The Evolution of the US Airline Industry: Technology, Entry, and Market Structure - Three Revolutions

Eldad Ben-Yosef

Follow this and additional works at: https://scholar.smu.edu/jalc

Recommended Citation
https://scholar.smu.edu/jalc/vol72/iss2/2

This Article is brought to you for free and open access by the Law Journals at SMU Scholar. It has been accepted for inclusion in Journal of Air Law and Commerce by an authorized administrator of SMU Scholar. For more information, please visit http://digitalrepository.smu.edu.
THE EVOLUTION OF THE US AIRLINE INDUSTRY:
TECHNOLOGY, ENTRY, AND MARKET STRUCTURE
—THREE REVOLUTIONS—

Eldad Ben-Yosef*

I. INTRODUCTION

Aviation technology has come a long way since the introduction of flight at the turn of the twentieth century. In fact, the industry is considered to be in a mature stage of its life cycle; technology has evolved—and the industry has locked-in—to a dominant technology standard, so that radical intra-industry-spawned product innovation and industry shakeouts are largely unlikely. This evolutionary process is path dependent: the initial conditions, history, and specific evolution of technology, markets, regulations, and many other processes co-evolved over time in a specific manner to create enormous barriers for critical changes. The general concept of path dependence and

---

* Ph.D., (Economics and International Business), NYU, Stern School of Business (1987). President of Aeron Aviation Resources, Inc. (aircraft leasing and airline investments). Author of, The Evolution of the US Airline Industry, Theory, Strategy and Policy, The Netherlands: Springer (2005). I would like to thank Professor Lawrence J. White for helpful comments, and Bruce Roswick for his help and encouragement. This article is in fondest memory of Bruce. The author can be contacted at byosef@nvbb.net.

1 On the concept of product life cycle, see, e.g., James M. Utterback, Mastering the Dynamics of Innovation xviii (1976); Steven Klepper, Entry, Exit, Growth, and Innovation over the Product Life Cycle, 86 Am. Econ. Rev. 562, 562-64 (1996). For a general discussion in an aviation context, see Earll M. Murman, Myles Walton & Eric Rebentisch, Challenges in the Better, Faster, Cheaper Era of Aeronautical Design, Engineering and Manufacturing, 104 AERONAUTICAL J. 481 (2000). The distinction between radical (revolutionary, non-continuous) and incremental (gradual, conservative) innovations is intuitively appealing but not always clear-cut. Entropy statistics techniques were used to measure the evolution of aircraft technology; see, e.g., Koen Frenken & Loet Leydesdorff, Scaling Trajectories in Civil Aircraft (1913-1997), 29 Res. Pol'y 331, 331 (2000) available at http://users.fmg.uva.nl/lleydesdorff/aircraft/preprint.pdf.

2 On the economic concept of path dependency and lock-in, see, e.g., Paul A. David, Clio and the Economics of QWERTY, 75 Am. Econ. Rev. 332, 335-36 (1985);
lock-in has attracted the attention of economists and policy makers, focusing on several intriguing questions: is the emerging dominant technology (and related markets, institutions, and infrastructure) socially efficient, or are we trapped in an inefficient position? Can new entry challenge the leading incumbent firms and their dominant market positions? Is lock-in a market failure? Should the government intervene and, if so, can it, in fact, move technologies and markets to more desirable positions (assuming such are known and conform to the will of the political majority)?

Management and business researchers, on the other hand, have analyzed a large number of case histories showing that mature and powerful incumbents often become vulnerable and lose their dominance to disruptive entry. They focused on somewhat different questions: what are the typical strengths of a small marginal entry, and what might make it disruptive? How should an incumbent respond to such entry? Can managers create and manage innovation paths (rather than let chance create dependency)? What are the implications of all of this for further technological innovation, competition, and market structure?

Life cycle theories point out that during its maturity stage, an industry's concentration tends to increase, innovation efforts tend to focus on production processes and cost reduction, competition centers on price, and incumbents become vulnerable to the threat of disruptive entry. This general notion conflicts with the traditional antitrust view that associates increased con-

---


3 For a discussion of these issues, see generally supra note 2.


6 See id.
centration with barriers to entry, market power, and high fares. In the late 1990s it appeared to many observers that the airline industry had reached an undesirable lock-in condition. Aircraft technology seemed largely stagnant, and free market forces seemed to have failed to challenge the dominant business model of the major incumbent airlines and their increasing market power. Antitrust and other regulatory efforts were launched against the major airlines.

Then, in the early 2000s, significant low-cost entry appeared, as if from nowhere, challenging the hegemony of the major incumbents and tipping the industry in a different direction. With hindsight, the antitrust and regulatory concerns and actions of the late 1990s may seem misplaced.

This paper discusses aspects of the U.S. commercial aviation industry using some general insight of dynamic views of technology and industry evolution. I will focus on the interaction and co-evolution of aircraft technology and airline markets, empha-

---

13 I focus on describing and interpreting the industry evolution leaving the normative analysis of antitrust and regulation policies outside the scope of the article. For a discussion on policy implications, see, e.g., ELDAD BEN-YOSEF, THE EVOLUTION OF THE US AIRLINE INDUSTRY: THEORY, STRATEGY AND POLICY 2, 279 (2005).
sizing the dynamic relationship between innovation and competition in the aircraft market and the airline market. I attempt to put a complex and turbulent reality into a general, abstract picture, emphasizing the major industry trends. In a manner typical of interpreting the behavior of complex dynamic systems, I believe I can tell quite a persuasive tale of the past (with hindsight!). Telling the future, however, is a different story. In this respect I will suggest possible, tentative directions for—or raise some questions regarding—the unfolding future of the industry.

II. LOCK-IN

During most of the 1990s, there was a general consensus that aircraft technology and related aircraft and airline markets and infrastructures were locked into dominant positions. In the airline market, hub-and-spoke networks became the dominant business model, and a small number of winning airlines ruled the skies. In the aircraft manufacturing market, Boeing established its market might as the dominant aircraft builder. There were clear relationships between airlines, aircraft technology, and market structure. Turboprop technology dominated the smaller-than 100-seat short-haul aircraft category, and turbofan jet technology dominated the larger-than 100-seat category. Major incumbent airlines operated turbofan jet aircraft and controlled regional affiliates that operated mostly turboprop technology. The major jet builders were not interested in competing for the relatively low-margin turboprop section of

---

14 I use the term aircraft market (or industry) to refer to the aircraft as input, and airline market (or industry) to refer to air travel services produced with aircraft. I focus on the U.S. airline industry.

15 Kroo, supra note 9.

16 American, United, and Delta emerged as the dominant airlines. See BEN- YOSEF, supra note 13, at 7.


the market, and this class of aircraft was designed and built by an independent group of manufacturers.

Boeing’s leadership position in the large aircraft manufacturing industry seemed unquestionable. In 1997, it acquired McDonnell Douglas and the civil jet aircraft manufacturing industry became a duopoly. Airbus expanded its aircraft offerings and gained in market share, yet Boeing’s position as the dominant airplane builder seemed secure. During the 1990s, Boeing introduced only one clean-sheet aircraft design—the 777. The main revolutionary innovation relating to the design of this aircraft involves changes in process technology—this aircraft was designed in a novel way, using three-dimensional digital-aided tools. Other product innovations during the 1990s were mainly of incremental changes to existing base-line aircraft technology. During this period, powerful computers drove the most noticeable innovations in airline technology as well. Major airlines put enormous efforts into developing and using complex revenue (yield) management systems.

---

21 Boeing Co., History: The Boeing Logbook: 1988–1992, http://www.boeing.com/history/chronology/cron14.html (last visited Sept. 13, 2007). Three categories of product (aircraft) innovations are usually distinguished by the industry: derivative, variant, and clean-sheet design. The latter involves creating a new base-line design (the introduction of the 707 or 777, for example). The former involves differentiation within a given base-line design. 737-300 and 737-400, for example, are two variants of the same base-line platform. The 737NG aircraft family, on the other hand, is a derivative of the previous generation 737Classic family, involving incremental changes in the base-line platform. Clean-sheet design is not necessarily a radical product innovation. The introduction of the 707 was a radical innovation in relation to the previously dominant piston engine technology. The introduction of a clean-sheet design 777 is an incremental product innovation relative to the 747 or 767, for example.


23 See, e.g., Kroo, supra note 9, at 2.

The dominance of Boeing and Airbus appeared unchallengeable because of the enormous barriers to entry into the large commercial aircraft building business. Similarly, the major network airlines and their complex hub-and-spoke network strategies appeared to block any meaningful new entry or any radical changes in the air travel market structure. Only major incumbent airlines acquired and operated new turbofan aircraft, and innovation in aircraft technology enhanced their competency. There was no successful and sustained new entry into the airline market—in spite of many attempts—except for the phenomenal expansion and success of Southwest Airlines. The industry history proved time and again that new startup entry is doomed to fail. The tragic accident of a DC9 aircraft flown by the most significant new entry of the 1990s—ValueJet—enhanced the public perception that 'old' technology aircraft, which had traditionally been used by new, undercapitalized entrants, represent a major safety challenge. Pushed by public opinion, the FAA made startup entry and aging aircraft major targets for safety regulations. New entry into the airline market became extremely challenging.

Antitrust proponents believed that the airline market was approaching a condition akin to the static model of a monopoly and that market creativity failed to challenge the power of the incumbent airlines. A wide use of price discrimination (yield

---

26 See, e.g., Service Problems, supra note 10, at 1–2.
27 Vietor, supra note 18, at 19–58.
28 Ben-Yosef, supra note 13, at 61, 241–42.
30 Steve Huettel, 10 Years After Tragedy, AirTran Flies On, St. Petersburg Times, May 11, 2006, at 1A. Used aircraft (of current or previous generations) have usually been considerably less expensive to acquire and therefore were used by startup entrants in order to reduce entry costs. Ben-Yosef, supra note 13, at 101 n.37, 241.
31 Id. at 241–42.
32 Id.
33 For DOT position, see, e.g., U.S. Dep’t of Transp., Proposed Statement of Enforcement Policy Regarding Unfair Exclusionary Conduct in the Air Transportation Industry (1998), http://www.dot.gov/affairs/dkt3713.htm. For DOJ position, see, e.g., Klein, supra note 7. For general policy analysis, see, e.g., Clinton V. Oster, Jr. & John S. Strong, Competition and Antitrust Policy, in Hand-
management) techniques increased the major airlines’ profits and their reliance on a relatively small group of high-willingness-to-pay passengers to produce a disproportionately large part of their revenues. Regulators and antitrust officials believed that the major network airlines exercised their market power by, on the one hand, charging monopolistic hub premiums and, on the other hand, fighting and deterring new entry attempts by predatory threats and practices. An unprecedented number of antitrust and regulatory initiatives were launched during this period. In the late 1990s most observers expressed surprise at the trajectory that the industry had adopted and questioned the validity of the basic premise that the airline industry is naturally competitive.

