**Air Transport**

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**1. The Rise of Air Transportation**

Air transportation was slow to take off after the Wright Brothers breakthrough at Kitty Hawk in 1903. More than ten years passed before first faltering efforts to launch scheduled passenger services. On January 1, 1914, the world’s first scheduled flight with a paying passenger hopped across the bay separating Tampa and St. Petersburg, Florida for a fare that eventually stabilized at $10 per person, round-trip (about $200 in 2006 dollars). By comparison, Low-Cost Carrier (LCC) Southwest Airlines could carry a passenger on a Tampa to Seattle rountrip, more than a hundred times farther, for only slightly more than $200 in 2007. Thus, in the 1930s and 1940s an airfare could account for up to 50% of the average annual per capita income of an American, by 2010 this figure was reduced to less than 2%.

World War I, which began just months after that first flight from Tampa, provided the first real spur to the development of commercial aviation as air power began to be used and better aircraft were quickly designed. The war left a legacy of thousands of unemployed pilots and surplus aircraft along with an appreciation for the future significance of this new technology. However, air transport still suffered from limitations in terms of capacity and range. 1919 marked the first commercial international air transport service between England and France. It was also the same year that with the Paris Convention that each country controlled the airspace over its territory. Governments played a crucial role in the next phase of aviation history. In Europe, governments established new passenger airlines while on the other side of the Atlantic, the American government heavily subsidized airmail. Airmail was one of the earliest avenues via which air transportation became commercially relevant because it helped to accelerate the velocity of the money supply and helped to better tie together far-flung enterprises, facilitating the emergence of continental and intercontinental enterprises. US airmail also subsidized the emergence of the first major US passenger airlines.

By the eve of World War II, air travel was quite literally taking off, borne aloft by important advances in technology. Particularly important was the Douglas DC-3, the first airliner that could fly profitably without government subsidies (air mail routes). The 21-seat DC-3 was a long-range aircraft for its time, able to fly across the US stopping just three times. By 1941, 80% of all commercial aircraft in the US were DC-3s. The DC-3 was a landplane; but on longer-haul, intercontinental routes, flying boats remained common through World War II. Flying boats, like the double-deck Boeing 314, were the largest commercial aircraft until the building of the B747. They could fly very long distances but their slow speeds undercut their profitability. The market for long-haul travel was very small, partly because of the extraordinarily high cost. Many of the long-haul air services were to colonies and dependencies. Only the elite or government officials was able to afford air travel.

War again encouraged the rapid growth of air transportation. Indeed, it was only after World War II that air transportation became the dominant mode of long-haul passenger travel in developed countries. In 1956, more people traveled on intercity routes by air than by Pullman car (sleeper) and coach class trains combined in the US. In 1958, airlines carried more passengers than ocean liners across the Atlantic for the first time. Even more momentous, in October 1958, the Boeing 707 took its maiden commercial flight with a Pan American World Airways route linking New York and Paris, with a refueling stop in Gander, Newfoundland. The B707 was not the first jetliner, but it was the first successful one. The B707 and other early jets, especially the Douglas DC-8, doubled the speed of air transportation and radically increased the productivity of airlines which enabled fares to fall. Just a few years after the B707’s debut, jet service had been extended to most major world markets.

Jet transportation facilitated the extension of the linkages between people and places, which is supported by ample evidence. A classic example concerns American major league baseball. Through the mid-1950s, all major league teams were located in the Manufacturing Belt, situated no more than an overnight rail journey apart from one another to permit closely packed schedules. The speed and ultimately lower cost of air transportation freed teams to move to the untapped markets of the Sunbelt so that by the mid-1960s, half a dozen teams were strung out across the South and West.

In the years since the beginning of the Jet Age, commercial aircraft have advanced markedly in capacity and range. Just 12 years after the debut of the B707, the B747 made its maiden flight. Not coincidentally, it too premiered on a transatlantic route from New York City. The entry of dozens of B747s into the market around the same time that the Arab Oil Embargo triggered a worldwide recession led to a torrent of red ink for early Jumbo enthusiasts like Pan Am; but the longer term effect was to push real airfares ever downward, thereby democratizing aviation beyond the so-called "Jet Set". The B747, particularly the longer-range B747-400 version introduced in the late 1980s, has been nicknamed the "Pacific Airliner" because of its singular significance in drawing Asia closer to the rest of the world and because Asia-Pacific airlines have been major B747 customers. However, by the 2010s, the majority of the B747s were being retired and replaced by longer range and more fuel efficient aircrafts such as the B777 and and A380.

