is clear to see that there appears to be a positive relationship between distance and cost for both small aircraft. However, there does not seem to be a relationship between airline cost and distance. This result could have been inferred through common knowledge of the domestic airline industry and its hub and spoke system, and therefore is not surprising. One key point to keep in mind is that 15 of the 31 top routes are not served by scheduled commercial service, so the destinations represented in the figure are the closest commercially-served airports. Figure 5 shows it is economically less expensive to travel on the Phenom to all locations instead of drive, or use airline travel when considering the highest salary level and DOC, except to Naples, FL. The average savings using DOC for the Phenom versus driving for the high, middle and low salary levels are $2,314.46, $1,532.85, and $956.00, respectively.

Using the baseline 0% productivity study, LCC, and considering the high salary level, nine of the ten top routes were better served economically by the Phenom than the airlines, as shown in figure 6. Under the same conditions, but also including the middle salary level, eight of the top ten routes were better served by the Phenom when given either of the airline scenarios, as shown in figure 7. Using the low salary level, five of the top ten routes are better served by the Phenom than the airlines, given the same conditions, shown in figure 8.

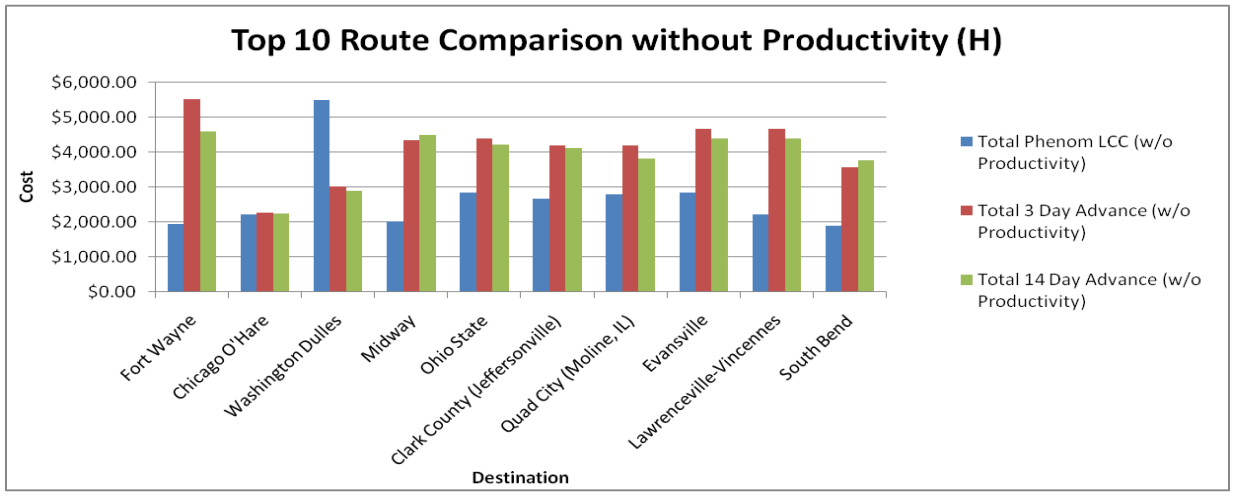

Figure 6. High Salary

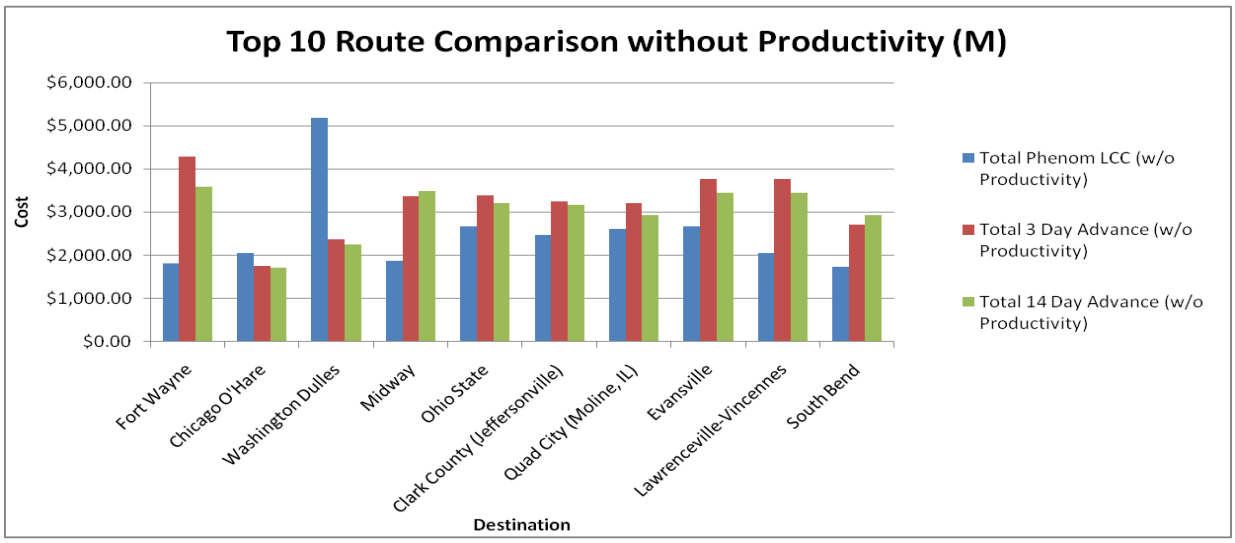

Figure 7. Middle Salary

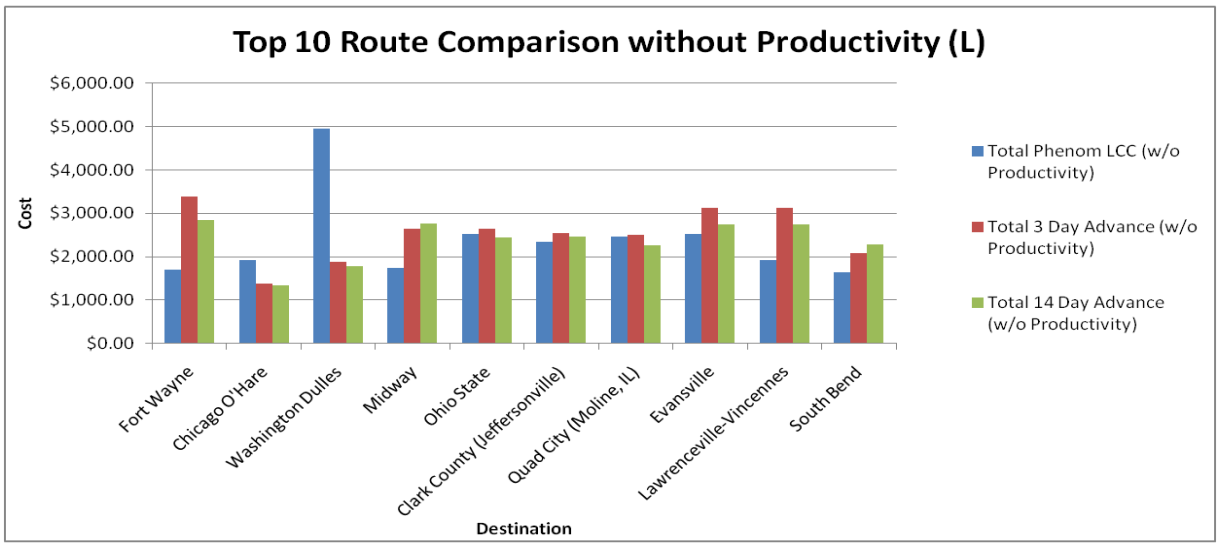

Figure 8. Low Salary

Table 5 shows the average cost for any given aircraft configuration and salary range, as well as the driving costs. Table 6 shows the different airline configurations and average salary ranges as well.

