

Alternatives to the Hub: A Survey of Nonstop Air Service Opportunities

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A renewed interest in nonhub air services marks a significant change in the philosophy of the airline industry. Several major airlines are venturing boldly from traditional hub-and-spoke route systems into markets that can support nonstop service of their own. Others, encouraged by the success of these firms, have announced large-scale plans to dedicate much of their soon-to-be-acquired capacity to similar purposes. In an era dominated by hub-and-spoke route systems, a group of nonhub cities appears to have emerged as a lucrative target for the initiation of new nonstop air service. Civil Aeronautics Board traffic data and published schedule information are used to survey the opportunities for new nonstop air services. The current status of nonstop air service between 50 major metropolitan areas in the United States is assessed, and the large imbalances in the availability of nonstop service that have evolved are investigated. This provides a useful perspective on the relative attractiveness of these metropolitan areas to entrepreneurs. Secondly, America's most heavily traveled markets without highly-valued nonstop services are identified, drawing attention to an important set of market incentives that will play a critical role in the reshaping of America's air travel network. The results of the study indicate that the introduction of new nonstop services in markets traditionally served only with connecting flights constitutes a viable and an increasingly attractive means of product differentiation.

Intricate hub-and-spoke systems linking metropolitan areas have greatly changed the structure of air transportation in the United States. Firms have invested heavily in hub facilities to protect market share and serve as foundations for expansion in a highly competitive environment, and have utilized them in more than 75 percent of their expansion since 1980. Atlanta, Chicago, Dallas, Denver, Houston, and St. Louis have emerged as premier connecting hubs. A dozen other cities have become important regional or minihubs.

Recently, however, several major airlines have ventured boldly from traditional hub operations into markets that can support nonstop service of their own. Others, encouraged by the success of these firms, have announced large-scale plans to dedicate much of the soon-to-be-acquired capacity to similar purposes. In an era of hub-and-spoke expansion, a group of nonhub cities appears to have emerged as a lucrative target for the initiation of new nonstop air services.

The renewed interest in nonhub air service marks a significant reversal in philosophy of the airline industry. Such a redirection in strategic planning is likely to decentralize the

U.S. intercity air network and greatly affect the quality of air service to many metropolitan areas. As airlines circumvent or supplement traditional hub operation with new point-to-point services, certain metropolitan areas are likely to experience disproportionate gains or losses in the scope of their nonstop air service.

The implications of these trends for both airlines and local economies indicate a need for ground-breaking research. Although previous studies provide useful econometric evidence of the effects of airline hubs (1, 2), individual markets have not been studied in the detail required to develop insight into the likely unfolding of new nonstop service. The objective of this paper is to bring much-needed attention to this timely issue.

In surveying the status of nonstop service between the 50 largest U.S. metropolitan areas, an appreciation is fostered for the panorama of opportunities available to nonstop operators in an environment dominated by hub-and-spoke route systems. First, Civil Aeronautics Board (CAB) traffic data and published schedule information are used to explore the large imbalances in the availability of service that have evolved, and to illustrate the relative attractiveness of the metropolitan areas to entrepreneurs. Secondly, the most heavily traveled U.S. markets without highly valued nonstop services are identified. This draws attention to an important set of market incentives that will play a critical role in the reshaping of the U.S. air travel network.

Entrepreneurship in new nonstop services is ultimately affected by numerous variables ranging from airport facility constraints, geography, and manpower planning concerns to local economic conditions. By concentrating on only one factor in this complex equation—the current imbalances in the scope of nonstop services between metropolitan areas—the analysis surfaces key issues that have been overlooked by more broadly focused studies.

CHANGING MARKET CONDITIONS

Four marketing factors are chiefly responsible for the heightened interest in new nonstop services. These factors are encouraging greater flexibility and innovation in route development, and are dissuading firms from concentrating their investment into a few major hub operations. A brief summary of these four conditions will serve as a useful groundwork for the analysis in the following sections on nonstop market opportunities and on the largest unserved city pairs in the United States.

Product Differentiation Opportunities

The number of airline hubs has increased twofold since the Airline Deregulation Act of 1978, and the oligopolistic structure that once characterized most markets has been replaced by one of highly decentralized competition. The result has been a growing number of alternatives available to the consumer (3).

The competition from the expanding number of hub operations, coupled with the successful expansion of low-cost operators, is exerting a powerful downward pressure on fares. In addition, competition is hampering the ability of firms to employ elaborate fare schemes designed to price discriminate (4). The result has been a 20 percent real decline in industry yield since 1981 (5).

Providing nonstop service in a traditionally one-stop market provides a firm with valuable product differentiation that, when used effectively, can shelter it from these highly competitive market conditions. A single nonstop flight in a market otherwise served only by connecting services generally provides a firm with a healthy base of full-fare business traffic, typically yielding over 20 cents per passenger mile, in the face of a rival's heavily discounted unrestricted fare that may yield less than 12 cents per passenger mile (4). This product differentiation technique affords a simultaneous increase in both market share and passenger yield, and generally protects a firm from unfavorable pricing actions introduced by its competitors.

Technological Change

A key deterrent to innovation in nonhub route development has been the absence of a limited-capacity aircraft capable of cost-effective long-range flying. Nonhub routes often have been unable to support larger aircraft, and the high costs of operating smaller planes have made break-even load factors prohibitively high (6).

However, a new generation of aircraft is markedly improving the economics of nonhub flying. The Fokker 100 aircraft, a German twin jet seating 85 passengers, and the British Aerospace 146 Jet with capacity ranging from 85 to 126 passengers, and others have sparked a flurry of entrepreneurship on routes previously unable to support nonstop service. Each has a maximum range exceeding 1,100 mi and provides service for less than 7 cents per seat-mile. This is well below the cost of their predecessors and only fractionally higher than that for larger aircraft (6).

