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Domestic hub airfares: An Analysis of domestic U.S. passanger airline fares from the consumer's perspective

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Domestic Hub Airfares: An Analysis of Domestic U.S. Passenger Airline Fares From the Consumer's Perspective

by

Robert I. Ward Jr.

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FORM I

ROCHESTER INSTITUTE OF TECHNOLOGY
School of Food, Hotel and Travel Management
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M.S. Hospitality-Tourism Management
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12/14/92 Richard Marecki

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ABSTRACT

Deregulation of the U.S. passenger airline industry has resulted in a few large carriers that have been successful in dominating the market, including dominance of selected routes originating from, or traveling through, key airports that have been designated as hubs. This investigation researched the simplified industry fares that were in place in the summer of 1992 and found that airfares for certain sub-categories of industry routings were consistently above average industry fares. The implications of these findings are reducible to simple measures that are meaningful to the flying public.

ACKNOWLEDGEMENTS

I humbly express my gratitude for the advice and support that I received from my thesis committee: Dr. Francis Domoy, Mr. Edward Steffens and especially Dr. Richard Marecki. Lastly, loving thanks to my understanding family whose belief and support have made this project possible.

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CHAPTER I

INTRODUCTION

The Commercial Passenger Airline Industry

The International Civil Aviation Organization reports that there are over 28,000 civilian airports in use, excluding those in the former U.S.S.R. (with an estimated 3500 fields) and China. The U.S. lists about 13,000 airports, although scheduled airlines served only 400 of that number (Funk & Wagnalls, 1986). A major U.S. domestic airline will schedule roughly 2500 flights daily. Larger airlines operate more than 400 aircraft (Sternstein & Gold, 1991).

The energy crisis, in particular the oil shortages of 1973, created financial pressures on the airlines industry, pinched between higher operating costs and a cap from Federal regulations that prevented raising fares to compensate for the increased costs of operating passenger service. Until 1978, The Civil Aeronautics Board regulated passenger air travel, granting airline routes, controlling fares, and protecting the interests of the public. In 1978, President Carter signed into law the Airline Deregulation Act, granting to the airlines the same rights to free competition that are enjoyed by other U.S. businesses. The gradual deregulation process was completed with the dismantling of the Civil Aeronautics Board in 1985.

Deregulation effected many changes in the U.S. commercial airline industry,

in terms of numbers of carriers, the financial health of the surviving carriers, the airfares, and the routing systems designed to serve the flying public. The routing system that evolved was not one of the planned aspects of deregulation, yet significantly changed the face of passenger flying.

Simple origin-to-destination routing between airports evolved into a modern airline version of a mass transit system that moves more planes to more places. The "hub-and-spoke" system that has dominated air travel since the mid-eighties evolved only after a handful of major airlines discovered that by controlling the flow of traffic in and out of large, strategically placed airports ("hubs"), they would gain much of the same power over routes and fares that the Government once exercised.

Major domestic airlines have constructed their flight schedules to use a particular city or cities as connecting points. This technique, with the primary city acting as the hub of a wheel and the outlying destinations as spokes, is intended to maximize the number of single-carrier connections that do not require the passenger to change terminals. The result is designed to lower airfares to the traveling public and create greater revenue for the airline.

The utility of the hub allows for more frequent flights and more choices for the flying public. By funneling thirty flights into a hub, letting passengers change planes and then dispatching thirty flights out of the hub, an airline can offer nine

hundred different route patterns using only those thirty aircraft.

The domestic U.S. airline industry is highly concentrated, largely due to the trend toward hubs. This trend will continue as each carrier consolidates its "fortress hubs", leaving travelers no choice but to use a hub. These airports that are designated as hubs exist today by virtue of a number of strategic, geographic, traditional and acquired site factors.

Today's Passenger Airline Industry

In 1978 there were 30 airlines. By the early 1980's, there were 200, mostly commuter lines offering limited service. As of 1988, there were 125 airlines, and 1991/1992 have seen continued carrier reductions, including names long on tradition, such as Braniff, Pan American, Eastern and Trans World Airlines. In 1978, the five biggest airlines (American, Northwest, United, Delta and Continental/Eastern) controlled about 60% of passenger traffic. That number rose to 70 percent in 1988.

As a further measure of the industry reverting back to it's pre-deregulation state of restrictive competition, by 1988, single carriers handled more than half of the passengers boarding at eighteen of the busiest U. S. airports. Today, five airlines - American, United, Delta, Northwest and USAir - dominate air travel in the United

States, handling 71 percent of all domestic air traffic, controlling 21 of the nation's 37 hub airports (see Table 1). Sources of strength of these mega-carriers include sheer size, the hub-and-spoke systems that enable dominance, and computer reservation systems (Business Week, 1988).

Industry Airfare Restructuring

In the most recent round of intense industry competition, American Airlines revealed a major restructuring of the passenger airfare schema for the announced intent of simplification and reduced costs to the flying public. The number of airfares changed by American Airlines alone was reduced from 540,000 to 70,000 (Travel Weekly, April 13, 1992). Immediate response by other carriers initially matched, then lowered American's offerings. This intense volatility continued during the period of this investigation. Currently, approximately 10,000 airfares change daily (Capwell, et al.)

Financial Health of U.S. Airlines

Current industry fare competition has taken it's toll on U.S. domestic carriers, although for the moment the flying public is enjoying the lower fares (Corporate Travel magazine, June 1992). Recent promotions have resulted in record high load factors and revenues per passenger mile.

Table 1

The Biggest Airlines

Selected operating statistics for calendar year 1991.

	Passengers (millions)	Fleet (No. of planes)
American	76.0	627
Delta	74.3	547
United	61.9	498
USAir	55.6	445
Northwest	41.1	363
Continental	37.0	319
British Airways	22.9	216

Source: The Wall Street Journal, July 22, 1992.

The Problem

Deregulation of the U.S. airline industry has enabled competition of carriers, routes, fares, slots, gates and related aspects. Carriers that have been successful in deregulation have created dominance in the market, including dominance at specific airports designated as hubs. Have the fares charged for flights from these hubs increased at a rate above industry averages, resulting in higher than average fares for flights originating from and through hub airports?

Hypotheses

The hypotheses that were tested in this investigation were:

1. Whether airfares for flights originating from domestic hub airports were higher than average industry airfares.
2. Whether airfares for flights routed through domestic hub airports were also higher.

The results of this investigation that are submitted as evidence of these hypotheses are:

1. The calculated average airfares, measured in dollars:
    a. For the hub-to-hub routes sampled.
    b. For the hub-to-spoke routes sampled.
    c. For the spoke-to-spoke routes sampled.

2. The calculated indices (in dollars) of Average Fare per Mile, for the above sampled routes.

Potential relationships in this investigation include the relationship of the captured airfares - fare per mile flown - and the distance between the specific spoke cities selected in the sample. Long point-to-point distances (e.g. between Midwestern and Northwestern cities) would skew the fare per mile figures higher; short distances (e.g. Northeastern cities) would skew the results lower.

The null hypotheses for this investigation is domestic airfares were not higher for flights originating from, or routed through, the domestic U.S. hub-and-spoke airline passenger system.

Long Range Consequences

The approach to, and findings resulting from, this investigation were compared against the findings of similar studies. Benefits from this study include an expected increase in public awareness of fare differences that exist when flying from or through hub airports. The value of the findings of this study lie in the ability of the flying public to use the results as travel tips for use in negotiating for lower airfares.

Definitions of Terms

The first category of terms that are referenced throughout this study are air transportation terms that are the jargon of the industry. These terms are essential to the understanding of similar data-based studies of this subject by others and as such will be mentioned to draw similarities to this study. On the whole, usage of these terms will be downplayed in favor of terms that are more meaningful to consumers, the primary focus of this study. An example might be "Revenue per Passenger-Mile", an industry standard used to measure one fare-paying passenger transported one mile. This study might introduce the term, but tend to put heavier use on consumer-identifiable terms and measures, such as out-of-pocket "dollars".

The second category of terms included terms used to describe functions, commands and screen displays that are associated with the computerized reservation systems and other tools used in this study. Terms like "Fare Shopper" and "Fare Quotations" are representative. It is recognized that terms within this category are be particularly meaningful to travel agents, and somewhat less relevant to the end consumer. Appendix A contains the definitions of terms used in this study.

Purpose

The purpose of this study was to analyze current airfares of the U. S. airline industry to test the validity of the theory that fares for flights originating either from or through designated U. S. "hub" cities have been increased to a fare level that is higher than industry averages, in a way that exploits the local travelers.

This study differs from similar studies in that it captured and analyzed airfares from the consumer's perspective, and used fares that were very recently published and available in the airline computer reservation systems.

This study also differs in that fares analyzed were based on the current industry fare structure. Other similar studies have been based on historical government and annual industry statistics. This distinction makes this study unique and more meaningful to the flying public. Because of the differentiating approaches above, this study will prove to be important to consumers, and not another industry analysis of airline industry costs of production.

CHAPTER II

LITERATURE REVIEW

Literature sources that were pertinent to this investigation include industry periodicals and journals, newspaper articles and consumer-oriented books and publications. Initial searches investigated topics related to airline rates, airline fares, deregulation, airline hubs, domestic airlines, and business travel.

Arguments for and against the relative merits of deregulation assess many dimensions, some viewing improved competition through a fewer number of carriers (Economist, 1991). It is well known that airports in general, but particularly hubs, are becoming increasingly congested, but with fewer competitors due to the consolidation of regional carriers (Fotos, 1990). The number of U.S. airline hubs has peaked, and there will only be occasional hub start-ups (Proctor, 1988). In published reports dating back to at least 1989, The U. S. Congress has been involved in ways to address the lack of competition at certain hub airports (Aviation Week and Space Technology, 1989).

Business Week (1988) wrote that with deregulation from ten years before, the government stopped approving routes that airlines could fly and the fares they could charge, and while passenger volume grew to unprecedented heights due to lower fares, service suffered due to inadequate airport gates and insufficient airline funds

to support the demand. They further stated that fares to smaller cities (specifically from Minneapolis-St. Paul) were much higher than they were before deregulation, and further stated that some of our cities are hostages to single carriers.

Heslett, Sasser and Hart (1990) provide a simple mathematical approach to illustrate the relative efficiencies of hub-and-spoke versus trunk routing. And while the virtues of hub-and-spoke routing have reduced airline costs and increased point-to-point routing, these gains have not necessarily translated into lower airfares (McShan and Windle, 1989). As one indication of the willingness of business travelers to pay a premium for convenience, meeting planners are now considering hub cities as prime meeting sites (Meetings & Conventions, 1990).

Studies based on Department of Transportation (DOT) data have found that when deriving average fare per mile (yield), an airline charges higher prices when it has a dominant position at an airport. Borenstein (1989) analyzed 1987 DOT data and studied the importance of route and airport dominance in determining the degree of market power exercised by an airline in order to establish more clearly the sources of market power in the airline industry. Results indicated that an airline's share of passengers on a route and at the endpoint airports significantly influences its ability to mark up price above cost. The high markups of a dominant airline, however, do not create much of an "umbrella" effect from which carriers with smaller operations in the same markets can benefit. Borenstein used two methods to analyze

the effects of route and airport dominance on the prices that an airline charges:

1. Estimate of the observed carrier's markup over cost, using airport and route shares and concentration variables.
2. Comparative estimation of two observed airlines' prices on a route, considering airlines' costs, service qualities and shares of traffic on the route and at the endpoints.

Market and price data used by Borenstein was from DOT "Origin and Destination Survey Databank 1A (DB1A)". These data are a random 10% sample of all tickets that originate in the U.S. on domestic carriers. Analysis was in terms of average fare (cents) per mile (yield). Airline flight operations data used was from the DOT "Service Segment Data" (a complete census of all flights, but not required from post-deregulation and smaller airlines). Both DOT sources are available from the Transportation Systems Center in Cambridge, Massachusetts.

Borenstein's findings:

1. An airline charges higher prices when it has a dominant position at an airport. These prices are generally higher than it charges throughout the remainder of the system.
2. An airlines' share of traffic at an airport, not just the concentration among all airlines at the airport, contributes to its market power; the dominant airline at these airports tends to charge higher prices than other major airlines with smaller operations there.

3. The airline's share of traffic on the route and at the endpoint airports seems to be a principal determinant of a carrier's ability to raise the price of its product.

4. A carrier that dominates both ends of a route, with 50% of the origination, is estimated to charge median and high-end prices 6% greater than the prices of an airline with a very small presence at the two airports.

5. A dominant presence at an airport significantly increases an airline's share of the passengers on any route that includes that airport. This would also increase fares indirectly.

6. Increases in concentration on the route appear to raise the carrier's low-end prices, but lower its high-end prices.

7. If a route is primarily discretionary travel, it appears that the carriers do not lower their deep-discount fares much, but they do make more tickets available at the moderate discount and "supercoach" (unrestricted discount) fares.

8. While it may be the case that routes with greater traffic density, and thus higher load factors, generally have lower prices, the carrier with a higher load factor on a given route may have more connecting traffic and, thus, a higher opportunity cost for its seats.

9. One source of market power on city-pair routes seems to be the size of a carrier's operations at the endpoints of the route.

10. An airline with a dominant share of the traffic at an airport has a competitive advantage on routes that include that airport. Distinguish between natural (e.g. reputation) and created advantages (e.g. computer reservation systems, frequent flyer programs, travel agent reward systems).

11. Airline controls of both slots and gates serve as entry barriers.

12. Hub-and-spoke air transport systems allow more efficient use of aircraft and other inputs than the point-to-point systems developed under government regulation. Still, dominance of major airports by one or two carriers, in many cases the result of hub formation, appears to result in higher fares for consumers who want to fly to or from these airports. Such strongholds seem to insulate the dominant carrier from competition.

13. Marketing devices and other sunk costs of entry (such as advertising and the setup of new airport facilities) provide some of the explanation for the advantages of airport dominance.

14. Benefits from hub operations include cost savings that are not fully passed along to consumers, but still increase total surplus in the form of profits. To the consumer, benefits include greater flight frequency, easier connections, and more nonstop flights.

15. These possible of mergers or other increases in airport shares should be weighed against the higher prices that seem likely to result.

Morrison and Winston (1990) studied DOT data and concluded that higher fares are present at slot-controlled and hub airports, and stated that these higher rates would likely erode as carriers expand their networks. Berry (1990) also used DOT data and concluded that airlines are able to increase prices at airports where they maintain a large presence. Recently, as a direct reflection of the above findings, major U.S. passenger carriers have agreed to pay a settlement in cash and discount fare coupons to settle a class action suit filed in 1990, whereby airlines illegally established fares by signalling each other through Airline Tariff Publishing. The suit represents any passenger who travelled between January, 1988 and May, 1992 through any of the domestic airlines hubs (Travel Weekly, June 25, 1992).

A finer distinction on airfare differences between spoke and hub cities has been in the sub-categorization of hubs. So-called "fortress hubs" exist where airlines have established dominant control and competition is limited, specifically airports at Atlanta, Pittsburgh, Houston, St. Louis and Detroit (Wall Street Journal, July 3, 1992). Barbareck (1992) cites a recent study that indicates that there is no premium in airfares for travel out of fortress hubs. Table 2 reflects the categorization of U.S. airports defined by Barbareck.

Competition is limited at established fortress hubs, yet remains intense at a handful of major airports. Airports having the most intense competition are New York (LaGuardia), Boston, Los Angeles, Washington (National) and San Diego

(Wall Street Journal, July 3, 1992).

Table 2

Classifications of U.S. Hub Airports

Fortress Hubs	Leading Competitive Hubs
St. Louis	Chicago
Houston	New York
Minneapolis/St. Paul	Denver
Detroit	Dallas
Atlanta	Los Angeles
Raleigh-Durham	Boston
Philadelphia	Phoenix
Pittsburgh	

Source: Barbareck, Bonnie, Corporate Travel Magazine, July, 1992

Huston and Butler (1991) have studied the factors that determine the location of airport hubs, including factors of convenience to route connections and demographic factors. Included among the considerations for designating hub status on an airport site is the designation of the site as an international gateway (see Table 3). Other factors considered in the designation of an airport site as a hub are the arrival and departure volumes. See Appendix B for daily arrival and departure volumes for cities that were selected for this study.

A number of consumer-oriented publications have jumped on the suspected premiums in hub airfare and have provided numerous traveller tips, including techniques of interline and hidden city itineraries, periodicals and newsletters and hotline telephone numbers (Bowman, 1991). Johnson and Poplin (1990) also focused on this and provided some travel tips. Barnett, et al (1992) studied 1977 and 1989 data and found that the level of coverage for nonstop point-to-point flights across the U.S. had improved since deregulation. He also stated that travelers have saved money at the tradeoffs of less safety and longer elapsed travel time. Borenstein (1989) showed that airlines charge higher prices on flights involving hub airports - that prices are higher on flights traveling from hub airports as opposed to flights traveling to hub airports.

Table 3

1989 Foreign Visitors Busiest U.S. Airports

Airport	Foreign Visitors
John F. Kennedy	4,942,400
Miami	2,610,400
Los Angeles	2,013,200
Honolulu	1,415,900
San Francisco	805,800
O'Hare (Chicago)	632,600
Orlando	509,000
Houston	505,800
Logan (Boston)	474,800
Dallas/Ft.Worth	340,400
Newark	299,100
Hartsfield (Atlanta)	274,600
Seattle-Tacoma	274,600
Total at 13 airports:	15,097,900
Total at all U.S. airports:	22,724,900

Source: Aviation Week and Space Technology, July 23, 1990.

Morrison and Winston (1990) stated that more customers choose airlines that have large operations (i.e. dominant carrier) out of the origin city. They also examined whether market forces were operating as freely as possible in fare determination following airline deregulation and found that fares fall with increased competition, but this effect is limited at slot-controlled airports. The authors' method was based on analysis of data from the Department of Transportation "Ticket Dollar Value Origin and Destination Survey (Data Bank 1A)". Morrison and Winston stated that as an airport becomes more concentrated, fares increase. They saw this problem as most serious when one of the airports is a carrier's hub. They also stated that hubs pose entry barriers for other carriers, and that higher fares associated with hubs should erode as carriers expand their networks. They also felt that abolition of hubs in the hopes of promoting competition may achieve the opposite effect.

Berry (1990) also studied the same source data and stated that airline entry decisions are highly correlated with airport presence. Berry theorized that if hubbing decreases costs, airline prices should fall as hubbing increases. Berry used data from DOT "Origin and Destination Survey" and argued that both simple cost-reducing and naive market power stories are inappropriate for the airline industry, and that there is demonstrable consumer willingness to pay premium prices for the services of a dominant airline at a given airport. He also stated that airlines gain many advantages from a large presence at an airport, including control over airport operations, frequent flyer plans, and travel agent commission schedules. The net

effect is enhanced market power enabling restrictions on output (capacity) and increased prices. Berry also claims that population affects the number of passengers carried, but not the price charged, and concludes that airport presence is related both to cost and demand advantages.