Table 6. Average Costs with Productivity for All 31 Trips-Driving

Salary	Aircraft				Driving
	Phenom 100		SR-20		
	DOC	LCC	DOC	LCC	
High	$1,376.62	$2,873.64	$825.81	$1,115.38	$3,691.07
Middle	$1,266.64	$2,763.66	$677.95	$967.51	$2,799.49
Low	$1,185.48	$2,682.50	$568.82	$858.39	$2,141.48

Table 7. Average Costs with Productivity for All 31 Trips-Airline

Salary	Airline Versus Phenom with Productivity			
	Phenom 100		Airline	
	DOC	LCC	3-Day	2 Week
High	$1,376.62	$2,873.64	$3,256.21	$3,192.61
Middle	$1,266.64	$2,763.66	$2,564.87	$2,496.24
Low	$1,185.48	$2,682.50	$2,054.64	$1,982.29

As shown in the table, an aggregate assessment shows that, when considering LCC and productivity, travel by airline in either scenario is very close to the same as travel by

Phenom. If one considers that the Phenom is being used for flight training already, and therefore must only recuperate its DOC, then it is considerably less to travel on the Phenom, on average.

Another comparison can be made between methods of travel and time spent traveling. Table 7 shows the average travel times for all methods of transportation for all 31 routes.

Table 8. Average Total Travel Time for All 31 Routes (in Hours)

	Method of Travel				
	Drive	SR-20	Phenom	Airline – 3 Day	Airline – 2 week
Time	11:20	3:45	2:12	10:22	10:15

From this table it is easy to see that travel using small aircraft is considerably shorter. In fact, travel by car is only about one hour longer than travel by airline on average for the top 31 routes.

SECTION 5. CONCLUSION

This section will be a discussion of the findings and will include suggestions for future studies.

5.1. Discussion

The intention of this study was to take an unbiased look at what, if any, economic benefits derive from using available small aircraft transportation instead of using alternative methods of travel, such as vehicle or airline. The study was conducted using all available Purdue University data in order to reflect actual associated economic costs. The goal of the study was to provide Purdue University administrators with a framework to help make informed decisions for travel via car, small aircraft, or airline, in terms of efficient and cost-effective employee travel. There are many scenarios presented in this study with regard to salary level, method of recognizing productivity, method of costing the travel, and destination. Given the amount of data it would seem like there would be some conclusive result to the study. However, there are many variables, predictable and unpredictable, associated with travel, and therefore many limitations to this study and suggestions for future studies. Nevertheless, there are conclusions that can be inferred from this study with its given assumptions and limitations.

5.1.1. Hypothetical Case Study

The results from the hypothetical case study show that in almost all cases, it is better to travel on the SR-20 than to drive. Only in the case of travel to Kokomo, the closest location to Purdue University (53.1 miles) is it economically less expensive to drive when considering the middle and low salary levels. Figure 9 displays the high salary

comparison, and figure 10 displays the low salary comparison. It can be assumed that the middle salary comparison falls between the high and low salary comparisons, and therefore is not shown.

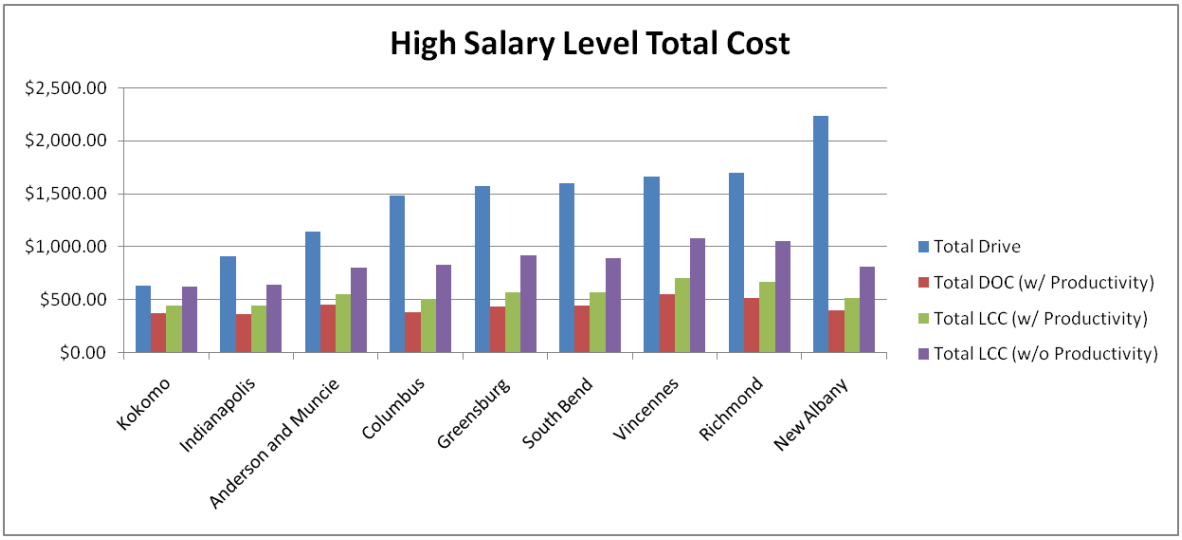

Figure 9. High Salary Comparison

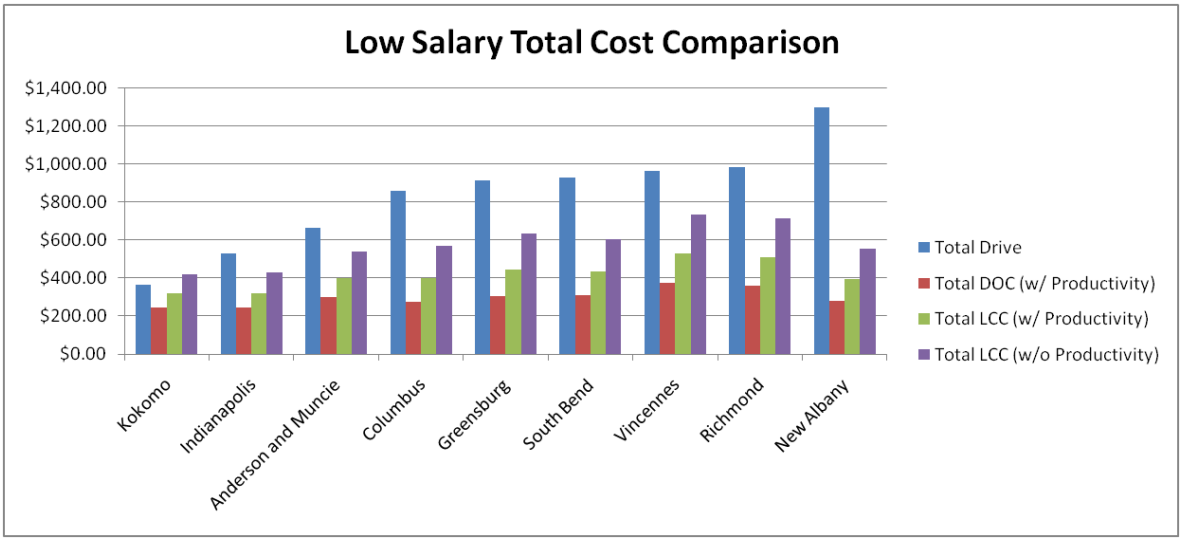

Figure 10. Low Salary Comparison

Along with economic cost savings, there was a substantial travel time savings of two hours and fifty minutes. It is noted that there may be extra time spent unloading the passengers at the destination airport and loading them into the rental vehicle. Also noted is the possibility that there may be road congestion when traveling via car, or flight delays when traveling via small aircraft. As mentioned earlier, crew costs are not

included in the DOC or LCC for the SR-20. There are also limitations to the type of weather in which SR-20 aircraft can be safely flown, making the drive or fly decision easier, regardless of the economic cost differential.

Another consideration is that up to three employees may travel on any aircraft with negligible operating cost increases. These scope limitations are good material for a live case study for future research. Using LCC and considering productivity, and assuming the same nine trips were conducted each month for a year, the approximate economic savings for the high, middle, and low salary levels are listed in Table 9.

Table 9. Average Yearly Savings

	Salary Level		
	High	Middle	Low
1 Employee Onboard (Year)	$95,572.74	$66,561.87	$27,730.96
3 Employees Onboard (Year)	$321,335.93	$234,303.31	$170,071.27

The additional usage of the aircraft would total approximately 135 hours per year. Since the SR-20 is already being used to conduct flight training, these additional 135 hours could be spread out over the entire fleet. This would lend a tendency to the utilization DOC since the 135 hours represent extra utilization of the aircraft, and may be a platform to utilize the aircraft additionally, while helping pilots gain valuable cross-country flight time.