Since their introduction in the late 1950s, commercial jets have not improved in terms of speed. The fastest airliners in regular use today are about as fast as the B707. The Anglo-French Concorde which cruised at twice the speed of sound was hamstrung by very poor economics – it weighed half as much as a first-generation B747 but could carry only a quarter as many passengers and had a range more than 3,000 kilometers shorter. Moreover, the Concorde was an early target of the nascent environmental movement, and restrictions on overland supersonic flights severely limited the market for the airliner. The only carriers to regularly operate it were British Airways and Air France, and although many cities had Concorde services in the first halcyon years of its early use, by the time the supersonic transport (SST) was finally grounded in 2003, only London, Paris, New York, and Washington had scheduled year-round services.

Three major categories of passenger jet planes may be recognized:

Short range aircraft. Bombardier’s CRJ series and Embraer’s ERJs are examples of planes with relatively small capacities (30-100 passengers) that travel over relatively short distances. They are usually referred to as regional jets that serve smaller markets and feed hub airports. They also provide high frequency point to point services between large city pairs.

Medium range aircraft. The airbus A320, with a range of 3,700 km, and its Boeing equivalent, the B737, are designed to service destinations within a continent. From New York, most of North America can be reached. This range can be applied to the European continent, South America, East Asia and Africa. This type of aircraft is also used for high demand regional services where low cost air carriers compete.

Long range aircraft. There are a variety of aircraft capable of crossing the oceans and linking together the continents. Early variants such as the B707 have evolved into planes offering high capacity, such as the B747 series, or long range abilities, such as B777 series or the A350 series which have ranges of up to 17,400 km.

2. Economic and Spatial Impacts

It is through increasingly long-haul nonstop services among an ever wider set of city-pairs rather than through increased aircraft speeds that air transportation continues to "shrink the world". After World War II aircraft were just beginning to be capable of crossing the Atlantic without stopping at intermediate places such as Newfoundland. In the mid-1950s, the Israeli carrier El Al advertised its transatlantic services with the slogan "No Goose, No Gander" to cleverly let travelers know that its turboprop services had to stop at neither Goose Bay nor Gander in Newfoundland to refuel. Today, commercial aircraft are now capable of making trips of up to 18 hours in duration. Such ultra-long-range flights servicing the world's metropolises are both a response and a driver for globalization.

The same capacity of air transportation to dramatically lower the cost (friction) of distance has, of course, been instrumental in fostering economic globalization, albeit in a highly uneven fashion. Manufacturers, especially those producing high-value microelectronics, are heavily reliant upon air transport to tie together spatially disaggregated operations. Intel, the world's foremost computer chip manufacturer is an example of a firm that relies heavily on air transportation, both passenger and cargo, to tie together its global production network. The firm’s Philippine operations, for instance, receive their main inputs and export their output almost exclusively by air.

Relatively inexpensive air transport has also been crucial to the growth of tourism. It is no coincidence, for instance, that the five major Disney theme parks are all located near one of the world’s thirty busiest airports: Disneyworld near Orlando International Airport, Disneyland near Los Angeles International Airport, Euro Disney near Paris-Charles de Gaulle, Tokyo Disneyland near Tokyo-Haneda, and the newest park in Hong Kong which shares Lantau island with the most expensive airport in history.

Microelectronics and tourists comprise only two of the many kinds of airborne traffic. Since the dawn of the Jet Age, air transport has ascended to astonishing heights. It is overwhelmingly dominant in transcontinental and intercontinental travel and is becoming more competitive for shorter and shorter trips. In the US, for instance, air travel is the most important mode for trips more than about 1,100 kilometers in one-way length. In developing countries, too, LCCs are proliferating, which is bring air fares down and propelling air traffic higher. Therefore, the world's busiest air routes are not long haul flights, but short range flights between cities less than 1,000 km apart.

