Producing airspace: the contested geographies of Nottingham East Midlands Airport

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Producing airspace: the contested geographies of Nottingham East Midlands Airport

by

Lucy C S Budd

A Doctoral thesis
Submitted in partial fulfilment of the requirements
for the award of
Doctor of Philosophy Loughborough University

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'In the leading machine the Head of the Air Force was sitting beside the pilot. He had a world atlas on his knees and he kept staring first at the atlas, then at the ground below, trying to figure out where they were going. Frantically he turned the pages...

"Where the devil are we going?" he cried.

"I haven't the foggiest idea," the pilot answered. "The Queen's orders were to follow the giant and that's exactly what I'm doing."

The pilot was a young Air Force officer with a bushy moustache. He was very proud of his moustache. He was also quite fearless and he loved adventure. He thought this was a super adventure. "It's fun going to new places", he said.

"New places!" shouted the Head of the Air Force. "What the blazes d'you mean new places?"

"This place we're flying over now isn't in the atlas, is it?" the pilot said, grinning.

"You're darn right it isn't in the atlas!" cried the Head of the Air Force. "We've flown clear off the last page!"

"I expect that old giant knows where he's going", the young pilot said.

"He's leading us to disaster!" cried the Head of the Air Force. He was shaking with fear. In the seat behind him sat the Head of the Army who was even more terrified.

"You don't mean to tell me we've gone right out of the atlas?" he cried, leaning forward to look.

"That's exactly what I'm telling you!" cried the Air Force man. "Look for yourself. Here's the very last map in the whole flaming atlas! We went over that an hour ago!" he turned the page. As in all atlases, there were two completely blank pages at the very end. "So now we must be somewhere here," he said, putting a finger on one of the blank pages.

"Where's here?" cried the Head of the Army.

The young pilot was still grinning broadly. He said to them, "That's why they always put two blank pages at the back of the atlas. They're for new countries. You're meant to fill them in yourself."

Roald Dahl, The BFG
Abstract

During the last 100 years, commercial aviation has developed into an established mode of transportation serving millions of passengers every year, but while researchers from other disciplines – most notably sociology, cultural history, and anthropology – have begun to appreciate the multiple dimensions of flight, geographers have written surprisingly little on the subject beyond quantitative analyses of airline networks. While perhaps understandable given the present geopolitical climate of passenger (in)security and commercial confidentiality, this nevertheless means many of the industry’s significant facets have yet to be adequately charted. Considering geography’s rich heritage of examining space, place, and spatial phenomena at a variety of scales, this thesis provides a distinctive contribution to theoretical and empirical knowledge by addressing the multiple geographies of airspace. Set in the context of the ongoing controversy surrounding the reorganisation of flightpaths at Nottingham East Midlands Airport (NEMA) in the United Kingdom, it considers the inherently geographical and often contested nature of airspace production. By detailing the complex interplay between how airspace is produced ‘on the ground’ by those who oppose its use, and ‘in the air’ by Air Traffic Controllers and airline pilots, it offers a new perspective for studies of geography and air transport in an age of mass aeromobility.
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I consider myself extremely fortunate that this research project has enabled me to combine my academic interest in geography with my passion for commercial aviation. However, I realise I would not have had the opportunity for such detailed theoretical reflection and empirical investigation had it not been for a studentship from Loughborough University, and I'd like to convey my thanks to everyone who worked to secure this for me. Furthermore, the thesis could not have been completed had it not been for the timely and enthusiastic involvement of numerous air traffic service providers, air traffic controllers, airport personnel, airlines, and pilots, for opening normally firmly shut doors to air traffic control centres, training simulators, and flightcrew briefing rooms. The nature of the research inevitably necessitated dealing with subjects outside my personal sphere of expertise, and I’ve had to rely on the generosity of others in sharing their skills, knowledge, experience, and, above all, time, with me. Consequently, I have accumulated a long list of intellectual and professional debts, many of which are acknowledged below. However, a number of individuals, for reasons of modesty or fear of compromising their position, did not wish to be identified. Naturally, I have respected their request for anonymity, but I thank them sincerely for their contribution.

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Preface

Take-off: the adventure begins

AMM368, like so many flights before and after it, executed a neat right-angled turn and lined up for departure on Gatwick's main runway. Awaiting take-off clearance, the aircraft paused briefly, before the throttles were opened and the dull roar from the engines rose in pitch and volume. A tangible frisson of excitement tinged with fear rippled through the cabin. The brakes were released, and the grass, terminals, and car parks outside disappeared in a backwards blur as the aircraft accelerated. After a take-off roll lasting some 20 seconds, the Boeing 757 powered into the murky skies above West Sussex. Jetset 368 was airborne.

It was the summer of 1994, and the flight was to prove to be a formative experience for the 13-year-old passenger in seat 11F who was staring with awe at the unfolding aerial panorama through the window. While this was not my first time in an aircraft, it was the first time that I had appreciated the enormity of flight, and I became acutely aware that my continued existence depended on the precise functioning of a network of sophisticated computer systems operated and maintained by an army of individuals, many of whom I would never see. However, such philosophical thoughts were soon overtaken by more pressing concerns; how to unwrap the various components of the pre-packaged meal that tottered precariously on the tray table in front of me to ensure I did not deposit their contents in my lap, how to avoid third-degree burns from the hot towels proffered by perpetually smiling flight attendants, and how to manipulate the in-flight entertainment system while simultaneously conducting an animated conversation with my brother and gazing out of the window. The sound of the passenger intercom interrupted my efforts. "Ladies and gentlemen, we have begun our descent and the captain has switched on the fasten seatbelt sign. Please return to your seats, fasten your seatbelts, ensure your hand luggage is correctly stowed, your tray table in the upright position, and your armrests down".