5.1.2. Top 31 Routes

Driving is ruled out of further discussion for the top 31 routes, since it was only economically superior to the SR-20 on distances less than 77 miles, and the shortest top 31 route is 79.7 miles. Although not all routes appear to be economically beneficial when using small aircraft transportation, it is clear that some are. For example, it takes approximately four hours and ten minutes to travel round trip to Fort Wayne using a car. It is approximately two hours and two minutes using the SR-20 and one hour and thirty one minutes using the Phenom and thirteen hours and twenty four minutes via airline. Using DOC costs, it is economically less expensive to use either the SR-20 or the

Phenom, but when making the travel decision, it would be best to use the SR-20. The SR-20 is also economically less expensive when using LCC. On the other hand, under no situation is it economically less expensive to travel to Naples, FL on either small aircraft, and not possible in one day by automobile.

Considering all three salary levels and 31 routes, there were a total of 93 possible employee-route combinations. Table 10 is a matrix representing the number of routes that are better served economically using the Phenom in different productivity and cost scenarios. Only comparable scenarios were analyzed and shown.

Table 10. Routes Better Economically Served (N=93)

			Airline			
			Productivity		No Productivity	
			3-Day	2-Week	3-Day	2-week
Phenom	Productivity	DOC	88	87		
		LCC	51	46		
	No Productivity	DOC			86	86
		LCC			52	48

This table shows that there is negligible difference in number of routes better economically served when considering productivity. More importantly is what is actually being compared. Table 11 helps explain why table 10 depicts such little emphasis on productivity relative to overall economic cost.

Table 11. Average Trip Metrics (LCC)

	SR-20	Phenom	Airline
Travel Time (hours)	3:45	2:12	10:19
Cost of Operation/Ticket	$277.45	$1,228.39	$520.34
Cost of Employee Time	$512.90	$318.20	$1,296.84
Productivity Savings	(295.99)	($155.81)	($298.44)
Total (with Productivity)	**$484.36**	**$1,390.78**	**$1,518.74**
Total (without Productivity)	**$790.35**	**$1,546.59**	**$1,817.18**

The cost of operation using LCC is so high, and the average trip is only two hours, which creates low productivity savings for the Phenom; when it is compared to the airline and productivity en-route is disregarded, the difference in economic cost goes up. The SR-20, on average, is clearly economically less expensive. Since a larger percentage of the time is spent in the air (72% productive) than traveling to the airport or processing (10% or 20% productive), the employee productivity savings is larger than it is for the Phenom. Another factor for the similarity in economic cost is the relatively low time multiplier. There are several ways, as mentioned earlier, to determine employee value both professionally and in business. Many of these are driven by insurance policy underwriters. Benefit term insurance, according to the Travel$ense user's guide discussion of the topic, generally demands a 5.0-7.0 multiplier (Travel$ense Business Travel Analysis Software (user's guide), 1999). Even using a multiplier of 3.5 would make the Washington Dulles trip more economically beneficial fly on the Phenom than use the airlines.

Given that, on average, the Phenom and airline travel methods are similar in cost, there are other factors that must be considered. There are not individual routes that are more economically viable using one method instead of another, but time and number of people traveling also make a difference. Again, the addition of employees to the SR-20, or more importantly, the Phenom increase the operating cost by a negligible amount. The addition of passengers to an airline flight means a cost increase for each additional employee due to purchasing extra tickets. As employees are added to the trip, up to the maximum number of seats on the Phenom, the economic cost for the Phenom will not change and costs will increase for airline use.

Other concerns, such as 15 of the top 31 routes could not be accessed by commercial travel, lend thought to future study. Further analysis needs to be done considering distance of travel between the closest commercially-served airport and the actual location of the meeting, versus the actual destination airport and the meeting location. The actual value of an employee to the university could be more accurately determined, other than the use of the facilities and overhead charges. Other considerations may be

needed for employee preference and perceptions of safety while onboard all three methods of transportation.

5.2. Closing Remarks

The top 31 route analysis is less conclusive than the hypothetical case study, but it does provide a good framework for future analysis and provokes further thought into the travel decision-making process. Based on this study, the similarity of average economic cost between airline and Phenom travel means the decision might lend itself to judgment based on passenger load and perceived importance of employee time.

This study provides a basis for future studies in the area of university aircraft use for employee lift. It outlines several concerns and several pros and cons of small aircraft use for employee travel. Further research is needed in the areas of productivity, perceived employee value, and time studies regarding trip length.

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APPENDIX A

Hypothetical Case Study

Name	Airport Used	Dis-tance	Time		Salary/ Hour	Time Multi-plier	Cost to Drive	Total Drive Cost	Aircraft Time	Aircraft DOC	Aircraft LCC	Total Drive	Total DOC w/ Prod.	Total DOC w/o Prod.	Total LCC w/ Prod.	Total LCC w/o Prod.
Anderson/ Muncie	KAID	96.5	1.75	H	$215.24	1.54	$48.25	$571.68	0.53	$45.90	$96.00	$1,143.36	$449.08	$703.66	$549.28	$803.85
Anderson/ Muncie	KAID	96.5	1.75	M	$158.46	1.54	$48.25	$433.59	0.53	$45.90	$96.00	$867.18	$363.19	$550.61	$463.39	$650.80
Anderson/ Muncie	KAID	96.5	1.75	L	$116.55	1.54	$48.25	$331.68	0.53	$45.90	$96.00	$663.35	$299.80	$437.65	$400.00	$537.84
Columbus	KCLU	125	2.27	H	$215.24	1.54	$62.50	$740.52	0.67	$57.38	$120.00	$1,481.03	$383.90	$702.12	$509.14	$827.36
Columbus	KCLU	125	2.27	M	$158.46	1.54	$62.50	$561.64	0.67	$57.38	$120.00	$1,123.29	$320.10	$554.37	$445.34	$679.61
Columbus	KCLU	125	2.27	L	$116.55	1.54	$62.50	$429.63	0.67	$57.38	$120.00	$859.26	$273.02	$445.32	$398.26	$570.56
Greensburg	I34	133	2.42	H	$215.24	1.54	$66.50	$787.91	0.73	$63.12	$132.00	$1,575.82	$433.72	$783.75	$571.48	$921.52
Greensburg	I34	133	2.42	M	$158.46	1.54	$66.50	$597.59	0.73	$63.12	$132.00	$1,195.18	$360.07	$617.76	$497.83	$755.52
Greensburg	I34	133	2.42	L	$116.55	1.54	$66.50	$457.13	0.73	$63.12	$132.00	$914.26	$305.72	$495.25	$443.48	$633.02
Indianapolis	I14	77	1.40	H	$215.24	1.54	$38.50	$456.16	0.42	$35.86	$75.00	$912.32	$363.32	$562.21	$441.60	$640.48
Indianapolis	I14	77	1.40	M	$158.46	1.54	$38.50	$345.97	0.42	$35.86	$75.00	$691.94	$294.30	$440.72	$372.58	$519.00
Indianapolis	I14	77	1.40	L	$116.55	1.54	$38.50	$264.65	0.42	$35.86	$75.00	$529.31	$243.37	$351.06	$321.64	$429.34
Kokomo	KOKK	53.1	0.97	H	$215.24	1.54	$26.55	$314.57	0.38	$32.99	$69.00	$629.14	$371.71	$554.69	$443.73	$626.70
Kokomo	KOKK	53.1	0.97	M	$158.46	1.54	$26.55	$238.59	0.38	$32.99	$69.00	$477.17	$299.18	$433.88	$371.19	$505.89
Kokomo	KOKK	53.1	0.97	L	$116.55	1.54	$26.55	$182.51	0.38	$32.99	$69.00	$365.01	$245.65	$344.72	$317.66	$416.74
New Albany	KJVY	189	3.44	H	$215.24	1.54	$94.50	$1,119.66	0.62	$53.08	$111.00	$2,239.32	$397.62	$691.97	$513.47	$807.82
New Albany	KJVY	189	3.44	M	$158.46	1.54	$94.50	$849.20	0.62	$53.08	$111.00	$1,698.41	$328.26	$544.95	$444.10	$660.80
New Albany	KJVY	189	3.44	L	$116.55	1.54	$94.50	$649.60	0.62	$53.08	$111.00	$1,299.20	$277.06	$436.45	$392.91	$552.29
Richmond	KRID	143	2.60	H	$215.24	1.54	$71.50	$847.15	0.80	$68.86	$144.00	$1,694.30	$518.53	$900.38	$668.81	$1,050.67