The recently introduced Boeing 737-300 aircraft, with total seating of up to 149 and a range of 1,500 mi, and the soon-to-be available McDonnell Douglas MD87 are encouraging similar innovation on long-haul routes. These aircraft are especially attractive to major airlines because of their compatibility with existing crew training and maintenance requirements, fuel efficiency, and two-man crews.

Declining Economies of Scale

Studies indicate that hub operations can reduce seat-mile costs by 10 percent or more (2). However, as indicated next, recent

escalations in hub operating expenses are rendering nonhub air services as an increasingly attractive economic alternative.

Airport congestion has become costly. Since 1980, the cost of air traffic delays has more than doubled, quickly offsetting many of the efficiency advantages of major hubs (7). This problem has been particularly significant at the major hubs of Atlanta, Chicago, Dallas-Fort Worth, and St. Louis where ground, gate, and air traffic delays have risen 140 percent faster than at airports less densely served. In addition, many major hubs are raising gate rental and landing fees, and assessing fuel surcharges and departure taxes in an effort to alleviate congestion. These user fees have risen by nearly 125 percent at major hub complexes in the past 3 years, encouraging a transfer of resources to less congested facilities.

Reductions in Labor Expense

A 10 percent decline in labor costs since deregulation (as a percent of total costs) is also increasing the attractiveness of relatively manpower-intensive nonhub services (7).

Hub-and-spoke operations permit manpower to be scheduled on efficient lines-of-flying from central locations, and allow more efficient planning for pilot and flight attendant reserve coverage. Nonhub operations tend to decentralize an airline's manpower needs. This not only complicates the effective allocation of manpower throughout the route system, but can inhibit the full utilization of labor as specified by labor contracts or federal law.

However, with the emergence of lower new-hire wage scales and a liberalization of work rules, the cost of layovers, waiting time, deadheading, and other operational problems associated with nonhub air service has steadily diminished. Only now, with these declining labor costs, are many firms able to justify departure from hub systems.

These four factors, coupled with spiraling demand for air passenger services, are largely responsible for the flurry of entrepreneurship in new nonstop air services. To provide a useful perspective on how these services are likely to unfold, the following section reviews the status of nonstop air services between the 50 largest population centers in the United States.

NONSTOP MARKET OPPORTUNITIES

The distribution of nonstop air services among metropolitan areas has been greatly affected by the popularity of hub-and-spoke route systems. Direct flights between nonhub cities has declined from 24.5 percent of total jet departures in 1978 to 13.3 percent today (8), and important voids in nonstop service have emerged between nonhub cities. Some of this relative decline in nonhub flying is attributable to the formation of new hubs in cities such as Dayton, Detroit, Kansas City, and Phoenix. However, an even greater factor has been the disproportionate share of resources devoted to the expansion of existing hub complexes.

The opportunity for rapid market share expansion in many nonhub cities is attracting firms capable of filling these voids in service. Heavily populated metropolitan areas with limited

nonstop service are emerging as lucrative targets for market entry. Others, already saturated with nonstop services or unable to support new nonstop services, appear to be benefitting little from the changing market conditions.

A useful measure of the scope of nonstop service available in a metropolitan area, and a revealing indication of its attractiveness to entrepreneurs, is the proportion of the traffic that is already served by nonstop flights. Termed "nonstop market penetration," this share of the market has already been captured by nonstop operators and thereby does not offer an opportunity for product differentiation through the introduction of new nonstop service.

A comparison of the nonstop market penetration rates in the 50 most heavily populated U.S. metropolitan areas provides a clear illustration of the widely divergent opportunities for the introduction of new nonstop services. The portion of the market that has not already been penetrated serves as an upper bound on the market share attainable through the introduction of new nonstop service in traditionally one-stop markets. With the industry's incessant battle for market share, it is a crucial variable in strategic planning.

For this comparison, 50 metropolitan areas are ranked according to official 1980 U.S. Census Bureau data (Table 1). Metropolitan areas outside the contiguous 48 states were excluded. Census data for the New York-Newark-Suffolk and San Francisco-Oakland-San Jose areas were consolidated into two listings due to their close proximity. Most airlines consider them as coterminals when planning operations and marketing. Although Los Angeles-Ontario, California and Detroit, Michigan-Toledo, Ohio are geographically close, they generally are

not considered coterminals and are maintained as separate entries.

An audit of the availability of nonstop service from each of these metropolitan areas (or cities) was conducted using schedule information published by Official Airline Guides, Inc. The results are summarized in Figure 1. Figure 1 is organized alphabetically, similar to a highway mileage chart, and indicates the status of nonstop service between the 50 largest population centers in the United States.

The extent of nonstop service varies considerably between cities. For example, Chicago and Atlanta have nonstop service to all other cities listed, while San Antonio and Providence have nonstop service to fewer than a dozen cities. The total number of cities served on a nonstop basis (also summarized in Figure 1) is a descriptive measure of the scope of nonstop service available from a city.

Estimates of market penetration of nonstop services in each of the 50 metropolitan areas were made by analyzing traffic data reported by CAB (10), which are the most recent and comprehensive data available. CAB organizes data on an origin-destination basis, and samples approximately 25 percent of domestic passenger traffic.