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I looked out of the window. We had broken through the scattered cloud, and the ground, which for so long had merely been a backdrop to our tropospheric passage, came rushing up to meet us as we flew lower and lower. The plane banked sharply to the right, dipping its wings in apparent deference to a local power station, before straightening up and swooping over the airport’s perimeter fence. With engines idling, the aircraft seemed to hover above the airfield, before reluctantly settling its wheels on the runway at Salzburg airport. We had made it and, a short while later, 230 excited holidaymakers deplaned into a warm Austrian sunset. Two hours, several hundred miles and, it seemed, half a world away.

Since then, I have flown as often as time and money allows, entrusting my life to a multitude of different carriers, aircraft and airline personnel. I’ve endured delays, been unnerved by turbulence, missed connections, and suffered claustrophobia in the back of an elderly DC-10, yet the thrill of flight has never diminished. As Willis Lee (1920 p310) remarked in one of the earliest publications on the geography of flight, ‘The airplane opens a new world to the geographer’, and the opportunity to gaze down on the earth from above has never lost its appeal. Thus, when I was offered the chance to undertake a three-year programme of self-directed postgraduate research, it seemed natural to combine my academic training in geography with my passion for commercial aviation, and the opportunity to conduct an in-depth inquiry into the geographical dimensions of commercial flight was enthusiastically embraced.

Since the Wright brothers’ first heavier-than-air powered flight in 1903, developments in aerodynamics, propulsion, avionics, navigation, and material sciences, have enabled aircraft to fly progressively further, faster, longer, and higher, overcoming the ‘tyranny of distance’ and reconfiguring understandings of presence, absence, and proximity, by selectively distorting international time/space relations while simultaneously embodying notions of modernity and shaping the fashions, attitudes, styles, and mobility patterns of the twentieth and twenty-first centuries. Aviation thus offers geographers a fascinating platform from which to explore a multitude of different phenomena, as time and space are continually rearranged in an effort to ‘shrink’ the world and emancipate humankind from the confines of a terrestrial existence. But, by and large, this exploration has not happened and, with a few notable exceptions (see Chapter Two), human geographers have continued to honour
the literal translation of their subject (writing about the earth and everything on it),
while largely ignoring the practices that continually (re)produce the airspace above
them. This is not to say the discipline is devoid of insightful commentary on the
socio-economic, political and environmental impacts of aviation; indeed, in recent
years, valuable literatures have emerged on inter-city air routes, the impacts of flying
on climate change, airport design, the ‘technogepopolitics’ of air travel, and local
responses to airport expansion (see Vowles 2006 and subsequent chapters). However,
it seems egregious that human geographers claim to be interested in “space” and the
spatial attributes of different phenomena, yet routinely neglect the spatial dimensions
of the sky. The present study thus arose from a potent combination of fascination and
frustration; fascination with the implications (on a variety of spatial scales) of an
aerial network that facilitates mass international aeromobility, and frustration at the
apparent paucity of geographical research into ‘how it works’ and ‘what it means’ to
those who produce this now taken-for-granted aeromobility. As such, the thesis
responds to Parker’s (2002 p16) call for in-depth studies into the ‘everyday, routine,
but essential operations, systems, and technologies that enable global mobility to
occur’.

Aim of the thesis
This thesis uses the ongoing controversy surrounding the reorganisation of controlled
airspace at Nottingham East Midlands Airport (NEMA), a regional airport in
northwest Leicestershire in the United Kingdom, to explore how airspace is produced
through contingent acts of ordering and flying that are designed to produce safe,
manageable pockets of space-time, but how these practices simultaneously result in
airspaces that are contested by communities who live below. The research makes a
theoretical and empirical contribution to extant geographies of air travel and mobility
by examining the practices and processes that produce particular airspace formations
and proposes a new agenda for geographical research into airspace.

Structure of the thesis
The thesis comprises seven distinct, but interrelated, chapters. The first, entitled
‘towards an aeromobile world’ provides an introductory overview of the development
of commercial aviation from prehistory to the present day. Charting innovations in
aeronautical design, technology, and practice, it explores how aviation has
reconfigured geographical patterns, relationships, and understandings, and identifies
different dimensions of flight that demand further theorisation as drivers of mobility
and globalisation. Chapter Two provides a review of salient literatures, detailing how
human geographers, sociologists, anthropologists, cultural commentators, and social
historians (among others) have approached the multifarious spaces of commercial air
travel, both past and present, to situate the study within wider academic debates.