Borenstein (1990) analyzed the effects of two controversial airline mergers that resulted in dominance that may have created substantial market power. The two mergers studied were Northwest's merger with Republic Airlines and Trans World Airlines' purchase of Ozark Airlines. In each case, the merger left the surviving carrier with more than three-quarters of the traffic at the major hub airport where the merging airlines had competed, Minneapolis/St. Paul for Northwest and St. Louis for TWA. Borenstein compared pre- and post-merger average prices on routes that include the major hubs of the eight major airlines relative to the industry average prices for routes of the same distance. His findings were that:

1. The two mergers resulted in the largest hub-airport price increases during the time periods examined.
2. Where other carriers were present, merging carriers' prices approximated industry averages. Where there were no carriers, prices were significantly above industry averages.

The papers cited above indicate that airlines that dominate the traffic out of a given city appear to charge higher prices than other carriers on the same routes

that may be serving a larger number of passengers.

Based on the literature review, this investigation is the only known study that approaches this topic and evaluates current industry airfare structures from the consumer's perspective. This provides an opportunity to present study results that are more directly translatable to the consumers' out-of-pocket costs for air travel than findings from other studies that are based on industry-oriented measures.

CHAPTER III

METHODOLOGY

Setting of the Study

Scope

The original scope of this study was to focus on city-pair fares for the five major domestic U.S. airline passenger carriers (specifically American Airlines, Delta Air Lines, USAir, United Airlines and Northwest), and the large national carriers (Continental, America West, Trans World Airlines, Alaska Air and Southwest Airlines). This scope was modified to capture all carriers' fares that were available on the day of data collection. Ultimately, for expedience in data recording, it was decided to drop carrier identification for captured fares. Thus, all domestic carriers were in the scope of this study, including post de-regulation airlines (such as Carnival, MGM Grand Air, Markair, Midwest Express, North American, and Tower Air), carriers in bankruptcy but still flying (including American West, TWA and Continental) and other large regional carriers (such as Alaska Air, Southwest, Hawaiian Air) and commuters such as American Eagle.

Design Limitations:

Difficulties in tracking airfare continuity due to major industry restructuring led to the design of a "snapshot" (convenience sample) approach, as opposed to a

trend tracking approach.

Sampling Limitations:

This study was limited to selected sample hub and spoke city pair and fare combinations. This was necessary due to the sheer numbers of routes and fares currently in the domestic airline industry.

Instrumentation Limitations:

This study was based only on published fares. This study does not reflect any unpublished airfares (e.g. resulting from corporate volume-based discount negotiations with carriers).

Data Analysis Limitations:

Analysis was based on sample data captured as the specified date. Analysis was based on the author's personal background, research and insights without privy to industry marketing factors which may be at work in the industry, which may be the primary determinants of airfares.

The Study Sample

The population studied was the U.S. domestic airline passenger industry. This population included all airports that have scheduled commercial passenger flights,

and the domestic airline passenger carriers that were operating in the domestic U.S., as of the date of the study. The sample for this investigation was defined in terms of passenger airline carriers and city-pairs (origin to destination routes). All passenger airline carriers operating in the domestic U.S. were potentially eligible to be included in the sample. As explained elsewhere, carrier identification was eliminated in the Data Recording phase, but airfares for city-pairs were gathered for whatever carriers were serving the city-pairs.

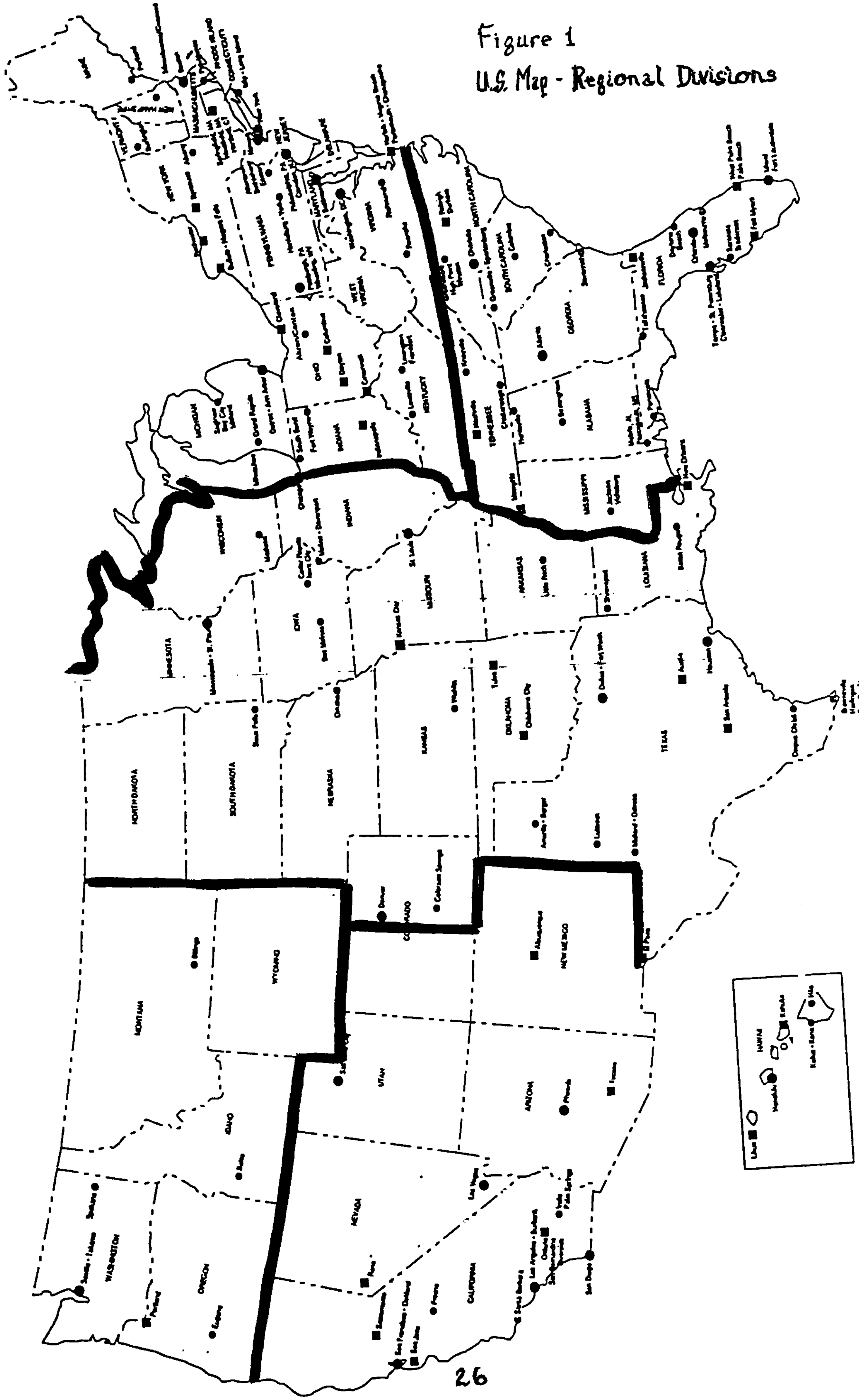
The methods of determining sample size for city-pairs were as follows:

1. For Hub Airport sites, each of the major and large national airlines (as listed elsewhere in this document) were contacted to derive the airport sites that were designated as hub airports. Note that "hub" sites do not include "hubs" for airlines other than the specified major and large national carriers (e.g. regional carriers). Refer to Appendix C, U.S. Airlines - Domestic Hubs.
2. For Spoke Airport sites, the selection strategy started with dividing the U.S. (lower 48 states) into five regions for purposes of making an equal number of subsequent random airport site selections from each region. Refer to Figure 1.

The method used to select spoke airports within regions was random. The selection criteria and selected airports are detailed in Appendix D (Selected Spoke

Figure 1

U.S. Map - Regional Divisions



Cities). Statistics for the study sample are outlined in Table 4.

A separate Data Validation phase was designed into the study early on to follow the Data Recording phase. The intent of this sample was to randomly select a small number of airports in the domestic U.S. to validate the findings of the data that were collected, recorded and calculated in earlier phases. The airports selected and the subsequent results are displayed in Appendix E, (Random Sample to Validate Findings).

Instruments Used

The tools used to conduct this investigation included:

1. The SABRE Computerized Reservation System.

   Specifically, the two main commands and equivalent displays were (a) Fare Shopper ("FS" commands), and (b) Point-to-point mileage ("W/-AT" commands). A sample printout of a Fare Shopper display (for a specified origin and destination city-pair) is in Appendix F. The point-to-point mileage display simply returns the distance in miles for the specified origin and destination city/airport codes, and is not included in the Appendices. The commands most frequently used in the study are outlined in Appendix G.

Table 4

City-Pair Fare Shopper Statistics

City-Pair Fare Shopper printouts during Thursday, July 30 and Friday, July 31, 1992 (both reflecting fares as of July 31st):

Hub-to-Hub City-Pairs (CPA's):

37 hubs less DAL (Dallas,TX Love field) and San Juan, PR = 35.

(35 times 35) less 35 = 1190 CPA's. 595 were used, as reverse direction fares are identical for any given city-pair.

Spoke-to-Spoke CPA's:

20 spoke cities times 20, subtract 20, then halved = 190.

Hub-to-Spoke CPA's:

35 hub cities times 20 spoke cities = 700 CPA's

Total CPA's Printed Out:

1190 + (LGA x 33 hubs) = 1223, plus 190 plus 700 = 2113.

Total CPA's Analyzed: 595 + 190 + 700 = 1485.

2. Mileage:

The primary source for point-to-point airline mileage was the mileage table found in Official Airline Guide - North American Edition. See Appendix H (U.S. and Canadian Domestic Airline Mileage). When selected cities (i.e. spoke cities) were not readily available on this table, the SABRE commands were used.

3. Lotus 1-2-3 (Version 2.2).

This commercially available software for spreadsheet applications on personal computers was used in the Data Recording and Data Analysis phases explained below. Using standard software functions, a simple model was developed to record selected SABRE data, perform calculations of simple indices, and to sort and display study data. Additional detail on the design of this model is described below in the Data Recording phase activities.

Period of Data Collection

On a designated day (Friday, July 31st), the SABRE computer reservation system was used to capture published airfares that were available as of that date.

Procedure

This study is from the present perspective and used the descriptive technique. This study differed from other similar studies in that data captured and analyzed were recent (in effect as of the above date of collection), consumer-identifiable (using computer reservation system flight fares), and measured in consumer-relevant terms (dollars and fare dollars per mile travelled).

Hypotheses

The hypotheses that were tested in this investigation were:

1. Whether airfares for flights originating from domestic hub airports were higher than average industry airfares.
2. Whether airfares for flights routed through domestic hub airports are also higher.

The results of this investigation that are submitted as pertinent to these hypotheses are:

1. The calculated average airfares, measured in dollars:
    a. For the hub-to-hub routes sampled.
    b. For the hub-to-spoke routes sampled.
    c. for the spoke-to-spoke routes sampled.
2. The calculated indices of Average Fare (in dollars) per Mile, for the above sampled routes.

Potential relationships include the relationship of the airfares - fare per mile flown - and the distance between the specific spoke cities selected in the sample. Long point-to-point distances (e.g. between Midwestern and Northwestern cities) would skew the fare per mile figures higher; shorter distances (e.g. Northeastern cities) would skew the results lower.

The null hypotheses for this investigation was domestic airfares were not higher for flights originating from, or routed through, the domestic U.S. hub-and-spoke airline passenger system.

Variables

Independent Variables:

City-pair routings selected for this study can be categorized as hub-to-hub, hub-to-spoke or spoke-to-spoke, based on the routing points of origin and destination, and the designation of specific origins and destinations as "hub" airport sites.

Dependent Variables:

Published airfares were presumed to depend upon differences in the independent variables.

Intervening Variables:

There were many intervening variables that were identifiable that were

expected to have positive relationships on the way the independent variable acts upon the dependent variable. These included, but were not limited to:

- Specific spoke cities that were selected for this study.
- Airport arrival and departure volumes.
- Designation of an airport site as an international gateway.
- Carrier dominance in either a specific selected airport or city pair route.

Design Preparation Activities

Identification of Domestic Hubs:

The process for identifying designated hub airport sites for this study is outlined above in The Study Sample (page 26). A note to add here pertains to the current volatility of hub airport designations, due to airport capacity constraints, international gateway positioning and airline financial considerations. For example, on April 16, 1992, TWA announced that it is adding nonstop flights between some cities, rather than routing through St. Louis, and was moving forward with plans to open a minihub in Atlanta (Travel Weekly, April 16, 1992, p.37). And, on April 27, 1992, TWA announced a new hub would be designated in Atlanta, effective June 1, 1992 (Travel Weekly, April 27, 1992, p. 55).

Creation of "Hub Flags":

A simple coding scheme was devised by the author early in the study for purposes of subsequent analysis. A so-called "hub flag" was named "FR1" and is a

coding scheme for hub airport sites that are based on proximities of geography and potential carrier competition. A second "hub flag" named "FR2" was assigned to selected hub airport sites, and borrowed from the designations assigned by Bonnie Barbareck (1992). This scheme is reflective of market share and competitive levels and codes are assigned to airports which Barbareck has designated to be either "fortress hubs" (F) or leading competitive hubs (L). Appendix C reflects these "hub flags". Further discussion on the use of these "hub flags" will appear in the Data Analysis, Results and Discussion sections.

Creation of U.S. Airline Domestic Hubs Map:

One important but missing tool that was needed for this study was a visual reference aid of the United States that depicts the locations of the designated hub airports, by carrier. A map was prepared and color stick pins were properly placed along with a cross reference matrix of carrier to airport. Appendix I contains a copy of this matrix. The extended utility of this map (beyond this study) led to a decision to place it in the SABRE lab at RIT for the use of travel students.

Selection of "Spoke Cities":

As discussed above in The Study Sample section, and detailed in Appendix D, twenty airport sites from the U.S. were selected for use in this study. These Spoke Cities were also given a unique stick pin color and added to the posted map in the SABRE lab.

Data Collection Strategy:

The over-arching differentiation strategy for this study was to base findings on current airfare structure and values. Using the power of the SABRE on-line computer reservation system, and realizing the formidable magnitude of city-pair fares that needed to be captured almost instantaneously, the most expedient method for data capture was to printout Fare Shopper displays for the designated city-pairs. This required tedious hours of data entry and printing, but enabled a more leisurely data analysis activity, while providing hard copy backup and reference materials. This decision subtly changed the study scope and procedures. The study then potentially captured all airlines flying in the U.S. domestic market, versus the five major and five large national carriers originally intended. This also enabled an expedience that was not encumbered by searching for class-specific information (class of service for the fares was captured and took on only an incidental meaning). This decision to "print now, analyze later" additionally enabled the Data Recording phase activity to also use highest fares for the city-pairs; thus, to enable calculation of a simple average fare and assorted indices.

Data Gathering

SABRE Fare Shopper displays were printed out for selected city-pairs in the sub-categories of:

1. Hub-to-hub.

2. Hub-to-spoke (spoke-to-hub).

3. Spoke-to-spoke.

These printed displays were then the source for scanning and recording the lowest and highest one-way airfares for each city-pair. Point-to-point distance mileage was obtained from either SABRE or Official Airline Guide sources and recorded for each city-pair.

Data Recording

Design of the Data Recording Model:

A tool was needed that could be locally designed and repeatedly modified from early prototype functionality to the expected (and unexpected) disparate needs of the Data Analysis phase. Lotus 1-2-3 computerized spreadsheet application software was selected for the development of an electronic repository of key fare information. The program design that evolved capitalized on the inherent power of the shell software, yet was customized with an eye on creating a basic structure that was easily modified for potential future projects.

Entry of Limited Samples:

The initial model, given a program name of PROTO, was a simple spreadsheet. As displayed in Appendix J (Prototype for Thesis), each row of data entered was taken directly from SABRE Fare Shopper printouts: city codes for origin

and destination airports, lowest published one-way fare and carrier(s) offering the low fare. Point-to-point mileage was entered from either SABRE or OAG sources (as described above). Finally a simple index was calculated dividing the low dollar fare by the miles. A limited sample of fifty-eight city-pairs was entered.

Refinements:

Early results from the limited sample in PROTO led to a series of model modifications. These modifications were driven by two forces: (1) an awareness of the current industry fare structure, unusual promotional fares and intense competition in the industry, and (2) the extraordinary amount of labor required for data entry in this phase. As a result, decisions were made to drop carrier identification, enter highest one-way fares for each city-pair, calculate a simple median fare (lowest fare plus highest fare divided by two), and calculate three indices (low, high and average fares divided by mileage) rather than the previous single index.

Current Design:

The model design continued to evolve (see Appendices K and L), and stabilized at PROTO6 (Appendix M). Extensive data entry was then begun. Computer memory constraints and performance degradation forced a need to create three separate models (which were functionally identical) to hold categorized city-pairs for:

1. Hub-to-hubs (PROTO6HH: see Appendix N)
2. Hub-to-spokes (PROTO6HS: see Appendix O)
3. Spoke-to-spokes (PROTO6SS - see Appendix P)

The final feature added was the Hub Flags coding to the city-pair entries in the PROTO6HH and PROTO6HS models. As explained below, this feature provided valuable insight in the Data Analysis phase. These three models can be readily merged into a composite worksheet as needed for data analysis. See Appendix Q (Composite PROTO6HH, PROTO6HS and PROTO6SS).

Data Entry from SABRE to Models:

Data was entered for the specified study sample (detailed above in Table 3). The totals for city-pairs entered:

Hub-to-hubs (total 592).

Hub-to-spokes (total 699).

Spoke-to-spokes (total 190)

Grand total 1481.

Summary information for all city-pairs selected in this study appear in Appendix R (Summaries of PROTO6xx Data).

Data Verification

After all Data Recording entries were complete, a designed quality check was implemented on a sample of deliberate and random Lotus model entries to provide a quality check of recording data from SABRE printouts. Lotus standard sorts were done by city-pair (both origin and destination city sorts), by fare (low and high dollars), by mileage, and by each of the calculated indices. The sampling done was on the extremes (e.g. lowest airfare city-pair, highest calculated index, etc.) and on random samples. Each of the incidents were double checked against data sources. The results indicated a high confidence (99 percent) of data recording and calculating accuracy during the Data Recording phase.

Data Analysis

General Objective:

The decision to add the above Data Recording activities was made with the regret that the required data (re-) entry could not be avoided, as electronic down-loading of SABRE fare data was not possible. However obtained, this data was recognized early in the study design as information that was needed for local manipulation and analysis in ways not fully definable at that time. Analysis was performed in a wide variety of ways, including by hub city and by spoke city. A simple median airfare was calculated from the lowest and highest airfares for each city-pair. Indices were calculated (consisting of dollar fare divided by city-pair distance miles) for low, average and high airfares, and posted to each city-pair.