The analysis considers all city pairs reported in the CAB data and, thus, involves substantially more city pairs than are shown in Figure 1. In the case of Dayton, Ohio, for example, CAB reports traffic to roughly 200 destinations. Using schedule information for May 1985 reported in the Official Airlines Guide (9), it was determined that 30 of these destinations had available nonstop service, and all others required connections at nearby hubs. The proportion of total traffic represented by

TABLE 1 POPULATION OF FIFTY LARGEST U.S. METROPOLITAN AREAS

Rank	Metropolitan Area	Population	Rank	Metropolitan Area	Population
1	New York-Newark-Suffolk, N.Y.-N.J.	13,692,128	26	Kansas City, Mo.-Kans.	1,327,106
2	Los Angeles-Long Beach-Anaheim, Calif.	9,910,212	27	Buffalo, N.Y.	1,242,826
3	Chicago-Gary-Hammond, Ill.-Ind.	7,746,405	28	Portland, Oreg.	1,242,594
4	Philadelphia, Pa.-N.J.	4,716,818	29	New Orleans, La.	1,187,073
5	Detroit, Mich.	4,353,413	30	Indianapolis, Ind.	1,166,575
6	San Francisco-Oakland-San Jose, Calif.	4,545,710	31	Columbus, Ohio	1,093,316
7	Washington, D.C.-Md.-Va.	3,060,922	32	San Antonio, Tex.	1,071,954
8	Dallas-Ft. Worth, Tex.	3,974,805	33	Fort Lauderdale-Hollywood, Calif.	1,108,200
9	Houston, Tex.	2,905,353	34	Sacramento, Calif.	1,014,002
10	Boston, Mass.	2,763,357	35	Rochester, N.Y.	971,230
11	St. Louis, Mo.	2,356,460	36	Salt Lake City-Ogden, Utah	936,255
12	Pittsburgh, Pa.	2,263,894	37	Providence-Warwick, R.I.-Mass.	919,216
13	Baltimore, Md.	2,174,023	38	Memphis, Tenn.	913,472
14	Minneapolis-St. Paul, Min-Wis.	2,113,533	39	Louisville, Ky.-Ind.	906,512
15	Atlanta, Ga.	2,029,710	40	Nashville-Davidson, Tenn.	850,505
16	Cleveland, Ohio	1,898,825	41	Birmingham, Ala.	837,487
17	San Diego, Calif.	1,861,846	42	Oklahoma City, Okla.	834,088
18	Miami, Fla.	1,625,781	43	Dayton, Ohio	830,070
19	Denver-Boulder, Colo.	1,620,902	44	Greensboro-Winston-Salem, N.C.	827,252
20	Seattle-Everett, Wash.	1,607,469	45	Norfolk-Virginia Beach, Va.	806,951
21	Tampa-St. Petersburg, Fla.	1,569,134	46	Albany-Schenectady-Troy, N.Y.	795,019
22	Ontario-Riverside, Calif.	1,558,182	47	Toledo, Ohio	791,599
23	Phoenix, Ariz.	1,509,052	48	Jacksonville, Fla.	737,541
24	Cincinnati, Ohio	1,401,491	49	Hartford Conn.	726,114
25	Milwaukee, Wis.	1,397,143	50	Orlando, Fla.	700,055

Source: U.S. Census Bureau Survey, 1980.

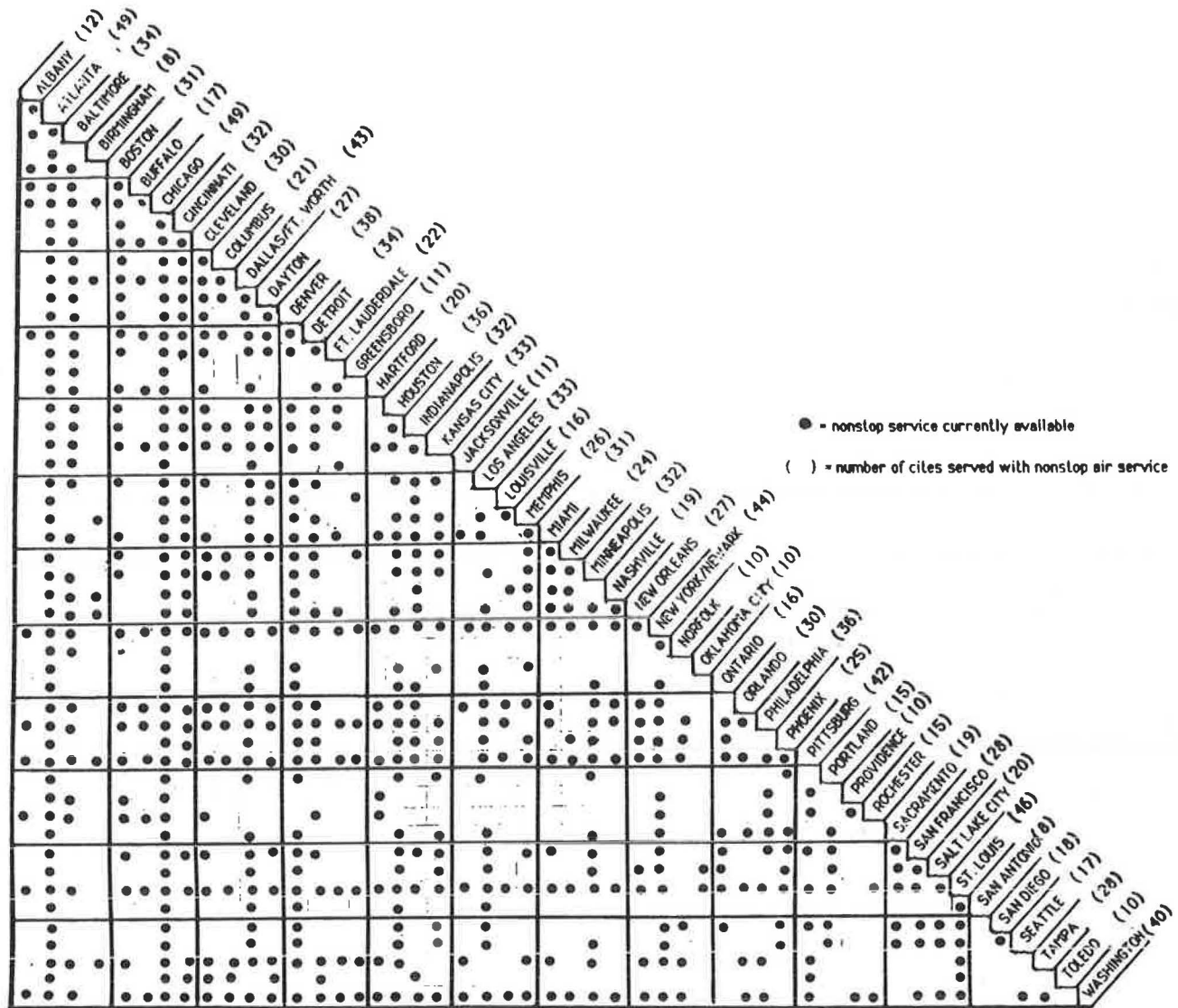


FIGURE 1 The status of nonstop air service between U.S. metropolitan areas, April 1985.

these 30 nonstop markets is 69.33 percent. Therefore, slightly more than 30 percent of the market is without nonstop air service.