Chapter Three introduces the case study of Nottingham East Midlands Airport
(NEMA), and shows how, over time, a local place of flight has become entwined in a
complex network of global airspaces. It also introduces the reasons for, and
subsequent controversy surrounding, the May 2005 reorganisation of controlled
airspace at the airport. Chapter Four examines the community reaction to this and
suggests that while the protest arose from an innate desire to defend the boundaries of
the body, home and local community, from the incursion of unwanted Others, it also
represented a challenge to the socio-technical and commercial knowledges that had
sought to determine the new contours of the airport’s airspace. In an effort to expose
the ‘hidden’ geographies of airspace production, Chapters Five and Six provide
alternative ways of exploring and theorising the unique spatialities involved.

Drawing on empirical fieldwork in Air Traffic Control (ATC) facilities in the United
Kingdom, Chapter Five discusses the international legislative protocols and everyday
spatial practices of ATC that facilitate the routine production of airspace above
NEMA. This is complemented by an investigation into the multiple geographies of the
flightdecks of commercial aircraft in Chapter Six. Based on original field material
obtained during visits to commercial flight training simulators and flightcrew briefing
rooms, it illustrates how the process of airspace production is the result of continual
negotiations between pilots and controllers and concessions to changing atmospheric
conditions, traffic flows, and the technological capability of different aircraft. The
final chapter draws together the main themes of the thesis, reflects on key findings,
and suggests future avenues of research.
However, as a result of its socio-economic importance, commercial aviation also represented a tempting target for terrorists, and the beginning of the twenty-first century saw scheduled passenger aircraft hijacked and converted into flying missiles (Gordon 2004).

While illicit aircraft seizure has existed almost as long as commercial aviation (the first recorded incident of aerial hijack occurred in 1931 when local revolutionaries hijacked a Pan Am flight to Cuba), it was not until the 1960s that the vulnerability of commercial aircraft made them a popular target for terrorism (Karber 2002). During the late 1960s and 1970s, hijacking reached epidemic proportions, with 33 occurrences reported in 1961 and 91 in 1969 (Crouch 2003). In response to the capture and eventual destruction of four commercial aircraft in Dawson’s Field, Jordan, in 1970 (see Pascoe 2001), the United States introduced pre-flight checks on baggage in 1972 and placed armed marshals on flights deemed to be ‘at risk’ of hijack, while ICAO, aviation’s international governing body, introduced new security protocols at airports (Crouch 2003). From this point on, airspace became ‘a police state whose electrified borders were crossed as one passed into the Schauplatz\textsuperscript{15} of the airport’ (Pascoe 2001 p196). Despite new security measures, terrorists were still able to exploit loopholes in the system. In 1985, an Air India B747 was blown up over the Atlantic killing 329 and in December 1988 a bomb destroyed Pan Am 103 over the town of Lockerbie, Scotland, killing 259 people in the air and 11 on the ground (Petzinger 1995). Hijacking still continued, sporadically, throughout the 1990s, but it was the use of four aircraft in the 11\textsuperscript{th} September 2001 attacks that has had a more lasting impact on practices of flying.

Following the 9/11 attacks, the global airline industry suffered one of its worst recessions. Several carriers, already teetering on the brink of insolvency owing to the success of new low-cost competitors, folded, while others shed thousands of jobs in a desperate bid to remain operational (Nolan et al 2004). Passenger numbers plummeted and a new discourse of vulnerability and (in)security permeated the industry, leading to the introduction of new security measures (Thomas 2003; Borger et al 2004). Flightdeck

\textsuperscript{15} Which Pascoe (2001 p166) defines as a ‘scene of action, a theatre of war, a political arena’.

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doors were retrofitted with bullet-proof material and armed sky marshals deployed on some flights (see Calder 2003b; and Chapter Six), while on the ground, sophisticated biometric identification systems were introduced and new full-body airport scanners tested (Taylor 2004; Woolf 2004)\(^{16}\). Shortly after 9/11, Calder (2003a p4) recalls a cartoon in a Florida newspaper showing a smiling check-in clerk saying to a passenger “Thank you for flying today. Do you have any reservations?” and the terrified passenger answering “Yes, but I’m still going”\(^{17}\).

Further disruption occurred again in the Christmas/New Year period of 2003-2004 following an alleged terrorist plot to blow up transatlantic airliners: tanks were deployed to patrol terminal forecourts, and innocent civilians denied travel because their surnames were homonyms of suspected terrorists (Beaumont et al 2004; Usborne and Sengupta 2004; Webster and Bowcott 2004)\(^{18}\). As one senior airline source remarked, “It’s got to the point where if there’s anybody called Mohammed aboard, your flight’s got a problem” (cited in Bowcott et al 2004 p3). Following a further alleged plot in August 2006, existing practices of passenger sorting and racial profiling increased in intensity (see Webster 2006), raising challenging questions about personal privacy, the role of the state, and an individual’s ‘right’ to mobility (see Chapter Two). Airbus and Boeing, meanwhile, continue to develop new airframes, which, they hope, represent the future of commercial flight (Bremner 2005). Airbus’s giant A380 is designed to carry more passengers, more cheaply, and more comfortably than ever before between key world airports (www.airbus.com 2005; Morgan 2003; Clark 2005a), while Boeing’s smaller

\(^{16}\) The use of these technologies raises interesting questions surrounding personal privacy and the invasion of the body. At Gatwick, authorities were quick to reassure travellers the scanning software not only incorporates ‘fig-leaf’ technology but that operators are ‘thoroughly screened to ensure their motives are not...voyeuristic’ (Woolf 2004).