The unfolding of two ‘revolutions’ in two different market sections was quite surprising, given the general background depicted above. The first is traceable to the early 1990s and the second to the late 1990s. I refer to the first revolution as the short-haul or regional-market revolution and to the second as the medium-haul low-cost revolution. In both cases, significant market changes with a potential for long-term dynamic effects have been unfolding. In both cases, potential disruptive innovations in the airline market—starting as a marginal entry with a slight chance of success, according to most industry observers—came to redefine respective market niches. Changes have emerged in non-continuous and somewhat surprising ways in response to long co-evolving dynamic processes of innovations in technol-

---


34 BEN-YOSEF, supra note 13, at 7.

35 Id. at 243.

36 Id.

37 Senator Hollings provided a vivid description of the industry: “... the result [of deregulation] is what we have today—a balkanization of our aviation system—16 major hubs dominated by one carrier. New entry, real new entry is virtually unheard of, and people in small communities now have little choice in airfares (which are too high).” Antitrust Issues in Airline Industry: Hearing Before the S. Comm. on Commc’n, Sci. & Transp., 106th Cong. (2000) (statement of Sen. Hollings, Member, S. Comm. on Commc’n, Sci., & Transp.).

38 For simplicity of exposition I broke down the market into three general sections: short-haul, medium-haul, and long-haul.

39 See BEN-YOSEF, supra note 13, at 242; SEEING WHAT’S NEXT, supra note 4, at xxvii.
ogy, regulations, and markets. In both cases, the interaction and co-evolution of innovations in aircraft and airline technologies created significant market changes and new competitive dynamics.

In the mid 2000s, it became apparent that a potential for a third revolution in the long-haul market was about to gain steam. This third revolution is directly related to innovations in new aircraft designed for the long-haul market section, as well as the airline industry response to this new technology, as major incumbents and new entrants are preparing for a battle for dominance over this market section.

III. THE SHORT-HAUL (REGIONAL) REVOLUTION

The emergence of the hub-and-spoke network as a dominant post-deregulation business model enabled the migration of otherwise financially struggling regional airlines to a new market niche. Concomitantly, for the first time since the introduction of jet engine technology four decades earlier, the concept of small (fifty-seat) jets gained large-scale commercialization. The regional jet revolution destroyed the traditional industry perception that small regional jets are inefficient because of their comparative unit cost disadvantage.

---

40 See SEEING WHAT'S NEXT, supra note 4, at 132.
42 SEEING WHAT'S NEXT, supra note 4, at xxiii.
44 BEN-YOSEF, supra note 13, at 7, 10.
46 Matt Bennett, Showdown in Regional Aviation, 17 MERCER MGMT. J. 78, 78-80 (2004). Small jets cost less to operate on per-flight basis, but more on per-seat/mile basis, in comparison to mainline aircraft. Id. at 78-79. Most costs are fixed in relation to the (smaller) number of seats and the (shorter) flying stage-lengths compared to mainline aircraft. There are various operational and technical reasons for this, including: 1) regional jets operate shorter stage lengths and thus spend a disproportional part of their block hours of operation on high energy consuming activities—on the ground (taxiing and maneuvering), taking-off, and climbing to altitude, relative to mainline aircraft; 2) smaller engines are less energy-efficient mostly because of a smaller and less efficient compressor section even at high by-pass ratios; 3) structure is heavier and therefore aircraft less efficient, mostly because engine weights do not scale linearly with thrust so that small engines have lower thrust-to-engine weight ratios.
the small jets eliminated the traditional dominance of turbo-prop technology in the regional market. The high unit cost of operating the small jets was justified by their contribution to the overall revenues of the major incumbent networks.

This market opportunity was seized by a small group of executive-jet and turboprop-aircraft manufacturers who developed derivatives of existing aircraft models to create (and fit into) the new market niche. These manufacturers migrated from their traditional markets into a newly redefined and expanding niche of building small commercial passenger jets. The incremental innovation and new application of existing standard technology enabled the development and design costs of the new jets to stay low. An important element in powering this revolution was the design of an efficient small engine family by General Electric (GE CF36), a derivative of a widely used military engine.

The emerging dominant regional jet-builders (Bombardier and Embraer) sustained up-market innovation and increased the size of their jets from 50-seat to 70-seat and to 100-seat, moving into the traditional low-cost, low-margin territory of the dominant large-aircraft builders. Engrossed in fierce competition, Boeing and Airbus were busy building large and expensive aircraft and were not attracted to the low-margin section of the market, nor did they seem bothered by the new entry. Con-

---


48 Bennett, supra note 46, at 78-79.


50 See Seeing What's Next, supra note 4, at 132.


54 Seeing What's Next, supra note 4, at 132.
comitantly, the regional airlines expanded their market niche, capturing parts of the traditional mainline markets. The move to larger jets improved the aircraft unit cost and the economic performance of the regional airlines.

Major incumbent airlines encouraged and facilitated the growth of the regional airlines, integrating them into their network systems while enjoying the benefits of joint-production and outsourcing synergies. The regional airlines have significantly consolidated since deregulation and operate almost exclusively in affiliation with major incumbents. The mode of integration between the majors and the regional affiliates varies and has changed over time. Several majors own their affiliates; several use market contracts and other combinations of the two modes. A few regional airlines serve more than one major airline. The regional airlines with their new jets became an integral part of the complex hub-and-spoke network system, expanding its reach and enhancing its pricing power.

The economic crisis of the early 2000s, the impact of the September 11 events, and high oil prices hit the major airlines hard, forcing them to shrink while concurrently accelerating the

---

55 Jet Industry, supra note 47, at 12; Seeing What's Next, supra note 4, at 144.
56 See U.S. Gen. Accounting Office, GAO-01-344, Regional Jet Service Yet to Reach Many Small Communities 5, 22–23 (2001), [hereinafter Small Communities], available at http://www.gao.gov/new.items/d01344.pdf; Aleksandra Mozdzanowska & R. John Hansman, Observations and Potential Impacts of Regional Jet Operating Trends 8 (2003), available at http://dspace.mit.edu/bitstream/1721.1/35865/1/amerajuly2003-Montreal.pdf; Bennett, supra note 46, at 78–79. The expansion of the regional airlines was constrained by strong labor unions' objections to outsourcing as reflected in the scope clauses of the labor agreements. See Mozdzanowska & Hansman, supra, at 8. These objections were relaxed (but not completely eliminated) especially after the bankruptcy filings of several of the major airlines. See id.
57 See Seeing What's Next, supra note 4, at 144.
58 See id.
59 See id.
60 See id.
62 Small Communities, supra note 56, at 18.
growth of the regional airlines. The traditional hub-and-spoke business model lost its strategic magic in the face of plummeting demand, strong new low-cost competition, and dissipating pricing power. The regional airlines, with their increasing fleets and aircraft size, and their low-cost structure (including but not limited to labor costs), assumed a new strategic role in the major incumbents’ battle for survival. Regional airlines were substituted for an increasing portion of mainline operations and were positioned by the majors to compete with new low-cost entrants in the medium haul. The medium-haul revolution (to be discussed next), in fact, accelerated the expansion of the regional airlines and their migration into the traditional mainline market.

This trend was perceived by labor unions as a threat to job security, and was a central issue of contention in labor bargaining. The strategic importance of the regionals increased, however, and managements of major airlines were pressured to accelerate the outsourcing of business to their regional affiliates in order to cut costs, maintain market presence, and respond to an unprecedented low-cost competition. Labor union opposition notwithstanding, the regionals have increased the size of their fleets, the size of their aircraft, and have expanded their reach to longer-haul routes and to new markets.

The expansion of the regional airlines increased the dependency and cooperation of major and regional airlines, as well as the potential for conflicts. Conflicts became more apparent as the majors became weaker and were forced to cut costs and shift revenues from the regional. Starting in the early 2000s, regionals were forced to accept amendments and changes in their affiliation contracts, reducing the level of payments and assum-

---

63 LCAs Are Growing and Profitable, supra note 12, at 18.
64 See id. at 5.
65 See id. at 1–2, 5, 9–10.
67 For a discussion of the operating trends of the regional airlines, see, e.g., Mozdzanowska, supra note 56, at 8.
68 Id. at 8.
69 Id. at 6–8.
71 See Seeing What’s Next, supra note 4, at 145; Bennett, supra note 46, at 80.
72 Bennett, supra note 46, at 80.
ing more risks. Several regionals were dragged by their major affiliates into bankruptcy courts.

Can the two groups continue growing in harmony? Can regional airlines maintain their lower cost structure? There is a natural conflict between two integrated organizations with two tiers of remuneration, especially when the income of one organization is an expenditure of the other (moreover, the more profitable organization pays its respective employees less, and pressures to increase remuneration may cause its cost advantage to erode).

Winning regional airlines are expected to sustain their up-market trajectory and further expand into the majors' traditional markets using larger jets. It appears that major airlines will continue outsourcing an increasing part of their short- and medium-haul operations, up to the 100-seat aircraft category, to expanding affiliated or spun-off regionals in spite of labor union objections. Will regionals grow to disrupt majors? The introduction of regional jets in the 100-seat category broke down the traditional distinction between small and large jet aircraft and the traditional distinction between the regional and mainline markets. Specializing regional airlines dominate the operation of the 50- and 70-seat category aircraft. Regional and mainline operators have acquired and operate the 100-seat category aircraft and it is not clear yet which group would dominate this category.