The results of the survey (Table 2) rank all 50 cities from the lowest penetration rate for nonstop service (Toledo with 38.11 percent) to the highest (Chicago with 91.93 percent). Cities that currently function as large domestic hubs, such as Chicago, St. Louis, and Denver, are designated by symbols. An airline must be serving at least 20 destinations on direct flights from a metropolitan area for it to qualify as a hub.

It is no surprise that airline hubs have a higher penetration of nonstop service than nonstop cities. What is significant, however, is the magnitude of these differences. The share of the market having available nonhub service differs by more than 100 percent between the 50 largest metropolitan areas in the United States. Although the nonstop market exceeds 80 percent in 12 cities, it remains below 60 percent in 13 others. None of the 20 lowest-ranked cities are large hubs.

The following subsections briefly review the scope and market penetration of nonstop services in each of the 50 metro-

politan areas studied. The next major section then isolates the largest individual city pairs without nonstop service. Both illuminate current discrepancies in nonstop service, and present the opportunities for entrepreneurship that have subsequently emerged. Nonstop penetration rates are shown in parenthesis.

Markets with Minimal Market Penetration

Consider first the 10 cities that currently have minimal levels of nonstop service (see Table 2). Service from these cities is principally limited to routes linking them with major hubs, and little entrepreneurship has taken place. The result has been a sizable void in nonstop service to major metropolitan areas.

Birmingham, Alabama (41.87 percent) and Toledo, Ohio (38.12 percent) offer the most vivid illustration of this effect, with nonstop services limited to 10 and 8 destinations, respectively. Travelers must make flight connections to reach over three-fourths of the metropolitan areas studied (Figure 1).

TABLE 2 NONSTOP MARKET PENETRATION RATES OF U.S. METROPOLITAN AREAS

Minimal Nonstop Penetration	Limited Nonstop Penetration	Moderate Nonstop Penetration	Heavy Nonstop Penetration	Extensive Nonstop Penetration
Toledo, Ohio, 38.12	Milwaukee, Wis., 55.12	Baltimore, Md. ^a , 64.10	Fort Lauderdale, Fla., 73.01	Salt Lake City, Utah ^a , 81.40
Birmingham, Ala., 41.18	Hartford, Conn., 56.19	Orlando, Fla., 64.82	Cleveland, Ohio ^a , 73.18	Pittsburgh, Pa. ^b , 81.41
San Antonio, Tex., 47.28	Ontario, N.Y., 58.39	New Orleans, La., 65.65	Detroit, Mich. ^a , 74.89	Denver, Colo. ^b , 83.13
Louisville, Ky., 48.61	Rochester, N.Y., 60.15	Buffalo, N.Y., 68.90	Cincinnati, Ohio ^a , 76.12	New York-Newark, N.Y.-N.J. ^b , 83.78
Oklahoma City, Okla., 49.55	Columbus, Ohio, 60.43	Philadelphia, Pa., 68.90	Sacramento, Calif., 77.80	Houston, Tex. ^b , 84.59
Providence, R.I., 52.35	Indianapolis, Ind., 60.56	Dayton, Ohio ^a , 69.33	Washington, D.C., 77.87	Minneapolis, Minn. ^b , 84.64
Greensboro, N.C., 53.20	Jacksonville, Fla., 61.80	Phoenix, Ariz. ^a , 70.06	Boston, Mass., 78.10	Dallas-Ft. Worth, Tex. ^b , 86.14
Albany, N.Y., 53.40	Nashville, Tenn., 62.87	Miami, Fla., 71.88	Kansas City, Mo. ^a , 78.83	St. Louis, Mo. ^b , 87.11
San Diego, Calif., 53.49	Portland, Oreg., 63.05	Tampa, Fla., 72.57	San Francisco, Calif. ^a , 80.15	Atlanta, Ga. ^b , 89.74
Norfolk, Va., 55.09	Seattle, Wash., 63.82	Memphis, Tenn. ^a , 72.93	Los Angeles, Calif., 80.47	Chicago, Ill. ^b , 91.93

Note: Items categorized and listed in ascending order. All numbers are percentages.

^aSecondary hub operations handling 1.0 to 2.5 million annual passengers on a single airline.

^bMajor hub operations handling more than 2.5 million annual passengers on an individual carrier.

Approximately 60 percent of the total traffic in these markets has no alternative to these connecting services.

The absence of nonstop service from these cities offers stark contrast to abundant service available from their similarly sized neighbors. Toledo has no nonstop service to the East Coast, Florida, or to points west of St. Louis. Its nonstop penetration rate is more than 30 percent lower than that of comparably sized Dayton, a thriving minihub with nonstop service to 27 of the cities. Birmingham, in contrast to nearby Memphis, has no nonstop service to major business centers such as New York, Philadelphia, Washington, or any West Coast destinations. These two cities also differ in nonstop penetration by more than 30 points. Because large portions of these markets remain untapped, Toledo and Birmingham are emerging as prime targets for new nonstop air services.

San Antonio, Texas (47.28 percent) and Oklahoma City, Oklahoma (49.55 percent) have also developed a heavy dependence on connecting hubs for long-haul air travel. They are among the largest U.S. metropolitan areas without nonstop service to the densely populated East Coast, and lack nonstop service to Florida, all cities in the Great Lakes region (except Chicago), and San Francisco. With nonstop service to only 8 and 10 of top population centers studied, respectively, they remain predominantly untapped markets.