Name	Airport Used	Dis-tance	Time		Salary/ Hour	Time Multi-plier	Cost to Drive	Total Drive Cost	Aircraft Time	Aircraft DOC	Aircraft LCC	Total Drive	Total DOC w/ Prod.	Total DOC w/o Prod.	Total LCC w/ Prod.	Total LCC w/o Prod.
Richmond	KRID	143	2.60	M	$158.46	1.54	$71.50	$642.52	0.80	$68.86	$144.00	$1,285.04	$426.16	$707.28	$576.45	$857.56
Richmond	KRID	143	2.60	L	$116.55	1.54	$71.50	$491.50	0.80	$68.86	$144.00	$983.00	$357.99	$564.76	$508.28	$715.05
South Bend	KSBN	135	2.45	H	$215.24	1.54	$67.50	$799.76	0.67	$57.38	$120.00	$1,599.51	$444.86	$763.08	$570.10	$888.32
South Bend	KSBN	135	2.45	M	$158.46	1.54	$67.50	$606.57	0.67	$57.38	$120.00	$1,213.15	$365.61	$599.87	$490.85	$725.11
South Bend	KSBN	135	2.45	L	$116.55	1.54	$67.50	$464.00	0.67	$57.38	$120.00	$928.00	$307.11	$479.42	$432.35	$604.66
Vincennes	KLWV	140	2.55	H	$215.24	1.54	$70.00	$829.38	0.80	$68.86	$144.00	$1,658.76	$551.26	$933.12	$701.55	$1,083.41
Vincennes	KLWV	140	2.55	M	$158.46	1.54	$70.00	$629.04	0.80	$68.86	$144.00	$1,258.08	$450.59	$731.71	$600.88	$882.00
Vincennes	KLWV	140	2.55	L	$116.55	1.54	$70.00	$481.19	0.80	$68.86	$144.00	$962.37	$376.30	$583.07	$526.59	$733.36

APPENDIX B

Top 31 Routes

	Airport Code	Distance	Time @ 55 MPH		SR-20 Aircraft Time	Phenom Aircraft Time	Airline Time-3 Day	Airline Time-Leg 2, 3 Day	Airline Time-2 week	Airline Time-Leg 2, 2 week	Airline 3 Day Ticket Price	Airline 2 week ticket Price
Fort Wayne	FWA	114	2.07	H	0.68	0.43	3.83	6.32	3.83	3.68	$789.00	$729.00
Fort Wayne	FWA	114	2.07	M	0.68	0.43	3.83	6.32	3.83	3.68	$789.00	$729.00
Fort Wayne	FWA	114	2.07	L	0.68	0.43	3.83	6.32	3.83	3.68	$789.00	$729.00
Chicago O'Hare	ORD	143	2.60	H	0.80	0.50	1.08	0.92	1.08	0.92	$243.00	$201.00
Chicago O'Hare	ORD	143	2.60	M	0.80	0.50	1.08	0.92	1.08	0.92	$243.00	$201.00
Chicago O'Hare	ORD	143	2.60	L	0.80	0.50	1.08	0.92	1.08	0.92	$243.00	$201.00
Washington Dulles	IAD	655	11.91	H	3.08	1.35	1.60	1.88	1.60	1.88	$483.00	$370.00
Washington Dulles	IAD	655	11.91	M	3.08	1.35	1.60	1.88	1.60	1.88	$483.00	$370.00
Washington Dulles	IAD	655	11.91	L	3.08	1.35	1.60	1.88	1.60	1.88	$483.00	$370.00
Midway	MDW	129	2.35	H	0.72	0.45	3.60	3.60	3.60	3.80	$573.00	$657.00
Midway	MDW	129	2.35	M	0.72	0.45	3.60	3.60	3.60	3.80	$573.00	$657.00
Midway	MDW	129	2.35	L	0.72	0.45	3.60	3.60	3.60	3.80	$573.00	$657.00
Ohio State	CMH (11)	248	4.51	H	1.30	0.67	2.92	4.58	2.85	4.92	$527.00	$277.00
Ohio State	CMH (11)	248	4.51	M	1.30	0.67	2.92	4.58	2.85	4.92	$527.00	$277.00
Ohio State	CMH (11)	248	4.51	L	1.30	0.67	2.92	4.58	2.85	4.92	$527.00	$277.00
Clark County	SDF (14)	173	3.15	H	1.00	0.62	3.12	3.82	3.12	3.82	$517.00	$450.00

	Airport Code	Distance	Time @ 55 MPH		SR-20 Aircraft Time	Phenom Aircraft Time	Airline Time-3 Day	Airline Time-Leg 2, 3 Day	Airline Time-2 week	Airline Time-Leg 2, 2 week	Airline 3 Day Ticket Price	Airline 2 week ticket Price
Clark County	SDF (14)	173	3.15	M	1.00	0.62	3.12	3.82	3.12	3.82	$517.00	$450.00
Clark County	SDF (14)	173	3.15	L	1.00	0.62	3.12	3.82	3.12	3.82	$517.00	$450.00
Quad City	MLI	265	4.82	H	1.27	0.65	3.10	4.10	3.10	3.20	$429.00	$363.00
Quad City	MLI	265	4.82	M	1.27	0.65	3.10	4.10	3.10	3.20	$429.00	$363.00
Quad City	MLI	265	4.82	L	1.27	0.65	3.10	4.10	3.10	3.20	$429.00	$363.00
Evansville	EVV	190	3.45	H	1.08	0.67	3.25	2.98	3.25	3.68	$1,221.00	$717.00
Evansville	EVV	190	3.45	M	1.08	0.67	3.25	2.98	3.25	3.68	$1,221.00	$717.00
Evansville	EVV	190	3.45	L	1.08	0.67	3.25	2.98	3.25	3.68	$1,221.00	$717.00
Lawrenceville	EVV (51)	169	3.07	H	0.80	0.50	3.25	2.98	3.25	3.68	$1,221.00	$717.00
Lawrenceville	EVV (51)	169	3.07	M	0.80	0.50	3.25	2.98	3.25	3.68	$1,221.00	$717.00
Lawrenceville	EVV (51)	169	3.07	L	0.80	0.50	3.25	2.98	3.25	3.68	$1,221.00	$717.00
South Bend	SBN	123	2.24	H	0.67	0.42	3.25	2.57	3.25	2.57	$267.00	$470.00
South Bend	SBN	123	2.24	M	0.67	0.42	3.25	2.57	3.25	2.57	$267.00	$470.00
South Bend	SBN	123	2.24	L	0.67	0.42	3.25	2.57	3.25	2.57	$267.00	$470.00
Gary	MDW (21)	97.7	1.78	H	0.72	0.38	3.60	3.80	3.60	3.80	$573.00	$657.00
Gary	MDW (21)	97.7	1.78	M	0.72	0.38	3.60	3.80	3.60	3.80	$573.00	$657.00
Gary	MDW (21)	97.7	1.78	L	0.72	0.38	3.60	3.80	3.60	3.80	$573.00	$657.00
Lansing	LAN	251	4.56	H	1.28	0.65	3.05	4.78	4.80	3.55	$777.00	$483.00
Lansing	LAN	251	4.56	M	1.28	0.65	3.05	4.78	4.80	3.55	$777.00	$483.00
Lansing	LAN	251	4.56	L	1.28	0.65	3.05	4.78	4.80	3.55	$777.00	$483.00
Willow Run	DTW (9)	287	5.22	H	1.37	0.68	1.38	1.30	1.38	1.43	$633.00	$433.00
Willow Run	DTW (9)	287	5.22	M	1.37	0.68	1.38	1.30	1.38	1.43	$633.00	$433.00
Willow Run	DTW (9)	287	5.22	L	1.37	0.68	1.38	1.30	1.38	1.43	$633.00	$433.00
Chicago Executive	ORD (9)	337	6.13	H	0.85	0.53	1.08	1.00	1.12	0.92	$243.00	$391.00
Chicago Executive	ORD (9)	337	6.13	M	0.85	0.53	1.08	1.00	1.12	0.92	$243.00	$391.00
Chicago Executive	ORD (9)	337	6.13	L	0.85	0.53	1.08	1.00	1.12	0.92	$243.00	$391.00
Porter County	SBN (39)	79.7	1.45	H	0.53	0.32	2.82	2.95	2.82	2.95	$392.00	$288.00