IV. THE MEDIUM-HAUL LOW-COST REVOLUTION

The hub-and-spoke network model became the target of a new wave of competitive battles by a new group of low-cost star-

---

73 Id. Traditional fee schedules involved fixed payment per trip, providing the regional with a stable income and a shield from market risks.
74 For example, Mesaba is a Northwest affiliate and Comair is a Delta affiliate.
75 See Seeing What's Next, supra note 4, at 146.
76 FAA Forecast 2005, supra note 66, at 30, 32.
78 The first attempt of a successful regional airline to separate from its major affiliate and migrate into national markets ended in bankruptcy liquidation (Independence Air). Bill Brubaker, Fly Is Latest Airline in Bankruptcy Protection, WASH. POST, Nov. 8, 2005, at A01.
79 See Jet Industry, supra note 47, at 12; Bennett, supra note 46, at 80.
80 See Seeing What's Next, supra note 4, at 132-33.
tup airlines in the early 2000s. This new group identified major cracks in the incumbents' dominant business model and attacked it while the latter airlines were struggling with the aftermath of the September 11 events, and the subsequent unprecedented economic crisis. Incumbent airlines were forced to contract while low-cost airlines persistently expanded. New successful entry and expansion, coupled with an unprecedented industry-wide economic crisis, forced the major incumbents to rethink and change their dominant strategy for the first time since deregulation.

Complex hub-and-spoke networks were forced to shrink, and flight frequencies were reduced and spread more evenly over the day in the face of sustained low-cost competition. Low-cost competition and increasing fare transparency through internet resources weakened the major incumbents' power of fencing potential buyers and using discriminating fare techniques. Traditional yield management lost its power. The major incumbent airlines lost their fare-setting power, and pricing leadership in this market-section shifted to the new entrants.

A. THE SOUTHWEST PHENOMENON

The term "low-cost airline" has become a catchall name for post-deregulation new entry and, in fact, disguises diverse airlines and heterogeneous strategies. It was first used in connection with the outstanding success of Southwest Airlines.

---

82 Ben-Yosef, supra note 13, at 17.
83 LCAs Are Growing and Profitable, supra note 12, at 4–5; Ben-Yosef, supra note 13, at 7.
84 Between the beginning of 2000 and the end of 2005 major incumbent airlines reduced domestic capacity by 14.9%. Low-cost airlines (including Southwest but not including regionals) increased their capacity by 50.8%. LCAs Are Growing and Profitable, supra note 12, at 4–5; FAA Forecast 2005, supra note 66, at 14.
86 Ben-Yosef, supra note 13, at 246.
87 See LCAs Are Growing and Profitable, supra note 12, at 3–4.
90 Southwest was a small local airline during the regulation regime. It consistently expanded after deregulation to become one of the largest U.S. major airlines. I use the term major incumbents to refer to all pre-deregulation major
Southwest designed an inferior product, using different lower-cost production and sale processes compared to the dominant business model of the major incumbents. In many respects, the Southwest model has been in binary opposition, a mirror image, of the dominant one. Southwest targeted smaller, secondary airports that were not served by the major airlines, offering a generic substitute service, not directly focusing on the major airlines' hubs or their main high-paying market base.

There was a general sense of balanced coexistence, live and let live, between Southwest and the majors, in spite of the consistent and threatening growth of the former and its competitive impact on fares. Fare levels have been significantly lower in parallel markets served by both Southwest and incumbents. There was usually, however, no fierce all-out competition or intense direct cutthroat fare wars.

For over two decades, Southwest has largely stuck to its winning strategy and has not launched direct aggressive efforts against the majors' main hub markets or their high-paying passengers. An important part of the success of Southwest is associated with developing new markets and expanding existing ones with no massive efforts at directly displacing incumbents' core service. Yet, as it has grown and expanded to traditional major airlines' territory, especially in the East Coast (Philadelphia, Baltimore, and Dulles Washington), Southwest has become a more direct and imminent threat to the incumbents.

B. THE LOW-COST REVOLUTION

By the late 1990s the major incumbents were locked-in to their winning strategies, generating outstanding revenues for all airlines except Southwest. These airlines are also sometime called legacy, network, or hub-and-spoke airlines.

91 SEEING WHAT'S NEXT, supra note 4, at 138-39.
92 Id. at 138. For an extensive bibliography list, see the Southwest website. Southwest Airlines, Bibliography, http://www.southwest.com/about_swa/press/bibliography.html (last visited Sept. 13, 2007).
94 SOUTHWEST EFFECT, supra note 93, at 6-8.
95 Id.
96 SEEING WHAT'S NEXT, supra note 4, at 138-39.
97 Id. at 138.
98 Id. In 2004, Southwest directly attacked the US Airways hub in Philadelphia.
most half a decade. In addition, they were busy aggressively bar-
gaining with labor unions that were trying to extract a share in
the financial success of the period. Over two decades of labor
bargaining failed to adjust labor costs and rigid work rules—
which have been an enduring legacy of the regulation regime—
to reflect the competitive threats of the deregulated market.
The incumbents were slow to recognize and react to the emerg-
ing new threats. They fell into the same trap that many in-
cumbent firms fell into before them—inertial continuation of
their dominant winning strategy that turned into failure. This
was particularly evident in fare (yield) management. They
kept using the same fare discrimination strategies and assump-
tions, blind to market changes that had eroded their ability to
segment and fence passengers into fare categories. They con-
tinued plugging-in mechanically generated demand-estimates
produced by their traditional computer models in a manner
that, in fact, reduced and spiraled-down their revenues. They
lost touch with their full-fare paying passengers who believed
that they were being cheated or otherwise paying too much, and
they ignored low-fare paying passengers who were frustrated
with encumbering restrictions attached to their tickets. They
were also slow to adapt to the new internet technology and to
realize its potential negative impact on their ability to discrimi-
nate fares using traditional distribution channels.

Then, starting in the early 2000s, after two decades of deregu-
lation and practically no successful new entry, a new wave of suc-
cessful entry and expansion emerged, tipping the traditional
industry balance. This new wave of expanding low-cost entry,
on top of the consistent expansion of Southwest, and given the

---

100 See id. at 12–13.
101 SEEING WHAT’S NEXT, supra note 4, at 136–37.
102 Id. at 137.
103 SOUTHWEST EFFECT, supra 93, at 3.
104 For an analytical exposure of the spiral down effect, see, e.g., William L. Cooper, Tito Homem-de-Mello & Anton J. Kleywegt, Models of the Spiral-Down Ef
105 See id.
106 See id.
107 LCAs Are Growing and Profitable, supra note 12, at 3–4; BEN-YOSEF, supra note 13, at 18.
108 See BEN-YOSEF, supra note 13, at 247, n.207. Included in this group are JetBlue, Air Tran, Spirit, Frontier, and ATA.
specific timing and post-September 11 industry crisis, created a direct and significant competitive blow to the majors, causing them to lose a large share of their traditional medium-haul market and their price leadership in this sector.\textsuperscript{109} While for over two decades Southwest had slowly conquered secondary positions surrounding the major fortress hubs and their controlled territory,\textsuperscript{110} the new low-cost entry took advantage of the unprecedented weakness of the incumbents and launched a frontal attack on their main markets.\textsuperscript{111} The competitive impact of this new startup attack has been considerably more significant than its size.\textsuperscript{112}

In 2003, Southwest was ranked second after Delta with respect to total number of domestic enplanements; in 2004 it was ranked first.\textsuperscript{113} In 2004, JetBlue was categorized a major airline by the Department of Transportation.\textsuperscript{114} In 2005, Delta joined US Airways, United, and Northwest in filing bankruptcy.\textsuperscript{115}

1. \textit{Innovation—Reducing Costs, Creating New Values}

The term 'low-cost airline' hides a set of diverse and subtle entry strategies that must be carefully interpreted. One should not confuse the important \textit{direct cost} advantage that is usually associated with this low-cost entry with the advantage they have created by implementing innovative processes and flexible work rules that further reduce costs and create new values.\textsuperscript{116} This strategy involves designing the product—and related production and sale processes—differently, to provide high (or different) values for overall lower costs. Most observers focus on labor cost differences as the major comparative advantage of the new startups.\textsuperscript{117} While this advantage is extremely important, it

\textsuperscript{109} Id. at 7.
\textsuperscript{110} \textsc{Seeing What's Next}, supra note 4, at 136–37.
\textsuperscript{111} \textsc{Ben-Yosef}, supra note 13, at 7.
\textsuperscript{112} See FAA Forecast 2005, supra note 66, at 5; Cooper et al., supra note 104, at 968; \textsc{Southwest Effect}, supra note 93, at 6–7.
\textsuperscript{114} U.S. Dep’t of Transp., Airline Classification, http://ostpxweb.dot.gov/aviation/airlineclassifications.htm (last visited Sept. 13, 2007). “Major” airlines are those generating operating revenues of more than $1 billion annually. \textit{Id.}
\textsuperscript{116} \textsc{Ben-Yosef}, supra note 13, at 248.
\textsuperscript{117} Id. at 250.
tells only part of the story. JetBlue may pay less for a respective employee compared to Delta or United, for example. But JetBlue and other entrants have also incorporated innovative processes (including a wide range of outsourcing, a wide use of internet technology, young aircraft fleets with high commonality, a simple dynamic pricing strategy, and more flexible work rules) that changed its resource utilization, reduced overall costs, increased productivity, and created a different product with different values for passengers. JetBlue pays less to produce a seat on a flight; yet, the product is viewed as having a higher value by its specific targeted market. This new entry model changed the traditional model of low-cost, low-quality combination (you pay less and you get less) that dominated previous entry attempts.

New startup airlines took advantage and incorporated new internet technology into their operations. This new technology enabled, for the first time since deregulation, creating an effective channel of direct ticket sales, while avoiding the traditional expensive distribution systems that were biased in favor of the major incumbents. Costs were significantly lowered by using internet-based booking, ticketing, and check-in, as well as automated luggage check-in points (kiosks). These cost reductions relate to reservation, booking, and ticketing systems and personnel; travel agents’ commission (traditionally 9%); and traditional check-in counter personnel at the airport. In addition, the new technology enables direct and efficient personal contact (emails), developing loyalty clubs, online sale of credit cards, car rentals, hotel accommodations, and other travel related bundled services and bookings. It also provides a comprehensive passenger database for sale promotions and other marketing efforts.

120 See id.
121 Gillen, supra note 118, at 373.
122 LCAs Are Growing and Profitable, supra note 12, at 3, 4.
123 Gillen, supra note 118, at 373.
These new processes have also changed product characteristics and value. A passenger self-selects a fare from a menu of flight and fare availability and a desirable seat assignment, all from her home computer. The passengers feel empowered by making their own selections in addition to saving encounters and frictions with reservation and other personnel (although at times the new process creates confusion and friction of its own). A passenger prints her own boarding pass, can leave her luggage at the airport curb (or at a kiosk), and walk straight to the gate. The new process significantly cuts the time a passenger must spend at the airport before boarding. It also reduces traditional frictions with check-in counter personnel. Many passengers find this to be a more desirable experience. Add to this the new aircraft, direct TV or satellite radio, and leather seats, and most passengers perceive a low-cost, high-value product that is usually very challenging to create and is appealing to a large market, including business travelers.