Both passenger and cargo traffic have grown rapidly and have outpaced the growth of the broader global economy. By 2012, approximately one million people were airborne on scheduled flights somewhere in the world at any one time. This is related to an annual traffic 2.4 billion passengers that travelled over 33,000 scheduled flight routes, underlining the enduring growth of air travel. This accounted for about 25% of the global population, but a much smaller share are actually air travellers as individuals who use air transportation usually do so several times per year. The propensity to fly is therefore highly uneven. Alone, North America and Europe accounted for 70.4% of all passenger movements in 2000, but this share is declining.

Air transportation’s share of world trade in goods is only 2% measured by weight but more than 40% by value. For the international operations, freight can account to 45% of the revenue of a regular airline. Typically, air cargo relates to time sensitive, valuable or perishable freight carried over long distances. This is particularly suitable in supporting "just-in-time" production and distribution strategies with low inventory levels. Air cargo has also a niche market for emergency situations where the fast delivery of supplies (e.g. medical, food) prevails over cost issues. The air freight market is serviced by five types of operations:

Dedicated cargo operators maintaining a fleet or cargo-only aircrafts and offering regular scheduled services between the airports they service. They also offer charter operations to cater to specific needs.

Combination services where an airline company will maintain a fleet of both specialized and passenger aircrafts able to carry freight in their bellyhold. Most of the cargo operations involve long haul services.

Passenger operators that will offer the freight capacity in the bellyhold of their aircrafts. For these operators, freight services are rather secondary and represent a source of additional income. It still remain an important market as about 50% of all the air cargo is carried in the bellyhold of regular passenger aircrafts. However, low cost airlines usually do not offer air cargo services.

Air freight integrators commonly operating hub and spoke freight services that reconcile short and long haul flights. They offer comprehensive services that are usually door-to-door and can support the logistics requirements of their customers.

Specialized operators fulfilling niche services that cater to specific cargo requirements (e.g. heavy loads) that do not fit the capabilities of standard cargo aircrafts.

Efficient and affordable air freight has contributed to changes in diet by making available new products or products in seasons during which they would not be available, to changes in retailing and correspondingly to changes in manufacturing. Examples abound, such as fresh produces growth on the southern hemisphere available in the northern hemisphere during winter, or merchandises purchased online and shipped promptly by air transport or a computer manufacturer depending of the global shipment of various components in the manufacturing and assembly processes. The increased importance of time-based competition ensures that air cargo augurs well for the future growth of air transportation.

3. The Geography of Airline Networks

There were about 725 airlines in the world in 2012 providing different range of services. Theoretically, air transport enjoys greater freedom of route choice than most other modes. Yet while it is true that the mode is less restricted than land transport to specific rights of way, it is nevertheless much more constrained than what might be supposed. Early in the history of aviation, physical obstacles such as the Rocky Mountains and the great gap of the North Atlantic limited the articulation of air transport networks. While those limitations have fallen, physical geography still affects the geography of intercity air transportation. Weather events such as snowstorms and thunderstorms can temporarily create major disruptions. Aircraft seek, for instance, to exploit (or avoid) upper atmospheric winds, in particular the jet stream, to enhance speed and reduce fuel consumption. Volcanic eruptions may also impede air travel by releasing ash in the atmosphere, which can damage and even shot down turbofan engines. Such occurrences are however rare and punctual, with the exception of April 2010 when a volcanic eruption in Iceland forced the closing down of airports in most of Europe as well as several North Atlantic routes. This represented the largest natural disruption of air travel in history.

Yet the limitations that structure air transportation are mainly human creations. First, in the interest of air safety, air traffic is channeled along specific corridors so that only a relatively small portion of the sky is in use. Jetway 554, for example, which passes from high over the Michigan-Indiana state line towards Jamestown, New York via Southern Ontario, accommodates flights from many different cities in the West and Midwest bound for the Northeast, with nonstop city-pairs such as San Diego-Boston, Chicago-Albany, Phoenix-Providence, and Los Angeles-Hartford. China is facing significant air capacity constraints not because its airports are congested, but mostly because a large segment of the airspace is regulated by the military.

