REGIONAL AIR TRANSPORTATION SYSTEM: FRACTIONAL AIRCRAFT OWNERSHIP ALTERNATIVES

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ABSTRACT

The business air traveler must consider a comprehensive air travel program that assesses the best utilization of capital, performance, cost and return on investment. The fastest growing segment in business aircraft utilization is Fractional Aircraft Ownership (FAO). A prospective aircraft owner can buy increments or fractional ownership in one or more airframes then pay a monthly management fee and an hourly usage fee.

Presently, one of the problems with FAO programs is the high initial start up costs and the high monthly management fee. In a recent article by Velocci (2002), it was noted that none of the major fractional ownership providers could claim to have made a profit in 2001. Although the fractional aircraft industry is growing, the overall understanding of the real costs of ownership are complicated.

This report presents the results of an analysis on the potential business viability of a Regional Air Transportation System, centered in Washington, D.C., based upon fractional ownership program. All aspects of operation will be evaluated utilizing linear program (LP) optimization techniques, an ARENA event simulation model and cost analysis. The STAR Team will introduce new technology that could provide plausible attractive solutions for the fractional aircraft ownership programs and ultimately attract a broader base of prospective customers by identifying efficient cost and optimization parameters. A business model with less than 2 years Return on Investment (ROI) is identified.

INTRODUCTION

The primary goal of the STAR Design Team is to provide a comprehensive air travel management system that enables the business, individual and governmental flier the flexibility of cost effective alternate air travel services via an on demand, fractional ownership transportation system.

In today's highly competitive global economy, getting the right product or service to market ahead of the competition and delivering it within budget is crucial. Significant delays directly translate into missed opportunities, lost profits, and unnecessary costs.

Fractional Aircraft Ownership enables a business, individual or governmental agency the opportunity to avoid the lost productive time, and logistic constraints of standard commercial air travel. This program utilizes existing aircraft acquisition concepts, including shared aircraft ownership, and provides for the management of the aircraft by an aircraft management company. The aircraft owners use a common management company to maintain the aircraft and administer the leasing of the aircraft among the owners.

Several obstacles exist in current FAO programs including poor optimization and utilization rates. Currently, most FAO programs operate the aircraft at 65%. A more attractive utilization rate would be 75% or better with a reduction in lost aircraft utility. Optimization of scheduling and routes traveled as well as hub locations can also be refined resulting in a better Return on Investment. A major barrier of the FAO program has been the initial price tag of the various aircraft selected for service. The STAR Team's linear program optimization and ARENA simulations indicate that efficiency and (ROI) can improve if overall cost of the aircraft is significantly reduced.

By increasing the marginal utility of the aircraft through Fractional Aircraft Ownership, the potential market demand could expand to include a broader range of prospective air travelers. Cost efficiencies, coupled with more flexibility and increased security will drive future demand for Fractional Aircraft Management companies.

OBJECTIVES

Our design approach was to identify business travelers' desires, and ownership/utilization strategies and then assess the cost and risk implications while incorporating new technologies. The final product encompasses financial performance data, flight optimization simulation and a linear programming analysis establishing a clear picture for revenue growth, profit growth, asset efficiency, and a comprehensive ownership program that can help any company, large or small, public or private, assess its business aircraft use and ownership and ultimately productivity gains and an improved competitive edge.

CONTEXT AND PERSPECTIVES

At present the commercial air transportation system is in a crisis situation as US airlines' hub and spoke system is overloaded, customer complaints are high and consumer confidence is at all time lows. Increased airport security after the September 11, 2001 terrorist attacks (9/11) is causing increased delays. Now after the 9/11 attacks, a typical business traveler requires 2 to 3 hours before departure and 1.5 hours hub transfer time (excluding actual travel time) for a business trip to one city.