Incumbents (including Southwest) were forced to respond to this new entry by cutting direct costs and by innovating and changing their traditional production and sales processes. This is a challenging task for an incumbent that is locked-in to a certain mode of operation—including existing labor agreements, production and sale processes, technologies, institutions, supply-chain relationships, and corporate culture—that has evolved over a long history. While it is too early to speculate regarding the long-term survivability and success of any of the new low-cost entrants, their market penetration is by all means impressive, and their impact on major airlines and the overall

---

127 JetBlue, for example, installed reservation posts in home-stations operated by housewives in Utah, significantly cutting the airline’s costs while maintaining a high quality service.
129 See id.
130 Id.
131 See Harrell, supra note 119.
133 See BEN-YOSEF, supra note 13, at 7.
industry organization and innovation has been immense.\(^{134}\) The low-cost revolution is not only about an unprecedented successful market entry, but also about accelerating a trend of process innovations that is pushing the industry toward a new model of leaner production and new service standards.

2. *The Role of New Aircraft*

In the late 1980s, Airbus decided to enter the medium-haul aircraft market that was overwhelmingly dominated by Boeing.\(^{135}\) Airbus implemented impressive and expensive new technologies in its design—especially in digital aircraft controls and the use of composite materials—that translated into only incremental product innovation with a small noticeable operational economic impact, if any, compared to the competition.\(^{136}\) In the late 1980s, the A320 was certified.\(^{137}\) A series of accidents related to Airbus aircraft in general, and automated cockpit technology in particular, made its market penetration even more challenging. The A321-100 and A321-200 commenced commercial flight during the second half of the 1990s, gaining in popularity and market share, mostly outside the US.\(^{138}\)

Boeing stopped production of the 727 and introduced its 737NG derivative family for which it implemented only conservative innovations.\(^{139}\) It decided not to incorporate fly-by-wire technology or aggressive use of composites for various reasons, the most important among them being that the cost of incorporating these new technologies seemed to be unjustifiable economically.\(^{140}\) In addition, passengers did not perceive the difference between hydraulic and digital control systems and


\(^{136}\) Id.

\(^{137}\) Id.


\(^{140}\) Boeing Counterattacks Airbus as Next-Generation 737 Rolls Out, AvIATION DAILY, Dec. 10, 1996, at 397.
were not ready to pay a premium for having these new technologies incorporated into their aircraft.\textsuperscript{141}

Not surprisingly, the two manufacturers followed a textbook example of price-centered competition over market shares with their two similar products.\textsuperscript{142} What turned out to be more surprising, perhaps, is that Airbus assumed price leadership by aggressively cutting prices in spite of Boeing’s clear advantage in lower (already sunk) development costs.\textsuperscript{143} This intense competition between the manufacturers triggered a significant and unprecedented downward trend in new aircraft prices and fueled the low-cost revolution.\textsuperscript{144}

The economic slowdown of the late 1990s, the September 11 events, and the subsequent industry crisis, hurt the major incumbents badly.\textsuperscript{145} Orders for new aircraft were cancelled and deliveries indefinitely delayed.\textsuperscript{146} Downward rigid aircraft production capacity and financially hurting incumbent airlines forced Boeing and Airbus to focus on the new startup entrants as the only significant potential demand for their production lines.\textsuperscript{147} Fierce competition between the major aircraft builders over the medium-haul market caused new aircraft prices to plummet and encouraged an unprecedented entry of new airlines operating new, very inexpensive aircraft.\textsuperscript{148} The traditional dominant model of ‘new startup entry acquiring low-(ownership) cost, old-generation aircraft’ was replaced by a new entry model.\textsuperscript{149}

Manufacturers have accommodated a worldwide movement of entrepreneurs taking advantage of increased global deregulation and liberalization and weak, financially struggling major incumbents, with a huge fleet of new aircraft.\textsuperscript{150} The new aircraft were acquired for very deep discounts relative to historic list

\textsuperscript{141} Michael Mecham, \textit{Boeing Translates 737 to Digital Era}, \textit{Aviation Wk. & Space Tech.}, Oct. 6, 1997, at 48.

\textsuperscript{142} \textit{Jet Industry}, supra note 47, at 12; Bennett, \textit{supra} note 46, at 80.

\textsuperscript{143} See Horng, \textit{supra} note 25, at 38.

\textsuperscript{144} For aspects of the strategic competition between Boeing and Airbus, see, \textit{e.g.}, \textit{John Newhouse, Boeing Versus Airbus: The Inside Story of the Greatest International Competition in Business} (2007); \textit{Matthew Lynn, Birds of Prey: Boeing vs. Airbus: A Battle for the Skies} (1997).

\textsuperscript{145} Ben-Yosef, \textit{supra} note 13, at 7.

\textsuperscript{146} \textit{Id.} at 246.

\textsuperscript{147} \textit{Id.} at 248–49.

\textsuperscript{148} \textit{Id.} at 250.

\textsuperscript{149} \textit{Id.}

\textsuperscript{150} \textit{Id.}
prices, and with highly accommodative financial terms, warranties, and technical support.\textsuperscript{151} In addition, during the first several years of operations, new aircraft require only minimal maintenance costs and exhibit a high level of mechanical reliability.\textsuperscript{152} This ‘honeymoon’ period is, obviously, very helpful during market penetration stages.\textsuperscript{153}

3. \textit{Point-to-Point vs. Hub-and-Spoke}

The term \textit{point-to-point} airline has become synonymous with Southwest and the wave of low-cost new entry, while the term \textit{hub-and-spoke} is used to describe major incumbent airlines.\textsuperscript{154} These two terms are somewhat misleading and must be carefully interpreted.\textsuperscript{155} It is important to note that Southwest and the low-cost airlines have adopted a point-to-point strategy, but in fact have created networks with one or more hubs.\textsuperscript{156} The major incumbents, on the other hand, adopted a certain hub-and-spoke strategy, yet, the majority of their flights connect nodes point-to-point.\textsuperscript{157} The term point-to-point signifies a mostly unbundled (one-way) simply priced, standard, no (or low) frill, and homogeneous service.\textsuperscript{158} This contrasts with the complex

\footnotesize
\begin{itemize}
    \item \textsuperscript{151} Id.
    \item \textsuperscript{152} Id.
    \item \textsuperscript{153} For a discussion of the low-cost startup entry and the role of new aircraft, see id. at 249–50.
    \item \textsuperscript{156} See Dipasis Bhadra & Pamela Texter, \textit{Airline Networks: An Econometric Framework to Analyze Domestic U.S. Air Travel}, 7 J. of Transp. & Statistics 1 (2006) [hereinafter \textit{Airline Networks}], available at http://www.bts.gov/publications/journal_of_transportation_and_statistics/volume_07_number_01/html/paper_06/ (a publication of the Bureau of Transp. Statistics) (last visited Sept. 13, 2007). Three generic network structures are often distinguished in the network literature and are relevant to our discussion: 1) a central (or major) hub network, all traffic flows through one central hub (star), all traffic except for hub origins and destinations require connections; 2) a decentralized network, consists of several smaller centralized hubs; and 3) a distributed network, which has no centralized hubs. For a non-technical review of network theory, see, e.g., \textsc{Albert-Laszlo Barabasi}, \textit{Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life} (2003).
    \item \textsuperscript{157} See \textit{Airline Networks}, supra note 156.
    \item \textsuperscript{158} Gillen, supra note 118, at 370–71.
\end{itemize}
discriminatory fare schemes, round-trip bundled, high frequency, sometimes-forcing hub connection, and purchase and travel restrictions that are associated with the incumbents' traditional hub-and-spoke strategy.¹⁵⁹

Many observers perceive the industry's evolution as two stylistic and binary opposite architectural standards competing over dominance.¹⁶⁰ There is a growing consensus among observers that the hub-and-spoke airlines might disappear—going the way of the dinosaurs.¹⁶¹ It is important not to confuse the two stylistic general network structures and their respective pros and cons with the fact that certain incumbents that used hub-and-spoke architecture strategically, in a specific manner, at a specific point in time, have lost their traditional market positions.¹⁶² It is not the structure that broke down but its specific strategic application by the major incumbents.¹⁶³ In addition, since evolving network structure is a complex dynamic phenomenon, relating to specific history, heterogeneous and changing demand, rigid infrastructure constraints, evolving technology, and strategic interaction among agents (and chance!), it does not look as if we are facing a winner takes all competition between two alternatives.¹⁶⁴ It is also important to distinguish between the evolving patterns of the overall industry network structure and the specific agents that are competing to capture markets, and their strategic selection, interaction, and impact on the emerging overall network structure.

Scheduled point-to-point and hub-and-spoke services co-exist in transportation systems (railroad, bus, shuttle-bus/taxi). Point-to-point service can be part of centralized, decentralized, or distributed network structures.¹⁶⁵ Such flights may connect nodes through centralized or decentralized hubs, or directly

¹⁵⁹ Id. at 369–70.
¹⁶⁰ See id. at 369.
¹⁶² Gillen, supra note 118, at 374–75.
¹⁶³ SEEING WHAT'S NEXT, supra note 4, at 136–37.
¹⁶⁴ Note in particular that physical infrastructural (grounds and airside spaces) constraints, as well as the geographical distribution of hubs and respective demand preferences, impose a truncated hub and distributed network structure.
¹⁶⁵ Gillen, supra note 118, at 382–84.
across a network. It is important to note that a hub-and-spoke usually describes a network structure, while point-to-point describes a connection between two nodes. A hub-and-spoke structure is composed of point-to-point connections. A set of nodes connected to one central hub airport makes a star shaped hub network, yet flights may or may not be made compatible for connection by the airline or may not be desirable for passengers. The ratio of point-to-point to connection-requiring flights in a given hub-and-spoke structure is affected mostly by flight compatibility (mostly through scheduling), passenger preferences, competing point-to-point and other alternatives, and fares. Roughly 30% of hub directed traffic during the high hub-and-spoke period of the 1990s was associated with catching connecting flights. A significant part of this traffic was generated by the economies of hub-and-spoke networks—connecting smaller markets that otherwise could not support point-to-point traffic.