Addition of Hub Flags:

The "Hub Flags" described above in Data Preparation Activities enabled a wide variety of categorizations that provided invaluable insights in characterizing hub airfares. Subsequent sorting and re-sorting combinations have proven the value of these schema, as explained in Chapter IV. Appendices S and T depict the summaries of these activities, for the hub-to-hub and hub-to-spoke city-pairs.

Sorting by City-Pair Distance:

Bracketing city-pair airfares by distance categories enabled further insight into fare structuring that downplayed the significance of the specific cities involved. Within each bracket (e.g. zero to 500 miles, 501 to 750 miles, etc.), low, high and average airfares and indices were calculated for the city-pair detail in each group. Appendices U, V and W show the summaries for the hub-to-hub, hub-to-spoke, and spoke-to-spoke city-pairs.

Validation Sampling:

As mentioned earlier, an additional sample of six cities was randomly selected to validate the findings of the study. The selection criteria, cities selected, and findings are outlined in Appendix E.

Subsequent Analysis:

Subsequent analysis (see Chapter IV) focused on the stated hypotheses of

premium pricing from and through hub airports, and also evaluated other dimensions, such as the potential impacts of "contention hubs", origin to destination distance, nonstop flights, nonstop and direct flights.

Display of Results:

The most salient documents that reflect the findings of the study and the relevance to the stated hypotheses are selected from the Appendices. Appendix R (Summaries of PROTO6xx Data) is the summary document for this investigation from which all other documents are further amplifications and re-sorts (each with it's own insight to the findings).

Assumptions

Ideological Assumptions

The author had no ideological assumptions about the problem itself, and about potential solutions to the problem.

Procedural Assumptions

It was assumed that the fares published and the data monitored and collected from the SABRE computer reservation system was reflective of reality (i.e. the price being paid by the flying public). It was assumed that the airfares that were available on the day of collection were as reflective a sample as if another study were to

embark on a periodic monitoring, trend-tracking approach (this is a convenience sample). It was assumed that the point-to-point mileage figures that are derived from the above specified sources are acceptable for purposes of this study. It was apparent that city-pair mileage may in fact be significantly different, based on the chosen carrier and actual flight routing (which may include connecting flights).

CHAPTER IV

RESULTS AND DISCUSSION

Restatement of the Problem

Deregulation of the U.S. passenger airline industry has resulted in a few large carriers that have been successful in dominating the market, including dominance of selected routes originating from, or traveling through, key airports that have been designated as hubs. This study sought to determine whether the airfares for flights originating from hub airports are higher than industry averages.

Analysis and Discussion of the Findings

Summary of Findings

The findings of this investigation indicate that the overall cost of the fares in the U.S. passenger airline industry averages $.60 per mile flown. Hub-to-hub fares average $.65 per mile, with both hub-to-spoke and spoke-to-spoke fares averaging $.58 per mile.

Relevance of Summary Findings to Hypotheses

The hypotheses that were stated for this investigation, and the findings:

1. Hypothesis: Airfares for flights that originate from hub airports were higher

than average industry airfares.

Findings: A. Flights from hub airports to other hub airports were higher, when indexed (dollar fare divided by distance).

B. Flights from hubs to destinations sampled that were not hubs (spokes) were not higher than hub-to-hub fares, when indexed.

2. Hypothesis: Airfares for flights that are routed through hub airports were higher than average industry airfares.

Findings: This study was unable to prove or disprove this hypothesis, due to the fact that literally "every" flight in the modern "hub-and-spoke" system is routed through hub airports.

Analysis of Summary Findings

The single document that summarizes the overall findings of this investigation is Appendix R, "Summaries of PROTO6xx Data". The reader should focus on the last block of numbers, labeled in the left column as "TOTALS". For each of the row and column combinations, the reader should follow the tracing of where the values were derived. While Appendix R displays the actual values, the following summary

quickly identifies the sources and categorization of city-pair routings that were examined in this study to show where extremes of low and high instances reside.

	LOW_$	HIGH_$	MILES	NDX	HNDX	AVG$	AVG_NDX
LOW RANGE	HH/HS	SS	HH	HH	SS	SS	SS
HIGH RANGE	HS/SS	HH	HH	HH	HH	SS	HH

(Where: "HH" is Hub-to-hub, "HS" is Hub-to-spoke, and "SS" is Spoke-to-spoke summary data.)

To summarize:

1. LOW_$/LOW RANGE: The incidents of the lowest of the low fares sampled. In this study, they coincidentally occured in the hub-to-hub and hub-to-spoke routes.

2. LOW_$/HIGH RANGE: The incidents of the highest of the low fares. Coincidentally, they occured in the hub-to-spoke and spoke-to-spoke routes.

3. HIGH_$/LOW RANGE: The incident of the lowest of the high fares occured in the spoke-to-spoke routes.

4. HIGH_$/HIGH RANGE: The incident of the highest of the high fares

occured in the hub-to-hub routes.

5.MILES/LOW RANGE, MILES/HIGH RANGE:

The incidents of both the lowest and the highest point-to-point distances occured in the hub-to-hub routes.

6. LNDX/LOW RANGE, LNDX/HIGH RANGE:

The lowest and highest results of the calculated low fare per mile index were in the hub-to-hub routes.

7. HNDX/LOW RANGE: The lowest instance of the calculated high fare per mile index occured in the spoke-to-spoke sampled routes.

8. HNDX/HIGH RANGE: The highest instance of the calculated high fare per mile index occured in the hub-to-hub routes.

9. AVG_$/LOW RANGE, AVG_$/HIGH RANGE:

Both the lowest and highest instances of the calculated average dollar fare occured in the

spoke-to-spoke routes sampled.

10. AVG_NDX/LOW RANGE: The lowest calculated average fare per mile instance occurred in the spoke-to-spoke routes.

11. AVG_NDX/HIGH RANGE: The highest calculated average fare per mile instance occurred in the hub-to-hub routes.

Next, the values of the calculated means that are shown in the TOTALS block can be compared against the similar means calculated and shown in the three sub-category summaries appearing in Appendix R. These calculated means in the TOTALS section represent the overall domestic U.S. passenger airline industry values resulting from this investigation.

1. LOW_$: The lowest one-way fares for city-pairs sampled in the industry average $266. The average low fares were lowest for hub-to-hub routes of all other low fare averages (i.e. the overall industry average, hub-to-spoke low fares and the spoke-to-spoke low fares).

2. HIGH_$: The average for the highest one-way fares sampled in this study was $799. The average high fares for hub-to-hub routes was lower, and spoke-to-spoke average high fares were higher.

3. MILES: The average point-to-point distance for city-pairs sampled in this investigation was 1129 miles. The average hub-to-hub distances was less (1106 miles).

4. LNDX: The average of the calculated indices of low fare dollar per mile traveled was coincidentally the same for the industry and the three city-pair categories ($.29 per mile).

5. HNDX: The average of the calculated indices of high dollar fare per mile traveled was higher in hub-to-hub city-pairs than either the industry average or any other category. The lowest was in the spoke-to-spoke routes sampled.

6. AVG_$: The calculated average dollar fare for the industry was $532. The average dollar fares were highest in spoke-to-spoke routes ($560), higher than the industry in hub-to-spoke routes ($536), and lowest in hub-to-hubs ($501).

7. AVG_NDX: The calculated average fare per mile traveled in the industry was $.60 per mile. Hub-to-hub fares averaged higher at $.65 per mile. Spoke-to-spoke and hub-to-spoke fare per mile averages were identical at $.58 per mile.

Discussion of Findings

Overall, based on analysis of Appendix R summaries, it would appear that the converse to the hypotheses are true; that is, that airfares in the U.S. hub-and-spoke airline passenger industry are lowest for hub-to-hub travel, at least based on the mean low dollar and mean high dollar fares.

When these dollar fares are indexed by dividing by point-to-point miles, the mean index results show that the low fare index (LNDX) result was identical across all three categories at 0.29 (fare cost in dollars per mile traveled). However, the high fare index (HNDX) was 1.01 for hub-to-hub, 0.87 for hub-to-spoke, and 0.85 for spoke-to-spoke city-pairs. This says that overall, at least the high airfares from hubs (whether to hubs or to spokes) were higher.

Low Fares Summary:

In analyzing Appendix R, the ranges of lowest dollar fares of all city-pairs across the three categories were remarkably close, from $29/$34 (the lowest of the low fares) to $500/$510 (the highest of the low fares), and the low fare index low range (LNDXL) was close across all three categories at 0.06, 0.07 and 0.09. But note the low fare index - high (LNDXH) differences: 1.33 for spoke-to-spoke, 1.22 for hub-to-spoke, and 2.34 for hub-to-hubs. This says that the hub-to-hub fares (indexed) were higher!

High Fares Summary:

As shown in Appendix R, the low range of the highest dollar fares were highest in hub-to-spoke ($279), followed by hub-to-hub ($170) and spoke-to-spoke ($84) routes. This says that the low range of fares from hubs was higher. When indexed, this also held true (see HNDXL).

The high range of the highest $ fares was highest for hub-to hub ($1385), followed by spoke-to-spoke ($1330) and hub-to-spoke ($1310). This says that hub-to-hub high range $ fares were higher! When indexed (HNDXH), the hub-to-hub result was highest (6.96), followed by hub-to-spoke (3.73) and spoke-to-spoke (3.43).

Average Fares Summary:

For spoke-to-spoke routes sampled, the simple mean average dollar fare calculated was lowest ($59) as well as highest ($905) than the hub-to-hub or hub-to-spoke fares. The rolled-up average dollar fare was highest of all three categories at $560. This result can be a function of the spoke cities selected. The spoke cities that were selected for this study may have skewed the results of the hub-to-spoke and spoke-to-spoke findings, based on relatively long or short distances in the selected random sample. Validation of the study findings is easily tested by deliberately selecting city-pairs having low point-to-point miles. However, the mean miles for the spoke cities that were selected was coincidentally 1141 miles for both the spoke-to-spoke and the hub-to-spoke city-pairs. When indexed, the hub-to-hub average index

(AVG NDX) mean was highest of all three categories.

Further Analysis of Findings:

The status of the U.S. airline passenger industry as of the date of data collection was one of intense competition. Since the major fare restructuring announced by American Airlines on April 13, 1992, fare promotions, record passenger loads but record financial losses have been the norm in the industry, with few exceptions. A number of bankruptcy-protected (i.e. Chapter 11) carriers were still flying during this time and were included in the Data Collection phase. Specifically, on the pre-determined date of data collection, two carriers, Delta and Continental Airlines, published yet another wave of promotional fares. These lower fares, combined with lower promotional fares for nearly every industry carrier, were commonplace during the summer of 1992 and captured in this study.

A number of questions come to mind when analyzing this data in an attempt to de-mystify the findings of the study. Some of these questions are submitted below for purposes of stimulating the reader for further probing and insight into this study.

Are close proximity airports (e.g. Washington- International and Washington-Dulles; Dallas-Love and Dallas-Ft. Worth; New York-Kennedy, Newark and New York-LaGuardia) fares identical, or is the hub/non-hub competition factor at work?

Designated hub airports that are in closest proximity can be identified in the following four clusters:

Washington D.C/Baltimore,MD:

Washington, D. C.: Dulles (airport code IAD) and National (DCA) airports are 24 miles apart. The distance between Baltimore International airport and Dulles is 31 miles; from Baltimore to National is 45 miles. Baltimore is a mini-hub for USAir. Dulles is a designated hub for United Airlines, National is a hub for Northwest.

Dallas-Ft. Worth, TX:

Love Field in Dallas (DAL) is separated from the Dallas-Ft. Worth airport by 13 miles. Love Field is a hub for Southwest Air, and Dallas-Ft. Worth is a hub for both American Airlines and Delta.

Newark, NJ/New York City:

The distance between John F. Kennedy airport (JFK) and Newark International (EWR) is 21 miles; the distance between Newark and LaGuardia is 17 miles. The distance from Kennedy airport to LaGuardia is 10 miles. Newark is a hub for Continental Airlines, and Kennedy is a hub for TWA.

San Francisco/San Jose, CA:

The distance from San Francisco International and San Jose airports is 33 miles. San Francisco is a designated hub for United, and San Jose is a hub for American Airlines.

Refer to Appendix S, "Hub-to-Hubs: Sorted by Hub Flags" and Appendix T, "Hub-to-Spokes: Sorted by Hub Flags". The city-pair routings for each category were individually sorted by the "Hub Flags" assigned to each record, and low, high and average fares and indices were computed to gain a sense of the degree of competition in the above "contention hubs". In hub-to-hub fares, Dulles (IAD) and Washington-International (DCA) Average Index was $.78 per mile, Baltimore (BWI) was $.66. In hub-to-spoke fares, DCA and IAD were $.56 and BWI was $.53 per mile. In hub-to-hub fares, Dallas-Ft. Worth (DFW) was $.54, and hub-to-spokes were $.59 per mile. Note that Dallas-Love Field (DAL) was dropped from the Data Collection phase due to minimal scheduled commercial flights in the SABRE Fare Shopper retrievals.

In hub-to-hub fares, New York-Kennedy (JFK) and Newark (EWR) Average Indices were nearly identical at $.66 per mile, and identical at $.53 per mile for hub-to-spoke fares. In hub-to-hub fares, both San Francisco and San Jose were $.66 per mile, and hub-to-spoke fares were both $.53 per mile.

These findings seem to suggest that "contention hubs" (Hub Flag categories b,f,j,k), seem to be matching or approximating fares of their immediate competitor. Here, the competitor is not necessarily another carrier, but primarily another airport within fifty miles. The findings are consistent with the designations for these sites by Barbareck (1992) as "leading competitive" (Hub Flag "L") airports.

What is the apparent effect (if any) of observed fares of airports (not necessarily hubs) that are designated as international gateways? Fares <u>to</u> gateway? Fares <u>from</u> gateway?

Table 3 (see Chapter II) listed the top thirteen U.S. airports in terms of foreign visitors. Table 5 shows an analysis, in order of most foreign visitors and displaying the calculated Average Fare Index (per Appendices S and T).

The overall industry Average Fare Indices computed in this study (Appendix R) were \$.65 per mile for hub-to-hub fares and \$.58 per mile for hub-to-spokes, and \$.60 per mile for all categories. Here, the question is whether the above index values were significantly higher for these hubs than the equivalent index values for other hubs. Findings indicated that Southeastern hubs (i.e. Miami, Orlando, Atlanta) were significantly higher than industry averages, while Houston, Los Angeles and Seattle-Tacoma were significantly lower.

Table 5

Average Fare Indices for the Thirteen Busiest U.S. International Gateways

Airport	Hub-to-Hub (Appendix S)	Hub-to-Spoke (Appendix T)
Kennedy	.65	.53
Miami	.74	.65
Los Angeles	.42	.51
Honolulu	NA	NA
San Francisco	.66	.53
Chicago (O'Hare)	.62	.54
Orlando	.74	.65
Houston	.48	.56
Boston (Logan)	.62	.54
Dallas/Ft.Worth	.54	.59
Newark	.66	.53
Atlanta (Hartsfield)	.68	.64
Seattle-Tacoma	.42	.52

What were the lowest dollar fares, by city-pair?

For hub-to-hub city-pairs, the lowest fare in dollars was $29 in a four-way tie between Chicago to Indianapolis, St. Louis to Indianapolis, Newark to Philadelphia and Kennedy to Philadelphia. The lowest calculated fare index was $.06 per mile from Columbus, Ohio and Los Angeles. For hub-to-spoke routes sampled in the study, the lowest fare was $29 from St. Louis to Kansas City. The lowest calculate fare index was $.07 per mile from Columbus, Ohio to San Diego. For spoke-to-spoke routes sampled, the lowest fare was $34 from Amarillo, Texas and Albuquerque, New Mexico. The lowest calculated fare index was $.09 per mile, in a four-way tie between Kansas City to Reno, Kansas City to San Diego, Tampa to Reno and New Orleans to San Diego.

What were the <u>highest</u> dollar fares?

For hub-to-hub routes, the highest fare was $1385 from Kennedy to Los Angeles. The highest calculated fare index was $6.96 per mile from San Francisco to San Jose. For hub-to-spoke routes sampled, the highest fare was $1,310 from San Francisco to Portland, Maine. The highest calculated fare index was $3.73 from Orlando to Tampa. For spoke-to-spoke routes sampled, the highest fare was $1,330 from Portland, Maine to Reno. The highest calculated fare index was $3.43 per mile from Billings, Montana to Casper, Wyoming.

What insights are apparent on lowest versus highest fare differences?

Investigations into the specific city-pairs that are reflected in the Appendix R summaries reveals some interesting insights. On the hub-to-hub routes, Baltimore to Washington (Dulles) had the lowest high fare at $170 and the lowest of the calculated average dollar fare ($110). Cincinnati to Dayton had the highest calculated index for low fares ($2.34) and the highest index for average fares ($4.42).

On the hub-to-spoke routes sampled, Phoenix to Albuquerque had the lowest of the high fares at $279, and the lowest of the calculated average dollar fare at $159. Orlando to Tampa had the lowest point-to-point miles (83 miles) of the samples, yet the highest calculated high fare index at ($3.73 per mile). On the spoke-to-spoke samples, the Amarillo to Albuquerque fare was at once the lowest of the low fares ($34), the lowest of the high fares ($84), and the lowest of the calculated high fare index at $.30 per mile. It was also the lowest of the calculated average dollar fare ($59), highest of the calculated average dollar fare (at $905), and the lowest of the calculated average fare index at $.21 per mile. One might expect a high level of carrier competition on such a low fare route, but investigation into the city-pair printout shows only a single carrier (Western Airlines).

What effect, if any, does distance traveled (origin to destination point-to-point miles) have on calculated index results?

Spoke-to-Spoke Routes:

As shown in Appendix W, "Spoke-to-Spokes: Sorted by Distance", sorting all spoke-to-spoke sampled records by city-pair mileage and bracketing as shown provided new insight into short-haul versus long-haul fares. When the Appendix R summary information for the spoke-to-spoke sub-category was traced back to Appendix W to derive the source of the values shown, some surprises were evident. From Appendix R, the Spoke-to-Spokes (encoded) were:

	LOW_$	HIGH_$	MILES	LNDX	HNDX	AVG_$	AVG_NDX
LOW RANGE	1	1	1	4	1	1	1
HIGH RANGE	6	6	6	1	1	6	1

Where the number keys 1 to 6 were coded from Appendix W brackets:

1	0 to 500 miles point-to-point
2	501 to 750
3	501 to 1000
4	1001 to 1500
5	1501 to 2000
6	2001 to (maximum)

As expected, the low range for fares, and the shortest distance occured in the short-haul (0 to 500 miles category 1). One surprise was the LNDX/LOW RANGE value of 4. This indicates that the incident of the lowest one-way fare occured not in the 0 to 500 mile routes, but in the 1001 to 1500 mile routes. This was not

significant, as the actual calculated index value was $.09 per mile, versus $.10 for the 0 to 500 mile routes. The high range instances for low fares, high fares and highest mileage occured predictably in code 6 (2001 to maximum distances). Also not surprising were the calculated cost per mile indices: it is most expensive to fly short-haul distances (code 1).