	Airport Code	Distance	Time @ 55 MPH		SR-20 Aircraft Time	Phenom Aircraft Time	Airline Time-3 Day	Airline Time-Leg 2, 3 Day	Airline Time-2 week	Airline Time-Leg 2, 2 week	Airline 3 Day Ticket Price	Airline 2 week ticket Price
Porter County	SBN (39)	79.7	1.45	M	0.53	0.32	2.82	2.95	2.82	2.95	$392.00	$288.00
Porter County	SBN (39)	79.7	1.45	L	0.53	0.32	2.82	2.95	2.82	2.95	$392.00	$288.00
Des Moines	DSM	444	8.07	H	2.18	1.00	2.83	3.83	2.83	3.83	$164.00	$228.00
Des Moines	DSM	444	8.07	M	2.18	1.00	2.83	3.83	2.83	3.83	$164.00	$228.00
Des Moines	DSM	444	8.07	L	2.18	1.00	2.83	3.83	2.83	3.83	$164.00	$228.00
Akron - Canton	CAK	337	6.13	H	1.80	0.85	3.95	3.80	3.77	6.75	$460.00	$429.00
Akron - Canton	CAK	337	6.13	M	1.80	0.85	3.95	3.80	3.77	6.75	$460.00	$429.00
Akron - Canton	CAK	337	6.13	L	1.80	0.85	3.95	3.80	3.77	6.75	$460.00	$429.00
Naples	RSW (27)	1212	22.04	H	6.07	2.50	2.38	2.48	2.38	2.48	$456.00	$627.00
Naples	RSW (27)	1212	22.04	M	6.07	2.50	2.38	2.48	2.38	2.48	$456.00	$627.00
Naples	RSW (27)	1212	22.04	L	6.07	2.50	2.38	2.48	2.38	2.48	$456.00	$627.00
Warsaw	SBN (39)	96	1.75	H	0.60	0.37	3.25	2.60	3.25	2.60	$267.00	$470.00
Warsaw	SBN (39)	96	1.75	M	0.60	0.37	3.25	2.60	3.25	2.60	$267.00	$470.00
Warsaw	SBN (39)	96	1.75	L	0.60	0.37	3.25	2.60	3.25	2.60	$267.00	$470.00
Port Columbus	CMH	247	4.49	H	1.37	0.68	3.42	3.20	2.90	2.62	$518.00	$405.00
Port Columbus	CMH	247	4.49	M	1.37	0.68	3.42	3.20	2.90	2.62	$518.00	$405.00
Port Columbus	CMH	247	4.49	L	1.37	0.68	3.42	3.20	2.90	2.62	$518.00	$405.00
Lambert - St. Louis	STL	287	5.22	H	1.35	0.68	3.58	1.00	1.08	1.00	$917.00	$363.00
Lambert - St. Louis	STL	287	5.22	M	1.35	0.68	3.58	1.00	1.08	1.00	$917.00	$363.00
Lambert - St. Louis	STL	287	5.22	L	1.35	0.68	3.58	1.00	1.08	1.00	$917.00	$363.00
Cincinnati	CVG (13)	186	3.38	H	1.05	0.65	0.98	1.03	0.98	1.03	$651.00	$501.00
Cincinnati	CVG (13)	186	3.38	M	1.05	0.65	0.98	1.03	0.98	1.03	$651.00	$501.00

	Airport Code	Distance	Time @ 55 MPH		SR-20 Aircraft Time	Phenom Aircraft Time	Airline Time-3 Day	Airline Time-Leg 2, 3 Day	Airline Time-2 week	Airline Time-Leg 2, 2 week	Airline 3 Day Ticket Price	Airline 2 week ticket Price
Cincinnati	CVG (13)	186	3.38	L	1.05	0.65	0.98	1.03	0.98	1.03	$651.00	$501.00
French Lick	SDF (54)	206	3.75	H	0.88	0.55	3.12	3.82	2.77	3.50	$517.00	$413.00
French Lick	SDF (54)	206	3.75	M	0.88	0.55	3.12	3.82	2.77	3.50	$517.00	$413.00
French Lick	SDF (54)	206	3.75	L	0.88	0.55	3.12	3.82	2.77	3.50	$517.00	$413.00
Lovell Field	CHA	496	9.02	H	2.33	1.05	3.98	3.87	3.60	3.60	$666.00	$482.00
Lovell Field	CHA	496	9.02	M	2.33	1.05	3.98	3.87	3.60	3.60	$666.00	$482.00
Lovell Field	CHA	496	9.02	L	2.33	1.05	3.98	3.87	3.60	3.60	$666.00	$482.00
Iowa City	CID (19)	329	5.98	H	1.58	0.77	2.67	3.08	2.67	3.08	$450.00	$450.00
Iowa City	CID (19)	329	5.98	M	1.58	0.77	2.67	3.08	2.67	3.08	$450.00	$450.00
Iowa City	CID (19)	329	5.98	L	1.58	0.77	2.67	3.08	2.67	3.08	$450.00	$450.00
Oconee Country	CEU	587	10.67	H	2.73	1.22	3.55	4.05	3.55	3.93	$508.00	$324.00
Oconee Country	CEU	587	10.67	M	2.73	1.22	3.55	4.05	3.55	3.93	$508.00	$324.00
Oconee Country	CEU	587	10.67	L	2.73	1.22	3.55	4.05	3.55	3.93	$508.00	$324.00
Minneapolis	MSP	530	9.64	H	2.68	1.20	4.07	3.00	4.07	1.72	$493.00	$668.00
Minneapolis	MSP	530	9.64	M	2.68	1.20	4.07	3.00	4.07	1.72	$493.00	$668.00
Minneapolis	MSP	530	9.64	L	2.68	1.20	4.07	3.00	4.07	1.72	$493.00	$668.00
Butler County	CVG (24)	173	3.15	H	0.97	0.60	0.98	1.03	0.98	1.03	$651.00	$501.00
Butler County	CVG (24)	173	3.15	M	0.97	0.60	0.98	1.03	0.98	1.03	$651.00	$501.00
Butler County	CVG (24)	173	3.15	L	0.97	0.60	0.98	1.03	0.98	1.03	$651.00	$501.00
Greenville	TRI (30)	494	8.98	H	2.23	1.02	3.20	3.38	3.37	4.65	$1,061.00	$1,061.00
Greenville	TRI (30)	494	8.98	M	2.23	1.02	3.20	3.38	3.37	4.65	$1,061.00	$1,061.00
Greenville	TRI (30)	494	8.98	L	2.23	1.02	3.20	3.38	3.37	4.65	$1,061.00	$1,061.00
Greater Peoria	PIA	172	3.13	H	0.95	0.58	2.73	2.67	2.73	2.67	$304.00	$283.00
Greater Peoria	PIA	172	3.13	M	0.95	0.58	2.73	2.67	2.73	2.67	$304.00	$283.00
Greater Peoria	PIA	172	3.13	L	0.95	0.58	2.73	2.67	2.73	2.67	$304.00	$283.00

	Airport Code	Distance	Time @ 55 MPH		SR-20 Aircraft Time	Phenom Aircraft Time	Airline Time-3 Day	Airline Time-Leg 2, 3 Day	Airline Time-2 week	Airline Time-Leg 2, 2 week	Airline 3 Day Ticket Price	Airline 2 week ticket Price
DeKalb-Peachtree	ATL (17)	600	10.91	H	2.85	1.27	1.85	1.60	1.85	1.60	$441.00	$441.00
DeKalb-Peachtree	ATL (17)	600	10.91	M	2.85	1.27	1.85	1.60	1.85	1.60	$441.00	$441.00
DeKalb-Peachtree	ATL (17)	600	10.91	L	2.85	1.27	1.85	1.60	1.85	1.60	$441.00	$441.00