In 1993, 32% of all passengers on domestic flights made connections, compared to 28% in 1978, before deregulation. This was not a big change, in spite of the post-deregulation strategic move to a hub-and-spoke model. Southwest, the pioneer of the point-to-point concept, in its annual statements during the early 2000s, reported that over 20% of its operations involved connecting flights. It is expected that the portion of Southwest’s connecting flights will keep growing following its code share agreement with ATA in 2005.

167 This point may be obvious, but there seems to be much confusion about this distinction.
169 BEN-YOSEF, supra note 13, at 45, 254–55; Gillen, supra note 118, at 369.
170 Gillen, supra note 118, at 370.
171 MORRISON & WINSTON, supra note 29, at 22.
172 Id. at 22–23.
173 Id. at 22.
174 Id. at 22.
175 See Southwest Airlines Co., Annual Report (Form 10-K), at 4 (Feb. 4, 2002). In general, the incumbents are expected to have more connecting flights since they also operate smaller aircraft and connect smaller markets (regionals) that cannot be efficiently served by Southwest’s one-size, larger aircraft fleet.
The major incumbents adopted integrated hub architecture as a foundation of their post-deregulation strategy. This strategy was aimed at capturing dominant positions in the largest and most dense national markets. It also enabled a better utilization of their existing rigid production capacity and high cost structure. The integrated hub provided economies in connecting many spokes and enabled the capture of physical control over limited groundside space (including gates) and airside space (including slots where applicable). A major integrated hub became an essential facility, which, once captured by an airline, created a regional monopolistic bottleneck. Coordinating high frequency inbound and outbound flights, especially during peak demand periods, facilitated connectivity and arguably enhanced product quality, while at the same time creating congestion and eliminating entry by competition. Moreover, overcapacity at a major hub deters entry by signaling a potential aggressive incumbent’s response to market penetration or expansion attempts.

Pricing strategy affects traffic flows over a network. Reducing fares on certain connecting segments, for example, has a system-wide impact on traffic and revenues. During the second half of the 1990s, the incumbents made extensive use of yield management techniques to maximize revenues. They often protected seats for late booking by high willingness-to-pay passengers on otherwise higher fare point-to-point hub flights. This strategy made point-to-point hub flights relatively more expensive and encouraged or even forced low payers to

176 Gillen, supra note 118, at 367–68.
177 BEN-YOSEF, supra note 13, at 4.
178 Id. at 42.
179 BEN-YOSEF, supra note 13, at 34; Vietor, supra note 18, at 54.
180 Vietor, supra note 18, at 54.
182 Id. at 34.
183 Gillen, supra note 118, at 370.
184 Id.
185 Yield Management Crucial in the 1990s, Says Consultant, AVIATION DAILY, Mar. 13, 1992, at 448. Initial yield management techniques focused on a single flight leg; however, emphasis shifted during the second half of the 1990s towards an overall network orientation. Id.
use connecting flights. This is an important point that is often overlooked: fare strategies and yield management techniques, in fact, contributed to an increased demand and use of connecting flights on the existing hub-and-spoke network structure.

5. The Southwest Network

Southwest’s network structure is an emerging outcome of its business model, rather than a strategic selection. Southwest focused on specific secondary, smaller airports that were big enough to sustain its operations of one aircraft type (the 737). It captured a leading position in each of the airports into which it moved by increasing frequency of flights. Its network structure has emerged and changed over time in response to a continuing search for, and expansion into, adequate markets that could support its model of operations.

The emerging Southwest network includes typical decentralized multi-hub network elements as well as distributed network elements. Once the large hubs were captured and developed by the major incumbents, smaller hubs were captured and developed by Southwest. Adequate spokes were tied into this alternative network. Over time, traffic in certain cities served by Southwest has grown quite substantially, and smaller, yet quite impressive hubs have emerged—for example, Dallas Love Field, Phoenix, St. Louis, Las Vegas, Philadelphia, and Denver. As distributed node markets have grown, this network also developed direct node connection possibilities (not through hubs). The code-share agreement into which Southwest recently entered using larger and longer-range aircraft, enables a new type of node connection that was not possible before—for example. The code-share agreement with which Southwest recently entered enables a new type of node connection that was

---

187 See id.
188 See Ben-Yosef, supra note 13, at 7.
189 Seeing What’s Next, supra note 4, at 138.
190 Id. at 137.
191 Id. at 138.
193 Seeing What’s Next, supra note 4, at 137–38.
194 Southwest Route Map, supra note 192.
195 Id.
196 Id.
not possible before—for example, by using larger and longer range aircraft.\textsuperscript{197}

The main differences between the incumbents' and Southwest's networks are a consequence of the differences in the constraints of their respective selected airports (physical infrastructure and market constraints) and pricing strategies.\textsuperscript{198} Moreover, since Southwest operates one aircraft size, it entered only certain airports and markets that support such operation, and did not connect shorter-(regional) or longer-range nodes into its network, which contrasts with incumbents that operate a diverse aircraft mix.\textsuperscript{199}

6. The New Low-Cost Model

There is an advantage to using a simple point-to-point service or building a simple small network in launching an attack on a section of an incumbent's complex hub-network system. The entrant does not have to duplicate—and sink enormous costs in building—a complex hub-and-spoke network. It can cherry-pick desirable points it wishes to serve based on cost or other advantages it may have. In addition, price discrimination associated with the large fixed-cost and low-marginal cost combination of a complex hub-and-spoke system may attract entry. A new entrant may respond with a strategy mix that includes lower fares (and/or no restrictions on tickets) on a desirable point-to-point segment. This general strategy drove the entry of the new low-cost airlines.\textsuperscript{200}

But these point-to-point airlines established, in fact, small hubs or, at least, the basis for one or more hub structures.\textsuperscript{201} JetBlue, for example, identified a market opportunity in New

\textsuperscript{197} The code-share with ATA, for example, enables new types of connections. See ATA Codeshare, \textit{supra} note 175.

\textsuperscript{198} Gillen, \textit{supra} note 118, at 370–71.

\textsuperscript{199} The characteristics of airline networks are different from the much studied computer based networks. They have general scale-free and power law characteristics but they are truncated and showing exponents of a considerably smaller magnitude because of their infrastructure and demand constraints. Even the largest incumbent hubs don't have more than 150 connections. Southwest's expansion strategy resembles in general the idea of a preferential attachment of nodes into a dynamically evolving network, which creates a (self emerging) scale-free hub network. Southwest, however, restricted itself to smaller airports and markets and to one size aircraft. On network theory, see, e.g., Barabasi, \textit{supra} note 156.

\textsuperscript{200} BEN-YOSEF, \textit{supra} note 13, at 17–18, 248.

\textsuperscript{201} See Southwest Route Map, \textit{supra} note 192.
York and established a base in JFK; since then, it has been adding nodes to its New York hub and created a second hub in Long Beach, California.\(^{202}\) In February 2003, just over two years after starting service, it operated eighty daily flights from JFK to Florida, twenty-two to upstate New York, and thirty-two to western U.S. destinations.\(^{203}\) Its hub structure enables passengers to connect to other destinations through the New York hub.\(^{204}\) JetBlue is perceived as a point-to-point airline; yet, expanding point-to-point service from its New York hub and increasing the number of daily flights have created an increasing number of possible compatible connections. JetBlue’s decision to expand by acquiring a large fleet of regional jets (EMB190) further suggests expansion of its hub network.\(^{205}\) Its location in New York City—a major international port city—is ideal for feeding into destinations over the Atlantic or connecting inbound traffic with destinations in the United States.

It is important to emphasize that although JetBlue is perceived as a point-to-point airline, it has, in fact, created a typical hub-and-spoke network structure that is similar to (although obviously significantly smaller than) the incumbents'. The above description is by no means unique to JetBlue. All startup point-to-point entrants have created hub-and-spoke networks: Airtran in Atlanta, Frontier in Denver, and Spirit in Fort Lauderdale.\(^{206}\) This is an important point that must be emphasized: the so-called ‘point-to-point’ low-cost airlines created and operate hub-and-spokes network systems.

Four main aspects differentiate the hub-and-spoke models established by the new entrants from the incumbents’ traditional models. The differences, however, may diminish as the size and complexity of the startup operations grow and their entry models evolve. First, there is the obvious aspect of size: incumbent hubs are large, while new entrants start small.\(^{207}\) These hubs are simpler and less expensive to operate, yet their size and com-

\(^{202}\) JetBlue Airways Corp., Annual Report (Form 10-K), at 3 (Feb. 18, 2003).
\(^{203}\) Id.
\(^{204}\) Id.
\(^{207}\) Gillen, supra note 118, at 372–73.
plexities are expected to grow over time if an entry is successful.\textsuperscript{208}

Second, scheduling plays an important role in making point-to-point service compatible for connection.\textsuperscript{209} The traditional incumbents' strategy involves flying concerted waves during peak demand times. The new entrants operate a smaller number of more evenly spread out flights during the day.\textsuperscript{210} This strategy reduces congestion-related costs but requires longer waiting time for connecting flights.\textsuperscript{211} This pattern may change as the number of spokes served grows, flight frequency increases, and the number of passengers carried grows.