Hub-to-Spoke Routes:

Using the same approach, Appendix R is traced to source routings bracketed by distance for hub-to-spoke routings (Appendix V).

	LOW_$	HIGH_$	MILES	LNDX	HNDX	AVG_$	AVG_NDX
LOW RANGE	1	1	1	5	6	1	6
HIGH RANGE	6	6	6	1	1	6	1

Where the number keys 1 to 6 were coded from Appendix V brackets:

1 0 to 500 miles point-to-point

2 501 to 750

3 501 to 1000

4 1001 to 1500

5 1501 to 2000

6 2001 to (maximum)

The coded sources were similar to the findings of the spoke-to-spoke sampled routes. The exceptions occured in LNDX/LOW RANGE, HNDX/LOW RANGE and AVG_NDX/LOW RANGE. For hub-to-spoke routes sampled, the lowest

instances of low and high one-way fares occured in the 1001 to 1500 mileage bracket. The instance of the lowest calculated average one-way fare was in the 0 to 500 mileage routes, which was surprising.

Hub-to-Hub Routes:

Using the same approach, Appendix R was traced to source routings bracketed by distance for hub-to-hub routings (Appendix U).

	LOW_$	HIGH_$	MILES	LNDX	HNDX	AVG_$	AVG_NDX
LOW RANGE	1	1	1	5&6	6	1	6
HIGH RANGE	6	6	6	1	1	6	1

Where the number keys 1 to 6 were coded from Appendix U brackets:

1 0 to 500 miles point-to-point

2 501 to 750

3 501 to 1000

4 1001 to 1500

5 1501 to 2000

6 2001 to (maximum)

The findings for hub-to-hub routes were nearly identical to the findings of the other two categories. The only deviations occured in the LNDX, HNDX and AVG_NDX/LOW RANGE results. For hub-to-hub routes, the lowest instance of the low fare cost per mile was in the long-haul routes (codes 5 and 6). The lowest

instance of the high fare cost per mile was in the longest distance routes (code 6). The lowest instance of the calculated average fare cost per mile traveled was in the longest distances (code 6).

Summary of Analysis by Distance:

For a final analysis of Appendix R summaries, the reader is pointed again to the TOTALS block. The following summarizes the sources of the instances:

	LOW_$	HIGH_$	MILES	LNDX	HNDX	AVG_$	AVG_NDX
LOW RANGE	HH1	SS1	HH1	HH5&6	SS1	SS1	SS1
HIGH RANGE	HS6/SS6	HH6	HH6	HH1	HH1	SS6	HH1

Where the number keys 1 to 6 are coded from Appendix U brackets:

1 0 to 500 miles point-to-point ("short-haul")

2 501 to 750

3 501 to 1000

4 1001 to 1500

5 1501 to 2000

6 2001 to (maximum miles) ("long-haul")

and:

HH Hub-to-Hub routes
HS Hub-to-Spoke routes
SS Spoke-to-spoke routes

1. LOW_$/LOW RANGE: The instance of the lowest of the low fares occured in hub-to-hub routes of 0 to 500 miles.

2. LOW_$/HIGH RANGE: The instances of the highest of the low fares occured coincidentally in the hub-to-spoke long-haul and spoke-to-spoke long haul routes sampled.

3. HIGH_$/LOW RANGE: The instance of the lowest of the high fares occured in the spoke-to-spoke short-haul routes.

4. HIGH_$/HIGH RANGE: The instance of the highest of the high fares occured in the hub-to-hub routes.

5. MILES/LOW RANGE: The instance of the shortest city-pair distance sampled occured in the hub-to-hub routes.

6. MILES/HIGH RANGE: The instance of the longest city-pair distance sampled occured in the hub-to-hub routes.

7. LNDX/LOW RANGE: The instances of the lowest calculated low fare cost per mile traveled occured in hub-to-hub routes in the 1501 to 2000 and 2000 to (maximum) distances.

8. LNDX/HIGH RANGE: The instance of the highest calculated low fare cost per mile traveled occured in hub-to-hub short-haul routes.

9. HNDX/LOW RANGE: The instance of the lowest calculated high fare cost per mile traveled occured in the spoke-to-spoke short-haul routes.

10. HNDX/HIGH RANGE: The instance of the highest calculated high fare cost per mile traveled occured in the hub-to-hub short-haul routes.

11. AVG_$/LOW RANGE: The instance of the lowest calculated average dollar fare occured in the spoke-to-spoke short-haul routes.

12. AVG_$/HIGH RANGE: The instance of the highest calculated average dollar fare occured in the spoke-to-spoke long-haul routes.

13. AVG_NDX/LOW RANGE: The instance of the lowest calculated average fare cost per mile traveled occured in the spoke-

to-spoke short-haul routes.

14. AVG_NDX/HIGH RANGE: The instance of the highest calculated average fare cost per mile traveled occured in the hub-to-hub short-haul routes.

Items 11 through 14 summarize the original question. Spoke-to-spoke fares were lower, specifically in the short-haul distances, than hub-to-spoke and hub-to-hub fares. When indexed, hub-to-hub fares, specifically over the short-haul routes, were the most expensive.

Under the hub-and-spoke system, are the only <u>real</u> variables in cost (and calculated index results) in the hub-to-spoke (and maybe the spoke-to-spoke) routes? In other words, are there relatively fixed costs for hub-to-hub routes?

Hub-to-hub fares (and the calculated index of fare cost per mile travelled), like all fares in the other categories, are obviously going to vary within each category directly as a function of the distance of the route between city-pairs traveled. So, because hub-to-hub fare costs are no more fixed than any other fares, the cost variables in the hub-and-spoke fares will include distance traveled and a host of factors (such as equipment, specific competitive city-pairs, labor, etc.) that are beyond

the scope of this investigation.

What insights do the Hub Flag designations provide to verify the hypotheses?

For hub-to-hub routes, sorting these city-pair fare records by the Hub Flags resulted in the summary displayed in Appendix S. Two calculated mean values provide a partial answer to the question. The ranking of AVG_$/MEAN shows that the highest average fare ($638) occurred in two hub cities (PDX Portland, Oregon and SEA Seattle), with FR1 code 'c' (one major carrier hub and one large national carrier hub at site). Per Appendix R, the AVG_$/MEAN for all hub-to-hub routes was $501; the overall industry was $532. The lowest ranking was $429 (STL St. Louis, with FR1 code "i" - single large national carrier hub at site). The point is, dollars alone do not provide much insight. Looking at the calculated index results in Appendix S, the AVG_NDX/MEAN top ranking was $.78 (DCA and IAD Washington D.C.), with FR1 code "b" (two or more major hubs within 50 miles). Sounds like a potentially intense competitive market (United Airlines and Northwest Airlines). One would expect just the opposite, or at least a lower fare cost per mile than the top ranking that resulted.

Continuing on, the next highest ranking was $.74 per mile. Look at the

results! Twelve cities that had been coded as "h" (where a single major carrier has a hub at each site) and five of these were coded as FR2 "F" (fortress hubs) by Barbareck. This was a closer correlation and a closer expectation for potentially dominant market share that one would expect at these hubs. The next highest was Atlanta, also designated as a fortress hub, so in line with expectations. The lowest values at $.42 were Los Angeles (LAX) and Phoenix (PHX), both designated by Barbareck as "leading competitive" hubs. Hub-to-spoke analysis in Appendix T shows top ranking to code "h" (having a single major carrier hub at a site), seven cities at $.65 per mile, tied with Denver (DEN), a leading competitive hub according to Barbarack. Atlanta and St. Louis rank next (both fortress hubs), all the way to Phoenix and Los Angeles (leading competitive hubs). So it appears that the results of the study - indexed fares, not dollars - correlate well with Barbareck's scheme, and moderately well with the FR1 scheme of the author.

Is there any correlation of dollar and index findings (low and high fares) with airport arrival and departure volumes?

Appendix B displays the arrival and departure volumes for the airports that were selected for this study. Atlanta is the busiest U.S. domestic airport.
In Appendix T "Hub-to-Spokes: Sorted by Hub Flags", Atlanta ranked second highest in calculated average fare per mile travelled. In Appendix S "Hub-to-Hubs: Sorted

by Hub Flags", Atlanta was fourth highest. Both values were higher than the overall industry AVG_NDX mean, so there was reasonably good correlation. Second busiest airport is O'Hare/Chicago (ORD). The Appendix T and Appendix S AVG_NDX means were higher than the mean for all hub-to-hub routes, but lower than the mean for hub-to-spokes. Correlation was not as close in this example. Appendix B includes the daily volumes for the selected spoke cities, but no conclusions on airport profiles for spoke cities were developed to satisfy the purposes of this study. Airport profiles is one recommended future study. The answer to this question is that it is not possible to draw high confidence conclusions on the correlation of volumes as a result of this study.

Similarities and Differences to the Work of Others

The findings of this study seem to suggest that the first hypothesis is true. Hub-to-hub airfares (when indexed as fare cost per mile traveled) are higher than both overall industry averages and fares of other categories. Appendix E shows the results of a random sample of six spoke airport sites selected to validate the study findings. The two key data fields are AVG_$/MEAN and AVG_NDX/MEAN. Hub-to-spoke results for this sample were higher than the calculated results for the spoke-to-spoke routes, thereby validating the study findings.

Morrison and Winston (1990) stated that as an airport becomes more concentrated, fares increase, a problem most serious when one of the airports is a carrier's hub. The findings of this study show that the fares in the industry today were highest in hub-originated flights. Borenstein (1989) stated that dominance of major airports by one or two carriers, in many cases the result of hub formation, appears to result in higher fares for consumers who want to fly to or from these airports. The findings of this study concur with Borenstein. Barbareck (1992), however, cites a recent study that indicates that there is no premium in airfares for travel out of "fortress" hubs. Particularly for fortress hubs, the findings of this study suggest that this is not always true. Appendices Q and R show calculated average fare index results that were at times significantly higher, and at times significantly lower than the industry average index. Berry (1990) observed that airlines gain many advantages from a large presence at an airport, including control over airport operations, frequent flyer plans, and travel agent commission schedules. The net effect is enhanced market power enabling restrictions on output (capacity) and increased prices. The findings of this study show that airfares in hub airports were at premium prices when compared to industry averages.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

The Problem

Deregulation of the U.S. airline industry has enabled competition of carriers, routes, fares, slots, gates and related aspects. Carriers that have been successful in deregulation have created dominance in the market, including dominance at specific airports designated as hubs. Have the fares charged for flights from hubs increased at a rate above industry averages, resulting in higher than average fares for flights originating from and through hub airports?

The Hypotheses

The hypotheses that were tested in this investigation were:

1. Whether airfares for flights originating <u>from</u> domestic hub airports were higher than average industry airfares.
2. Whether airfares for flights routed <u>through</u> domestic hub airports were also higher.

The null hypotheses for this investigation is that domestic airfares were not higher for flights originating from, or routed through, the domestic U.S. hub-and-spoke airline passenger system.

Methodology

Descriptive research was used from the present perspective. A convenience sample was defined consisting of capturing and analyzing all one-way airfares published in the SABRE computerized reservation system. The sample consisted of approximately fifteen hundred city-pair (origin-destination) fares representing the thirty-five designated "hub" airports for all U.S. major and large national airlines, and twenty randomly selected "spoke" airports. The routings were categorized and additional indices and coding schemes were devised for analytical purposes.

Summarization of Findings

The results of this investigation that are submitted as findings for these hypotheses are summarized in Appendix R.

The calculated average airfares, measured in dollars:

a. For the hub-to-hub routes sampled: lowest ($501).

b. For the hub-to-spoke routes sampled: $536.

c. For the spoke-to-spoke routes sampled: highest ($560).

d. For the overall routes sampled: $532.

The results of calculated indices of average fare (in dollars) per mile traveled, for the above sampled routes:

a. For the hub-to-hub routes sampled: highest ($.65 per mile).

b. For the hub-to-spoke routes sampled: $.58 per mile.

c. For the spoke-to-spoke routes sampled: $.58 per mile.

d. For the overall routes sampled: $.60 per mile.

Further, it was found that the lowest average fare cost per mile traveled occurs in the spoke-to-spoke short-haul (under 500 miles routes). The highest average fare cost per mile traveled occurs in the hub-to-hub short-haul routes.

Problems Which Were Identified in the Study

Point-to-point miles that were posted (either in the Official Airline Guide or in computerized reservation systems) were inaccurate, in that the actual flight routing was variable with carrier and scheduled flight. Actual routing from spoke origin to spoke destination was most likely via an intermediate hub or hubs anyway. As evidence of the infrequency of scheduled nonstop or direct flights, the reader is invited to scan any spoke-to-spoke Fare Shopper printouts (similar to that shown in Appendix F), or consult Official Airline Guide reference manuals. The effect of this problem was rationalized to be minimal, as each city-pair distance (however variable in actuality) was dollarized; the focus of this study was on airfare dollars. The reader should note that the calculated indices of airfare cost per mile was based on these published distances.

Limitations of the Study

Design Limitations

Difficulties in tracking airfare continuity due to major industry restructuring led to the design of a "snapshot" (convenience sample) approach, as opposed to a trend tracking approach.

Sampling Limitations

This study was limited to selected sample hub and spoke city-pair and fare combinations. This was necessary due to the sheer numbers of routes and fares currently in the domestic airline industry.

Instrumentation Limitations

This study was based on published fares only. This study did not reflect any unpublished airfares (e.g. resulting from corporate volume-based discount negotiations with carriers).

Data Analysis Limitations

Analysis was based on sample data captured as of the specified date. Analysis was based on the author's personal background, research and insights without privy to industry marketing factors at work in the industry, which may be the primary determinants of airfares.

Generalization of Findings

Industry Education

The findings of this study are differentiated from other similar investigations in that the results are based on analysis of current fares. The findings provide up-to-date insights on how the new industry fare re-structuring has changed basic hub-and-spoke airfares.

Consumer Education

As useful travel tips, there is value in a consumer awareness of airline passenger industry averages, and possibly of the low and high indices for a known or approximate origin-to-destination distance. The indices of low, high and average fare cost per mile traveled can aid the flying public as a bargaining tool for calculating the high and low airfares, and negotiating lower fares. One similar current example of consumer awareness of lowest airfares is shown in Appendix X. These weekly fares are verifiable via SABRE Fare Shopper inquiries, as used in the methodology for this study.

Recommendations

Further studies should be undertaken as warranted to dispel any doubts or uncertainties of seasonality, and potential "one-time" flukes (such as summer promotion fares) that may exist. Future investigations are easily executed using a similar methodology and building on the Data Recording spreadsheet structure that

was implemented in this study. Some suggestions for future studies would include the following areas:

1. Composite Analysis of All Sample Data

This composite would merge the three sets of captured fare records to enable further analysis and insights, including scrutiny of specific city-pair routes, specific airport fares, etc. A sample in shown in Appendix Q.

2. Analysis of Captured Airfare Data by Carrier.

Appendix J shows the original Data Recording model which showed this functionality with a limited sample of city-pair routes. Encoding the available Fare Shopper data into this PROTO model very rapidly enables analysis by carrier (e.g. to identify low cost leaders, by city-pair). Based on the findings of this study, a number of analyses are possible (e.g. speculation could be made on the prospects for carriers that are currently in Chapter 11, based on analysis of fares, city-pair markets, etc.).

3. International Air Costs.

Using the same approach, worldwide airfares can be captured and worldwide travel costs computed.

4. U.S./Worldwide Passenger Rail Costs.

Comparative pricing is easily enabled by capturing passenger rail fares using

the same approach.

5. U.S. Motorcoach Costs.

Comparative pricing of passenger motorcoach travel is possible using the same approach.

6. U.S. Automobile Costs.

Other sources (e. g. American Automobile Association) do this now. These costs could easily be added to the Data Recording model to build a U.S. and/or Worldwide Travel Cost Index.

7. What are the Classes of Service for lowest published fares?

Merely adding this data element to the Data Recording model from captured Fare Shopper data will provide the answer.

The value of this and future studies lie in the methodology designed to obtain the fare data, and in the utility and power of the tools used and developed for the phases of data gathering, data recording and data analysis.

The benefits of this study lie in the ability to generalize the study findings - in academic and travel industry environments, and ultimately in the marketplace of the end consumer, the traveler.

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Appendix A

Definitions of Terms

AVG NDX: Average index. Low index value added to high index value, then divided by 2.

AVG$: Average dollar fare. Low $ added to High $, and divided by two.

Booking Code ("class"): The code which appears in the airline itinerary and on the passenger ticket (e.g. F is First Class, Y is Coach).

Connection (Connecting flight): Involves two or more flight segments required to get the passenger from the origin point to the final destination. Each connecting flight is a leg on a routing.

Contention Hubs: Designated hub airport sites that lie within fifty miles of geographic proximity to another hub airport.

CPAs: The number of city-pair routings.

Direct flight: A flight that proceeds directly to the final destination without

any connecting flights. A direct flight may be nonstop, or it may make one or more stops, but it does not require the passenger to change planes.

Economy fare: On U.S. airlines, a level below coach.

Fare Basis: Refers to a particular price category at which passengers are charged for air travel.

Fortress Hubs: Any city where 70% or more of the seats are concentrated on one carrier.

FR: Origin airport ("From").

FR1: A hub flag. From hub flag number 1. See Appendix C.

FR2: A hub flag. From hub flag number 2. Based on Barbareck scheme. See Appendix C.

Gate: The physical assets of the airport (i.e. the building and jetways).

HNDX: High Index. Highest dollars or miles for a city-pair.

High Range: Maximum value.

High $: Highest one-way fare for a city-pair.

Hubs: Cities or strategically selected airport sites in which the airline operates a major air routing connection site.

Hub Flags: See FR1 and FR2 entries.

Interline connections: Different carriers.

Joint Fares: A thoroughfare for a trip involving more than one carrier. An interline agreement is a contract between two carriers in which both parties agree to accept tickets issued by the other airline, forward luggage, and participate in joint fares.

Large National Airline: Annual revenues of $75 million to $1 billion; currently U.S. domestic airlines consists of six carriers; aggregate revenues represent 10% of total domestic industry revenues. For this study, this term will refer to five carriers, specifically Trans World Airlines, Continental, America West Airlines, Alaska Airlines and Southwest Airlines.

Large Regional Airline: Annual revenues of $10 to 75 million; currently, U.S. domestic airline industry consists of 10 to 12 airlines; aggregate represents 1% of total domestic industry revenues.

LNDX: Low Index. Lowest dollars or miles for a city-pair.

Load Factor: The percentage of seats occupied by paying passengers.

Local fare: A fare that applies to transportation over the routing of a single carrier as published in the local fares tariff.

Low Range: Minimum value.

Low $: Lowest one-way fare for a city-pair.