\(^{17}\) In the UK, it was reported that sales of aromatherapy oils in The Body Shop’s airport outlets rose dramatically as travellers sought to alleviate stress and anxiety (Younge 2001).

\(^{18}\) British Airways flight BA223 from Heathrow to Washington was cancelled twice owing to ‘specific intelligence’ of a terrorist plot against it (Cornwell 2004). One theory was that ‘223’ might relate to the United Nation’s general assembly resolution 223 which concerned the Israeli treatment of Palestinians on the occupied territories in Gaza and the West Bank (Bowcott et al 2004). Air France and AeroMexico flights were also cancelled (Usborne and Sengupta 2004). Another flight from Baltimore was escorted into Heathrow by Tornado fighter jets after a member of the cabin crew overheard two men saying “we’ve been planning this for six months – let’s do it”. When questioned, it turned out the two passengers were referring to a family reunion with a long-lost aunt (McGavin 2004).
carbon-composite 'Dreamliner', due to enter service in 2008, is designed to be lighter and more fuel efficient than any of its competitors (Harrison 2004).

1.7 Summary
This chapter has documented the growth of commercial air travel from its humble beginnings to a time where it has become the normal mode of global travel (hence the use of the term 'aeromobility' to describe a world where international air travel is routine for many). The rapid normalisation of passenger flight, which undoubtedly manifests itself most clearly in the globally standardised landscapes of airports, terminal buildings, and runways, is also evident in the tangled web of air routes that have gradually spread to envelop all corners of the world. In these terms, airspace (as an entity which is produced and reproduced by human activity) can be understood as a global binding agent, connecting places more or less tightly within an increasingly fast, internationally networked world of mobility. By examining how airspace is produced above NEMA, this thesis explores how the sky is conceived, practised, and contested at a variety of spatial scales.
Chapter Two

In the air and on the move; the changing spaces of aeromobility

A literature review

'The diversity and dynamic nature of the air transport industry provides a rich research vein for geographers to explore. The very geographic nature of the industry allows the viewpoints of geographers to be sought after by researchers in other disciplines and by practitioners within the industry'

Vowles (2006 p18)

2.1 Introduction
Within a discipline where space-time convergence and the associated distanciation of social life are deemed the defining characteristics of globalization, successive innovations in transport and information technology have been routinely depicted as enabling the creation of new global networks. Over the last hundred years, geographers (among others) have highlighted air travel’s pivotal role in facilitating the construction of an increasingly thick web of aerial flows that envelopes the earth’s surface. As Vowles (2006) argues in his exploration of the changing ways geographers have approached the subject, increasingly sophisticated cartographic and statistical methods have allowed geographers to map and visualise such flows, with data on passenger and freight flows used to reveal the scale and scope of the global air transport network (see Cattan 1995; Smith and Timberlake 1995, 2002; O’Kelly 1998; Bowen 2002; Burghouwt et al 2003; Derudder et al 2004; Witlox et al 2004 amongst others). But while such work sheds light on the unfolding networks of air transportation, Vowles (2006) and others neglect to consider the equally-significant other ways geographers can (and do) contribute to an understanding of air transportation as socially- and culturally-produced and consumed. Moreover, Vowles’s article centres on studies that adopt very particular methodological and conceptual approaches, and thus the research he cites primarily examines the operational practices and/or the ‘political economy’ of airports and (to a lesser extent) airlines in the context of changing global geopolitical relations.
Drawing upon more recent work from other sub-disciplines – most notably social and cultural geography – this literature review presents some alternative geographies of air travel to highlight the multitude of ways geographers might usefully approach the subject. By suggesting air travel involves an intricate enmeshing of the social and technical, it argues that aeromobility is produced through complex socio-spatial processes which remain to be adequately charted (hence, the work undertaken in this thesis).

In order to explore what is a diverse (and growing) body of literature, and highlight these particular lacunae, this chapter is arranged in five subsections. The first explores traditional geographical approaches to the study of aeromobility, from initial observations about air travel through to increasingly sophisticated mappings of air routes. This section concludes by noting the rise of a putative ‘mobilities’ paradigm, which challenges some of these traditional approaches. The second - on ‘imagining aeromobilities’ – relates air travel to issues of citizenship, colonialism, modernity, and public spectacle/spectatorship to suggest how the growth (in scale and scope) of commercial flight has transformed geographical vision, theory and imagination. The third section explores emerging work on the cultural production and social consumption of airspace at a variety of spatial scales. Here, particular emphasis is directed towards understanding how modern discourses of aviation (in)security create highly uneven geographies of access and participation, and why new techniques of passenger profiling and biometric screening are raising challenging questions about personal privacy and the social (re)production of airspace. The chapter concludes by outlining the main themes and ideas that will be taken forward into the empirical analysis, alighting on key issues of airspace practise and contestation.