Post 9/11, airlines have placed a new one-piece carry-on limitation; considering the majority of business travelers carry a laptop, a briefcase and an overnight bag, the need to check baggage makes 6.5 hours of travel time for a one-way trip quite common. Add a 2-hour client meeting with one hour round trip car service, and it's now well into the evening requiring an over night stay. Another consideration for FAO is the ticket prices charged for last minute business air travel. In a recent article in The Wall Street Journal, the average last minute airfare ticket price averaged $2,260.00. High cost and excessive travel time help fuel the argument for the business air consumer to consider purchase options.

The decision to use business aviation has generally been intuitive – a common–sense feeling by the CEO or individual that the choice of greater mobility would be good for business affairs because of strategic competitive urgency, accelerated transaction value, improved productivity, increased practicality, and increased security. In today's technical Internet-driven, video conferencing society, most non-critical circumstances can be resolved, but the face-to-face meeting still exceeds any other communications method. To secure this communication advantage, a growing number of companies, individuals and governmental employees rely on the travel efficiencies that are unique to business aviation and specifically fractional aircraft ownership.

In a fractional ownership arrangement, owners purchase a fractional interest in an aircraft program typically ½, ¼, 1/6, 1/8, 1/16 or the fraction stipulated. A typical fractional program will purchase a fleet of aircraft comprised of one or more specific aircraft types, and then will sell off each aircraft in pieces or fractions. Each such sale is conditional upon the new owner contracting with the fractional program to manage the aircraft. The fractional program then operates all the aircraft in the program as a single fleet. The fractional program charges a fixed monthly management fee, plus an hourly rate for all flights.

The benefits of fractional ownership are many:

- Aircraft are available from virtually any location nationally with minimal notice depending on the program.
- The program manager provides aircraft management and pilots if desired.
- A buyer can purchase the fraction of an aircraft that best reflects current or projected annual travel needs, and later increase or decrease the ownership percentage to reflect changing travel needs.
- A fractional owner is entitled to a corresponding depreciation deduction when permitted by IRS regulations.

The fractional aircraft programs are expected to experience significant growth, comprising 15-17% of worldwide business aircraft fleets by 2011, compared with 6% currently. The use of private aviation has increased by up to 25% for the past 5 years, while the growth of commercial aviation has been flat at about 3% per year (ARG/US, 2002).

ANALYSIS

Linear Program (LP) Model Analysis

Because of the time limit placed on the design and development of the linear program, several assumptions had to be made in order to complete the project within the allowable timetable.

1) Aircraft comparison – In order to maintain comparability between the computations of the linear program and the aircraft purchasing methods of the current Fractional Aircraft Ownership companies, the prices for the aircraft represent today's average purchase price.

2) Aircraft delay time – Since a customer may fly to a city in order to attend a particular meeting before returning home, a continuous uniform distribution was used to represent "dead head" time during each trip to each city. An assumption was made that if a meeting lasted 1 to 3 hours the aircraft would wait for the passenger, but if the passenger was expecting to stay longer than 3 hours the aircraft could be called back to service other passengers.

3) Arrivals and Departures – Due to limitations in the linear program analysis, all flights originated and terminated at the Manassas Regional Airport–the center of operations. Manassas Regional Airport is approximately 45 miles from the center of Washington, D.C.

4) Time limit on length of trip – Based on analysis of current travel patterns and passenger comfort, we restricted the flight time to 2½ hours. Therefore, trips that would take longer than 2½ hours to complete were not allowed to take place in the linear program. The ARENA simulation relaxed this assumption.

5) Time measurement – Since the decision variables for total time (H_{ij}) = total distance (D_j) /average speed (S_i) were measured in hours and the operating cost of each airplane was measured in hours, an 18-hour working day was assumed.

6) Allowable matrix size – Several constraints were placed on the linear program. Since 10 aircraft were under study, only 19 cities were included in the simulation. These 19 cities were randomly selected from the 35 cities identified by the analysis team. All trips originated at the Manassas, Virginia Regional Airport (HEF). Furthermore, the 19 cities are representative of industrial cities within a 1,000nmi radius from the Manassas Regional Airport. Only trips to a particular city and back were evaluated for the LP optimization. The ARENA simulation relaxed this constraint.