Major Airline: An airline with annual revenues of more than $1 billion; currently consists of 9 domestic airlines; aggregate revenues represent 88% of total industry domestic revenues. For purposes of this study, this term will refer to the top five domestic airlines, specifically American Airlines, Delta Air Lines, United Airlines, USAir and Northwest Airlines.

Mean: Average value.

Miles: Point-to-point miles between origin and destination.

Mini-hubs Airport sites that have been designated by an airline to be an important connecting site, but where a dominant share of air traffic currently exists (e.g. USAir at Baltimore; Delta at Boston, Los Angeles, Portland and Orlando).

Nonstop flight: A flight that does not make any stops between the origin and the destination in a segment.

On-line connection: Same carrier on connecting segments.

Point-to-point fare: Basic transportation rate from one city to another.

Promotional fare: Lower than normal fare offered by a carrier to promote travel during off-season or slack periods.

Revenue passenger mile: One paying passenger flown one mile.

Routing: The collective points between the origin and destination.

Small Regional Airline: Annual revenues of under $10 million; aggregate represents 1% of total domestic industry revenues.

Slot: The right to have a plane take off or land at an airport during a certain time period.

Tariff: An official publication listing the prices and fares charged for air transportation of passengers or cargo. Airline tariffs are published by the Airline Tariff Publishing Company, for reference by travel agents.

Thoroughfare: On-line fare from point of origin via one or more connecting points on same carrier's routing.

TO: Destination airport.

TO1: A hub flag. To hub flag number 1. See Appendix C.

TO2: A hub flag. To hub flag number 2. Based on a scheme by Barbareck. See Appendix C.

Appendix B

Daily Airport Arrival and Departure Volumes for Selected Hub-and-Spoke Cities

City	Volume
Atlanta, GA	2200
Baltimore, MD	650
Boston, MA	1160
Charlotte, NC	480
Chicago, IL (O'Hare)	2100
Chicago, IL (Midway)	200
Cincinnati, OH	750
Cleveland, OH	300
Dallas, TX (Love)	114
Dallas/Ft Worth, TX	2000
Dayton, OH	225
Denver, CO	1100
Detroit, MI	1000
Houston, TX	1000
Indianapolis, IN	350
Las Vegas, NV	555
Los Angeles, CA	1400
Memphis, TN	500
Miami, FL	1000
Minneapolis-St.Paul, MN	926
Nashville, TN	590
New York, NY (JFK)	Data Not Available
Newark, NJ	300
Orlando, FL	800
Philadelphia, PA	1500
Phoenix, AZ	1500
Pittsburgh, PA	1055
Portland, OR	520
Raleigh-Durham, NC	250
Salt Lake City, UT	556

City	Volume
San Francisco, CA	1350
San Jose, CA	425
Seattle	1075
St. Louis	1400
Washington, DC (Dulles)	605
Washington, DC (National)	1000
Albuquerque, NM	200
Billings, MT	40
Bismarck,ND	15
Boise, ID	180
Charleston, SC	45
Casper, WY	16
Charleston, WV	70
Jackson, MS	70
Kansas City, MO	200
New Orleans, LA	240
Omaha, NB	133
Portland, ME	70
Reno, NV	140
Rochester, NY	200
San Antonio, TX	145
San Diego	400
Spokane, WA	200
Tampa, FL	250
Knoxville, TN	130
Amarillo, TX	Data Not Available

Source: Successful Meetings Source Book 1992.

HUBS.WK1
As of 7-28-92

Appendix C

US AIRLINES - DOMESTIC HUBS

+ Bankrupt, still flying

Key		Hub Cities		AmAir AA	Delta DL	United UA	USAir US	Nrthwst NW	Contl CO+	Am West AW+	Alaska AS	TWA TW+	Southwst WN
				|-----MAJORS				-----|	|-----LARGE NATIONALS			-----|
g	F	Atlanta, GA	ATL		*				*			*	
k		Baltimore, MD	BWI				■						
a	L	Boston, MA	BOS		■			*					
h		Charlotte, NC	CLT				*						
a	L	Chicago, IL/O'Hare	ORD	*		*							
h		Cincinnati, OH	CVG		*								
i		Cleveland, OH	CLE						*				
i		Columbus, OH	CMH							*			
j		Dallas, TX Love	DAL										*
f	L	Dallas-Ft Worth, TX	DFW	*	*								
h		Dayton, OH	DAY				*						
c	L	Denver, CO	DEN			*			*				
h	F	Detroit, MI	DTW					*					
d	F	Houston, TX	IAH						*				*
h		Indianapolis, IN	IND				*						
i		Las Vegas, NV	LAS							*			
e	L	Los Angeles, CA	LAX		■	*			*				
h		Memphis, TN	MEM					*					
h		Miami, FL	MIA	*									
h	F	Minneapolis, MN	MSP					*					
h		Nashville, TN	BNA	*									
j	L	New York/Kennedy	JFK									*	
k		Newark, NJ	EWR						*				
h		Orlando, FL	MCO		■								
h	F	Philadelphia, PA	PHL				*						
d	L	Phoenix, AZ	PHX							*			*
h	F	Pittsburgh, PA	PIT				*						
c		Portland, OR	PDX		■						*		
h	F	Raleigh-Durham, NC	RDU	*									
i		Salt Lake City, UT	SLC		*								
k		San Francisco, CA	SFO			*							
k		San Jose, CA	SJC	*									
c		Seattle, WA	SEA					*			*		
i	F	St Louis, MO	STL									*	
b		Wash DC Dulles	IAD			*							
b		Wash DC National	DCA					*					
		Total # Cities:	36										

Key (Category selection in CAPS):
a = 2 Majors' HUBS at site
b = 2 or more major HUBS within 50 miles.
c = 1 major HUB at site and 1 large national HUB at site.
d = 2 large national HUBS at site.
e = 2 majors' HUBS and 1 large national HUB at site.
f = 2 majors' HUBS at site and 1 large national HUB within 50 miles.
g = 1 major HUB and 2 large nationals' HUBS at site.
h = Single major HUB at site.
i = Single large national carrier HUB at site.
j = Single large national carrier HUB at site with major carrier HUB within 50 miles.
k = Single major HUB at site and other major's HUB within 50 miles.
■ = mini-hub
F = Fortress hub (one carrier >70% of seats).
L = Leading competitive hub

Appendix D

Selected Spoke Cities

Selection of the airport sites to be the spoke cities for the thesis study was arbitrary. Criteria included:

1. A city that is not a designated hub (at least for the five major and 5 large national carriers as defined in this study).

2. Population is irrelevant; must be an airport with scheduled passenger service (i.e. a three-digit city code) within 20 miles of the selected city.

3. Select via a "fill the (U.S. map) holes" strategy.

Twenty cities were selected. Candidate cities were selected from the five designated regions on the U.S. map.

Northeast	PWM	Portland, ME
	ROC	Rochester, NY
	CRW	Charleston, WV
Southeast	TPA	Tampa, FL
	TYS	Knoxville, TN
Southeast	JAN	Jackson, MS
	CHS	Charleston, SC

Central	MSY	New Orleans, LA
	SAT	San Antonio, TX
	MCI	Kansas City, MO
	BIS	Bismarck, ND
	OMA	Omaha, NE
	AMA	Amarillo, TX
Northwest	BIL	Billings, MT
	BOI	Boise, ID
	GEG	Spokane, WA
	CPR	Casper, WY
Southwest	SAN	San Diego, CA
	RNO	Reno, NV
	ABQ	Albuquerque, NM

PROTO6RM Appendix E
AS OF 8-13-92

Random Sample to Validate Findings

Random Spoke sites selected:

PAH	Paducah. KY
SGF	Springfield, MO
FAR	Fargo, ND
FSD	Sioux Falls, SD
ALB	Albany, NY
AVP	Scranton-Wilkes Barre, PA

==

Overall Summary:

	LOW$	HI$	MI	LNDX	HNDX	AVG $	AVG NDX
LOrange	$92	$84	124	0.26	0.19	$106	0.28
HIrange	$1,302	$550	900	1.60	3.62	$826	2.42
Mean	$307	$234	419	0.65	0.76	$270	0.71
CPAs	26						

==

Spoke-to-Spokes:

CPA FR TO	LOW$	HIGH $	MILES	LOW NDX	HIGH NDX	AVG $	AVG NDX
PAHSGF	170	480	265	0.64	1.81	325	1.23
SGFFAR	1090	240	680	1.60	0.35	665	0.98
FARBIS	189	84	420	0.45	0.20	137	0.33
FSDOMA	162	210	400	0.40	0.53	186	0.47
ALBROC	198	180	360	0.55	0.50	189	0.53
AVPROC	157	130	480	0.32	0.27	144	0.30

Summary: Spoke to Spokes:

	LOW$	HI$	MI	LNDX	HNDX	AVG $	AVG NDX
LOrange	$157	$84	265	0.32	0.20	$137	0.30
HIrange	$1,090	$480	680	1.60	1.81	$665	1.23
Mode							
Mean	$328	$221	434	0.66	0.61	$274	0.64
Median							
CPAs	6						

==

Hub-to-Spokes:

CPA FR TO	LOW$	HIGH $	MILES	LOW NDX	HIGH NDX	AVG $	AVG NDX
ALBJFK	144	105	430	0.33	0.24	125	0.29
ALBBOS	145	130	340	0.42	0.38	138	0.40

ALBPHL	206	109	414	0.49	0.26	158	0.38
AVPEWR	92	120	350	0.26	0.34	106	0.30
AVPJFK	112	120	420	0.26	0.28	116	0.28
AVPPHL	102	109	280	0.36	0.38	106	0.38
PAHBNA	150	450	124	1.20	3.62	300	2.42
PAHORD	200	510	344	0.58	1.48	355	1.03
PAHMEM	107	268	157	0.68	1.70	188	1.19
PAHSTL	130	410	151	0.86	2.71	270	1.79
PAHIND	210	550	224	0.93	2.45	380	1.70
PAHCVG	200	530	255	0.78	2.07	365	1.43
SGFMCI	164	150	540	0.30	0.27	157	0.29
SGFSTL	196	160	380	0.51	0.42	178	0.47
SGFMEM	243	220	500	0.48	0.44	232	0.46
SGFDFW	363	104	540	0.67	0.19	234	0.43
FARMSP	223	99	390	0.57	0.25	161	0.41
FARPHX	1225	340	900	1.36	0.37	783	0.87
FSDMSP	196	99	480	0.40	0.20	148	0.31
FSDBOS	1302	350	870	1.49	0.40	826	0.95

Summary: Hub-to-Spokes:						AVG	AVG
	LOW$	HI$	MI	LNDX	HNDX	$	NDX
LOrange	$92	$99	124	0.26	0.19	$106	0.28
HIrange	$1,302	$550	900	1.50	3.63	$826	2.42
Mode							
Mean	$286	$247	404	0.65	0.93	$266	0.79
Median							
CPAs	20						

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Appendix F
SABRE Fare Shopper Display

FS*APIT
LGAPIT 31JUL92 USD
AA 3/ 0/ 7 CO 0/ 0/ 3 TW 5/ 0/ 0 UA 0/ 0/ 6
US 11/ 0/19
PUBLISHED SELLING CURRENCY USD

	F/B	O/W	R/T	CXRS	EFF	EXP	TKT
1	VEOJFKNR		90.00	TW	-	-	-
2	VE14NR9J		100.00	US	-	-	-
3	QE14IP		100.00	CO	-	-	-
4	KE14N		100.00	TW	-	-	-
5	KE14NR		105.00	AA	-	-	-
6	HE7NR		145.00	AA	-	-	-
7	QE7N		145.00	TW	-	-	-
8	VAP21NR	89.00	178.00	TW	-	-	-
9	MFS	89.00	178.00	TW	30JL	-	30JL
10	QE14NR		180.00	UA	-	-	-
11	KE14NR		180.00	US	-	-	-
12	MFS	99.00	198.00	TW	30JL	-	-
13	M9JFK	99.00	198.00	US	-	-	-
14	KEOJFKNR		200.00	TW	-	-	-
15	VE7IP		210.00	CO	-	-	-
16	V25	105.00	210.00	CO	-	-	-
17	Y26	105.00	210.00	AA	-	-	-
18	QJFK	109.00	218.00	TW	-	-	-
19	HE7NR		220.00	UA US	-	-	-
20	YR25		240.00	TW	-	-	-
21	Y25	120.00	240.00	TW	-	-	-
22	C25	130.00	260.00	TW	-	-	-
23	FR25		290.00	TW	-	-	-
24	F25	145.00	290.00	TW	-	-	-
25	Y	260.00	520.00	TW	-	-	-
26	A25	270.00	540.00	CO	-	-	-
27	YONE25	270.00	540.00	CO	-	-	-
28	C	270.00	540.00	TW	-	-	-
29	H25	270.00	540.00	CO	-	-	-
30	Y8	290.00	580.00	US	-	-	-
31	YUA	290.00	580.00	UA	-	-	-
32	Y	300.00	600.00	CO	-	-	-
33	F	310.00	620.00	TW	-	-	-
34	Y	316.00	632.00	UA US	-	-	-
35	F8	340.00	680.00	US	-	-	-
36	FUA	340.00	680.00	UA	-	-	-
37	F	400.00	800.00	CO	-	-	-
38	F	470.00	940.00	UA US	-	-	-

END OF DISPLAY

Z330.Z3306AZX 1642/30JUL92 17F306

Appendix G

Functions/SABRE Commands/References

The following list represents the methodology of capturing SABRE fare data for this study:

References:

Capwell, Lee and Resnick, SABRE Reservations, Basic and Advanced Training, Southwestern Publishing, Cincinnati, 1989.

SABRE Computer Automation Training manual (unpublished).

Signin: SI*3333$4TRAVL (Note: '$' is the end-item key).

Signout: SO*

Printer: Designate: PTR/17F32A

Undesignate: PTR/END

Fare quotations: FQ......(date)-.. FQROCORD19JUL-UA

Historical Fare Quotation:

FQ FQ19JUN92ROCORD20JUL92-DL

Fare Shopper Quotes:

To compare various airlines for a certain market.

FSROCMIA17MAY-UA

Rule Display:

for FQ: RDn RD*n

for FS: RDDFWMIA1MAYK26-AA (Add *M for menu).

Fare Breakdowns:

W/225 (Returns base fare,tax)

W/B225 (Returns total tax)

Functions Handbook:

F*FOX f*n

Connecting Point: To view all pre-programmed connecting points.

T*CP-ROCBOS

Direct Ref System:

Y/ See notes

N*/SYSHOT14

Inquiries:

W/-CC	City code	?? W/-CY ?
W/-AL	Airline code	
W/*	Unfamiliar code	
W/-AT	Airport code	

Point-to-point miles:

W/-AT...#AT...	W/-ATROC#ATLAX
W/-CY...#CY...	W/-CYBUFFALO,NY#ATROC

Bargain Finder:

Need itinerary first: e.g. 0US337F14JULROCBOSNN1

WPNCS Search

City-pair Availability:

1ddmmmROCLAX plus optionsl $FQ for fare quotes

Schedules:

S09MARROCLAX No seat availability display

To find Friday updates:

N*/ARC

STARS:

N*/VL Universal STARS

Appendix H

	ALBUQUERQUE, NM	ATLANTA, GA	AUSTIN, TX	BALTIMORE, MD	BOSTON, MA	CALGARY, ALB	CHARLOTTE, NC	CHICAGO, IL	CINCINNATI, OH	CLEVELAND, OH	DALLAS/FT. WORTH, TX	DAYTON, OH	DENVER, CO	DETROIT, MI	FT. LAUDERDALE, FL	HARTFORD, CT	HONOLULU, HI	HOUSTON, TX	INDIANAPOLIS, IN	KANSAS CITY, MO	LAS VEGAS, NV	LOS ANGELES, CA	MEMPHIS, TN	MIAMI, FL	MILWAUKEE, WI
ALBUQUERQUE, NM		1280	612	1668	1971	1213	1449	1121	1240	1414	574	1271	340	1355	1686	1887	3230	751	1161	716	488	677	948	1689	1152
ATLANTA, GA	1280		811	578	947	1975	228	599	375	561	725	434	1207	605	582	860	4495	691	434	693	1744	1943	332	596	671
AUSTIN, TX	612	811		1342	1694	1669	1039	973	958	1184	183	1020	770	1168	1107	1613	3770	148	938	644	1100	1239	556	1107	1035
BALTIMORE, MD	1668	578	1342		369	2001	362	611	429	312	1211	406	1500	404	929	283	4849	1240	517	966	2102	2323	786	949	640
BOSTON, MA	1971	947	1694	369		2117	728	858	751	557	1556	708	1763	622	1241	92	5088	1602	819	1255	2376	2604	1138	1260	859
CALGARY, ALB	1213	1975	1669	2001	2117		1983	1393	1648	1690	1527	1623	899	1599	2557	2044	3124	1759	1561	1441	1035	1197	1767	2570	1364
CHARLOTTE, NC	1449	228	1039	362	728	1983		590	336	435	930	371	1346	506	634	644	4674	916	429	809	1926	2121	512	652	654
CHICAGO, IL	1121	599	973	611	858	1393	590		255	311	801	230	907	237	1175	774	4246	935	168	408	1518	1746	487	1190	75
CINCINNATI, OH	1240	375	958	429	751	1648	336	255		227	808	64	1079	240	935	660	4428	879	99	540	1676	1895	402	951	318
CLEVELAND, OH	1414	561	1184	312	557	1690	435	311	227		1023	168	1215	94	1069	470	4557	1105	266	698	1825	2051	628	1086	331
DALLAS/FT. WORTH, TX	574	725	183	1211	1556	1527	930	801	808	1023		857	650	995	1112	1465	3784	233	759	461	1061	1240	427	1115	852
DAYTON, OH	1271	434	1020	406	708	1623	371	230	64	168	857		1095	176	985	620	4447	942	111	563	1698	1919	464	1001	284
DENVER, CO	340	1207	770	1500	1763	899	1346	907	1079	1215	650	1095		1142	1710	1680	3349	876	987	542	614	845	879	1716	907
DETROIT, MI	1355	605	1168	404	622	1599	506	237	240	94	995	176	1142		1137	539	4480	1096	241	639	1754	1982	621	1154	244
FT. LAUDERDALE, FL	1686	582	1107	929	1241	2557	634	1175	935	1069	1112	985	1710	1137		1177	4876	959	1009	1246	2173	2343	853	20	1246
HARTFORD, CT	1887	860	1613	283	92	2044	644	774	660	470	1465	620	1680	539	1177		5015	1523	730	1168	2292	2519	1057	1197	783
HONOLULU, HI	3230	4495	3770	4849	5088	3124	4674	4246	4428	4557	3784	4447	3349	4480	4876	5015		3917	4336	3891	2759	2553	4169	4876	4238
HOUSTON, TX	751	691	148	1240	1602	1759	916	935	879	1105	233	942	876	1096	959	1523	3917		855	657	1230	1385	478	959	997
INDIANAPOLIS, IN	1161	434	938	517	819	1561	429	168	99	266	759	111	987	241	1009	730	4336	855		452	1587	1809	382	1024	238
KANSAS CITY, MO	716	693	644	966	1255	1441	809	408	540	698	461	563	542	639	1246	1168	3891	657	452		1136	1358	393	1253	436
LAS VEGAS, NV	488	1744	1100	2102	2376	1035	1926	1518	1676	1825	1061	1698	614	1754	2173	2292	2759	1230	1587	1136		234	1414	2176	1521
LOS ANGELES, CA	677	1943	1239	2323	2604	1197	2121	1746	1895	2051	1240	1919	845	1982	2343	2519	2553	1385	1809	1358	234		1616	2341	1750
MEMPHIS, TN	948	332	556	786	1138	1767	512	487	402	628	427	464	879	621	853	1057	4169	478	382	393	1414	1616		862	557
MIAMI, FL	1689	596	1107	949	1260	2570	652	1190	951	1086	1115	1001	1716	1154	20	1197	4876	959	1024	1253	2176	2341	862		1261
MILWAUKEE, WI	1152	671	1035	640	859	1364	654	75	318	331	852	284	907	244	1246	783	4238	997	238	436	1521	1750	557	1261	
MINNEAPOLIS, MN	1033	908	1037	934	1122	1067	930	344	596	623	854	574	693	532	1490	1048	3967	1048	502	394	1297	1530	700	1503	297
MONTREAL, QUE	1858	999	1671	478	265	1858	829	737	712	487	1508	655	1642	515	1393	260	4956	1591	750	1146	2254	2459	1114	1413	735
NASHVILLE, TN	1120	215	756	587	942	1788	329	402	230	454	626	293	1052	467	795	866	4346	663	250	492	1608	1793	200	808	476
NEW ORLEANS, LA	1021	419	458	993	1362	1970	645	831	698	919	447	761	1071	934	667	1275	4221	310	718	742	1508	1676	349	669	906
NEW YORK, NY	1814	756	1511	179	191	2028	538	721	580	411	1378	545	1626	491	1073	108	4966	1415	655	1103	2234	2459	956	1092	735
ONTARIO, CA	652	1897	1192	2280	2563	1236	2094	1705	1852	2016	1193	1883	806	1942	2295	2471	2601	1339	1773	1337	201	48	1568	2295	1713
ORANGE COUNTY, CA	665	1921	1196	2303	2588	2164	2107	1730	1875	2041	1208	1906	832	1967	2300	2504	2510	1352	1803	1365	229	43	1597	2308	1739
ORLANDO, FL	1548	397	996	782	1116	2371	462	990	750	893	974	802	1547	957	187	1045	4758	848	823	1067	2035	2212	679	201	1060
PHILADELPHIA, PA	1744	667	1430	91	280	2019	449	668	507	360	1297	477	1567	447	997	195	4913	1330	587	1037	2173	2395	874	1016	689
PHOENIX, AZ	325	1581	865	1990	2291	1222	1767	1439	1562	1734	869	1593	583	1673	1970	2204	2918	1012	1482	1036	257	374	1257	1968	1453
PITTSBURGH, PA	1483	528	1208	210	495	1792	368	403	257	105	1063	215	1300	198	998	405	4646	1125	325	773	1906	2130	652	1016	430
PORTLAND, OR	1123	2169	1735	2356	2545	567	2280	1745	1971	2046	1619	1975	983	1954	2693	2471	2602	1834	1913	1525	787	825	1862	2699	1720
RALEIGH/DURHAM, NC	1562	356	1167	257	613	2030	130	637	391	419	1055	453	1447	505	683	532	4788	1046	490	905	2036	2235	634	702	709
ST. LOUIS, MO	932	485	717	736	1045	1516	575	257	308	492	548	339	780	451	1058	955	4123	679	229	238	1369	1588	256	1070	318
SALT LAKE CITY, UT	493	1587	1105	1866	2100	720	1725	1255	1447	1566	993	1475	380	1492	2090	2029	2996	1204	1367	916	365	584	1259	2096	1263
SAN ANTONIO, TX	609	873	71	1409	1764	1695	1101	1042	1028	1254	248	1090	796	1238	1150	1682	3742	191	1007	708	1071	1212	626	1150	1100
SAN DIEGO, CA	628	1888	1159	2290	2584	1298	2074	1727	1862	2028	1174	1893	839	1962	2265	2498	2611	1306	1782	1330	263	119	1564	2265	1746
SAN FRANCISCO, CA	896	2135	1508	2453	2698	1017	2292	1851	2032	2161	1468	2047	954	2083	2580	2622	2397	1641	1940	1495	412	330	1803	2582	1841
SAN JOSE, CA	871	2127	1483	2434	2684	1050	2259	1833	2013	2144	1441	2029	934	2070	2553	2607	5294	1612	1921	1476	383	299	1797	2556	1841
SEATTLE, WA	1182	2178	1787	2329	2489	510	2275	1726	1960	2018	1663	1956	1017	1927	2719	2428	2678	1883	1894	1485	863	946	1866	2728	1690
TAMPA, FL	1493	408	927	848	1191	2375	512	1006	776	936	919	831	1510	994	200	1117	4696	779	841	1049	1980	2153	656	207	1078
TORONTO, ONT	1557	750	1374	346	440	1677	590	436	416	191	1200	356	1332	208	1220	367	4648	1295	442	844	1946	2174	818	1235	425
VANCOUVER, BC	1309	2305	1882	2380	2518	427	2359	1769	2024	2076	1762	1999	1112	1985	2822	2452	2706	1988	1937	1612	990	1071	1991	2828	1750
WASHINGTON, DC	1639	541	1307	37	406	1983	327	590	399	298	1176	379	1473	391	903	319	4822	1204	487	937	2073	2294	751	923	623
WEST PALM BEACH, FL	1670	546	1098	887	1200	2521	609	1137	895	1026	1096	952	1688	1095	43	1135	4867	950	973	1217	2157	2331	824	63	1210

	MINNEAPOLIS, MN	MONTREAL, QUE	NASHVILLE, TN	NEW ORLEANS, LA	NEW YORK, NY	ONTARIO, CA	ORANGE COUNTY, CA	ORLANDO, FL	PHILADELPHIA, PA	PHOENIX, AZ	PITTSBURGH, PA	PORTLAND, OR	RALEIGH/DURHAM, NC	ST. LOUIS, MO	SALT LAKE CITY, UT	SAN ANTONIO, TX	SAN DIEGO, CA	SAN FRANCISCO, CA	SAN JOSE, CA	SEATTLE, WA	TAMPA, FL	TORONTO, ONT	VANCOUVER, BC	WASHINGTON, DC	WEST PALM BEACH, FL
ALBUQUERQUE, NM	1033	1858	1120	1021	1814	652	665	1548	1744	325	1483	1123	1562	932	493	609	628	896	871	1182	1493	1557	1123	1639	1670
ATLANTA, GA	908	999	215	419	756	1897	1921	397	667	1581	528	2169	356	485	1587	873	1888	2135	2127	2178	408	750	2305	541	546
AUSTIN, TX	1037	1671	756	458	1511	1192	1196	996	1430	865	1208	1735	1167	717	1105	71	1159	1508	1483	1787	927	1374	1882	1307	1098
BALTIMORE, MD	934	478	587	993	179	2280	2303	782	91	1990	210	2356	257	736	1866	1409	2290	2453	2434	2329	848	346	2380	37	887
BOSTON, MA	1122	265	942	1362	191	2563	2588	1116	280	2291	495	2545	613	1045	2100	1764	2584	2698	2684	2489	1191	440	2518	406	1200
CALGARY, ALB	1067	1858	1788	1970	2028	1236	2164	2371	2019	1222	1792	567	2030	1516	720	1695	1298	1017	1050	510	2375	1677	427	1983	2521
CHARLOTTE, NC	930	829	329	645	538	2094	2107	462	449	1767	368	2280	130	575	1725	1101	2074	2292	2259	2275	512	590	2359	327	609
CHICAGO, IL	344	737	402	831	721	1705	1730	990	668	1439	403	1745	637	257	1255	1042	1727	1851	1833	1726	1006	436	1769	590	1137
CINCINNATI, OH	596	712	230	698	580	1852	1875	750	507	1562	257	1971	391	308	1447	1028	1862	2032	2013	1960	776	416	2024	399	895
CLEVELAND, OH	623	487	454	919	411	2016	2041	893	360	1734	105	2046	419	492	1566	1254	2028	2161	2144	2018	936	191	2076	298	1026
DALLAS/FT. WORTH, TX	854	1508	626	447	1378	1193	1208	974	1297	869	1063	1619	1055	548	993	248	1174	1468	1441	1663	919	1200	1762	1176	1096
DAYTON, OH	574	655	293	761	545	1883	1906	802	477	1593	215	1975	453	339	1475	1090	1893	2047	2029	1956	831	356	1999	379	952
DENVER, CO	693	1642	1052	1071	1626	808	832	1547	1567	583	1300	983	1447	780	380	796	839	954	934	1017	1510	1332	1112	1473	1688
DETROIT, MI	532	515	467	934	491	1942	1967	957	447	1673	198	1954	505	451	1492	1238	1962	2083	2070	1927	994	208	1985	391	1095
FT. LAUDERDALE, FL	1490	1393	795	667	1073	2259	2300	187	997	1970	998	2693	683	1058	2090	1150	2265	2580	2553	2719	200	1220	2822	903	43
HARTFORD, CT	1048	260	866	1275	108	2471	2504	1045	195	2204	405	2471	532	955	2029	1682	2498	2622	2607	2428	1117	367	2452	319	1135
HONOLULU, HI	3967	4956	4346	4221	4966	2601	2510	4758	4913	2918	4646	2602	4788	4123	2996	3742	2611	2397	2430	2678	4696	4648	2706	4822	4867
HOUSTON, TX	1048	1591	663	310	1415	1339	1352	848	1330	1012	1125	1834	1046	679	1204	191	1306	1641	1612	1883	779	1295	1988	1204	950
INDIANAPOLIS, IN	502	750	250	718	655	1773	1803	823	587	1482	325	1913	490	229	1367	1007	1782	1940	1921	1894	841	442	1937	487	973
KANSAS CITY, MO	394	1145	492	742	1103	1337	1365	1067	1037	1036	773	1525	905	238	916	708	1330	1495	1476	1485	1049	844	1612	937	1217
LAS VEGAS, NV	1297	2254	1608	1508	2234	201	229	2035	2173	257	1905	787	2036	1369	365	1071	263	412	383	863	1980	1946	990	2073	2157
LOS ANGELES, CA	1530	2459	1793	1676	2459	48	43	2212	2395	374	2130	825	2235	1588	584	1212	119	330	299	946	2153	2174	1071	2294	2331
MEMPHIS, TN	700	1114	200	349	956	1568	1597	679	874	1257	652	1862	634	256	1259	626	1564	1803	1797	1866	656	818	1991	751	824
MIAMI, FL	1503	1413	808	669	1092	2295	2308	201	1016	1968	1016	2699	702	1070	2096	1150	2265	2582	2556	2728	207	1235	2828	923	63
MILWAUKEE, WI	297	735	476	906	735	1713	1739	1060	689	1453	430	1720	709	318	1263	1100	1746	1841	1841	1690	1078	425	1750	623	1210
MINNEAPOLIS, MN		1022	695	1049	1017	1493	1520	1304	978	1270	725	1423	981	449	990	1102	1531	1586	1574	1395	1308	714	1453	918	1454
MONTREAL, QUE	1022		941	1397	338	1066	1096	1252	400	2176	483	2425	725	966	1992	1741	2464	2568	2538	2368	1309	308	2279	502	1355
NASHVILLE, TN	695	941		468	758	1769	1782	610	675	1442	462	1977	442	272	1408	822	1748	1987	1968	1978	614	644	2105	552	760
NEW ORLEANS, LA	1049	1397	468		1171	1630	1643	541	1083	1303	914	2054	775	604	1431	501	1610	1914	1888	2088	477	1110	2183	956	655
NEW YORK, NY	1017	338	758	1171		2426	2449	938	89	2136	331	2440	425	882	1975	1579	2432	2572	2554	2406	1010	352	2437	215	1031
ONTARIO, CA	1493	1066	1769	1630	2426		30	2167	2356	327	2097	840	2211	1544	559	1168	95	364	332	958	2105	2126	1085	2251	2283
ORANGE COUNTY, CA	1520	1096	1782	1643	2449	30		2182	2379	340	2120	860	2241	1567	588	1181	77	373	341	979	2120	2156	1106	2274	2298
ORLANDO, FL	1304	1252	610	541	938	2167	2182		857	1843	829	2530	528	875	1922	1039	2148	2442	2415	2545	89	1051	2659	753	150
PHILADELPHIA, PA	978	400	675	1083	89	2356	2379	857		2067	268	2401	339	812	1923	1497	2366	2516	2501	2373	927	342	2427	127	955
PHOENIX, AZ	1270	2176	1442	1303	2136	327	340	1843	2067		1806	1006	1884	1255	502	841	307	651	619	1103	1780	1875	1230	1960	1958
PITTSBURGH, PA	725	483	462	914	331	2097	2120	829	268	1806		2148	330	553	1658	1277	2102	2249	2234	2119	878	222	2172	194	955
PORTLAND, OR	1423	2425	1977	2054	2440	840	860	2530	2401	1006	2148		2362	1705	630	1717	934	550	571	130	2493	2137	251	2335	2671
RALEIGH/DURHAM, NC	981	725	442	775	425	2211	2241	528	339	1884	330	2362		667	1820	1229	2190	2399	2366	2351	592	552	2406	226	640
ST. LOUIS, MO	449	966	272	604	882	1544	1567	875	812	1255	553	1705	667		1153	787	1554	1732	1711	1706	870	659	1833	707	1024
SALT LAKE CITY, UT	990	1992	1408	1431	1975	559	588	1922	1923	502	1658	630	1820	1153		1087	627	599	584	689	1890	1688	816	1836	2068
SAN ANTONIO, TX	1102	1741	822	501	1579	1168	1181	1039	1497	841	1277	1717	1229	787	1087		1131	1483	1454	1776	970	1444	1903	1374	1141
SAN DIEGO, CA	1531	2464	1748	1610	2432	95	77	2148	2366	307	2102	934	2190	1554	627	1131		449	417	1052	2085	2163	1179	2261	2256
SAN FRANCISCO, CA	1586	2568	1987	1914	2572	364	373	2442	2516	651	2249	550	2399	1732	599	1483	449		33	679	2387	2260	800	2426	2564
SAN JOSE, CA	1574	2538	1968	1888	2554	332	341	2415	2501	619	2234	571	2366	1711	584	1454	417	33		699	2360	2266	820	2407	2531
SEATTLE, WA	1395	2368	1978	2088	2406	958	979	2545	2373	1103	2119	130	2351	1706	689	1776	1052	679	699		2522	2061	127	2312	2690
TAMPA, FL	1308	1309	614	477	1010	2105	2120	89	927	1780	878	2493	592	870	1890	970	2085	2387	2300	2522		1100	2622	818	178
TORONTO, ONT	714	308	644	1110	352	2126	2156	1051	342	1875	222	2137	552	659	1688	1444	2163	2260	2266	2061	1100		2085	355	1177
VANCOUVER, BC	1453	2279	2105	2183	2437	1085	1106	2659	2427	1230	2172	251	2406	1833	816	1903	1179	800	820	127	2622	2085		2359	2800
WASHINGTON, DC	918	502	552	956	215	2251	2274	753	127	1960	194	2335	226	707	1836	1374	2261	2426	2407	2312	818	355	2359		861
WEST PALM BEACH, FL	1454	1355	760	655	1031	2283	2298	150	955	1958	955	2671	640	1024	2068	1141	2256	2564	2531	2690	178	1177	2800	861	

EXPLANATORY NOTES

This table shows airport-to-airport mileages computed in statute miles along the shortest route operated by certificated air carriers. Mileages are based on the official mileage record of the International Air Transport Association where available.

Appendix I

As of 7-28-92 **U. S. AIRLINES - DOMESTIC HUBS**

Pin Color Cross-Reference

Pin Color	Carrier
Clear	Selected Spoke Cities (20)
MAJORS:	
Red	AA American Airlines
Yellow	DL Delta Airlines
Blue	UA United Airlines
Yellow w/red	US US Air
Green	NW Northwest Airlines
LARGE NATIONALS:	
White w/red	AS Alaska Airlines
Green w/black	WN Southwest Airlines
Yellow w/black	AW American West *
White w/green	TW TransWorld Airlines *
White	CO Continental Airlines *
	* = Bankrupt, still flying.