2.2 Geographical approaches to air transport, past and present

While geographers ‘have long addressed the nature and organisation of human movement across distant spaces’ (Zook and Brunn 2006 p472), geographers initially had surprisingly little to say about the emerging discipline of aeronautics. Possible reasons for this were suggested by the Prince of Wales in a speech to the Royal Geographical Society in 1920:
'We earth-bound geographers are inclined to look with a jealous eye upon these fine gentlemen of the air. For they soar up aloft and glide gracefully over the most terrible obstacles, unsurmountable to us geographers. We dislike them especially for a very nasty habit they have contracted of taking photographs of us from that superior position in which men appear like ants, mountains like mole hills, and even the President of the Royal Geographical Society appears of very insignificant proportions. But we geographers get our own back upon them in the long run, because they cannot stay up in the air forever. Sooner or later they have to come to earth again, and then they become very particular indeed about their geography. If they are in an aeroplane they are most anxious that the surface of the earth beneath them is not water, and if they are in a flying boat, they do not want it to be land. They want to know about the surface of the earth. They want to know if it is covered with forests or buildings, whether it is hilly or plains, whether it is crowded or free and open, and whether there are communications in their landing place. They want, in fact, to know everything they can about its geography. So in the end they are glad enough, these haughty airmen, to shake hands with us humble geographers. And we geographers are glad enough to shake hands with them, because we realize what great use aviation may be to geography.'

The earliest geographical studies of aviation thus addressed practical issues – the suitability of landing grounds, the introduction of new routes, or weather phenomena (Taylor 1919; Air Ministry 1919; Blake 1923b); how applied aerial surveying and photography could further the geographic method (MacLeod 1919; Lee 1920, 1922; Moffit 1920; Dowson 1921; Grosvenor 1924; Miller 1931; McKinley 1932); and descriptions of the cartographic techniques employed in the production of early air navigation charts (Woodhouse 1917; Miller 1933). Articles documenting the success of pioneering long-distance flights (Walmsey 1920; Byrd 1925; Wilson 1926; Wilkins 1928; Lindbergh 1928, 1934; Stevens 1931; Light 1935; Scott 1935) and descriptive works on the development of aviation in different regions of the world also began appearing in geographic journals (Wilcox 1930; Mason 1936; Pollog 1937), together with discussions surrounding the strategic geopolitical implications of an evolving aviation industry to the maintenance and administration of empire (Thomas 1920; Sykes 1920; Dowson 1921), issues which would be subject to continual analysis over the following decades by scholars from a variety of disciplines (see, for example, McCormack 1974, 1976; Killingray 1984; Pirie 1990; and Dierikx 1991). Aviation also enabled geographers to reach areas ‘inaccessible by land’ and ‘beyond the limits’ of colonial penetration (Blache 1921 p477), which resulted not only in the discovery of peoples and places previously unknown to Anglo-American geography (see Street
1926; Wilson 1929; Byrd 1930; Goddard 1930; Ricketson and Kidder 1930; Shippee 1932a, 1932b; Light and Light 1946), but also the publication of accounts detailing the ‘benefits’ such contact with western civilisation afforded these groups (see Light and Light 1938). Related to these discourses of aerial discovery, American geographers, in particular, produced a large corpus of work describing how different countries ‘looked from the air’, and documented the discovery of new archaeological sites in remote regions of the world (Beazley 1919; Dargue 1927; Pinedo 1928; Simpich 1931; Shippee 1933).

Geographers were also well placed to comment on the development and potential of international air routes for passenger and mail services (see Steffansson 1922; Wood 1930; Grosvenor 1933; Washburn 1938) and comment on the physical and human processes that had shaped the land below. The first aerial photographs of the United States appeared in the *National Geographic* Magazine in 1924 (Grosvenor 1924), and looking down on, other parts of the world (see Groves 1926 for details of a journey from Cairo to Jerusalem; Cobham 1928 for aerial views of Africa, Asia and Australia; Van Zandt 1925 and 1939 on the ‘thrills’ of seeing Europe by air; and Blacker 1933 on the ‘aerial conquest’ of Everest). Such accounts helped foster a popular discourse of aviation as adventurous, inherently geographical and, by implication, highly educational (see later this chapter).

While some authors had commented on aviation’s role in World War One (see Berrotta 1918; De Sieyes 1918; Grosvenor 1918; and Tulasne 1918 for details), discussed the importance of the future development of aviation to US national defence and economic development (Mitchell 1921), and charted ‘Man’s amazing progress in conquering the air’ (Hildebrand 1924), a distinctive geographical discourse of commercial flight did not emerge until after World War Two, when the post-war development of aeronautical technology and its subsequent utilisation by a fledgling commercial industry (see Crouch 2003) shifted attention towards studies of transnational aviation and the formation of early airline networks (see Plischke 1943; Hinks *et al.* 1944; Spoehr 1946; Rawson 1947; Whittlesey *et al.* 1947; Pearcy and Alexander 1951, 1953). In particular, geographers were keen to emphasise the time-saving (or distance shrinking) effects of these flights, a phenomenon anticipated by
Darley in 1939 when he suggested that the introduction of transoceanic air routes would render the Atlantic Ocean 'only one day wide'.