	Total Drive	SR-20 DOC w/ Prod.	SR-20 DOC w/o Prod.	SR-20 LCC w/ Prod.	SR-20 LCC w/o Prod.	Phenom DOC w/ Prod.	Phenom DOC w/o Prod.	Phenom LCC w/ Prod.	Phenom LCC w/o Prod.	Airline- 3 Day w/ Prod.	Airline-3 Day w/o Prod.	Airline-2 week w/ Prod.	Airline 2 week w/o Prod.
Fort Wayne	$1,350.70	$518.82	$844.99	$647.19	$973.37	$896.50	$1,103.34	$1,741.45	$1,948.29	$ 4,480.55	$ 5,523.53	$ 3,860.80	$ 4,590.65
Fort Wayne	$1,024.44	$412.98	$653.10	$541.35	$781.47	$802.90	$955.17	$1,647.86	$1,800.13	$ 3,526.17	$ 4,294.00	$ 3,054.09	$ 3,591.40
Fort Wayne	$783.65	$334.87	$511.48	$463.24	$639.85	$733.82	$845.82	$1,578.78	$1,690.78	$ 2,821.82	$ 3,386.58	$ 2,458.73	$ 2,853.93
Chicago O'Hare	$1,694.30	$560.56	$942.42	$710.85	$1,092.71	$992.21	$1,230.87	$1,967.16	$2,205.82	$ 2,070.50	$ 2,276.01	$ 2,071.04	$ 2,234.01
Chicago O'Hare	$1,285.04	$449.01	$730.12	$599.30	$880.41	$895.35	$1,071.05	$1,870.30	$2,046.00	$ 1,607.90	$ 1,759.19	$ 1,597.21	$ 1,717.19
Chicago O'Hare	$983.00	$366.68	$573.45	$516.96	$723.73	$823.86	$953.09	$1,798.81	$1,928.04	$ 1,266.48	$ 1,377.76	$ 1,247.52	$ 1,335.76
Washington Dulles	$7,760.60	$1,377.46	$2,849.21	$1,956.70	$3,428.44	$2,212.58	$2,856.97	$4,844.94	$5,489.33	$ 2,649.76	$ 3,007.70	$ 2,579.30	$ 2,894.70
Washington Dulles	$5,886.02	$1,154.09	$2,237.56	$1,733.32	$2,816.80	$2,074.09	$2,548.48	$4,706.46	$5,180.84	$ 2,097.66	$ 2,361.16	$ 2,015.97	$ 2,248.16
Washington Dulles	$4,502.53	$989.23	$1,786.15	$1,568.47	$2,365.39	$1,971.88	$2,320.80	$4,604.25	$4,953.17	$ 1,690.19	$ 1,884.00	$ 1,600.22	$ 1,771.00
Midway	$1,528.42	$530.75	$872.83	$665.38	$1,007.46	$920.43	$1,135.22	$1,797.88	$2,012.68	$ 3,589.83	$ 4,329.68	$ 3,762.11	$ 4,479.97
Midway	$1,159.23	$423.27	$675.11	$557.91	$809.74	$826.01	$984.14	$1,703.47	$1,861.59	$ 2,813.46	$ 3,358.12	$ 2,962.45	$ 3,490.93
Midway	$886.76	$343.96	$529.19	$478.59	$663.82	$756.33	$872.64	$1,633.79	$1,750.09	$ 2,240.48	$ 2,641.09	$ 2,372.28	$ 2,760.99
Ohio State	$2,938.37	$739.45	$1,359.97	$983.66	$1,604.18	$1,231.50	$1,549.72	$2,531.43	$2,849.65	$ 3,612.44	$ 4,383.12	$ 3,465.97	$ 4,221.52
Ohio State	$2,228.60	$603.40	$1,060.22	$847.62	$1,304.44	$1,126.47	$1,360.74	$2,426.41	$2,660.67	$ 2,817.97	$ 3,385.33	$ 2,644.19	$ 3,200.40
Ohio State	$1,704.78	$503.00	$839.00	$747.22	$1,083.22	$1,048.96	$1,221.27	$2,348.90	$2,521.20	$ 2,231.63	$ 2,648.94	$ 2,037.69	$ 2,446.80
Clark County	$2,049.75	$632.12	$1,109.44	$819.98	$1,297.30	$1,159.71	$1,454.06	$2,362.15	$2,656.50	$ 3,472.84	$ 4,185.29	$ 3,448.38	$ 4,118.29
Clark County	$1,554.63	$510.77	$862.16	$698.63	$1,050.02	$1,057.14	$1,273.83	$2,259.58	$2,476.27	$ 2,712.56	$ 3,237.05	$ 2,676.87	$ 3,170.05
Clark County	$1,189.22	$421.21	$679.67	$609.07	$867.53	$981.43	$1,140.82	$2,183.87	$2,343.25	$ 2,151.45	$ 2,537.23	$ 2,107.49	$ 2,470.23
Quad City	$3,139.79	$727.52	$1,332.13	$965.48	$1,570.09	$1,207.57	$1,517.83	$2,475.01	$2,785.27	$ 3,445.83	$ 4,185.68	$ 3,216.52	$ 3,821.35
Quad City	$2,381.37	$593.11	$1,038.21	$831.07	$1,276.17	$1,103.36	$1,331.77	$2,370.80	$2,599.21	$ 2,669.46	$ 3,214.12	$ 2,483.24	$ 2,928.50
Quad City	$1,821.64	$493.91	$821.30	$731.87	$1,059.25	$1,026.45	$1,194.45	$2,293.89	$2,461.89	$ 2,096.48	$ 2,497.09	$ 1,942.05	$ 2,269.56
Evansville	$2,251.17	$661.93	$1,179.03	$865.44	$1,382.54	$1,231.50	$1,549.72	$2,531.43	$2,849.65	$ 4,016.74	$ 4,657.25	$ 3,715.38	$ 4,385.29
Evansville	$1,707.40	$536.50	$917.18	$740.01	$1,120.69	$1,126.47	$1,360.74	$2,426.41	$2,660.67	$ 3,298.69	$ 3,770.23	$ 2,943.87	$ 3,437.05
Evansville	$1,306.08	$443.93	$723.93	$647.44	$927.44	$1,048.96	$1,221.27	$2,348.90	$2,521.20	$ 2,768.76	$ 3,115.59	$ 2,374.49	$ 2,737.23
Lawrenceville	$2,002.35	$560.56	$942.42	$710.85	$1,092.71	$992.21	$1,230.87	$1,967.16	$2,205.82	$ 4,016.74	$ 4,657.25	$ 3,715.38	$ 4,385.29
Lawrenceville	$1,518.68	$449.01	$730.12	$599.30	$880.41	$895.35	$1,071.05	$1,870.30	$2,046.00	$ 3,298.69	$ 3,770.23	$ 2,943.87	$ 3,437.05
Lawrenceville	$1,161.72	$366.68	$573.45	$516.96	$723.73	$823.86	$953.09	$1,798.81	$1,928.04	$ 2,768.76	$ 3,115.59	$ 2,374.49	$ 2,737.23
South Bend	$1,457.33	$512.86	$831.08	$638.10	$956.32	$872.57	$1,071.45	$1,685.03	$1,883.91	$ 2,967.44	$ 3,565.14	$ 3,212.98	$ 3,768.14