Louisville, Kentucky (48.61 percent) and Greensboro, North Carolina (53.20 percent) are steadily building nonstop routes to certain East Coast and Midwestern destinations, but are without highly demanded service to the West Coast, most of Florida, and the Southwest. These cities have nonstop service to only 16 and 11 of the cities studied, respectively, and are attractive markets for expansion when compared to comparably sized neighbors such as Charlotte, North Carolina, and Memphis. Valuable market niches have been secured by nonstop operators to the east; similar developments can be anticipated to distant cities to the west such as Denver, Los Angeles, and San Francisco.

Furthermore, Albany, New York (53.40 percent), Norfolk, Virginia (55.09 percent), and Providence, Rhode Island (52.35 percent) have minimal levels of nonstop penetration. These cities have very little nonstop service to nonhub cities outside the eastern seaboard and have no nonstop service to points west of St. Louis. Regional operators recently have helped fill the void in nonstop service to upstate New York and New England

cities, but little expansion has occurred to nonhub cities of the West or South. Providence and Norfolk are currently linked with only 10, and Albany with 12 of the metropolitan areas studied.

The largest city with only a minimal penetration of nonstop services is San Diego, California (53.49 percent), which ranks 18th in population and 42nd in nonstop penetration. Although it has nonstop service to most major hubs and to secondary hubs west of the Mississippi River, it is without nonstop service to almost all nonhub cities outside of the West Coast. Because of its peripheral location, San Diego is an attractive untapped market for airlines capable of long-range flying.

Markets with Limited Nonstop Penetration

The nonstop market penetration of cities in this category range between 55 and 64 percent, measurably higher than those in Category 1. A limited number of new nonstop routes already have been initiated from these cities, but these have been principally limited to regional destinations. Many heavily traveled distant destinations remain unserved.

This category includes Portland, Oregon (63.05 percent) and Seattle, Washington (63.83 percent)—the largest U.S. cities not linked to the important airline hubs of Cleveland, Detroit, Philadelphia, Pittsburgh, and Miami. They are without service to important nonhub cities such as Boston, Indianapolis, Philadelphia, or any Florida cities, and are linked with only 15 and 17 of the population centers studied, respectively. The peripheral location of the cities has undoubtedly been a factor in the sluggish development of nonstop services; however, with a new generation of limited-capacity narrowbody aircraft, they are emerging as attractive expansion targets.

Extensive short-haul nonstop services are available from Columbus, Ohio (60.43 percent); Hartford, New York (56.19 percent); Indianapolis, Indiana (60.56 percent); and Rochester, New York (60.15 percent); often with high frequencies and numerous airlines. However, many highly demanded long-haul markets from these cities remain untapped. With the exception of Indianapolis, these cities are among the largest metropolitan areas not linked with the important mid-United States hubs of Denver, Houston, and Memphis and the western cities of Los Angeles and San Francisco. Although Indianapolis has

developed a slightly more extensive nonstop network, the pervasiveness of its nonstop services dims in comparison with its comparably sized neighbors of Cincinnati and Dayton.

Jacksonville, Florida (61.80 percent) and Nashville, Tennessee (62.87 percent) are also highly dependent on connecting air services. Nashville is linked with only 19 of the population centers in the study, Jacksonville with only 11. Neither has nonstop service to Boston, Detroit, Houston, Los Angeles, or San Francisco. These voids in service have recently attracted new nonstop operators.

The final two metropolitan areas with limited nonstop penetration are Milwaukee, Wisconsin (55.12 percent) and Ontario, California (58.39 percent). These cities are located within close proximity to much larger metropolitan areas, and exhibit market penetration rates considerably below their rank in population. Ontario is the largest metropolitan area in the United States without nonstop transcontinental service and has nonstop links to 16 of the cities studied. Milwaukee, the largest U.S. city without nonstop service to the West Coast, has nonstop service to 24 cities. Nonstop networks from these cities are primarily limited to destinations within 500 mi.

Markets with Moderate Nonstop Penetration

Metropolitan areas in this category have developed moderate nonstop networks consisting of both long- and short-haul routes. Baltimore, Maryland; Dayton, Ohio; Memphis, Tennessee; and Phoenix, Arizona, are fledgling minihubs. The six others are nonhub cities that enjoy above-average levels of nonstop service.

Dayton (69.33 percent) and Memphis (72.93 percent) are more densely saturated with nonstop service than any cities of their size in the United States, and are the smallest mid-U.S. cities to offer nonstop service to Denver, Los Angeles, and San Francisco. As rapidly expanding airline hubs, these cities are linked with more than 25 of the cities studied, and offer comparatively few opportunities for new nonstop services.

Baltimore (64.10 percent) and Phoenix (70.06 percent), on the other hand, offer several of the United States' most densely traveled one-stop markets. They are fledgling regionally oriented domestic hubs, although they lack significant long-haul nonstop service. Transcontinental service is limited to a single route from both of these cities. Phoenix is linked nonstop to 25 of the metropolitan areas in the study; Baltimore is linked to 34.

Miami, Florida (71.88 percent); Orlando, Florida (64.82 percent); and Tampa-St. Petersburg, Florida (72.57 percent)—important leisure destinations—are steadily developing services to many larger nonhub cities and enjoy frequent, nonstop service to most major hubs. Among the larger unserved markets are upstate New York, most California destinations, and smaller nonhub midwestern cities. Miami, Orlando, and Tampa-St. Petersburg enjoy nonstop service to 31, 30, and 28 of the cities studied, respectively. These levels of service are well above other comparably sized nonhub cities.