The 1940s were an important decade in the development of aviation geography. Renner (1942) and Van Zandt (1944) published influential works examining the complex interactions between aviation and geography at a variety of scales in terms of the impact of aviation on sub-disciplines of geography and the formation of early air routes; Whittlesey (1945) explored how aircraft were expanding geographical vision by increasing the altitude from which the earth could be viewed; Balchin (1947) discussed the 'geometrically static' but 'geographically dynamic' nature of distance in an era of global air travel in 'Air Transport and Geography'; and Huntingdon (1947) speculated about the future implications of air travel on human civilisation in terms of effecting time-space compression (my words not his), global population distribution, cultural diffusion, and the spread of agricultural pests and human diseases in 'Geography and Aviation'. These works were followed by a range of studies exploring the utility of flight or specific geographical dimensions of aeronautical technology. In 1948, Cochené discussed the physical geography of 'soaring', noting the importance of local knowledge about atmospheric conditions and topography to flight, while Dunn (1948 p66) argued for a comprehensive geography of air navigation, suggesting geographers (and the techniques they employed) could teach aviators much about global weather patterns, local climatic conditions and 'remote parts of the earth', as well as contributing to the planning of new air routes. Colton (1948), George (1949) and Weatherhead (1949) meanwhile pursued a more 'geo-technological' agenda, describing how the development of radar and radio aids helped pilots navigate over hostile and sparsely populated terrain, and reporting on new techniques of, and applications for, aerial photography.

The quantitative revolution in the late 1950s and early 1960s stimulated the publication of a corpus of work examining and mapping the network attributes (in terms of cost, distance, and time relations) of airline operations, and resulted in what became arguably the dominant paradigm in transport geography. In the United States, Edward Taaffe (1956, 1958a, 1958b, 1959, 1962) pioneered work into the description and visualisation of the new spatialities and urban linkages created by passenger airlines (see Figure 2.1), while Kish (1958) demonstrated the primacy of Moscow in
Figure 2.1 Air passenger traffic increase among the 91 cities of Chicago's air passenger hinterland, March 1949 compared with March 1955
(Source: Taaffe 1967 p587)
the USSR air network by means of an isochrone map based on flight times to and from the Soviet capital. Lavrishchev (1969), working in what is now Russia, similarly depicted his country’s ‘continually expanding’ network of air routes (Figure 2.2 overleaf) and emphasised the ‘outstanding’ nature of Soviet aircraft manufacture (ibid. 1969 p372 and p374). In this way, the scale and scope of a nation’s airline network came to embody the notion the country in question was modern, progressive, and technologically capable.

In the 1950s, British geographers also began examining airport nodes themselves, rather than simply the linkages between them. Dudley Stamp (1950) lamented the ‘sterilising’ effect of airfields on the British landscape, while Kenneth Sealy (1957) explored the geographies of airport location, providing detailed descriptions of the physical, economic and regulatory environment of global aviation, together with insights into the regional characteristics of air transport operation in Europe (see Figure 2.3), the U.S., and ‘under-developed areas’, in his seminal work, ‘The Geography of Air Transport’.

The 1960s saw a gradual shift away from such network-based studies and the diversification of geographic research on air transport (Vowles 2006). William Warntz (1961) examined the effects of pressure systems on transatlantic flights, and Michael Donne (1964) produced a lavishly illustrated piece on the ‘revolution’ in air communications the introduction of the first generation of long-range pressurised jet airliners, including America’s B707 and DC-8, and Britain’s Comet and Vickers’ VC-10, had effected. Significantly, in addition to describing the effects of a new phenomenon now understood as ‘time-space convergence’ (see Janelle 1969), Donne also examined global airport architecture and remarked upon the ‘feeling of modernity’ airport terminals engendered (Donne 1964 p441). Predating Relph’s (1976) work on ‘placeslessness’, and drawing obvious parallels with Auge’s thesis (1995, 1999) on ‘non-places’ (see later this chapter), Donne (1964 p439) contended that ‘airports all over the world are very similar’ and ‘at first glance it would be very hard without previous knowledge to say where [they] are’. In an effort to better understand the physical ‘placing’ of airports, Sealy (1967, 1976, 1979) explored the

1 The China Handbook (1984) is also interesting in this respect for its presentation of the development of Chinese Civil Aviation and airport/aircraft construction.
Figure 2.2 The USSR air network according to Lavrischev (1969) (not paginated)
Figure 2.3 Mapping the network - European air routes by seat capacity, 1956
(Source: Sealy 1957 p109)
geographical dimensions of airport planning on a variety of scales, a theme also

By the 1970s, the introduction of Concorde and progressively larger jet aircraft had
raised the issue of aircraft noise around airports (Adams 1971; Wrigley 1976, 1977;
Harvey et al 1979), while the vacillations and controversy surrounding the choice of
site for London’s third airport ensured issues of airport location, economics, and
development were placed firmly on the geographical agenda (see Adams 1970; Hall
1974; Hoare 1974, 1975; Lancaster 1974; Sealy 1970, 1979). Furthermore,
geographers became increasingly aware of the possible network diseconomies that
would result from there being insufficient airport or airspace capacity (see Robinson
1972; Hay 1973; Gates 1979) to handle growing numbers of aircraft, including the
recently introduced B747 ‘Jumbo Jet’. However, in a significant departure from
conventional quantitative studies, a few geographers began exploring the corporeal
experiences of air travel, with Borgstrom (1974) in particular writing about the
behavioural geographies and affective experiences of flight.