The analysis team designed the linear program using Microsoft Excel. The objective function of this linear program is to find the optimal fleet size and mix by minimizing the cost of procurement and operating costs for the chosen aircraft. The linear program places constraints on the demand placed by the customers, a constraint in the number of aircraft allowed to fly in an 18-hour working day, and a constraint on the procurement and cost of operations budget. The LP program would then select the best-case alternative when comparing all the cost variables and constraints.

The linear program was started with a minimum amount of money in the budget–5 million dollars. The initial amount for the budget was simply chosen as a logical starting amount to begin the simulation. Additionally, a discrete uniform distribution was set to calculate the travel demand to each city. The demand was initially set to D = {0,1,2}. Each time the LP was executed a city had an equal chance of being chosen 0, 1 or 2 times as a destination. The demand was increased incrementally in steps of one additional city. Each iteration involved increasing the demand to produce results until the linear program showed no feasible solutions. At such a point, the budget would be increased in 1 million dollar increments. The Eclipse 500 was chosen along with the Cessna Citation CJ2 and the Beechjet 400A. The linear program chose the above jets in a ratio of 2:1:1 respectively.

Linear Program Results

The linear programs' solution repeatedly favored the Eclipse 500. According to the liner program, Eclipse is comparable to Beechjet 400A, which was ranked the "Most Popular Model" listing for the year 2000. Furthermore, Eclipse's price tag of $837,500 gave it an advantage of being chosen 2:1:1 times when compared to Beechjet 400A and the Cessna Citation CJ2. An article in the February 2001 AOPA Pilot's newsletter reads, "The Eclipse 500, a jet with an expected 4700-pound maximum takeoff weight, 355-knot cruise speed, and $837,500 price tag will revolutionize air travel". This observation is supported by this analysis.

Another newcomer into the piston driven aircraft market is the Cirrus SR22. A procurement cost of only $300,000 and $150 operating cost per hour puts this small aircraft at an advantage for short-range trips, those trips of 500nmi or less. The low price of procurement and operation also places the Cirrus into a price range and travel time that is affordable and attractive to the average business traveler for a trip less than 500nmi.

At this time, fractional aircraft ownership has found a market with companies and individuals that are interested in making an investment in business aircraft. The Eclipse 500 is comparable to the other jets in its class in terms of comforts, efficiency and speed, but the Eclipse 500 is in a class of its own when it comes to price; a price that will allow a larger market of the business travelers to take advantage of this new opportunity

ARENA SIMULATION

The other analysis method used by the STAR Team was a design simulation utilizing software called ARENA, developed by Rockwell Software. The ARENA simulation was developed in order to enhance understanding of design performance for a specific set of adjusted parameters given a fixed customer base. The simulation also added the capability to better understand the complexities of the system that the linear program could not. The simulation was used to further comprehend system costs based on the results of the performance measures taken. The performance parameters that were measured were used to maximize system performance for a given customer base. The key metrics that were examined are customer satisfaction, design performance, and aircraft utilization. Customer satisfaction was further defined as customer delay time and flight request satisfaction. The depth of the simulation also allowed the team to examine the design performance given more complex routes and a more diverse customer base. Finally, the team also found that the simulation provided insight into when the design would need to be expanded to include other customer markets.

The simulation used a Monte Carlo trip generation method to simulate variable customer demands. Using an arrival rate based on an exponential distribution with a one-hour mean, the simulation produced on average 1340 requests for a two-month period of time. Additional parameters were put in place to further control the number of customers in the system.

The cities used in the simulation were chosen to represent high population density areas, large production and business areas, and frequent travel areas. Additionally, the cities used are located within a 3-hour operational flight radius, or approximately 1000nmi, of Manassas, VA. Given these considerations, the 35 cities chosen for use in the simulation are found in Table 1.