The final three cities with moderate levels of nonstop service are Buffalo, New York (68.90 percent); New Orleans, Louisiana (65.65 percent); and Philadelphia, Pennsylvania (68.90 percent) all with nonstop penetration considerably higher than

other nonhub cities of their size. The opportunities for new nonstop service are primarily in long-haul markets. New Orleans and Philadelphia serve only two cities west of Denver, and are linked with 27 and 36 of the cities studied, respectively. Buffalo and Rochester have no nonstop service to destinations west of St. Louis, and are linked with 17 and 15 of the cities studied, respectively. The size of these metropolitan areas makes them prime candidates for the introduction of new transcontinental air services.

Markets with Heavy Nonstop Penetration

Fifteen of the 20 metropolitan areas most densely penetrated with nonstop service are airline hubs. Boston, Ft. Lauderdale, Los Angeles, Sacramento, and Washington—all with metropolitan area populations exceeding one million—are the only nonhub U.S. cities offering nonstop services to more than three-fourths of their consumers.

Boston (78.10 percent) and Washington (77.87 percent) have both developed extensive nonstop air service networks. Washington is linked to 40 of the United States' top 50 metropolitan areas—more than any nonhub city; Boston is linked with 31. These developments have helped these cities overcome many of the disadvantages of their nonhub status.

Nevertheless, opportunities remain. The Washington area ranks seventh in population, but 16th in nonstop service penetration, and 10th in the number of top population centers served. Boston ranks 10th in population, but 15th in nonstop service penetration, and 19th in the number of top population centers served. The absence of service to destinations such as Phoenix, San Antonio, San Diego, and Seattle represent lucrative opportunities for entrepreneurs.

Cincinnati, Ohio (76.12 percent); Cleveland, Ohio (76.12 percent); Detroit, Michigan (74.89 percent); Kansas City, Missouri (78.83 percent); and San Francisco, California (80.15 percent) are most characteristic of cities in this category. As expanding airline hubs, their nonstop market penetration rates exceed 70 percent. All have nonstop service to each of the nation's 15 largest cities. With nonstop service to an average of 31 cities, these cities offer comparatively few opportunities for market share expansion through the introduction of new nonstop service.

The United States' largest city not considered a hub for domestic purposes is Los Angeles, California (80.47 percent). Although it is an important international hub, the scope of its domestic nonstop services is considerably poorer than domestic hubs such as Chicago and New York. Los Angeles ranks 11th in market penetration and is linked with 33 of the cities studied. The 12 nonhub cities east of the Mississippi that lack nonstop service to Los Angeles, which include Columbus, Milwaukee, Orlando, and Tampa-St. Petersburg, are especially attractive expansion targets.

Ft. Lauderdale, Florida (73.01 percent) and Sacramento, California (77.80 percent) also exhibit exceptionally high market penetration rates among nonhub cities. They have become important regional transportation centers and are linked with nearly every major hub in the United States. Ft. Lauderdale's network of nonstop service links it with 22 of the cities studied.

Sacramento is linked with only 19. Both are without transcontinental air service.

Markets with Extensive Nonstop Service

The 10 most comprehensive airline hubs in the United States have nonstop market penetration rates exceeding 81 percent. Nine of these cities have nonstop service penetration that ranks considerably higher than their population rank—Salt Lake City is the most extreme example, ranking 36th in population and 10th in nonstop penetration.

This select group, in ascending order of nonstop penetration, consists of Salt Lake City, Utah (81.40 percent); Pittsburgh, Pennsylvania (81.41); Denver, Colorado (83.14 percent); Houston, Texas (84.59 percent); Dallas-Ft. Worth, Texas (86.54 percent); Minneapolis-St. Paul, Minnesota (84.64 percent); St. Louis, Missouri (87.11 percent); Atlanta, Georgia (89.74 percent); and Chicago, Illinois (91.93 percent).

On average, the nine major hubs in this category are linked with nonstop flights to all but six of the metropolitan areas studied. The cities not served principally rank below 25th in population and are over 1,500 mi distant. Atlanta and Chicago are linked with all population centers studied, with market penetration approaching or exceeding 90 percent, which is almost double the average for cities in the first category.

With at least two airlines establishing major hubs in each of these nine locations (with the exception of Pittsburgh), these cities offer little opportunity for rapid expansion of market share through the initiation of new nonstop routes. On the contrary, there is evidence to suggest that the concentration of services at hubs is having detrimental effects on many airlines' efforts to achieve break-even load factors. (3).

New York-Newark (83.78 percent) is the only metropolitan area in this category performing below its rank in population in terms of both nonstop market penetration and the number of cities served. Though easily ranking first in population, it ranks seventh in market penetration and fourth in the number of population centers served (44). Its Newark hub, despite a 200 percent expansion in flights in only three years, still lacks the scope of more centrally located facilities.

A brief summary has been presented of the diverse opportunities available to entrepreneurs in each of the 50 metropolitan areas. To supplement this city-by-city summary, it is useful to review the most heavily traveled markets (city pairs) without nonstop service in the United States.

THE LARGEST UNSERVED CITY PAIRS IN THE UNITED STATES

Using data from Figure 1 and CAB, the most heavily traveled city pairs without nonstop service in the United States are identified, and insight into likely patterns in the development of new nonstop services is provided. A review of these markets illustrates some of the effects of the existing imbalance in nonstop air service between cities, and suggests that the benefits of new nonstop services are likely to accrue unevenly.

The findings are given in Table 3. The 60 largest unserved city pairs are ranked, and an index is shown indicating the

nondirectional volume of local traffic in the CAB sample. The development of new nonstop routes would be expected to be closely correlated with the amount of local traffic traveling over the route.

The CAB data indicate that San Diego-Washington, D.C. is the nation's most heavily traveled market without nonstop service—CAB recorded 16,278 passengers in their sample. Closely following is the New York-San Antonio market (13,431). Other high-volume one-stop markets include New Orleans-San Francisco (11,815), and Orlando-Los Angeles (11,810), closely followed by Phoenix-Washington (11,028), Boston-Seattle (9,848), Boston-Phoenix (9,846), and Ft. Lauderdale-Los Angeles (9,432).