Third, the new entrants adopted a one-aircraft-type entry strategy, enjoying operational economies of commonality and standardization, but specializing in a certain product and market.\textsuperscript{212} Incumbents, on the other hand, service many markets with several aircraft types and sizes.\textsuperscript{213} As mentioned before, JetBlue has changed its one aircraft fleet penetration strategy by ordering new Embraer aircraft,\textsuperscript{214} Airtran upgraded its old DC9 aircraft to B717\textsuperscript{215} and later added 737NG aircraft, and Southwest entered a code share using larger aircraft.\textsuperscript{216} These and other low-cost airlines indicated that they are considering expanding their reach by code share agreements with other airlines.\textsuperscript{217} The complexity and diversity of the new low-cost airline fleets, operations, and products are expected to grow if their growth is sustained.\textsuperscript{218}

Finally, there is an important issue regarding fare strategy. In general, low-cost entrants tend toward dynamic, inter-temporal price discrimination based on expected demand for a specific unbundled (one-way) flight.\textsuperscript{219} But the new entrants are cur-

\textsuperscript{208} \textit{Seeing What's Next, supra} note 4, at 139.
\textsuperscript{209} Ben-Yosef, \textit{supra} note 13, at 41–42; Gillen, \textit{supra} note 118, at 371, 374.
\textsuperscript{210} Gillen, \textit{supra} note 118, at 371, 374.
\textsuperscript{211} \textit{See id.}
\textsuperscript{213} \textit{Id.}
\textsuperscript{214} Jet Industry, \textit{supra} note 47, at 41.
\textsuperscript{216} ATA Codeshare, \textit{supra} note 175.
\textsuperscript{217} Low-Cost Carriers Start to Change Their Roadmaps, \textit{Aviation Daily}, June 5, 2006, at 4.
\textsuperscript{218} \textit{Id.}
\textsuperscript{219} \textit{See David Gillen & Tim Hazledine, The New Price Discrimination and Pricing in Airline Markets: Implications for Competition and Antitrust} 3 (XIV Pan-American Con-
rently facing increasing costs as well as other growing pains. The honeymoon period of minimal costs for maintaining new aircraft fleets is about to end, and expensive engine and airframe maintenance, as well as higher fuel and interest expenses, have been pushing costs up. The low-cost entrants may not be able to sustain their low penetration fares much longer. Now that they have established a critical market mass, they are pressured to increase fares. Will they stick to their entry fare strategy, or will they introduce traditional or other elements of fare discrimination in order to increase revenues? Bundling tickets on a round-trip basis locks-in passengers that otherwise may use a competing airline for a return flight. Also, restrictions related to return flights have constituted a major element in the traditional market segmentation technique of high-willingness-to-pay passengers. Setting fares of connecting flights has an important impact on overall network revenues and traffic flows. Under certain circumstances, setting a lower fare on a connecting segment—or rejecting a point-to-point passenger for a connecting one—may increase overall system revenues. How will the new entrants develop their fare strategy as connection possibilities grow and their products become more complex? Also, the new internet-based direct ticket distribution systems,

ference on Traffic & Transportation Engineering, Sept. 20–23, 2006), available at http://www.transport.gov.nz/assets/NewPDFs/18-September-06-paper-from-Profs-Gillen-and-Hazledine-re-pricing.pdf. There is generally no (or only limited) inter-personal or inter-group price discrimination on the basis of demand elasticity. A business passenger and a tourist will pay the same fare on the same seat. Fares, however, change in relation to the demand for a specific flight over time.

See SEEING WHAT'S NEXT, supra note 4, at 139.

Ben-Yosef, supra note 13, at 259.


The number of days stayed at a destination (as well as weekend return) was a major product versioning and market segmentation device in the traditional incumbents’ yield management model. SEEING WHAT'S NEXT, supra note 4, at 137–38.

Gillen, supra note 118, at 370.


In traditional yield management a seat is “damaged” in order to segment passengers. Passengers are usually frustrated with what look to them as artificially imposed restrictions on similar seats. Airlines have recently started experimenting with fare discrimination based on physical demand attributes, for example, charging a premium on a seat with more legroom, or for window or aisle seats. Northwest Airlines to Charge More for Legroom, M-TRAVEL.COM, Mar. 15, 2006, http://www.m-travel.com/news/2006/03/northwest_airline.html.
created by the startups, enabled them to overcome the historic barrier to entry imposed by the traditional global distribution systems.\textsuperscript{227} Will these new systems be sufficient to sustain growth in the long run, or will connection to the traditional systems be necessary in order to do so?\textsuperscript{228}

V. THE LONG-HAUL REVOLUTION

The first sixty years of aircraft technology were punctuated by frequent radical innovations and changes.\textsuperscript{229} During this ferment era, technology explorations drove the industry, changing the shape, functionality and uses of aircraft, creating new markets, and redefining existing ones.\textsuperscript{230} In the late 1950s, the Boeing 707 revolutionized the industry and emerged as the dominant design-concept of commercial jet aircraft, starting an impressive gradual and evolutionary strand of successor aircraft models.\textsuperscript{231} Competition shifted from inter-standard to intra-standard orientation.\textsuperscript{232} Over time, the aircraft building industry has consolidated into a duopoly,\textsuperscript{233} while experiencing a consistent process of increasing specialization and vertical disintegration as more design and production tasks and risks have been outsourced to lower level supply-chain members.\textsuperscript{234} Boeing and Airbus have assumed the role of the prime system integrators.\textsuperscript{235} Lower-level integrators (engines, avionics, material) drove most of the innovations and changes within the constraints of existing and grad-

\begin{footnotes}
\footnote{227} Gillen, \textit{supra} note 118, at 373.
\footnote{228} Code-share and other interlining agreements with U.S. major or foreign airlines require connecting with the global distribution systems. Using global distribution systems increases costs considerably in comparison to direct internet systems. Gillen, \textit{supra} note 118, at 373.
\footnote{229} See Murman et al., \textit{supra} note 1, at 481–82; Kroo, \textit{supra} note 9, at 1.
\footnote{230} See \textit{id}.
\footnote{231} Kroo, \textit{supra} note 9, at 1.
\footnote{233} \textit{JET INDUSTRY}, \textit{supra} note 47, at xi.
\footnote{235} See Horng, \textit{supra} note 25, at 30–42.
\end{footnotes}
ually evolving interface standards. Subsystem innovations have been integrated without causing major disruptions to the overall aircraft system or to its operational environment such as airports or air traffic control.

The general non-exclusive and shared-nature of lower level supply-chain relationships and the mandatory standards imposed by regulatory bodies facilitate industry-wide accumulation and diffusion of standard and modular technology. Prime integrators tap into a largely similar technology base offered by supply-chain members. Innovations achieved in aircraft-specific projects often trigger feedback into the supply-chain network, and affect and drive further innovation and competition. This is particularly noticeable in (but by no means limited to) engine design, which, to a large extent, has driven aircraft evolution. For example, new technology developed by an engine manufacturer for a specific aircraft model has been used in the same or similar version or in derivative engines to power competing aircraft designed by the same or other aircraft manufacturers. In a manner typical to other mature industries, market segmentation and aircraft customization have also increased significantly. The current availability of intra- and inter-aircraft family variety is quite impressive in comparison to the one-size-fits-all paradigm of the late 1950s and 1960s.

A. Innovation and Competition in the Long-Haul Aircraft

The main implication of the pattern roughly sketched above is that it has become increasingly more costly to effect (even

---

237 See Horng, supra note 25, at 30-42.
238 JET INDUSTRY, supra note 47, at xi; Restructuring, supra note 236 at 8; Horng, supra note 25, at 23.
240 See Horng, supra note 25, at 30-42.
241 See Horng, supra note 25, at 54, 84.
242 Kroo, supra note 9, at 1.
244 See, e.g., GeroSkI, supra note 5, at 72.
only incrementally) product innovations and changes from one aircraft generation to the next. Moreover, such innovations may not be perceived as significant or may not even be noticeable to passengers. In addition, it is difficult for Boeing and Airbus to differentiate same-generation competing aircraft models from each other. Despite impressive innovations, most aircraft performance measures have not changed much since the 1960s, except for significant reduction in fuel consumption and noise. In addition, although the numbers of origins and destinations served by airlines have grown dramatically and average real fares have declined, the speed and most other quality characteristics of the average travel service have not changed much compared to regulation-era levels.

These general observations are typical for an industry in a mature stage of its life cycle and suggest that competition is expected to increasingly center on price. A state-of-the-art Airbus A340, for example, looks quite similar to the standard-setting Boeing B707 of the late 1950s. Its subassemblies and components, however, are radically different. The dramatic accumulation of evolutionary incremental innovations and changes occurring mostly at the subsystem and component levels for almost five decades has not destroyed the dominant model that emerged with the 707, but, rather, improved its efficiency. In addition, to most boarding passengers, an Airbus A330 looks quite similar to a competing Boeing 777 and offers a similar service.

This general evolutionary path sheds light on the dilemma faced by Boeing and Airbus during the late 1990s and early 2000s: where could they go next with aircraft technology, innovation, and competition? They explored opportunities for sustaining up-market innovations by pushing existing technology boundaries to increase the size, speed, and efficiency of aircraft. Both companies explored the possibility of building a super jumbo for over a decade, separately and jointly.

245 See Horng, supra note 25, at 37.
246 Kroo, supra note 9, at 1.
247 Id.
248 See id.
249 See id.
250 Id.
251 See id.
252 Id.
253 Seeing What's Next, supra note 4, at 130–31.
254 See id.
ing—at the time enjoying a monopolistic position in building the largest aircraft, the 747-400—was consistently more skeptical of a super jumbo program, citing, among other things, high design and prototype production costs relative to the potential size of the market. The pursuit of supersonic commercial flying, once considered a natural direction for innovation, was largely abandoned or at least delayed because of economic and environmental considerations.

In the late 1990s it seemed that Boeing had settled on increasing aircraft speed and Airbus on increasing aircraft size. Boeing introduced the concept of the sonic cruiser, a medium size aircraft that would almost reach the speed of sound. Airbus decided to break the record of aircraft size and focused on building an even larger jumbo than Boeing’s. In the early 2000s Boeing dropped its sonic cruiser concept. In 2004 it launched the 787 program, a medium-size aircraft in the long-haul market with largely standard operational characteristics and with most innovations focusing on making it more cost-efficient.

For a moment the situation seemed to have sorted itself out. Airbus would build the A380, a super jumbo aircraft in the 555-seat category. Boeing would build the 787, a super efficient aircraft in the 250- to 300-seat category. Although there were skeptics on both sides, it made sense for Boeing, which had terminated its 757 and 767 aircraft programs, and was about to shut down the 747-400 lines, to launch the 787 family. This,

255 See id.
259 See Sonic Cruiser, supra note 257.
261 Horng, supra note 25, at 81.
262 Id. at 87.
and the larger 777 family (including the largest 777-300 that became available in the early 2000) would substitute for the production lines to be shut down and cover the long-haul markets. A potential hole in the medium-haul market could be taken care of by stretching the 737. The 787 could provide point-to-point travel from many desirable destinations, including smaller airports, without the need to connect to major hubs. Because of its size, the A380 would be suitable for operation in the highest density, long-haul hub markets. The A380 could gain potential market share from the shutting down of the Boeing 747-400 program, complementing the relatively young Airbus A330 and A340 families.

The above scenario seemed like a reasonable solution. Each player would focus on a different niche, enabling large enough market shares to amortize the huge costs of designing and building the prototypes of these aircraft, and each party would maximize expected income related to its niche. At the end of 2004, however, Airbus announced the launch of the A350 in competition with the 787. In 2005, Boeing announced the launch of the 747-800, a new derivative of the 400 model in the 400- to 500-seat category. The long-haul market has never been so crowded, and competition is expected to be fierce.