Table 1 - Service Cities

City	State		City	State		City	State
Mobile	AL		Detroit	MI		Tulsa	OK
Little Rock	AR		Lansing	MI		Philadelphia	PA
Ft Lauderdale	FL		St. Paul	MN		Pittsburgh	PA
Miami	FL		Kansas City	MO		Providence	RI
Orlando	FL		St. Louis	MO		Memphis	TN
Atlanta	GA		Raleigh-Durham	NC		Nashville	TN
Chicago	IL		Omaha	NE		Dallas	TX
Indianapolis	IN		NY City	NY		Houston	TX
Wichita	KS		Cincinnati	OH		Manassas	VA
Louisville	KY		Cleveland	OH		Roanoke	VA
New Orleans	LA		Columbus	OH		Green Bay	WI
Boston	MA		Oklahoma City	OK			

Once the service cities were defined, the team set out defining the routes that would be used as a representative sample of all possible routes traveled. It was decided that the number of destinations traveled would be confined to a trip that could be completed within 24 hours. The 24-hour time limit included travel time between destinations, to include landing, take-off and taxi times, as well as time allotted to meetings while the aircraft would not be in use, but awaiting the customer so that the flight could be completed or continued. Therefore, the team decided that it would be feasible for a businessman to conduct a trip that involved one, two, or three destinations.

Since all flights were assumed to originate in Manassas, the STAR Team decided to include all single destination routes that originated from the Manassas airport to the other 34 destination cities. These routes were divided into short, medium and long-range flights by determining the length of any single leg. The simulation also considered a sample of the routes that included two destinations for a customer for a given business trip. Finally, the simulation also considered a sample of the routes that included three destinations for a customer for a given business trip. In all the routes defined, the route classification depended on the length of the longest flight leg, with all flight legs considered to be non-stop.

Simulation Results

The final simulation production runs appeared successful in that the number of satisfied customer requests was high (98%), while the cumulative travel delay time was low (e.g., approx. 1hr). Aircraft utilization was at expected levels for a fractional aircraft service design. When more customers were added into the system, delay time increased, which again was expected. It was found that the system would need to expand to additional airports before the customer base grew above 36 fractional shares (13 aircraft). At 36 shares, aircraft utilization was near 80% and customer delay was over 5 hours. The simulation showed that the number of rejected requests was unreasonably high with a flight request satisfaction just over 68%. This low level of satisfaction can be attributed to the number of aircraft and the amount of delay that was being incurred at the Manassas airport location since it was the only source of flights. Based on these results, the team recommends an initial expansion to nearby Stafford airport, which has significant expansion potential. Subsequent expansion should investigate expanding operations to other regions thereby opening other customer markets.

COMPARATIVE COST ANALYSIS

The STAR Team included two different cost perspectives in the comparative cost analysis of the FAO program. The methodology was to look at cost from a stakeholder point-of-view and a consumer point-of-view. The consumer view considered first includes a comprehensive comparison of like aircraft with acquisition, management and hourly usage cost considered. The desired result of the consumer view analysis shows how existing competitors' costs compare with the data supported in the LP and ARENA simulation results including data introducing the Eclipse 500 aircraft.

The stakeholder cost view focuses on return on investment (ROI) comparing acquisition, operational, and maintenance cost to those costs of existing FAO programs. The LP cost model provides the basis of operational parameters that are used in the comparison following cost elements: Acquisition Cost - the manufacturer's suggested retail price for purchase; Fixed Annual Costs - includes hull insurance, personnel, hanger facilities, liability insurance and training; and Direct Operating Costs - fuel, maintenance labor expense, miscellaneous trip expense, and parts expense.

After comparison of each cost element, several conclusions can be made:

1) Acquisition of fractional shares of the Eclipse 500 averages 66% less than the competitors (See Figure 1).
2) Monthly management fees are less because of the cost savings of hull insurance, which is calculated using the replacement cost of the airframe.
3) From a stakeholder perspective when compared to other traditional aircraft cost, the Eclipse 500 will realize an 18 month faster return on investment as compared to a Beechjet 400A or a Cessna Citation Bravo (See Figure 2).