Possible sampling errors dictate a need to use caution in interpreting the data for individual city pairs. In addition, the differing characteristics of ridership might render the findings a misleading indicator of the potential profitability of nonstop air service. However, the general trend clearly supports the observation that nonhub cities appear to offer considerably greater opportunities than most hub cities. Nonhub cities account for 110 of the 140 entries in Table 3, or 78 percent. Major hubs are represented only seven times. Secondary air hubs such as Cincinnati, Kansas City, Memphis, Salt Lake City, and San Francisco are slightly more pervasive, appearing 23 times.

The likelihood of a city appearing in Table 3 is closely associated with the classification of its nonstop service (discussed in the previous section). Nine of the 10 cities with minimal nonstop service are represented (Albany does not appear). All 10 cities with limited nonstop service, and nine cities with moderate nonstop service, are represented. Dayton does not appear. Seven cities (80 percent with heavy levels of nonstop service, and only four (40 percent) of the cities with extensive nonstop service, are represented.

An even more illustrative measure of the differing attractiveness of metropolitan areas is the frequency with which they are represented. Eighteen cities appear three or more times on the list, and 14 of these are nonhub cities.

Boston appears most frequently with nonstop service to fewer destinations than any other city of comparable size. It appears nine times in three of the first 12 entries. The pervasiveness of Boston and other nonhub eastern cities such as Washington, D.C. and Philadelphia (which appear 6 and 7 times, respectively), reflects important voids in nonstop air service to distant destinations such as Birmingham, Phoenix, San Antonio, San Diego, and Seattle.

San Diego, already shown to be the largest U.S. city with a minimal level of nonstop service, appears eight times, second only to Boston. With an absence of nonstop service to top 10 population centers such as Boston, Detroit, Washington, San Diego appears three times among the first 15 entries.

Los Angeles, the largest U.S. city not serving as a hub according to the definition from the Section on nonstop market opportunities, also appears eight times. There is a strong latent demand for nonstop air service between Los Angeles and nonhub destinations throughout the South and Midwest.

Other nonhub cities that appear most frequently are New Orleans (seven times) Miami (six), Seattle (six), Orlando (five), Nashville (five), Tampa (five), San Antonio (four), Indianapolis (three), Norfolk (three), and Columbus (three). The lack of nonstop services to other nonhub destinations such as Boston,

TABLE 3 RANKING OF U.S. CITY PAIRS WITHOUT NONSTOP AIR SERVICE

Rank	City Pair	Index	Rank	City Pair	Index
1	San Diego, Calif.-Washington, D.C.	16278	36	New Orleans, La.-Oklahoma City, Okla.	4633
2	New York, N.Y.-San Antonio, Tex.	13431	37	Indianapolis, Ind.-Houston, Tex.	4554
3	New Orleans, La.-San Francisco, Calif.	11815	38	Cleveland, Ohio-San Diego, Calif.	4243
4	Orlando, Fla.-Los Angeles, Calif.	11810	39	Columbus, Ohio-Miami, Fla.	4169
5	Phoenix, Ariz.-Washington, D.C.	10028	40	Nashville, Tenn.-Los Angeles, Calif.	4143
6	Boston, Mass.-Phoenix, Ariz.	9846	41	Ontario, Calif.-New York, N.Y.	3984
7	Ft. Lauderdale, Fla.-Los Angeles, Calif.	9432	42	Boston, Mass.-Portland, Oreg.	3854
8	Boston, Mass.-Seattle, Wash.	9421	43	Boston, Tex.-Jacksonville, Tenn.	3792
9	Detroit, Mich.-San Diego, Calif.	9176	44	Norfolk, Va.-Orlando, Fla.	3783
10	New York, N.Y.-Oklahoma City, Okla.	8962	45	Miami, Fla.-Louisville, Ky.	3742
11	Boston, Mass.-New Orleans, La.	8298	46	Memphis, Tenn.-Philadelphia, Tenn.	3771
12	San Antonio, Tex.-Washington, D.C.	8217	47	Rochester, N.Y.-Orlando, Fla.	3762
13	Philadelphia, Pa.-San Diego, Calif.	7750	48	New Orleans, La.-Minneapolis, Minn.	3743
14	Hartford, Conn.-Los Angeles, Calif.	7698	49	Philadelphia, Pa.-San Antonio, Tex.	3682
15	Philadelphia, Pa.-Phoenix, Ariz.	7318	50	Nashville, Tenn.-Boston, Mass.	3619
16	Cleveland, Ohio-Phoenix, Ariz.	7028	51	Buffalo, N.Y.-Los Angeles, Calif.	3616
17	San Francisco, Calif.-Tampa, Fla.	6753	52	Columbus, Ohio-San Francisco, Calif.	3583
18	Orlando, Fla.-San Francisco, Calif.	6536	53	Boston, Mass.-San Antonio, Tex.	3576
19	Ft. Lauderdale, Fla.-San Francisco, Calif.	6269	54	Phoenix, Ariz.-Miami, Fla.	3549
20	Philadelphia, Pa.-Seattle, Wash.	6164	55	Jacksonville, Fla.-Philadelphia, Pa.	3492
21	Hartford, Conn.-San Francisco, Calif.	6162	56	Baltimore, Md.-San Diego, Calif.	3546
22	Columbus, Ohio-Los Angeles, Calif.	6006	57	New Orleans, La.-Seattle, Wash.	3434
23	Detroit, Mich.-Seattle, Wash.	5919	58	Birmingham, Ala.-Washington, D.C.	3406
24	Baltimore, Md.-San Francisco, Calif.	5533	59	Indianapolis, Ind.-San Diego, Calif.	3406
25	Portland, Oreg.-Washington, D.C.	5467	60	Oklahoma City, Okla.-San Francisco, Calif.	3376
26	Orlando, Fla.-Kansas City, Mo.	5387	61	New Orleans, La.-Phoenix, Ariz.	3439
27	Miami, Fla.-Norfolk, Va.	5300	62	Rochester, N.Y.-Tampa, Fla.	3328
28	Houston, Tex.-Nashville, Tenn.	5196	63	Providence, R.I.-Tampa, Fla.	3315
29	Los Angeles, Calif.-Milwaukee, Wis.	4994	64	Boston, Mass.-Salt Lake City, Utah	3256
30	Nashville, Tenn.-Detroit, Mich.	4967	65	Louisville, Ky.-Philadelphia, Pa.	3242
31	Boston, Mass.-Indianapolis, Ind.	4869	66	New York, N.Y.-Toledo, Ohio	3212
32	Nashville, Tenn.-Miami, Fla.	4830	67	New Orleans, La.-San Diego, Calif.	3209
33	Miami, Fla.-Seattle, Wash.	4813	68	Greensboro, N.C.-Los Angeles, Calif.	3278
34	Milwaukee, Wis.-San Diego, Calif.	4792	69	Seattle, Wash.-Tampa, Fla.	3197
35	Oklahoma City, Okla.-Washington, D.C.	4694	70	Norfolk, Va.-Tampa, Fla.	3190