EXCLUDED:

A. Post de-regulation airlines:
- BE Braniff
- KW Carnival
- MG MGM Grand Air
- BF Markair
- YX Midwest Express
- XG/LY North American
- FF Tower Air

B. Bankrupt:
- ML Midway Airlines
- PA Pan American Airlines

C. Other Excluded:
- HA Hawaiian Airlines

PROTO Appendix J

AS OF 8-5-92 <u>PROTOTYPE FOR THESIS</u>

CPA		------CARRIERS ------									
FR TO	LOW$	CO	DL	US	UA	NW	AA	TW	HP	MILES	NDX
PWMROC	190	X	X	X		X				372	0.51
PWMCRW	270					X				692	0.39
PWMTPA	298					X				1276	0.23
PWMJAN	390	X	X			X				1326	0.29
PWMTYS	300					X		X		904	0.33
PWMCHS	300		X	X	X					908	0.33
PWMMSY	210							X		1445	0.14
PWMSAT	310							X		1829	0.16
PWMOMA	380		X	X	X	X		X		1311	0.28
PWMMCI	340	X	X	X	X	X		X		1298	0.26
PWMBIS	350				X	X				1494	0.23
PWMBIL	430	X	X		X	X				1867	0.23
PWMBOI	490		X		X					2274	0.21
PWMCPR	410	X			X					1809	0.22
PWMGEG	470	X				X				2267	0.20
PWMSAN	470	X	X	X	X	X		X			ERR
PWMRNO	480	X	X	X	X					2540	0.18
PWMABQ	430	X				X				2013	0.21
PWMAMA	438				X					1763	0.24
ROCCRW	200		X	X	X	X				387	0.51
ROCTPA	310							X		1078	0.28
ATLAMA	330		X				X			991	0.33
BWIAMA	365				X					1402	0.26
BOSAMA	397				X					1718	0.23
ATLBWI	170							X		578	0.29
ATLBOS	160							X		947	0.16
ATLCLT	59							X		228	0.25
ATLORD	260		X							599	0.43
ATLCVG	200	X		X	X	X	X	X		375	0.53
ATLCLE	260	X	X	X	X	X	X	X		561	0.46
ATLCMH	139							X		447	0.31
ATLDFW	260	X	X	X	X	X	X	X		725	0.35
ATLDAY	180	X		X	X	X	X	X		434	0.41
ATLDEN	330	X	X	X	X	X	X	X		1207	0.27
ATLDTW	109	X		X	X			X		605	0.18
ATLIAH	260			X	X	X	X	X		691	0.37
ATLIND	200	X			X	X	X	X		434	0.46
ATLLAS	203							X		1744	0.11
ATLLAX	239								X	1943	0.12
ATLMEM	200						X			332	0.60
ATLMIA	250		X	X		X	X			596	0.41
ATLMSP	290	X		X	X	X	X	X		908	0.31
ATLBNA	180					X	X			215	0.83
ATLLGA	189							X		756	0.25
ATLEWR	260	X	X	X	X		X	X	X	746	0.34
ATLMCO	99		X					X		397	0.24
ATLPHL	103	X								667	0.15

PROTO4 Appendix K
AS OF 8-5-92 Prototype for Thesis: PROTO4

CPA		------CARRIERS					------				
FR TO	LOW$	CO	DL	US	UA	NW	AA	TW	HP	MILES	NDX
ATLSEA	209							X		2178	0.09
ATLPDX	239								X	2169	0.11
ATLLAS	203							X		1744	0.11
ATLLAX	239								X	1943	0.12
ATLPHX	213							X		1581	0.13
PWMMSY	210							X		1445	0.14
ATLSJC	320	X	X		X	X	X	X	X	2127	0.15
ATLSLC	239								X	1587	0.15
ATLPHL	103	X								667	0.15
ATLBOS	160							X		947	0.16
PWMSAT	310							X		1829	0.16
PWMSAN	470	X	X	X	X	X		X		2622	0.17
ATLDTW	109	X		X	X			X		605	0.18
PWMRNO	480	X	X	X	X					2540	0.18
ATLDCA	109	X	X	X	X			X	X	541	0.20
ATLIAD	109	X	X	X	X			X	X	541	0.20
PWMGEG	470	X				X				2267	0.20
PWMABQ	430	X				X				2013	0.21
PWMBOI	490		X		X					2274	0.21
PWMCPR	410	X			X					1809	0.22
PWMBIL	430	X	X		X	X				1867	0.23
BOSAMA	397				X					1718	0.23
PWMTPA	298					X				1276	0.23
PWMBIS	350				X	X				1494	0.23
PWMAMA	438				X					1763	0.24
ATLMCO	99		X					X		397	0.24
ATLLGA	189							X		756	0.25
ATLCLT	59							X		228	0.25
BWIAMA	365				X					1402	0.26
PWMMCI	340	X	X	X	X	X		X		1298	0.26
ATLDEN	330	X	X	X	X	X	X	X		1207	0.27
ROCTPA	310							X		1078	0.28
PWMOMA	380		X	X	X	X		X		1311	0.28
PWMJAN	390	X	X			X				1326	0.29
ATLBWI	170							X		578	0.29
ATLSFO	259							X	X	873	0.29
ATLPIT	160							X		528	0.30
ATLCMH	139							X		447	0.31
ATLMSP	290	X		X	X	X	X	X		908	0.31
PWMCHS	300		X	X	X					908	0.33
PWMTYS	300					X		X		904	0.33
ATLAMA	330		X				X			991	0.33
ATLEWR	260	X	X	X	X		X	X	X	746	0.34
ATLDFW	260	X	X	X	X	X	X	X		725	0.35
ATLIAH	260			X	X	X	X	X		691	0.37
PWMCRW	270					X				692	0.39
ATLBNA	180					X	X			215	0.83

PROTOS Appendix L

AS OF 8-7-92 <u>Prototype for Thesis: PROTOS</u>
(Added High Fares for CPA's)

CPA FR TO	LOW$	CO	DL	US	UA	NW	AA	TW	HP	MILES	LOW NDX	HIGH $	HIGH NDX
		Low, High, Both									x	x	x
		------CARRIERS ------											
ATLAMA	330		L		H		L			991	0.33	860	0.86
ATLBNA	180					B	L			215	0.83	360	1.67
ATLBOS	160				H			B		947	0.16	670	0.70
ATLBWI	170			H				L		578	0.29	580	1.00
ATLCLE	260	L	L	L	L	L	L	B		561	0.46	630	1.12
ATLCLT	59		H	H				L		228	0.25	470	2.06
ATLCMH	139							B		447	0.31	530	1.18
ATLCVG	200	L		L	L	L	L	B		375	0.53	530	1.41
ATLDAY	180	L		L	L	L	L	B		434	0.41	530	1.22
ATLDCA	109	L	L	B	B	H		B	L	541	0.20	580	1.07
ATLDEN	330	L	B	L	L	L	L	L		1207	0.27	904	0.74
ATLDFW	260	L	L	B	L	L	L	L		725	0.35	680	0.93
ATLEWR	260	L	L	L	L		B	L	L	746	0.34	710	0.95
ATLIAD	109	L	L	B	B	H		B	L	541	0.20	580	1.07
ATLIAH	260			B	L	L	L	L		691	0.37	680	0.98
ATLIND	200	L			L	L	L	B		434	0.46	1100	2.53
ATLLAS	203			H				L		1744	0.11	930	0.53
ATLLAX	239	H		H	H	H		H	L	1943	0.12	990	0.50
ATLLGA	189					H		L		756	0.25	710	0.93
ATLMCO	99		L					L		397	0.24	546	1.37
ATLSEA	209		H					L	H	2178	0.09	1113	0.51
PWMOMA	380		L	B	L	L		L		1311	0.28	960	0.73
PWMRNO	480	L	L	B	L					2540	0.18	1330	0.52
ROCCRW	200		L	B	B	L				387	0.51	440	1.13
ROCTPA	310			H				L		1078	0.28	880	0.81
		11	13	18	16	14	10	21	5		Times H, L or B		

	Count CPAs				25
$59	Range low	215	0.09	$360	0.50
$480	Range hi	2540	0.83	$1,330	2.53
$200	Mode	541	0.23	$580	0.93
$221	Mean	879.	0.31	$732	1.06
$260	Median	908	0.26	$860	0.86

PROTO6
AS OF 8-9-92

Appendix M

PROTOTYPE FOR THESIS
(Based on PROTO5,w/o carriers,3 groups)

	LOW$	HI$	MI	LNDX	HNDX
LOrange	$34	$84	372	ERR	ERR
HIrange	$510	$1,330	2622	ERR	ERR
Mode					
Mean	$296	$825	1499	ERR	ERR
Median					
CPAs	190				

	LOW$	HI$	MI	LNDX	HNDX
LOrange	$29	$170	0	ERR	ERR
HIrange	$500	$1,385	2728	ERR	ERR
Mode					
Mean	$229	$772	1124	ERR	ERR
Median					
CPAs	591				

	LOW$	HI$	MI	LNDX	HNDX
LOrange	$29	$279	991	ERR	ERR
HIrange	$510	$1,310	2584	ERR	ERR
Mode					
Mean	$272	$800	1672	ERR	ERR
Median					
CPAs	698				

SPOKE TO SPOKES------------------

CPA FR TO	LOW$	HIGH $	MILES	LOW NDX	HIGH NDX
PWMABQ	430	1210	2013	0.21	0.60
PWMAMA	438	1070	1763	0.24	0.60
PWMBIL	430	1152	1867	0.23	0.61
PWMBIS	350	1095	1494	0.23	0.73
PWMBOI	490	1260	2274	0.21	0.55
PWMCHS	300	760	908	0.33	0.83
PWMCPR	410	1030	1809	0.22	0.56
PWMCRW	270	710	692	0.39	1.02
PWMGEG	470	1200	2267	0.20	0.52
PWMJAN	390	930	1326	0.29	0.70
PWMMCI	340	940	1298	0.26	0.72
PWMMSY	210	990	1445	0.14	0.68
PWMOMA	380	960	1311	0.28	0.73
PWMRNO	480	1330	2540	0.18	0.52
PWMROC	190	500	372	0.51	1.34
PWMSAN	470	1260	2622	0.17	0.48
PWMSAT	310	1140	1829	0.16	0.62
PWMTPA	298	940	1276	0.23	0.73
PWMTYS	300	840	904	0.33	0.92
ROCCRW	200	440	387	0.51	1.13
ROCTPA	310	880	1078	0.28	0.81
ROCJAN	330	824		ERR	ERR
ROCTYS	250	610		ERR	ERR

HUB TO HUBS ---------------------

CPA FR TO	LOW$	HIGH $	MILES	LOW NDX	HIGH NDX
ATLBNA	180	360	215	0.83	1.67
ATLBOS	160	670	947	0.16	0.70
ATLBWI	170	580	578	0.29	1.00
ATLCLE	260	630	561	0.46	1.12
ATLCLT	59	470	228	0.25	2.06
ATLCMH	139	530	447	0.31	1.18
ATLCVG	200	530	375	0.53	1.41
ATLDAY	180	530	434	0.41	1.22
ATLDCA	109	580	541	0.20	1.07
ATLDEN	330	904	1207	0.27	0.74
ATLDFW	260	680	725	0.35	0.93
ATLEWR	260	710	746	0.34	0.95
ATLIAD	109	580	541	0.20	1.07
ATLIAH	260	680	691	0.37	0.98
ATLIND	200	1100	434	0.46	2.53
ATLLAS	203	930	1744	0.11	0.53
ATLLAX	239	990	1943	0.12	0.50
ATLJFK	189	710	756	0.25	0.93
ATLORL	99	546	397	0.24	1.37
ATLMEM	200	464	332	0.60	1.39
ATLMIA	250	648	596	0.41	1.08
ATLMSP	290	690	908	0.31	0.75
ATLORD	260	680	599	0.43	1.13

HUB TO SPOKES--------------------

CPA FR TO	LOW$	HIGH $	MILES	LOW NDX	HIGH NDX
ATLAMA	330	860	991	0.33	0.86
BWIAMA	365	904	1402	0.26	0.64
BOSAMA	397	990	1718	0.23	0.57
CLTAMA	340	900		ERR	ERR
ORDAMA	300	700		ERR	ERR
CVGAMA	290	720		ERR	ERR
CLEAMA	340	845		ERR	ERR
CMHAMA	340	854		ERR	ERR
DFWAMA	35	506		ERR	ERR
DAYAMA	320	810		ERR	ERR
DENAMA	210	597		ERR	ERR
DTWAMA	330	823		ERR	ERR
IAHAMA	59	648		ERR	ERR
INDAMA	290	720		ERR	ERR
LASAMA	89	812		ERR	ERR
LAXAMA	119	940		ERR	ERR
MEMAMA	260	637		ERR	ERR
MIAAMA	376	930		ERR	ERR
MSPAMA	300	823		ERR	ERR
BNAAMA	290	710		ERR	ERR
JFKAMA	386	950		ERR	ERR
EWRAMA	386	950		ERR	ERR
ORLAMA	350	930		ERR	ERR

PROTO6HH Appendix N
AS OF 8-19-92

HUB TO HUBS

	LOW$	HI$	MI	LNDX	HNDX	AVG $	AVG NDX
LOrange	$29	$170	33	0.06	0.41	$110	0.26
HIrange	$500	$1,385	2728	2.34	6.96	$895	4.42
Mode							
Mean	$229	$773	1103	0.29	1.01	$501	0.65
Median							
CPAs	592						

HUB TO HUBS---------------------------------

CPA FR TO	LOW$	HIGH $	MILES	LOW NDX	HIGH NDX	AVG $	AVG NDX	FR1	FR2	TO1	TO2
ATLBNA	180	360	215	0.83	1.67	270	1.26	g	F	h	
BOSBNA	210	770	942	0.22	0.81	490	0.52	a	L	h	
BWIBNA	210	564	587	0.35	0.96	387	0.66	k		h	
CLEBNA	84	540	454	0.18	1.18	312	0.69	i		h	
CLTBNA	170	400	329	0.51	1.21	285	0.87	h		h	
CMHBNA	84	500	338	0.24	1.47	292	0.86	i		h	
CVGBNA	40	490	230	0.17	2.13	265	1.15	h		h	
DAYBNA	200	510	293	0.68	1.74	355	1.21	h		h	
DENBNA	290	824	1052	0.27	0.78	557	0.53	c	L	h	
DFWBNA	260	680	626	0.41	1.08	470	0.75	f	L	h	
DTWBNA	59	580	467	0.12	1.24	320	0.68	h	F	h	
IAHBNA	79	648	663	0.11	0.97	364	0.55	d	F	h	
INDBNA	180	451	250	0.72	1.80	316	1.26	h		h	
LASBNA	200	992	1608	0.12	0.61	596	0.37	i		h	
LAXBNA	155	1050	1793	0.08	0.58	603	0.34	e	L	h	
MEMBNA	160	464	200	0.8	2.32	312	1.56	h		h	
MSPBNA	260	648	695	0.37	0.93	454	0.65	h	F	h	
ORDBNA	59	580	402	0.14	1.44	320	0.79	a	L	h	
ATLBOS	160	670	947	0.16	0.70	415	0.44	g	F	a	L
BWIBOS	109	600	369	0.29	1.62	355	0.96	k		a	L
ATLBWI	170	580	578	0.29	1.00	375	0.65	g	F	k	
ATLCLE	260	630	561	0.46	1.12	445	0.79	g	F	i	
BOSCLE	240	680	557	0.43	1.22	460	0.83	a	L	i	
BWICLE	170	474	312	0.54	1.51	322	1.03	k		i	
CLTCLE	200	630	435	0.45	1.44	415	0.95	h		i	
CVGCLE	190	401	227	0.83	1.76	296	1.30	h		i	
ORDCLE	39	520	311	0.12	1.67	280	0.90	a	L	i	
ATLCLT	59	470	228	0.25	2.06	265	1.16	g	F	h	
BOSCLT	210	680	728	0.28	0.93	445	0.61	a	L	h	
BWICLT	150	577	362	0.41	1.59	364	1.00	k		h	
ATLCMH	139	530	447	0.31	1.18	335	0.75	g	F	i	

PROTO6HS
AS OF 8-16-92

Appendix O

HUB TO SPOKES

	LOW$	HI$	MI	LNDX	HNDX	AVG $	AVG NDX
LOrange	$29	$279	83	0.07	0.42	159	0.26
HIrange	$510	$1,310	2723	1.22	3.73	895	2.14
Mode							
Mean	$272	$800	1141	0.29	0.87	$536	0.58
Median							
CPAs	699						

HUB TO SPOKES---------------------------------

CPA FR TO	LOW$	HIGH $	MILES	LOW NDX	HIGH NDX	AVG $	AVG NDX	HUB FR1	FLAGS FR2
ATLABQ	234	900	1280	0.18	0.70	567	0.44	g	F
ATLAMA	330	860	991	0.33	0.86	595	0.60	g	F
ATLBIL	380	930	1523	0.24	0.61	655	0.43	g	F
ATLBIS	310	930	1248	0.24	0.74	620	0.50	g	F
ATLBOI	430	1060	1838	0.23	0.57	745	0.41	g	F
ATLCHS	200	410	254	0.78	1.61	305	1.20	g	F
ATLCPR	390	883	1352	0.28	0.65	637	0.47	g	F
ATLCRW	180	518	363	0.49	1.42	349	0.96	g	F
ATLGEG	440	1100	1967	0.22	0.55	770	0.39	g	F
ATLJAN	180	475	340	0.52	1.39	328	0.96	g	F
ATLMCI	260	630	693	0.37	0.90	445	0.64	g	F
ATLMSY	99	530	419	0.23	1.26	315	0.75	g	F
ATLOMA	300	695	822	0.36	0.84	498	0.61	g	F
ATLPWM	170	820	1027	0.16	0.79	495	0.48	g	F
ATLRNO	259	1090	1992	0.13	0.54	675	0.34	g	F
ATLROC	170	627	749	0.22	0.83	399	0.53	g	F
ATLSAN	239	990	1890	0.12	0.52	615	0.33	g	F
ATLSAT	280	690	873	0.32	0.79	485	0.56	g	F
ATLTPA	99	546	405	0.24	1.34	323	0.80	g	F
ATLTYS	110	311	153	0.71	2.03	211	1.38	g	F
BNAABQ	155	782	1120	0.13	0.69	469	0.42	h	
BNAAMA	290	710	845	0.34	0.84	500	0.59	h	
BNABIL	370	930	1314	0.28	0.70	650	0.49	h	
BNABIS	270	889	1033	0.26	0.86	580	0.56	h	
BNABOI	400	1080	1642	0.24	0.65	740	0.45	h	
BNACHS	210	540	434	0.48	1.24	375	0.86	h	
BNACPR	350	883	1151	0.30	0.76	617	0.54	h	
BNACRW	180	470	320	0.56	1.46	325	1.02	h	
BNAGEG	420	1062	1760	0.23	0.60	741	0.42	h	
BNAJAN	200	503	327	0.61	1.53	352	1.07	h	
BNAMCI	492	533	492	1	1.08	513	1.04	h	

PROTO6SS Appendix P
AS OF 8-12-92

SPOKE TO SPOKES

(Based on PROTO5,w/o carriers,3 groups)

	LOW$	HI$	MI	LNDX	HNDX	AVG $	AVG NDX
LOrange	$34	$84	148	0.09	0.30	$59	0.21
HIrange	$510	$1,330	2622	1.33	3.43	$905	2.39
Mode							
Mean	$296	$825	1141	0.29	0.85	$560	0.58
Median							
CPAs	190						

SPOKE TO SPOKES--------------------------------

CPA FR TO	LOW$	HIGH $	MILES	LOW NDX	HIGH NDX	AVG $	AVG NDX
AMAABQ	34	84	279	0.12	0.30	59	0.21
TPARNO	219	1178	2265	0.09	0.52	699	0.31
TPASAN	209	1115	2084	0.10	0.53	662	0.32
PWMSAN	470	1260	2622	0.17	0.48	865	0.33
ROCSAN	440	1100	2251	0.19	0.48	770	0.34
TPAGEG	460	1142	2313	0.19	0.49	801	0.35
MSYSAN	145	964	1598	0.09	0.60	555	0.35
SATRNO	149	832	1390	0.10	0.59	491	0.35
ROCRNO	450	1100	2181	0.20	0.50	775	0.36
PWMRNO	480	1330	2540	0.18	0.52	905	0.36
MCIRNO	127	823	1332	0.09	0.61	475	0.36
CHSRNO	450	1161	2241	0.20	0.51	806	0.36
TPABOI	450	1101	2154	0.20	0.51	776	0.36
JANABQ	113	587	970	0.11	0.60	350	0.36
TPABIL	390	970	1875	0.20	0.51	680	0.36
CHSSAN	450	1110	2144	0.20	0.51	780	0.36
PWMGEG	470	1200	2267	0.20	0.52	835	0.37
TYSSAN	410	1030	1902	0.21	0.54	720	0.38
CHSGEG	480	1180	2191	0.21	0.53	830	0.38
CHSBOI	460	1120	2076	0.22	0.53	790	0.38
MSYGEG	410	1042	1891	0.21	0.55	726	0.38
PWMBOI	490	1260	2274	0.21	0.55	875	0.38
MSYRNO	400	980	1791	0.22	0.54	690	0.39
ROCGEG	420	1080	1942	0.21	0.55	750	0.39
TYSRNO	430	1097	1965	0.21	0.55	764	0.39
CRWGEG	450	1035	1908	0.23	0.54	743	0.39
CRWRNO	480	1110	2042	0.23	0.54	795	0.39
TPACPR	400	930	1686	0.23	0.55	665	0.39