	Total Drive	SR-20 DOC w/ Prod.	SR-20 DOC w/o Prod.	SR-20 LCC w/ Prod.	SR-20 LCC w/o Prod.	Phenom DOC w/ Prod.	Phenom DOC w/o Prod.	Phenom LCC w/ Prod.	Phenom LCC w/o Prod.	Airline- 3 Day w/ Prod.	Airline-3 Day w/o Prod.	Airline-2 week w/ Prod.	Airline 2 week w/o Prod.
South Bend	$1,105.31	$407.83	$642.10	$533.07	$767.34	$779.79	$926.20	$1,592.24	$1,738.66	$ 2,274.54	$ 2,714.56	$ 2,508.85	$ 2,917.56
South Bend	$845.51	$330.32	$502.63	$455.56	$627.87	$711.31	$819.00	$1,523.77	$1,631.46	$ 1,763.16	$ 2,086.80	$ 1,989.19	$ 2,289.80
Gary	$1,157.57	$530.75	$872.83	$665.38	$1,007.46	$824.71	$1,007.69	$1,572.17	$1,755.15	$ 3,635.57	$ 4,395.97	$ 3,762.11	$ 4,479.97
Gary	$877.96	$423.27	$675.11	$557.91	$809.74	$733.56	$868.26	$1,481.02	$1,615.72	$ 2,847.13	$ 3,406.93	$ 2,962.45	$ 3,490.93
Gary	$671.60	$343.96	$529.19	$478.59	$663.82	$666.29	$765.37	$1,413.75	$1,512.83	$ 2,265.25	$ 2,676.99	$ 2,372.28	$ 2,760.99
Lansing	$2,973.91	$733.48	$1,346.05	$974.57	$1,587.13	$1,207.57	$1,517.83	$2,475.01	$2,785.27	$ 3,938.68	$ 4,743.61	$ 3,805.39	$ 4,620.88
Lansing	$2,255.56	$598.26	$1,049.22	$839.34	$1,290.30	$1,103.36	$1,331.77	$2,370.80	$2,599.21	$ 3,124.10	$ 3,716.67	$ 2,948.41	$ 3,548.75
Lansing	$1,725.40	$498.46	$830.15	$739.55	$1,071.24	$1,026.45	$1,194.45	$2,293.89	$2,461.89	$ 2,522.92	$ 2,958.77	$ 2,315.94	$ 2,757.50
Willow Run	$3,400.45	$763.30	$1,415.64	$1,020.04	$1,672.38	$1,255.43	$1,581.60	$2,587.86	$2,914.03	$ 2,616.79	$ 2,892.52	$ 2,489.82	$ 2,736.72
Willow Run	$2,579.07	$623.99	$1,104.23	$880.73	$1,360.97	$1,149.59	$1,389.71	$2,482.02	$2,722.14	$ 2,112.95	$ 2,315.94	$ 1,966.72	$ 2,148.48
Willow Run	$1,972.87	$521.18	$874.41	$777.92	$1,131.15	$1,071.47	$1,248.09	$2,403.90	$2,580.52	$ 1,741.11	$ 1,890.41	$ 1,580.66	$ 1,714.34
Chicago Executive	$3,992.86	$578.45	$984.18	$738.13	$1,143.86	$1,040.07	$1,294.64	$2,080.02	$2,334.59	$ 2,089.56	$ 2,303.64	$ 2,268.66	$ 2,435.06
Chicago Executive	$3,028.38	$464.45	$763.13	$624.13	$922.82	$941.57	$1,128.99	$1,981.52	$2,168.93	$ 1,621.93	$ 1,779.53	$ 1,792.82	$ 1,915.33
Chicago Executive	$2,316.57	$380.31	$600.00	$539.99	$759.68	$868.88	$1,006.73	$1,908.83	$2,046.67	$ 1,276.80	$ 1,392.72	$ 1,441.65	$ 1,531.75
Porter County	$944.31	$465.16	$719.73	$565.35	$819.92	$729.00	$880.15	$1,346.47	$1,497.62	$ 3,081.00	$ 3,673.57	$ 3,019.54	$ 3,569.57
Porter County	$716.21	$366.66	$554.07	$466.85	$654.27	$641.11	$752.39	$1,258.58	$1,369.85	$ 2,391.12	$ 2,827.35	$ 2,318.43	$ 2,723.35
Porter County	$547.87	$293.97	$431.81	$394.16	$532.01	$576.25	$658.09	$1,193.72	$1,275.56	$ 1,881.97	$ 2,202.83	$ 1,801.00	$ 2,098.83
Des Moines	$5,260.62	$1,055.47	$2,097.63	$1,465.63	$2,507.79	$1,710.08	$2,187.40	$3,659.98	$4,137.30	$ 3,058.85	$ 3,743.89	$ 3,165.39	$ 3,807.89
Des Moines	$3,989.91	$876.17	$1,643.39	$1,286.33	$2,053.55	$1,588.73	$1,940.12	$3,538.63	$3,890.02	$ 2,314.66	$ 2,818.98	$ 2,409.97	$ 2,882.98
Des Moines	$3,052.10	$743.85	$1,308.15	$1,154.01	$1,718.31	$1,499.17	$1,757.63	$3,449.07	$3,707.53	$ 1,765.43	$ 2,136.37	$ 1,852.46	$ 2,200.37
Akron - Canton	$3,992.86	$918.33	$1,777.51	$1,256.48	$2,115.66	$1,494.72	$1,900.44	$3,152.13	$3,557.86	$ 3,602.62	$ 4,398.99	$ 4,246.95	$ 5,285.07
Akron - Canton	$3,028.38	$757.80	$1,390.32	$1,095.95	$1,728.46	$1,380.71	$1,679.40	$3,038.13	$3,336.82	$ 2,793.07	$ 3,379.34	$ 3,259.23	$ 4,023.48
Akron - Canton	$2,316.57	$639.33	$1,104.56	$977.48	$1,442.71	$1,296.58	$1,516.27	$2,953.99	$3,173.68	$ 2,195.59	$ 2,626.81	$ 2,530.27	$ 3,092.39
Naples	$14,360.08	$2,444.80	$5,340.56	$3,584.48	$6,480.24	$3,863.66	$5,056.97	$8,738.41	$9,931.72	$ 2,939.16	$ 3,439.24	$ 3,152.69	$ 3,610.24
Naples	$10,891.38	$2,075.32	$4,207.13	$3,215.01	$5,346.82	$3,668.86	$4,547.35	$8,543.61	$9,422.10	$ 2,303.58	$ 2,671.73	$ 2,505.89	$ 2,842.73
Naples	$8,331.41	$1,802.65	$3,370.64	$2,942.33	$4,510.32	$3,525.09	$4,171.24	$8,399.84	$9,045.99	$ 1,834.51	$ 2,105.29	$ 2,028.54	$ 2,276.29
Warsaw	$1,137.43	$489.01	$775.40	$601.73	$888.12	$800.78	$975.80	$1,515.75	$1,690.76	$ 2,975.06	$ 3,576.19	$ 3,220.60	$ 3,779.19