Strategic and political factors have also influenced route choice. For example, the flights of South African Airways were not allowed to over-fly many African nations during the apartheid period, and Cubana Airlines has been routinely prohibited from over-flying the US. Even more significant was the opening up of Siberian airspace to Western airlines after the Cold War. The new freedom permitted more direct routes not only between cities like London and Tokyo or New York and Hong Kong but also between transpacific city pairs like Vancouver-Beijing. Few large areas of airspace forbidden to carriers on political grounds remain. However, the intervention of the state in airline networks remains pervasive. From its infancy, air transport was then seen as a public service and as an industry that should be regulated and protected. In many parts of the world, government intervention in the industry took the form of state-owned airlines. As recently as the early 1970s, Air Canada, Air France, British Airways, Japan Airlines, Qantas, and most other flag carriers throughout the world were fully state-owned. In the US, the government did not own any airlines but it did strongly affect the industry’s development via regulation of fares, in-flight service, routes, and mergers.

Beginning in the 1970s, the relationship between the airline industry and the state changed, although the timing of liberalization (a term which refers to both deregulation and privatization) and its extent has varied among the world’s main markets. Across the globe, dozens of airlines have been at least partially privatized, and many airline markets have been deregulated. In the United States, the Air Deregulation Act of 1978 opened the industry to competition. The results, seen from the vantage point of more than 25 years later, have been dramatic. Once hallowed names, like TWA, Pan Am, and Braniff sank into bankruptcy (though Pan Am has been reborn as a much smaller carrier along the Atlantic coast) and many new players emerged. Most lasted only a short time, but some have had a profound, enduring effect on the industry and air transportation more generally.

4. Deregulation and its Consequences

Geographically, a key outcome of airline deregulation has been the emergence of hub-and-spoke networks centered on major airport where a single carrier is often dominant. Such networks existed before deregulation to some degree, but the Civil Aeronautics Board hampered the expansion of airlines and the rationalization of networks. United Airlines, for instance, was allowed to add only one city to its network between 1961 and 1978. Hub-and-spoke systems rely on the usage of an intermediate airport hub. They can either connect a domestic (or regional) air system if the market is large enough (e.g. United States, China, European Union) or international systems through longitudinal (e.g. Dubai, Reykjavik) or latitudinal (Panama City) intermediacy. An important aspect of an intermediate hub concerns maintaining schedule integrity since the majority of passengers are using connecting flights. Airports that are prone to delays due to congestion are not effective hubs since they compromise the schedule integrity.

After deregulation, most of the surviving major carriers tended to construct nationwide hub-and-spoke networks with several hubs to facilitate travel between different regions of the country. The traffic feed through hubs like Atlanta enables Delta and other carriers to offer higher frequency service at higher load factors which in turn lowers the per passenger-kilometer cost. The advantages of large airlines were further deepened when nationwide hub-and-spoke networks were coupled to computer reservations systems and frequent flyer programs. Yet by the late 1990s, large carriers like Delta were on the run. Low cost carriers, especially Southwest Airlines in North American and Ryanair in Europe, cut into the market share of the "legacy" carriers. LCCs are distinguished by several common features:

Fleet simplicity. Legacy carriers operate diverse fleets because they serve many kinds of routes, from long hauls to feeders. LCCs emphasize on relatively short-haul routes. The minimal number of aircraft types (Southwest and Ryanair only flies B737s, though several different models) lowers costs.

Fast turnaround times. LCCs operate their networks in ways that keep their aircraft in the air earning money for a higher number of hours on average compared to legacy carriers. Minimal inflight service, for instance, reduces the time needed to clean and cater flights.

Rapid growth. This is not just a product of the LCCs’ success but an element in it. Fast growth enables the LCCs to continue to add aircraft and staff at a steady pace which keeps the average fleet age and average years of employee service low – both of which help to keep operations costs low.

Emphasis on secondary airports. Secondary airports, such as Houston-Hobby instead of George Bush Houston Intercontinental or Charleroi instead of Brussels National, typically have lower landing and parking fees for airlines as well as a more entrepreneurial approach to recruiting new airline service. However, LCCs have also directly challenged established carriers in major hubs.

Reduced importance of hubs. Most LCCs do have hubs, but for some carriers hubs are substantially less important than they are for legacy carriers. Southwest Airlines, for instance, distributes air traffic more evenly among a ten or so top “focus cities” in its network than is true of any traditional hub-and-spoke airline.

Aggressive use of the Internet. Internet booking has partially neutralized the one-time advantage that legacy carriers enjoyed through their proprietary computer reservations systems. The Internet is an additional way of reducing costs.