Appendix Q

COMBINED PROTO6HH, PROTO6HS AND PROTO6SS
AS OF 8-17-92

	LOW$	HI$	MI	LNDX	HNDX	AVG $	AVG NDX
LOrange	$29	$84	33	0.06	0.30	$59	0.21
HIrange	$510	$1,385	2728	2.34	6.96	$905	4.42
Mode							
Mean	$258	$792	1126	0.29	0.93	$525	0.61
Median							
CPAs	1481						

CPA FR TO	LOW$	HIGH $	MILES	LOW NDX	HIGH NDX	AVG $	AVG NDX	----HUB FR1	FR2	FLAGS-- TO1	TO2
AMAABQ	34	84	279	0.12	0.30	59	0.21				
AMABIL	280	694	812	0.34	0.85	487	0.60				
AMABIS	300	770	796	0.37	0.96	535	0.67				
AMABOI	320	798	965	0.33	0.82	559	0.58				
AMACHS	350	980	1244	0.28	0.78	665	0.53				
AMACPR	250	618	589	0.42	1.04	434	0.74				
AMACRW	370	812	1133	0.32	0.71	591	0.52				
AMAGEG	365	902	1182	0.30	0.76	634	0.54				
AMAJAN	99	506	697	0.14	0.72	303	0.43				
AMAMCI	209	690	475	0.44	1.45	450	0.95				
AMAMSY	79	733	757	0.10	0.96	406	0.54				
AMAOMA	260	710	525	0.49	1.35	485	0.92				
AMAPWM	438	1070	1763	0.24	0.60	754	0.43				
AMARNO	330	823	1035	0.31	0.79	577	0.56				
AMAROC	397	970	1394	0.28	0.69	684	0.49				
AMASAN	111	920	904	0.12	1.01	516	0.57				
AMASAT	56	546	435	0.12	1.25	301	0.69				
AMATPA	340	863	1231	0.27	0.70	602	0.49				
AMATYS	330	830	998	0.33	0.83	580	0.58				
ATLABQ	234	900	1280	0.18	0.70	567	0.44	g	F		
ATLAMA	330	860	991	0.33	0.86	595	0.60	g	F		
ATLBIL	380	930	1523	0.24	0.61	655	0.43	g	F		
ATLBIS	310	930	1248	0.24	0.74	620	0.50	g	F		
ATLBNA	180	360	215	0.83	1.67	270	1.26	g	F	h	
ATLBOI	430	1060	1838	0.23	0.57	745	0.41	g	F		
ATLBOS	160	670	947	0.16	0.70	415	0.44	g	F	a	L
ATLBWI	170	580	578	0.29	1.00	375	0.65	g	F	k	
ATLCHS	200	410	254	0.78	1.61	305	1.20	g	F		
ATLCLE	260	630	561	0.46	1.12	445	0.79	g	F	i	
ATLCLT	59	470	228	0.25	2.06	265	1.16	g	F	h	
ATLCMH	139	530	447	0.31	1.18	335	0.75	g	F	i	
ATLCPR	390	883	1352	0.28	0.65	637	0.47	g	F		
ATLCRW	180	518	363	0.49	1.42	349	0.96	g	F		
ATLCVG	200	530	375	0.53	1.41	365	0.97	g	F	h	
ATLDAY	180	530	434	0.41	1.22	355	0.82	g	F	h	
ATLDCA	109	580	541	0.20	1.07	345	0.64	g	F	b	
ATLDEN	330	904	1207	0.27	0.74	617	0.51	g	F	c	L
ATLDFW	260	680	725	0.35	0.93	470	0.65	g	F	f	L
ATLDTW	109	580	605	0.18	0.95	345	0.57	g	F	h	F
ATLEWR	260	710	746	0.34	0.95	485	0.65	g	F	k	
ATLGEG	440	1100	1967	0.22	0.55	770	0.39	g	F		

SUMMARY.WK1 Appendix R
AS OF 8-17-92

Summaries of PROTO6xx Data

SPOKE TO SPOKES:	LOW $	HIGH $	MILES	LNDX	HNDX	AVG$	AVG NDX
LOW RANGE	$34	$84	148	$0.09	$0.30	$59	$0.21
HIGH RANGE	$510	$1,330	2622	$1.33	$3.43	$905	$2.39
MEAN	$296	$825	1141	$0.29	$0.85	$560	$0.58
CPAs	190						

HUB TO HUBS:	LOW $	HIGH $	MILES	LNDX	HNDX	AVG$	AVG NDX
LOW RANGE	$29	$170	33	$0.06	$0.41	$110	$0.26
HIGH RANGE	$500	$1,385	2728	$2.34	$6.96	$895	$4.42
MEAN	$229	$773	1106	$0.29	$1.01	$501	$0.65
CPAs	592						

HUB TO SPOKES:	LOW $	HIGH $	MILES	LNDX	HNDX	AVG$	AVG NDX
LOW RANGE	$29	$279	83	$0.07	$0.42	$159	$0.26
HIGH RANGE	$510	$1,310	2723	$1.22	$3.73	$895	$2.14
MEAN	$272	$800	1141	$0.29	$0.87	$536	$0.58
CPAs	699						

TOTALS:	LOW $	HIGH $	MILES	LNDX	HNDX	AVG$	AVG NDX
LOW RANGE	$29	$84	33	$0.06	$0.30	$59	$0.21
HIGH RANGE	$510	$1,385	2728	$2.34	$6.96	$905	$4.42
MEAN	$258	$792	1126	$0.29	$0.93	$525	$0.61
CPAs	1481						

FLAGSHH Appendix S

AS OF 8-19-92 HUB-TO-HUBS: SORTED BY HUB FLAGS

		|--- AVG $----|			|--- AVG NDX--|		|--- MILES----|		
FR1	FR2	LOW	HIGH	MEAN	LOW	HIGH	MEAN	LOW	HIGH	MEAN	CPAs
a	L	190	805	472	0.26	1.55	0.62	168	2698	1012	68
b		110	778	455	0.28	2.97	0.78	37	2426	953	66
c		187	855	638	0.26	1.44	0.42	130	2728	1782	68
c	L	285	718	531	0.37	0.77	0.49	380	1763	1130	34
d	F	250	650	499	0.32	1.07	0.48	233	1883	1105	34
d	L	186	735	549	0.26	0.72	0.42	257	2291	1434	34
e	L	210	822	599	0.28	1.01	0.42	234	2604	1670	34
f	L	250	630	516	0.36	1.07	0.54	233	1663	1026	34
g	F	265	707	458	0.29	1.49	0.68	215	2178	856	34
h		180	870	480	0.28	4.42	0.74	64	2728	926	270
h	F	180	895	469	0.28	2.52	0.74	89	2516	913	170
i		180	783	490	0.26	2.53	0.65	71	2376	1120	136
i	F	178	662	429	0.25	1.25	0.63	229	1732	814	34
j	L	185	822	479	0.29	2.07	0.65	89	2572	1081	33
k		110	895	546	0.26	4.09	0.66	33	2698	1382	135

Total CPAs: 1184

FLAGSHS

AS OF 8-19-92

Appendix T

HUB-TO-SPOKES: SORTED BY HUB FLAGS

		---- AVG $	------	------	---- AVG NDX	---	---	---- MILES	----	----	CPAs
FR1	FR2	LOW	HIGH	MEAN	LOW	HIGH	MEAN	LOW	HIGH	MEAN	
a	L	227	836	554	0.26	1.61	0.54	221	2584	1218	39
b		285	756	538	0.31	1.25	0.56	228	2272	1199	40
c		335	880	608	0.27	1.64	0.52	225	2536	1488	40
c	L	250	710	489	0.39	1.12	0.65	232	1794	874	20
d	F	185	690	482	0.34	1.00	0.56	191	1695	980	20
d	L	159	790	526	0.34	0.73	0.50	307	2338	1151	20
e	L	205	840	568	0.30	1.71	0.51	119	2641	1370	20
f	L	220	630	463	0.38	0.89	0.59	248	1620	886	20
g	F	211	770	501	0.33	1.38	0.64	153	1992	1009	20
h		170	842	531	0.30	2.14	0.65	83	2518	1055	160
h	F	245	790	530	0.32	1.61	0.59	164	2366	1097	100
i		205	810	514	0.30	2.10	0.59	132	2409	1076	80
i	F	230	630	457	0.34	1.11	0.64	238	1573	825	20
j	L	255	790	580	0.30	1.03	0.53	262	2432	1339	20
k		200	895	585	0.29	1.24	0.53	188	2723	1369	80

DISTHH
AS OF 8-17-92

Appendix U

Hub-to-Hubs: Sorted by Distance

Miles 0 to 500	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	29	170	33	0.09	1.05	110	0.59
HIRange	250	1100	495	2.34	6.96	650	4.42
Mean	130	479	310	0.49	1.82	304	1.16
CPAs	156						

501 to 750	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	69	530	502	0.10	0.84	332	0.49
HIRange	270	830	750	0.51	1.31	540	0.88
Mean	200	644	616	0.32	1.05	422	0.69
CPAs	90						

501 to 1000	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	69	530	502	0.10	0.67	332	0.43
HIRange	320	1102	995	0.51	1.31	681	0.88
Mean	214	688	740	0.29	0.95	451	0.63
CPAs	168						

1001 to 1500	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	114	710	1001	0.09	0.57	449	0.34
HIRange	380	1070	1492	0.33	0.82	642	0.58
Mean	249	855	1221	0.21	0.70	552	0.46
CPAs	81						

1501 to 2000	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	119	870	1501	0.07	0.49	511	0.29
HIRange	430	1190	1995	0.26	0.69	765	0.45
Mean	291	1003	1775	0.16	0.57	647	0.37
CPAs	94						

2001 to (max)	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	150	975	2013	0.07	0.41	581	0.26
HIRange	500	1385	2728	0.21	0.57	895	0.38
Mean	343	1114	2307	0.15	0.48	728	0.32
CPAs	93						

DISTHS
AS OF 8-17-92

Appendix V

Hub-to-Spokes: Sorted by Distance

Miles		LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
0 to 500								
	LORange	29	279	83	0.09	0.71	159	0.42
	HIRange	492	892	493	1.22	3.73	520	2.14
	Mean	149	489	334	0.48	1.58	319	1.04
	CPAs	120						

501 to 750		LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
	LORange	50	510	503	0.08	0.71	315	0.47
	HIRange	370	900	750	0.57	1.49	630	0.96
	Mean	220	645	624	0.35	1.04	432	0.70
	CPAs	97						

501 to 1000		LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
	LORange	50	510	503	0.08	0.66	315	0.43
	HIRange	370	940	997	0.57	1.49	630	0.95
	Mean	236	691	755	0.31	0.93	463	0.62
	CPAs	206						

1001 to 1500		LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
	LORange	99	660	1005	0.08	0.54	405	0.33
	HIRange	440	1160	1497	0.38	0.90	800	0.62
	Mean	290	861	1233	0.23	0.70	575	0.47
	CPAs	176						

1501 to 2000		LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
	LORange	139	850	1508	0.07	0.49	495	0.29
	HIRange	490	1140	1999	0.28	0.66	795	0.46
	Mean	344	1000	1739	0.19	0.57	672	0.38
	CPAs	115						

2001 to (max)		LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
	LORange	199	993	2026	0.08	0.42	650	0.25
	HIRange	510	1310	2723	0.23	0.55	895	0.38
	Mean	403	1119	2258	0.17	0.49	761	0.33
	CPAs	82						

DISTSS
AS OF 8-17-92

Appendix W

Spoke-to-Spokes: Sorted by Distance

Miles

0 to 500	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	34	84	148	0.10	0.30	59	0.21
HIRange	320	778	495	1.33	3.43	535	2.38
Mean	165	527	366	0.50	1.55	346	1.02
CPAs	23						

501 to 750	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	64	469	525	0.10	0.70	275	0.41
HIRange	370	790	748	0.64	1.35	550	0.93
Mean	225	652	645	0.35	1.01	438	0.68
CPAs	35						

501 to 1000	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	64	469	525	0.10	0.60	275	0.36
HIRange	370	920	998	0.64	1.35	580	0.93
Mean	237	689	738	0.32	0.95	463	0.64
CPAs	61						

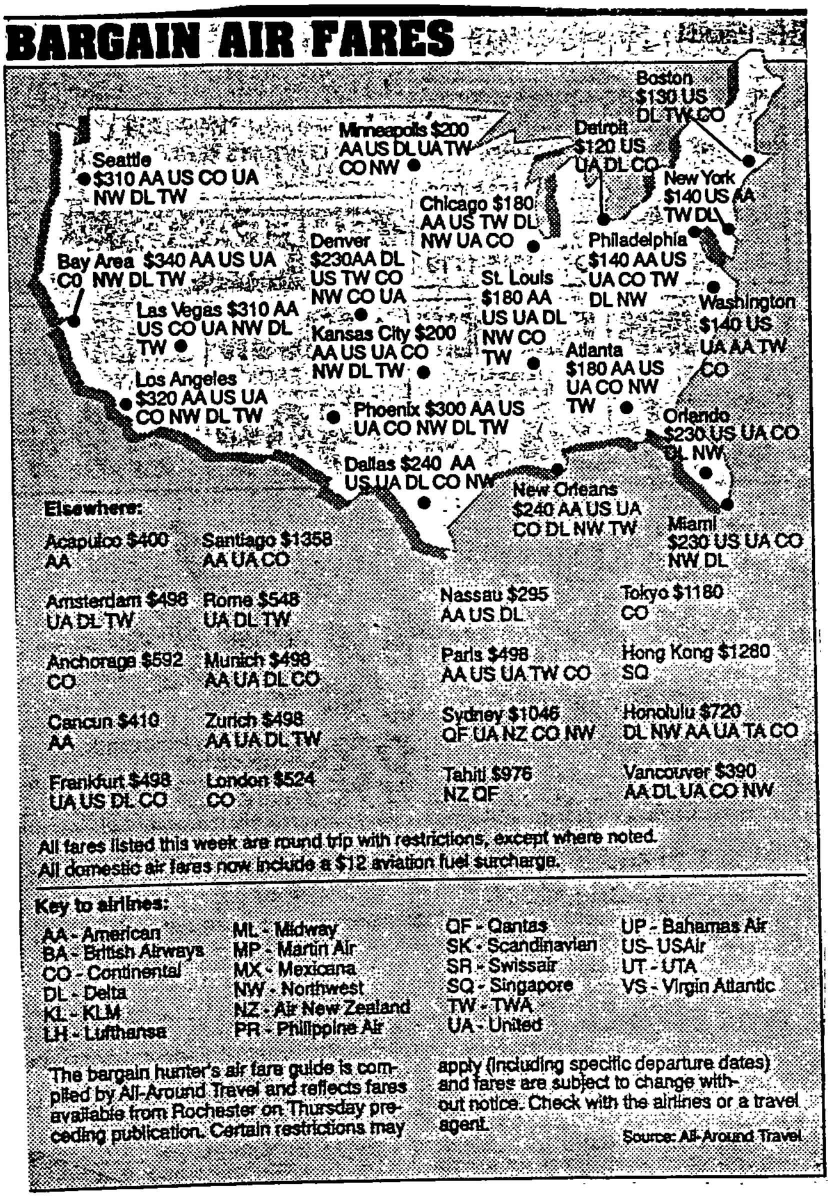
1001 to 1500	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	119	660	1006	0.09	0.58	475	0.35
HIRange	430	1095	1497	0.39	0.83	723	0.59
Mean	312	872	1238	0.25	0.70	592	0.48
CPAs	59						

1501 to 2000	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	145	922	1523	0.09	0.51	555	0.34
HIRange	460	1180	1965	0.27	0.71	805	0.48
Mean	403	1041	1757	0.22	0.59	722	0.41
CPAs	30						

2001 to (max)	LOW$	HIGH$	MILES	LNDX	HNDX	AVG$	AVG NDX
LORange	209	1100	2013	0.09	0.48	662	0.30
HIRange	510	1330	2622	0.25	0.60	905	0.40
Mean	435	1166	2217	0.19	0.52	800	0.36
CPAs	17						

Appendix X

Airfares Guide



BARGAIN AIR FARES

Boston $130 US DL TW CO

Detroit $120 US UA DL CO

New York $140 US AA TW DL

Minneapolis $200 AA US DL UA TW CO NW

Seattle $310 AA US CO UA NW DL TW

Chicago $180 AA US TW DL NW UA CO

Philadelphia $140 AA US UA CO TW DL NW

Denver $230 AA DL US TW CO NW CO UA

Bay Area $340 AA US UA CO NW DL TW

St. Louis $180 AA US UA DL NW CO TW

Washington $140 US UA AA TW CO

Las Vegas $310 AA US CO UA NW DL TW

Kansas City $200 AA US UA CO NW DL TW

Atlanta $180 AA US UA CO NW TW

Los Angeles $320 AA US UA CO NW DL TW

Phoenix $300 AA US UA CO NW DL TW

Orlando $230 US UA CO DL NW

Dallas $240 AA US UA DL CO NW

New Orleans $240 AA US UA CO DL NW TW

Miami $230 US UA CO NW DL

Elsewhere:

Acapulco $400 AA

Santiago $1358 AA UA CO

Amsterdam $498 UA DL TW

Rome $548 UA DL TW

Nassau $295 AA US DL

Tokyo $1180 CO

Anchorage $592 CO

Munich $498 AA UA DL CO

Paris $498 AA US UA TW CO

Hong Kong $1280 SQ

Cancun $410 AA

Zurich $498 AA UA DL TW

Sydney $1046 QF UA NZ CO NW

Honolulu $720 DL NW AA UA TA CO

Frankfurt $498 UA US DL CO

London $524 CO

Tahiti $976 NZ QF

Vancouver $390 AA DL UA CO NW

All fares listed this week are round trip with restrictions, except where noted. All domestic air fares now include a $12 aviation fuel surcharge.

Key to airlines:

AA - American
BA - British Airways
CO - Continental
DL - Delta
KL - KLM
LH - Lufthansa
ML - Midway
MP - Martin Air
MX - Mexicana
NW - Northwest
NZ - Air New Zealand
PR - Philippine Air
QF - Qantas
SK - Scandinavian
SR - Swissair
SQ - Singapore
TW - TWA
UA - United
UP - Bahamas Air
US - USAir
UT - UTA
VS - Virgin Atlantic

The bargain hunter's air fare guide is compiled by All-Around Travel and reflects fares available from Rochester on Thursday preceding publication. Certain restrictions may apply (including specific departure dates) and fares are subject to change without notice. Check with the airlines or a travel agent.

Source: All-Around Travel

Source: Democrat and Chronicle. Rochester, N.Y. July 12, 1992