Nevertheless, such studies did not make a widespread impact as, throughout the
1970s, the economic and political arguments favouring deregulation increasingly
dominated academic agendas. In 1978, the Carter Administration passed the Airline
Deregulation Act, which increased market access, revoked tariff-setting legislation
and removed capacity constraints at airports (see Doganis 1994; Williams 1994,
Petzinger 1995; Taaffe et al 1996; and Caves 1997 for details). This new regulatory
freedom had profound spatial implications, including the consolidation of regional
flights at key hub airports, the mass transfer of passengers to connecting long-haul
flights, network rationalisation (Button et al 1998), and the emergence of a new type
of low-cost carrier who flew from smaller, less congested regional airports (Calder
were well placed to discuss the changes this regulatory reform enacted, providing
details of the geographical implications of new hub-and-spoke networks for
passengers, airports, and the regions they served. However, despite renewed interest
in airline linkages following deregulation, individual airports remained a key focus of
geographic research on aviation in the 1980s. Cruikshank (1981) and Raguraman
(1986) respectively published case studies of Atlanta Hartsfield Airport and Singapore
Changi, while Pepper (1980) and Parsons (1984) focused on the social geographies of airport protest groups and the controversy surrounding airport expansion.

In 1985, Farrington discussed the future for deregulation in the UK market, noting Margaret Thatcher’s enthusiasm for privatisation and reform, a situation that would result in the country taking a leading role in liberalising European air services and reducing air fares (see Farrington 1988 and Chapter Five for details). Meanwhile, more ‘popularist’ geographic literature focused on the operational geographies that collectively ‘produce’ a flight (Gates 1985) and the experience of flying round the world by jet ‘plane (Adeben 1985). The 1980s also saw the emergence of an ‘historical geography’ of aviation, with Kingston and Kingston (1983) and Walford (1984, 1987) writing retrospectively about the effect of pioneering flights and air races in stimulating public interest and enthusiasm for flight. However, without doubt, the most unusual paper was Fleming’s (1984) piece in the Geographical Review on the cartographic strategies employed by airlines in their advertising copy (see later this chapter).

The 1990s saw a substantial increase in geographic research on commercial aviation, a phenomenon Vowles (2006) attributes to the combined effects of the rising use of the Internet to make travel reservations, the founding of dedicated transport geography journals, and an increased awareness that deregulation had fundamentally changed the form and function, and thus the patterns and processes of flight, by dramatically increasing the number of available air services. Some of these studies focused on individual airlines themselves, either in terms of their service strategies (see Kuby and Gray 1993; Ivy 1997; Vowles 2000, 2001) or their role in nation building (Raguraman 1997), while Scott and Mattingley (1989) explored the economic geography of aircraft parts manufacturing in southern California. Others explored the geographies of airport economics and location. Case studies, including Caruana and Simmons’ (1995, 2001) work on Manchester Airport that sought to situate the airport’s historical development within a broader socio-economic and cultural context, have added much to geographical understandings of the changing use and ‘place’ of airports in society through time. However, this represents but one perspective, and other authors have variously analysed the spatialities of global airport privatisation (see Humphreys 1999 on UK airports or Costas-Cantivany 1999 on the
situation in Spain), assessed the unique roles individual airports perform in the wider air service network (Graham and Guyer 2000; Frenken et al 2004), or discussed the effects of air traffic congestion (Tyler 1993). Such studies of specific airports and/or national airport policy differ from broader scale works, such as those by O’Kelly (1998) and colleagues (O’Kelly and Miller 1994; O’Kelly and Bryan 1998), where airport location theory is used to inform research on the development of major airports in an era of hub-and-spoke networks. Drawing on the work of Smith and Timberlake (1995, 1998, 2002), Keeling (1995), and Cattan (1995), who compiled indices of global connectivity and produced global airport hierarchies, O’Kelly et al’s research concentrates on assessing optimal airport location and maximising productivity and operating efficiencies through the effective scheduling of activities. In this respect, it is salient to note the contributions made by Debbage (1994) and Graham (1995) to geographical understandings of the spatial and temporal characteristics of global airline alliances.

The easy-availability of airline route information on the Internet, combined with developments in cartographic representation and statistical computation, also enabled geographers to describe and visualise evolving airline networks in increasingly innovative ways at a variety of spatial scales (see Figures 2.4 and 2.5). Key scholars in this field include Bowen (2000, 2002), O’Connor (2003), Burghouwt and colleagues (Burghouwt and Hakfoort 2001, 2002; Burghouwt et al 2003), Zook and Brunn (2005, 2006), Witlox (Witlox et al 2004), Derudder (Derudder and Witlox 2005a, 2005b; Derudder et al 2004; Derudder et al 2005a; Derudder et al 2005b) and Taylor (Taylor et al 2006a, 2006b). In mapping the network attributes of global airlines and airports to describe world city hierarchies, these studies, and others (Matsumoto 2004; Dobruszkes 2006), also demonstrate how deregulation and liberalisation policies have fundamentally changed the spatial configuration of airline networks around the globe (see also Reynolds-Feighan 2001), simultaneously resulting in network contraction and rationalisation by some carriers, and dramatic expansion by others (Burghouwt et al 2003). While the majority of this work has focused on airline networks in/from/to the globalised ‘west’, some studies (notably Sagers and Maraffa 1990 on the USSR; Akpoghomeh 1999 on Nigeria; Jin et al 2004 on China; and Taylor et al 2006b on airline services in the ‘Global South’) have charted the development of airline networks in other areas, while Kassim (1997) and
Figure 2.4 The five most important air transport hubs (in absolute terms) per region, 2005
(Source: Derudder, Devriendt, and Witlox (2005) (not paginated))
Figure 2.5 Flight patterns and service frequencies in the ‘Global South’, 2005
(Source: Taylor et al 2006a Figure 1c (not paginated))