Although Southwest Airlines is commonly regarded as the pioneer LCC and is the only LCC to rank among the world’s 20 largest airlines, the phenomenon has now taken off in Europe and to a lesser extent in other parts of the world. In general, the propensity to travel is highly correlated with incomes, but the LCCs are important in broadening the air transportation market beyond the relatively small affluent population in countries like Indonesia. Southwest Airlines is exceptional in that its network is purely domestic (International flights are operationally more complex and would erode the carrier’s enviable turnaround time.) Most large and medium-sized airlines have at least some international routes. Nevertheless, about 90% of the air traffic generated by countries such as the United States, Canada, Russia, Japan, Brazil and Australia is domestic. The United States generates alone 70% of the global domestic air traffic.

Under threat by LCCs in shorter-haul markets, legacy carriers are becoming more dependent on longer-haul international markets. International markets, too, have been opened up by deregulation, though not to the same degree as the US domestic market. The Chicago Convention of 1944 established the basic geopolitical guidelines of international air operations, which became known as the air freedom rights. First and second freedom rights are almost automatically exchanged among countries. The US, which emerged from World War II with by far the strongest airline industry in the world, had wanted third and fourth freedom rights to be freely exchanged as well. Instead, these and the other rights have been the subject of hundreds of carefully negotiated bilateral air services agreements (ASAs). In an ASA, each side can specify which airlines can serve which cities with what size equipment and at what frequencies. ASAs often include provisions that also regulate fares and the sharing of revenue among the airlines serving a particular international route.

Yet even in international markets, the extent and degree of state intervention has diminished. An important trend in the past decade has been the proliferation of Open Skies agreements. Open Skies agreements remove most restrictions on the number of carriers and the routes that they may fly between two countries. This is irrespective of the size of the size of the respective air markets as long as national carriers are granted equal rights. By the end of 2006, the US, for instance, had such agreements with nearly 80 countries. Open Skies agreements can be viewed as a roundabout way for the US to gain what it could not get at the 1944 Chicago Conference – relatively unfettered access for American carriers to foreign markets. Indeed, the US has pursued a beachhead strategy playing one country in a region against another, putting pressure on Japan to liberalize its markets for instance by inaugurating Open Skies agreements with Singapore, Taiwan, South Korea and other Asian economies. Potentially the most important Open Skies agreement would be between the US and European Union, which began in 1992 with an Open Skies agreement with the Netherlands, an important hub in the European air network. This also incites the setting of alliance agreements between carriers. Moves in that direction have been stymied by US unwillingness to relax restrictions on foreign ownership of American carriers, among other concerns.

Nevertheless, many more airlines now operate internationally than before the liberalization of the airline industry began in the 1970s. The proliferation of international carriers has fostered the fragmentation of intercontinental and transcontinental markets. As a result, on intercontinental and transcontinental routes, the former dominance of the B747 has been challenged by longer-range, widebody twinjet (two-engine jetliners) like the B767, B777, and the A330. The triumph of widebody twinjets is most evident in the transatlantic market. The transpacific market is more concentrated among a smaller number of gateway cities, and the B747 is still dominant; but there is a clear trend towards fragmentation and displacement of the B747 by smaller aircraft, including ultra-long-range ones like the A340-500.

An important aspect of international airline networks is the recent formation of alliances. Alliances are voluntary agreements to enhance the competitive positions of the partners, particularly where the persistence of restrictive bilateral ASAs make it difficult for an airline to expand on its own. Members benefit from greater scale economies, a lowering of transaction costs, and a sharing of risks, while remaining commercially independent. The first major alliance was established in 1989 between KLM and Northwest Airlines. Today, the largest alliance is the Star Alliance, which was initiated in 1993 by Lufthansa and United Airlines. In 1996 British Airlines and American Airlines formed the oneworld alliance. Members of airline alliances cooperate on scheduling, frequent flyer programs, and equipment maintenance, and schedule integration. Most importantly, they permit carriers to tap markets that would otherwise be beyond their reach. Indeed, each of the major alliances encompasses almost every significant market across the globe, although each is dominated by US and European carriers.