	Total Drive	SR-20 DOC w/ Prod.	SR-20 DOC w/o Prod.	SR-20 LCC w/ Prod.	SR-20 LCC w/o Prod.	Phenom DOC w/ Prod.	Phenom DOC w/o Prod.	Phenom LCC w/ Prod.	Phenom LCC w/o Prod.	Airline- 3 Day w/ Prod.	Airline-3 Day w/o Prod.	Airline-2 week w/ Prod.	Airline 2 week w/o Prod.
Warsaw	$862.68	$387.25	$598.09	$499.96	$710.80	$710.45	$839.29	$1,425.41	$1,554.26	$ 2,280.15	$ 2,722.69	$ 2,514.47	$ 2,925.69
Warsaw	$659.91	$312.15	$467.22	$424.86	$579.94	$643.78	$738.55	$1,358.74	$1,453.51	$ 1,767.29	$ 2,092.79	$ 1,993.32	$ 2,295.79
Port Columbus	$2,926.52	$763.30	$1,415.64	$1,020.04	$1,672.38	$1,255.43	$1,581.60	$2,587.86	$2,914.03	$ 3,401.41	$ 4,081.32	$ 3,079.36	$ 3,603.70
Port Columbus	$2,219.61	$623.99	$1,104.23	$880.73	$1,360.97	$1,149.59	$1,389.71	$2,482.02	$2,722.14	$ 2,660.24	$ 3,160.78	$ 2,393.34	$ 2,779.35
Port Columbus	$1,697.90	$521.18	$874.41	$777.92	$1,131.15	$1,071.47	$1,248.09	$2,403.90	$2,580.52	$ 2,113.24	$ 2,481.39	$ 1,887.04	$ 2,170.96
Lambert - St. Louis	$3,400.45	$757.33	$1,401.72	$1,010.94	$1,655.33	$1,255.43	$1,581.60	$2,587.86	$2,914.03	$ 3,335.35	$ 3,806.32	$ 2,252.10	$ 2,423.64
Lambert - St. Louis	$2,579.07	$618.84	$1,093.23	$872.46	$1,346.84	$1,149.59	$1,389.71	$2,482.02	$2,722.14	$ 2,716.87	$ 3,063.59	$ 1,773.24	$ 1,899.53
Lambert - St. Louis	$1,972.87	$516.64	$865.56	$770.25	$1,119.17	$1,071.47	$1,248.09	$2,403.90	$2,580.52	$ 2,260.42	$ 2,515.44	$ 1,419.84	$ 1,512.72
Cincinnati	$2,203.77	$650.00	$1,151.19	$847.26	$1,348.45	$1,207.57	$1,517.83	$2,475.01	$2,785.27	$ 2,482.31	$ 2,689.54	$ 2,374.85	$ 2,539.54
Cincinnati	$1,671.45	$526.21	$895.17	$723.46	$1,092.43	$1,103.36	$1,331.77	$2,370.80	$2,599.21	$ 2,018.70	$ 2,171.26	$ 1,900.02	$ 2,021.26
Cincinnati	$1,278.58	$434.84	$706.22	$632.09	$903.48	$1,026.45	$1,194.45	$2,293.89	$2,461.89	$ 1,676.55	$ 1,788.76	$ 1,549.58	$ 1,638.76
French Lick	$2,440.74	$590.38	$1,012.01	$756.32	$1,177.95	$1,064.00	$1,326.53	$2,136.44	$2,398.97	$ 3,472.84	$ 4,185.29	$ 3,258.90	$ 3,860.30
French Lick	$1,851.18	$474.74	$785.14	$640.68	$951.08	$964.69	$1,157.95	$2,037.13	$2,230.40	$ 2,712.56	$ 3,237.05	$ 2,527.62	$ 2,970.37
French Lick	$1,416.06	$389.40	$617.70	$555.34	$783.65	$891.39	$1,033.54	$1,963.84	$2,105.99	$ 2,151.45	$ 2,537.23	$ 1,987.92	$ 2,313.57
Lovell Field	$5,876.73	$1,109.14	$2,222.89	$1,547.48	$2,661.23	$1,781.86	$2,283.05	$3,829.26	$4,330.45	$ 3,831.50	$ 4,638.14	$ 3,541.37	$ 4,238.68
Lovell Field	$4,457.20	$922.49	$1,742.42	$1,360.83	$2,180.76	$1,658.06	$2,027.03	$3,705.46	$4,074.43	$ 3,015.90	$ 3,609.74	$ 2,753.78	$ 3,267.12
Lovell Field	$3,409.55	$784.74	$1,387.82	$1,223.08	$1,826.16	$1,566.70	$1,838.08	$3,614.09	$3,885.48	$ 2,413.98	$ 2,850.76	$ 2,172.51	$ 2,550.09
Iowa City	$3,898.07	$840.81	$1,596.57	$1,138.26	$1,894.02	$1,375.07	$1,741.02	$2,870.00	$3,235.94	$ 3,135.19	$ 3,726.04	$ 3,177.73	$ 3,726.04
Iowa City	$2,956.49	$690.90	$1,247.27	$988.34	$1,544.72	$1,265.15	$1,534.55	$2,760.07	$3,029.48	$ 2,446.31	$ 2,881.29	$ 2,477.63	$ 2,881.29
Iowa City	$2,261.58	$580.25	$989.48	$877.70	$1,286.93	$1,184.02	$1,382.18	$2,678.95	$2,877.10	$ 1,937.90	$ 2,257.84	$ 1,960.94	$ 2,257.84
Oconee Country	$6,954.92	$1,252.24	$2,556.93	$1,765.73	$3,070.41	$2,021.15	$2,601.89	$4,393.53	$4,974.27	$ 3,616.32	$ 4,397.27	$ 3,448.17	$ 4,174.60
Oconee Country	$5,274.95	$1,046.01	$2,006.49	$1,559.49	$2,519.98	$1,889.19	$2,316.72	$4,261.57	$4,689.10	$ 2,815.81	$ 3,390.73	$ 2,643.48	$ 3,178.26
Oconee Country	$4,035.10	$893.80	$1,600.26	$1,407.29	$2,113.75	$1,791.80	$2,106.26	$4,164.18	$4,478.64	$ 2,225.02	$ 2,647.89	$ 2,049.60	$ 2,442.95
Minneapolis	$6,279.57	$1,234.35	$2,515.17	$1,738.45	$3,019.26	$1,997.22	$2,570.01	$4,337.10	$4,909.89	$ 3,479.33	$ 4,205.48	$ 3,404.11	$ 3,956.20
Minneapolis	$4,762.73	$1,030.57	$1,973.48	$1,534.66	$2,477.58	$1,866.08	$2,287.75	$4,205.96	$4,627.63	$ 2,711.01	$ 3,245.59	$ 2,701.80	$ 3,108.23
Minneapolis	$3,643.27	$880.17	$1,573.71	$1,384.26	$2,077.80	$1,769.29	$2,079.44	$4,109.17	$4,419.32	$ 2,143.97	$ 2,537.16	$ 2,183.48	$ 2,482.42
Butler County	$2,049.75	$620.19	$1,081.60	$801.79	$1,263.20	$1,135.79	$1,422.18	$2,305.73	$2,592.12	$ 2,482.31	$ 2,689.54	$ 2,374.85	$ 2,539.54

	Total Drive	SR-20 DOC w/ Prod.	SR-20 DOC w/o Prod.	SR-20 LCC w/ Prod.	SR-20 LCC w/o Prod.	Phenom DOC w/ Prod.	Phenom DOC w/o Prod.	Phenom LCC w/ Prod.	Phenom LCC w/o Prod.	Airline- 3 Day w/ Prod.	Airline-3 Day w/o Prod.	Airline-2 week w/ Prod.	Airline 2 week w/o Prod.
Butler County	$1,554.63	$500.47	$840.16	$682.07	$1,021.75	$1,034.02	$1,244.86	$2,203.96	$2,414.80	$ 2,018.70	$ 2,171.26	$ 1,900.02	$ 2,021.26
Butler County	$1,189.22	$412.12	$661.96	$593.72	$843.56	$958.92	$1,114.00	$2,128.86	$2,283.94	$ 1,676.55	$ 1,788.76	$ 1,549.58	$ 1,638.76
Greenville	$5,853.04	$1,073.36	$2,139.38	$1,492.91	$2,558.94	$1,734.00	$2,219.28	$3,716.40	$4,201.68	$ 3,936.79	$ 4,613.27	$ 4,307.15	$ 5,088.38
Greenville	$4,439.23	$891.61	$1,676.40	$1,311.17	$2,095.95	$1,611.84	$1,969.09	$3,594.24	$3,951.49	$ 3,197.63	$ 3,695.64	$ 3,470.28	$ 4,045.41
Greenville	$3,395.80	$757.48	$1,334.71	$1,177.03	$1,754.26	$1,521.68	$1,784.45	$3,504.08	$3,766.84	$ 2,652.11	$ 3,018.41	$ 2,852.65	$ 3,275.67
Greater Peoria	$2,037.90	$614.23	$1,067.68	$792.69	$1,246.15	$1,111.86	$1,390.30	$2,249.30	$2,527.74	$ 2,909.14	$ 3,464.03	$ 2,930.68	$ 3,443.03
Greater Peoria	$1,545.64	$495.33	$829.15	$673.79	$1,007.62	$1,010.91	$1,215.89	$2,148.35	$2,353.33	$ 2,241.38	$ 2,649.88	$ 2,251.70	$ 2,628.88
Greater Peoria	$1,182.34	$407.57	$653.11	$586.04	$831.58	$936.41	$1,087.18	$2,073.85	$2,224.62	$ 1,748.56	$ 2,049.02	$ 1,750.59	$ 2,028.02
Dekalb-Peachtree	$7,108.95	$1,293.98	$2,654.35	$1,829.38	$3,189.75	$2,092.94	$2,697.55	$4,562.81	$5,167.42	$ 2,600.14	$ 2,954.65	$ 2,642.68	$ 2,954.65
Dekalb-Peachtree	$5,391.77	$1,082.04	$2,083.52	$1,617.44	$2,618.92	$1,958.53	$2,403.63	$4,428.40	$4,873.50	$ 2,050.04	$ 2,311.03	$ 2,081.36	$ 2,311.03
Dekalb-Peachtree	$4,124.46	$925.61	$1,662.23	$1,461.02	$2,197.63	$1,859.33	$2,186.71	$4,329.20	$4,656.59	$ 1,644.06	$ 1,836.02	$ 1,667.09	$ 1,836.02