Horng, supra note 25, at 87.

Id.

See id.


B. IMPLICATIONS FOR THE AIRLINE MARKET

What are the possible implications of the above for the airline market? First, the competition between Boeing and Airbus is expected to drive new aircraft prices and respective airline fares down (everything else remaining equal).\textsuperscript{271} Aggressive marketing and manufacturers’ rivalry—to which the industry has become accustomed for over a decade—includes, but is not limited to government subsidized financing, equity participation, mezzanine financing, risk sharing, old aircraft trade-in, warranties, promotional advertising, training, technical and other after-sale support, as well as many other sale promotion techniques used by the manufacturers.\textsuperscript{272} One cannot overestimate the importance of this issue and its impact on aircraft price and industry dynamics and structure.\textsuperscript{273} Competition in the airline industry is driven, to a large extent, by the evolution of the aircraft industry.\textsuperscript{274} The general move from Boeing as a single dominant supplier to a new structure of an aggressively competing duopoly has driven aircraft prices down.\textsuperscript{275} This trend has already affected the medium-haul market and is expected to affect the long-haul as well.\textsuperscript{276}

Second, it is expected that startup airline entry attempts will emerge in the long-haul markets.\textsuperscript{277} Such entry may imitate or apply the experience of the medium-haul market using the new aircraft in a low-cost point-to-point strategy.\textsuperscript{278} In fact, various

\textsuperscript{271} Jet Industry, supra note 47, at 50–52.
\textsuperscript{272} Jet Industry, supra note 47, at 20, 155, 157, 164–72.
\textsuperscript{273} Ibid.
\textsuperscript{274} Kroo, supra note 9, at 1.
\textsuperscript{275} Ben-Yosef, supra note 13, at 101.
\textsuperscript{277} Air Transport Action Group, supra note 47, at 155, 157, 164–72.
\textsuperscript{278} Ibid.
startup ventures around the world announced their intent to do so and several have placed orders for new aircraft.\textsuperscript{279} The almost frantic attempts of the manufacturers to book sales in order to justify launching their respective programs fuel such attempts.\textsuperscript{280} The launching of the new aircraft is expected to push prices of previous generation aircraft down, and possibly encourage new entry into the long-haul with these aircraft as well (i.e., the 767 and 747).\textsuperscript{281}

Third, medium-haul, low-cost airlines could expand their operations with new aircraft, mostly the B787 or A350. JetBlue could, arguably, be tempted to expand to destinations across the Atlantic or in Latin America using the A350, for example. The European low-cost airlines EasyJet or Ryanair could do the same from the other side of the Atlantic.\textsuperscript{282} Low-cost airlines on both sides of the Atlantic could connect with the new long-haul aircraft through subsourcing (code share) or direct ownership and operations.\textsuperscript{283}

Fourth, for the major incumbents, this is a major battle for survival; for some of them, perhaps, the last battle. They have outsourced an increasing portion of their short-haul operations and have become increasingly dependent on their regional affiliates in the first revolution.\textsuperscript{284} They have lost a significant part of their traditional domestic market to new medium-haul, low-cost entry in the second revolution.\textsuperscript{285} Their experience in the second revolution has demonstrated that potential new startup entry to the long-haul market must be taken seriously even if one assumes that the chance of such an entry to succeed is small.\textsuperscript{286} They must re-establish their grip over the long-haul market in a new way in order to survive. They face strong competition from other airlines, national and foreign, in their major


\textsuperscript{280} See Ben-Yosef, supra note 13, at 250.

\textsuperscript{281} Id.; Olson, supra note 279; Compart, supra note 279.

\textsuperscript{282} Olson, supra note 279; Compart, supra note 279.


\textsuperscript{285} FAA FORECAST 2005, supra note 66, at 5.

\textsuperscript{286} Ben-Yosef, supra note 13, at 16, 241–44.
incumbent group, and potential competition from new startup entrants targeting the long-haul market. They face a trend of increasing liberalization toward open skies, which encourages more competition and new entry by U.S. and foreign airlines. An open sky agreement with Europe, once concluded, will open the Atlantic to unprecedented competition.

The major incumbents are facing this revolution in a weakened state, burdened by enormous debt, continuous reorganization efforts (in and out of bankruptcy courts), high fuel prices, and labor disputes. Aggressive restructuring and workouts must address this new condition. Will they be in a position to upgrade fleets to the new aircraft? This may require retiring aircraft that still have long lives remaining and high balance sheet values. In the new competitive environment, a startup entry that is clear of historic commitments to labor, aircraft owners, and debtors and can acquire new aircraft under extremely favorable terms, is a power to reckon with, even if only for a short time.

For passengers, this new war on the long-haul is expected to translate into lower fares; for airlines it means lower margins and increasing pressures for reducing costs.

VI. PUTTING IT ALL TOGETHER

During the regulation regime the government imposed a three-category structure on the industry, consisting of: 1) local (commuter); 2) regional (intrastate); and 3) major (trunk) airlines. Airlines in each category specialized in operating different aircraft classes and related markets. Interlining across categories was possible subject to a regulated fare agreement.

Regulation kept the structure of the airline industry rigid and

287 Sparaco, supra note 277, at 72.
289 See id.
290 FAA FORECAST 2005, supra note 66, at 5.
291 The major U.S. airlines are financially weaker in comparison to many of their foreign competitors. These foreign airlines are in a better position to acquire the new aircraft.
292 See BEN-YOSEF, supra note 13, at 248-49.
293 See Sparaco, supra note 277, at 72.
294 BEN-YOSEF, supra note 13, at 53.
295 Id.
296 Id.
eliminated shakeouts. Only major airlines acquired new aircraft technology. They began acquiring the revolutionary new jet aircraft in the late 1950s, enhancing their competence with no significant changes in the structure of the regulated cartel. Fixed, regulated fares encouraged largely homogenous, high-quality service and eliminated the possibility of fare-based differentiation and low-fare competition or entry.

Deregulation spurred a rigorous trend by major airlines to expand and consolidate networks using complex integrated hub-and-spoke architecture. The regulated three-category structure was destroyed by competition. Pre-deregulation, non-trunk airlines consolidated and integrated into the major airlines' networks. The consolidation of the major airlines (including the demise of Pan Am, Eastern, Braniff, and later TWA) created a group of only a few winning major airlines dominated by American, United, and Delta. International alliances further integrated and expanded networks on a global basis. Each major network operated the medium- and most of the long-haul flights and code-shared most other flights, providing seamless interlining over regional, national, and international markets across continents. Each major network operated like a large travel department store, offering a diverse set of products and services for all passengers.

In the regional revolution, the interaction of incremental aircraft innovations and the unfolding hub-and-spoke strategy enabled the creation of a new market niche. Bombardier and Embraer emerged as the dominant manufacturers in this new niche, and their sustained up-market drive further threatens to disrupt Boeing and Airbus in the smaller aircraft section of the jet building market.

---

298 *Id.* at 25–28.
299 *Id.*
300 For the industry's structure during regulation, see, e.g., Vietor, *supra* note 18, at 19–58.
301 BEN-YOSEF, *supra* note 13, at 53.
302 *Id.*
303 *Id.*
304 *Id.* at 7.
306 Bilateral regulation precludes mergers and acquisition of control over foreign airlines. Complex and varied code share and other marketing arrangements enable cross-national network integration.
308 JET INDUSTRY, *supra* note 47, at 35.
migrated into and captured an increasing part of the traditional mainline market, specializing in operating one aircraft category (50- to 100-seat) and respective markets. In a few of the regionals grew larger than others, taking advantage of economies of scale and risk-sharing to create a new trend of regional specialist serving more than one major incumbent.

In the medium-haul market section, Southwest and a group of startup airlines have destroyed the dominant incumbent business model of the 1990s, capturing an increasing share of the domestic market and assuming price leadership in this niche. This airline group specializes in one aircraft-category (100- to 160-seat) and respective markets. Applying new process-technology, the startup entry of the early 2000s accelerated an industry-wide trend of innovation, restructuring, and pushing toward leaner production processes and further real fare reductions.

The two airline revolutions and the approaching third represent a shift toward increasing vertical specialization and dis-integration of production, as well as product differentiation based on market segmentation. We have already seen the emerging new regional and national specializing airlines that have captured an increasing part of the traditional incumbent markets. It is not clear yet how the long-haul market will evolve and whether the major incumbents will lose their dominance in this market to U.S. or foreign incumbents and startups. A battle over dominance of this market has already started and is expected to accelerate with the delivery of the new generation aircraft, and as further deregulation and liberalization becomes effective. We already see startups getting organized in an attempt to apply low-cost/low-fare entry strategies to the long-haul

---

310 Mozdzanowska, supra note 56, at 5. This trend appears in many industries; most noticeable is lower-level supply-chain members in computer and consumer electronics that specialize and provide similar components to several primary integrators.
311 FAA Forecast 2005, supra note 66, at 5.
312 Wachovia Securities, supra note 212, at 16.
313 Horng, supra note 25, at 92.
314 See 787 Dreamliner, supra note 260.
315 The share of regional and low-cost airlines in domestic traffic in 2000 was 30% and increased to 45% in 2005. FAA Forecast 2005, supra note 66, at 5.
316 Relaxing international (bilateral) regulations is expected to increase entry and expand point-to-point service into U.S. destinations, including secondary markets that currently require hub connections. Open Skies, supra note 288.
market, as well as segmentation and differentiation attempts targeting the high paying business section of this market.\textsuperscript{317}

This general trend of vertical disintegration, market segmentation, and increased specialization by new entry is expected to reduce the incumbents’ overall market share\textsuperscript{318} and is likely to push further for consolidation of the incumbent major airlines through mergers, code-share arrangements, and liquidation.\textsuperscript{319} A possible outcome of this trend is that a smaller and leaner group of winning major incumbents will provide the standard core service (including complex, seamless interlining with regional and international alliance partners), and a group of smaller (specializing) airlines will focus on serving niche markets. It will be interesting to see if any one of the specializing airlines will migrate significantly to displace or dominate the service in the traditional incumbents’ markets or otherwise provide an alternative low-cost global network service.