A final important aspect of airline networks is the emergence of separate air cargo services. Traditionally, cargo was carried in the bellyhold of passenger airplanes, and provided supplementary income for airline companies. However, since passengers always had the priority when a plane was overloaded, such air freight services tended to be unreliable. Moreover, passenger aircraft are operated on routes that make sense for passengers, but may not attract much cargo. Today, about half of all air cargo is carried in dedicated freighters, aircraft in which goods are carried both on the maindeck and in the bellyhold. FedEx and UPS operate the largest freighter fleets in the world, operating 338 and 243 freighters respectively (by comparison, the largest passenger airline fleet is that of American Airlines with nearly 700 aircraft). Each deploys its aircraft worldwide. Yet many freighters are flown by so-called combination carriers like Northwest that carry both passengers and cargo. Northwest deploys its freighters primarily on transpacific routes where too little bellyhold capacity is available to accommodate the burgeoning trade between the US and Asia. Interestingly, one of the primary freighter hubs is Anchorage, a city which passenger aircraft on transpacific and transpolar routes (between Europe and Asia) regularly overfly now; but because freighters have shorter ranges than passenger aircraft and because freight is less sensitive to intermediate refueling stops than passengers, many freighters refuel in Alaska in order to maximize their payload. Still, cargo operations are ripe with inefficiencies. About 70% of the transit time for a payload carried by air is spent on the ground, mostly at congested major airport terminals. This tends to mitigate the major speed advantage air freight is known for.

5. The Future of Flight

Although the past century witnessed the dramatic growth of air transportation, important challenges cloud its future. First, the airline industry may not be financially healthy enough to pay for commercial advances that have benefited to the continuing growth of air transportation in the past. The development costs of new jetliners, even after adjusting for inflation, are unprecedented, partly because the latest generation of aircraft incorporate so many interfacing systems (e.g. in-seat inflight entertainment consoles). Meanwhile, the rise of the LCCs has put great pressure on the bottom lines at legacy carriers, and overall the airline industry has not been especially profitable. Air carriers have embraced various strategies to boost revenues, including yield management and various fees, such as check luggage fees. The financial woes of the industry have implications for the future of air transportation for it is the great carriers that have provided the launch orders for new airliners in the past. Pan Am, for instance, launched the B707 and B747; United launched the B767 and B777; and Air France and Lufthansa provide the launch orders for most of Airbus' airliners. By contrast, the LCCs’ focus on a handful of smaller, relatively short-haul aircraft limits their capacity to serve as catalysts for technological breakthroughs in aviation.

It should be quickly noted, however, that not all legacy carriers are struggling. Singapore Airlines, in particular, has emerged as one of the industry’s most consistently profitable legacy carriers and one of the aircraft industry’s most important customers. SIA is a launch customer for the 555-seat Airbus A380 which ended the B747’s long reign as the largest regularly used commercial aircraft when the "Superjumbo" finally took paying passengers in 2007. Asian carriers more generally are key players in the airline and aircraft industries today. Boeing has bet that Asian markets will be fragmented like those over the Pacific and has tailored its newest offering, the B787 Dreamliner, for that purpose. Interestingly, both the A380 and B787 are very long-range aircraft.

Both Boeing and Airbus promise that their newest jetliners will offer unparalleled fuel efficiency. That is important because a second basic threat to the future of the airline industry is the price and availability of fuel. In 2006, fuel accounted for about 30% of the operating costs of US airlines, up sharply from a few years earlier. For air transportation, finding a substitute for oil-based fuels is much more difficult than in ground transportation because the economic viability of flight depends on the use of a concentrated form of explosive energy. There is no easy substitute for fossil fuels in this regard. Still, the fuel efficiency of air transport has substantially improved in recent decades, as high as 70% between 1960 and 2000, and possible future reductions are expected to take place at a rate of 1 to 2% per year.

A third threat is terrorism and security. The rise of the airline industry was facilitated in part by the steady advance in the safety and predictability of air travel from the early post-WW I days of "Flying Coffins". Terrorism directed against civil aviation threatens the confidence of ordinary travelers in addition to impose additional security constraints taxing passengers in terms of delays. The September 11 attacks caused a two-year dip in traffic levels. The attacks of that day were unprecedented not only in their scale but also in their geography. Although American carriers had been targeted before, no major terrorism incident against the airline industry had occurred in the US previously. Instead, earlier attacks against aircraft and airports and airlines had been concentrated in Europe and the Middle East. Last, with the growth of air traffic, airports are facing capacity pressures and congestion which in some cases has resulted in changes in the scheduling of flights. The will to fly seems irrepressible, and aviation is now inextricably entwined in the fabric of 21st century everyday life across much of the world.