Los Angeles, and Philadelphia explains the frequency of these cities and offers excellent opportunities for entrepreneurship. Nashville and New Orleans are by far the smallest cities to be represented five or more times.

Four cities functioning as airline hubs appear three times or more on the list: Detroit (three times), New York (four), San Francisco (eight), and Phoenix (six). The frequency with which these cities appear reflects the opportunities that exist to many transcontinental destinations and illustrates the limited scope of these air hubs when compared with more centrally located hub complexes. There appears to be strong demand for nonstop air service from these cities to mid-U.S. nonhub cities such as Birmingham, Oklahoma City, and San Antonio. Of these three cities, the most lucrative opportunities appear to be from Phoenix. Four of the city's unserved destinations—Boston, Cleveland, Philadelphia, and Washington, D.C.—appear among the first 20 entries. This reflects the concentration of nonstop service from Phoenix to points west of the Mississippi River.

Of 10 cities not represented, eight currently function as hubs: Atlanta, Chicago, Cincinnati, Dallas-Ft. Worth, Dayton, Denver, Pittsburgh, and St. Louis. Two nonhub cities, Albany and Sacramento, do not appear. Of course, these hub facilities will continue to expand as important connecting complexes. However, from the perspective of the local population, they

offer considerably less opportunity for market share expansion, and this factor will play a critical role in future route development (3).

IMPLICATIONS FOR THE INDUSTRY

Changing market conditions suggest that successful airlines will begin to shift their focus from conventional hub-and-spoke flights to new nonstop services. Many variables will ultimately affect the development of new nonstop air service in the United States. However, as has been shown, the current imbalances in nonstop service fostered by the development of hub-and-spoke route structures are likely to play a significant role in future route growth. Entrepreneurs are attracted by markets offering opportunities for product differentiation and rapid expansion of market share. These opportunities exist in markets where nonstop air service is currently unavailable especially as nonhub service is becoming more cost effective.

There are numerous other methodologies in which this issue can be viewed; no individual assessment can be considered complete. The objective of this study is simply to bring much needed attention to this timely issue. In surveying the status of nonstop service between 50 metropolitan areas, an attempt has

been made to foster an appreciation for the numerous opportunities available to nonstop operators in an environment dominated by hub-and spoke route structures.

The results of this study are not intended as forecasts for the future development or profitability of nonstop service but rather as the identification of an important set of market incentives that will affect growth. The evidence suggests, for example, that the most lucrative opportunities for new nonstop services radiate from major nonhub metropolitan areas such as Boston, Philadelphia, Los Angeles, San Antonio, and San Diego, in addition to several regionally oriented hubs such as Detroit and San Francisco. The development of nonstop services in these markets has only partially offset the imbalances engendered by hub-and spoke systems, leaving many major city pairs unserved. The bulk of these are of distances unsuitable for the regional airlines that have been most aggressive in filling these service niches.

The greatest imbalances in nonstop service exists in cities with populations of less than one million. In these markets, nonstop penetration ranges from 38 to 70 percent, and hub cities in this category exhibit penetration rates almost 40 percent higher than nonhub cities. Although a broad scope of service is available to major hub cities, there is comparatively little service from these cities to major nonhub destinations. With traffic data indicating that these city pairs are among the largest without nonstop service, new service between these cities is likely to bring about important structural changes in the U.S. air network.

In metropolitan areas with populations of one to two million—where hub cities exhibit nonstop penetration rates 30 percent higher than nonhub cities—the evidence suggests that the industry is responding more briskly to the imbalances in service. Many carriers are enjoying a rapid escalation in market share from these cities by supplementing their existing hub operations with new point-to-point services. Nevertheless, opportunities remain, and many of the largest markets in the United States without nonstop service radiate from these cities.

A costly consequence of the cautious response of most major carriers has been the rapid expansion of new low-cost airlines, generally with significant cost advances. Thus far, only a handful of major firms have invested significantly in nonhub air services, leaving lucrative opportunities for newly formed airlines.

These rapidly growing airlines have flourished in an environment dominated by hub-and-spoke systems. Virtually no corner of the country remains untouched by these new entrepreneurs, and they are providing new nonstop services from nonhub cities such as Buffalo, Milwaukee, New Orleans, and Orlando. Others are rapidly seeking financing for services from cities overly dependent on connecting services such as Columbus, Rochester, and San Jose.

In the incessant battle for market share, it is becoming increasingly important for airlines to differentiate their products. As shown in this paper, the introduction of new nonstop services in markets traditionally served only with connecting services constitutes a viable and an increasingly attractive means of gaining a competitive advantage. The potential market share gain from the implementation of this technique appears greatest in a select group of nonhub cities.

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