While the change in each airline market section taken separately appears to be revolutionary, taken together as an industry system they amount to incremental overall change that fits into the general pattern of evolution observed in other industries.\textsuperscript{320} During maturity stages, consolidation tends to increase, production costs and prices tend to decrease, production processes tend to disintegrate vertically through increasing specialization and outsourcing, and market segmentation tends to drive product differentiation and increased product customization.\textsuperscript{321} It is expected in this industry stage that new niche entries will attempt price/quality-differentiation, targeting under-served or over-served market segments.\textsuperscript{322}

The main difference is that the airline industry has exhibited these typical trends relatively late in its history because of the


\textsuperscript{318} FAA \textit{Forecast} 2005, \textit{supra} note 66, at 5.


\textsuperscript{320} UTTERBACK, \textit{supra} note 1, at 215; \textit{Restructuring, supra} note 236, at 3.

\textsuperscript{321} UTTERBACK, \textit{supra} note 1, at xviii.

\textsuperscript{322} Id.; Harrell, \textit{supra} note 119.
constraints of regulation.\textsuperscript{323} It was only in the 1980s, two de-
cades after jet technology became a dominant standard, that air-
lines were permitted to compete.\textsuperscript{324} At the same time, the
collapse of the Soviet Union and the emergence of a New World
Order shifted the traditional trajectory of the arms race in dif-
ferent directions and with it the significant technology spillovers
enjoyed by the industry for several decades.\textsuperscript{325} Moreover, oil
prices and environmental concerns assumed major priorities in
aircraft design and operations.\textsuperscript{326} Together, all of these changes
put immense pressures on aircraft builders and operators to in-
novate and change their products and processes, searching for
new ways to adjust their dominant business models to a signifi-
cantly changing landscape.\textsuperscript{327}

VIII. WHAT NEXT?

According to life cycle studies, incumbents tend to become
vulnerable to disruptive entry during an industry's mature
stage.\textsuperscript{328} Can we identify signs for potential disruptions in the
aircraft and airline markets? Will any of the specialist entrants
emerge to overshadow the respective leading incumbents?

Predicting emerging disruption is a tricky exercise and re-
quires consideration of complex interactions of many processes
including new technologies, several industries, and changing
regulations. Judging by historical experience, most disruptive
entries become obvious only with hindsight.\textsuperscript{329} A few intriguing
questions, however, are worth posing. Will Embraer or Bombar-
dier be able to sustain their up market trajectory and affect the
aircraft production business as did Toyota, which, starting with
an inferior product, revolutionized the car industry by pioneer-

\textsuperscript{323} This is in comparison to the car industry, which experienced these trends
earlier.
\textsuperscript{324} Vietor, supra note 18, at 24, 27–30, 37–38.
\textsuperscript{325} Murman, supra note 1, at 481–82; Jet Industry, supra note 47, at 27; See also
enzymes/commercial/cf34/ (last visited Sept. 14, 2007) (discussing the military
origins of the now commercial CF34 engine).
\textsuperscript{326} See Frenken, supra note 1, at 6; Murman, supra note 1, at 48–82; Sonic
Cruiser, supra note 257.
\textsuperscript{327} Utterback, supra note 1, at xviii; Restructuring, supra note 236, at 6, 8, 9.
\textsuperscript{328} Geroski refers to this tendency as "the 'crisis of mature industries,' which
seems to afflict most well-established markets sooner or later." Geroski, supra
note 5, at 203.
\textsuperscript{329} See generally, Innovator's Dilemma, supra note 4.
ing the *lean* production concept? Will new entrants into the jet-building niche, particularly China and Russia, be able to commercialize their regional aircraft projects and become disruptive to the incumbent aircraft builders?

The medium-haul revolution destroyed a long history of exclusive access enjoyed by major incumbent airlines with respect to new aircraft technology. In particular, sustaining incremental innovation in dominant aircraft technology that traditionally had enhanced the competence of dominant incumbent airlines has been acquired by startup entry and used against the incumbents. A similar trend is possible with the launching of the new long-haul aircraft. It remains to be seen if the major incumbents will remain the dominant operators of the new generation of long-haul aircraft.

Will low-cost airlines grow to disrupt the incumbent traditional market position as core providers of a general, global air transportation service? Will Southwest change its traditional strategy and expand its direct attacks on the incumbents' markets? The move by Southwest to code-share with ATA and a recent announcement that it is considering other code-share possibilities (including with a major incumbent) raises some intriguing possibilities. Southwest has exploited most of the market potential of its traditional strategy. It could continue restructuring its operations and expand its network through outsourcing (code-share) agreements with regional and longer-range operators including international airlines, and it could emerge as a new version of a differently-integrated lean and effective alternative global network. Similarly, as mentioned before, low-cost startups may expand their network through upstream and downstream integration, through self-operation, or

---


331 Both the Russian and Chinese governments introduced new regional jet families (RRJ and ARJ21, respectively), as well as larger aircraft programs characterized by complex multinational joint-venture arrangements with major Western incumbents.


333 Id.


335 Seeing What's Next, *supra* note 4, at 132–33.

through outsourcing to other airlines.\textsuperscript{337} Code-share arrangements enable network expansion of niche-specializing airlines without the need to sink enormous costs in building such networks.\textsuperscript{338}

What about possible innovations in aircraft technology? Will a possible new radical innovation in an aircraft core subsystem (a revolutionary power plant technology or new energy source) be compatible (modular) or destructive to the current dominant aircraft design and to the dominant incumbent aircraft builders? How will it affect the airline industry? How will computer aided tools further impact aircraft technology? These tools have revolutionized aircraft design processes in two major ways: 1) reducing design, testing, and building costs; and 2) improving the product design.\textsuperscript{339} Most of the current applications have focused on incremental improvement and increased efficiency of standard product-technology (improving wing efficiency is a good example).\textsuperscript{340} But the new technology opens the door for (virtual) testing and building of many new and alternative configuration concepts that were prohibitively costly before.\textsuperscript{341} This technology could relax somewhat the historical lock-in constraints of path dependency and open new directions for innovation. Will this new process-technology yield significant product innovation?\textsuperscript{342}

Evolutionary theories suggest that it is often outside industry players that pioneer disruptive technology.\textsuperscript{343} This was the case with Embraer and Bombardier.\textsuperscript{344} For almost four decades supersonic flight was believed by many to be the next aircraft revolution in the making; yet, it appears that Boeing and Airbus have put their plans on hold while other players keep up efforts in this direction.\textsuperscript{345} Business jet designers are focusing on devel-

\begin{footnotesize}
\textsuperscript{337} Lori Ranson, \textit{Low-Cost Carriers Start to Change Their Roadmaps}, \textit{Aviation Daily}, June 5, 2006, at 4.
\textsuperscript{338} \textit{Jet Industry}, supra note 47, at 102.
\textsuperscript{340} Murman, supra note 1, at 481.
\textsuperscript{341} The availability of standard dominant design tools (CATIA) and the shared access to this technology by inside and outside members of the aircraft building duopoly contribute much to driving design innovations.
\textsuperscript{342} The Blended Wing design is a good example.
\textsuperscript{343} \textit{Seeing What's Next}, supra note 4, at 270–71
\textsuperscript{344} \textit{Id.} at 132–33.
\textsuperscript{345} See Sonic Cruiser, supra, note 257.
\end{footnotesize}
opining supersonic business jets. Will such a technology be commercialized? Who will operate such aircraft? How will this affect the airlines? Will the deal signed by the governments of Japan and France in 2005 to develop supersonic commercial aircraft materialize into a large supersonic aircraft? Who will build this aircraft, and who will operate it? Will the new concept of very light jet aircraft (VLJ), which has been introduced into the market recently, create a significant and reliable on-demand regional air-taxi service that could noticeably affect traditional commercial airlines?

Aircraft and airline markets coevolve and interact with the aircraft operational environment (including airports and air traffic control systems) and a complex set of economic, safety, and environmental regulations (domestic and international). Government control and intervention in these areas directly affect innovation and industry structure. While in some respects governments have encouraged and facilitated innovation and changes, in many others they have not. The rate of innovation and changes in the air traffic control and airport system that are under various levels of governmental controls is particularly disappointing. Privatization or a shift to incentive-based operation and regulation of these systems can have a significant impact on innovation and competition. Continuing the trend of deregulation and liberalization of international (bilateral) agreements could significantly affect the airline industry. The current system is still based to a large extent on the post-WWII


348 A few companies in Europe and the United States already placed a large number of orders for such aircraft for commercial use. According to Acting Transportation Secretary Maria Cino: "Thousands of new jets like this are going to redefine the way Americans travel, help cut airport congestion and drive economic growth in cities and towns across the country that today only dream of commercial air service." Press Release, U. S. Dep't of Transp., U.S. Department of Transportation Approves Provisional Type Certificate for Eclipse 500 (July 27, 2006), http://www.dot.gov/affairs/dot8106.htm.


351 Id.

national/political structure. A move to a market-driven, global, network system could significantly affect the airline industry as well.

Finally, the story of the airline industry has important policy implications that are beyond the scope of this article. It demonstrates that, after all, one should not underestimate the creativity of the free market forces. In the late 1990s, it appeared to many observers that market creativity failed to challenge the major incumbents’ market power. Unprecedented antitrust and regulation efforts were launched for the first time since deregulation.

Looking back, these efforts may seem redundant and irrelevant. This is, however, reflective of the basic antitrust and regulation challenges: it is only with hindsight that we can tell the future. Moreover, because of the complexity of the issues involved, one can find quite persuasive arguments for and against government regulation and antitrust, even with hindsight. Market creativity entails destruction of previously dominant products, processes, and organizations. Measuring the net benefits of such creativity is extremely difficult, if at all possible, and subject to judgment and debates. The low-cost revolution has reduced real fares significantly, to the benefit of passengers. It accelerated, however, labor layoffs and enormous write-offs of pension and other labor benefits, outstanding loan balances, and aircraft and airline equity values.

In the market battle for survival, there are winners, losers, and a mixed bag of costs and benefits with ambiguous dynamics and overall net social impact. This leaves the traditional policy debate regarding regulation and antitrust of the airline industry still young and lively, in spite of the industry’s mature age.

---

354 BEN-YOSEF, supra note 13, at 16.
355 Id.
356 Id. at 2–3, 16–17.
357 Id.
358 Memorandum from Kenneth M. Mead, Inspector Gen., Office of the Sec’y of Transp. to the Sec’y of Transp. 2 (June 30, 2005).
359 LCAs Are Growing and Profitable, supra note 12, at 3, 5.