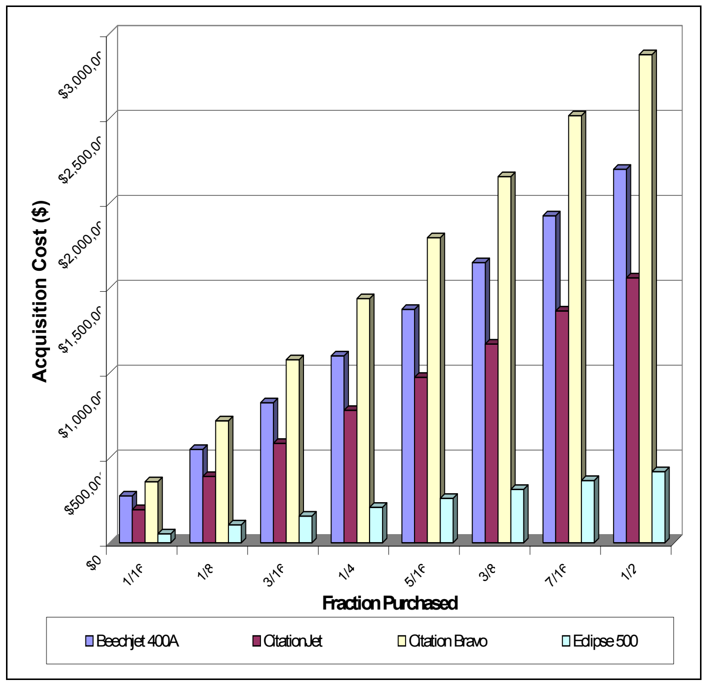

Figure 1. Relative Jet Aircraft Acquisition Cost.

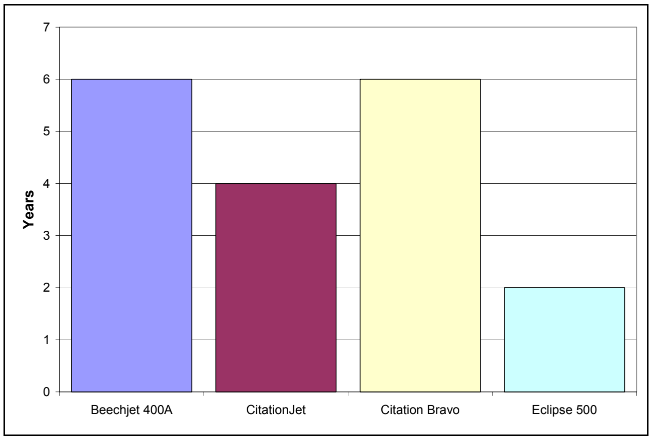

Figure 2. Estimate of ROI Break-Even Year for different Jet Aircraft Purchase.

CONCLUSION

When considering all aspects of cost, ROI, and aircraft utilization, the introduction of the Eclipse 500 should immediately impact all other forms of business aircraft utilization. To date Fractional Aircraft Ownership Programs have been costly, mainly due to the initial start up costs, specifically acquisition. The LP, ARENA and cost analysis repeatedly tell the same story; reduced acquisition cost opens up many potential opportunities for investors and end users of business aviation. FAO programs should all benefit from utilization and efficiencies directly caused by the introduction of the vast numbers of less expensive aircraft introduced into the system.

We conclude that a regional air transportation system based upon a mixture of Eclipse 500 jet aircraft (for city pairs in excess of 500nmi) and Cirrus SR22 piston aircraft (for city pairs between 200 to 500nmi) would be a viable business venture with a projected ROI within two years. Other business models that may be considered include a service on demand air taxi or a mixed fractional and air taxi operation.

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BIOGRAPHY

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