**Flight Patterns 2005**

[Map showing flight patterns with different line thicknesses indicating weekly flights.]
Rodrigue (1999) questioned to what extent air travel drives globalisation. A further, relatively new, area of geographical inquiry into commercial airline operations concerns the development of airfreighting, both in terms of network characteristics (see Rodrigue 1999; Bowen et al 2002; Bowen 2004) and environmental impact (Gillingwater et al 2003). However, the relative paucity of schedule information, combined with commercial confidentiality and the 'ad-hoc' nature of the business renders airfreight an as-yet underdeveloped area of research.


Nevertheless, these are not the only ways geographers can write about commercial flight. For instance, heightened awareness of the epidemiological and environmental implications of global air travel has led to investigations into the role of airline networks in the spread of global diseases (see Cliff and Haggett 1995; and Bowen and Laroe 2006 for an account of the rapid diffusion of the SARS (Severe Acute Respiratory Syndrome) virus in 2003), and personal experience of U.S. customs shows how seriously they take the threat of air travellers importing agricultural pests. Arguably as significant, in an age of widespread aeromobility where 'Business men [sic]...hop back and forth' between countries at will (Huntingdon 1947 p529), is an...
awareness of the plurality and sociality of air travel. In this respect, Tim Cresswell (2006) and Peter Adey (2006) are forging new agendas for aviation geography that do not fit into conventional classification systems. By broadening their horizons to look at all the parts (that were often neglected by earlier studies) that go into making the whole, cleaners, escalator mechanics, business travellers, check-in staff, construction workers, asylum seekers, and ‘plane spotters’, have been brought into the remit of geographies of air travel.

This increasing attention given to social and cultural dimensions of air travel is, in part, inspired by the ‘mobilities’ turn in the social sciences. In his recent overview of the geographies of mobility, Cresswell (2006) considers the metaphysics of movement in Western social thought, arguing that sedentarist suspicion about mobility is being superseded by a new nomadic worldview in which mobility is seen to be the norm, not the exception. Mirroring this, it has been widely argued social scientists’ traditional preoccupation with the fixed and sedentary needs to be replaced with a concern for the mobile and fluid. Zygmunt Bauman (2000), for example, argues liquidity is the defining characteristic of contemporary society. Such flows, whether material or virtual, increasingly ooze, seep and percolate their way around the world, often spilling over the ‘dams’ and ‘defences’ (such as immigration controls, customs inspection points, and computer firewalls) designed to impede their progress (see Collinson 1996 and Neumayer 2006 for discussions on how countries use visa restrictions to try and regulate/restrict international mobility). The use of hydraulic metaphors demands theoretical perspectives that are able to comprehend these new ‘geographies of flow’: from Massey’s ‘progressive sense of place’ (1994) to Castells’ space of flows (1996), contemporary geography is replete with theories attuned to the extraordinary levels of mobility – or hypermobility – which characterise the contemporary world (Shields 1996).

Given this increased attention to questions of movement, Urry (2004 p4) argues ‘there is a ‘mobility turn’ spreading into and transforming the social sciences’. By definition,

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2 As such, it is interesting to reflect on how academic geographers’ corporeal experiences of flying might have impinged on their own geographical imaginations, encouraging them to develop accounts of globalisation which suggested time and space have become flexible, reconfigured according to the speed of the latest aeroplane, while the unique features of place are increasingly subsumed under a global aesthetic of mobility (see Van Zandt 1944; Rimmer and Davenport 1998).
Chapter One

Towards an aeromobile world

‘At a cruising speed of 250mph the antipodes of any place...are no more than fifty hours away...Were relays of planes and pilots waiting, a girdle might be put about the earth.’ ‘Geography of an Air Age’ (Taylor 1945 p19)

In 1957, in anticipation of the launch of their new B707s into service, Pan American Airlines unveiled their new corporate identity. Designed by Edward Larrabee Barnes and Charles Forberg, it featured a sky blue circle inscribed with abstracted lines of latitude, a graphic ambassador for a new age of global aeromobility in which distance, that great obstacle to mobility, had been overcome (Zukowsky 1996). The simple motif invoked notions of globality, speed, and global domination (at least in commercial aviation terms), signifying their passenger and cargo networks encircled the earth (see Eisenbrand 2004 and Figure 1.1). As the American politician Wendell Wilkie enthused, ‘there are no distant places any longer: the world is small and the world is one’ (cited in Grant 2003 p376).

Figure 1.1 Pan Am Airlines, the world by air. The airline’s trademark adorned aircraft, airport counters, fixtures, buildings, and staff uniforms and, in the 1960s, was second only to Coca Cola in terms of global customer recognition (Kaplan 1994, Rau 1996).

In addition to promoting utopian notions of spatiality and unhindered global travel (see Thurlow and Aiello 2005), Leslie (2005 p70) suggests the revised logo ‘symbolized the dissipation of the local into the abstract ether of global travel’ and the ‘elimination of
this turn represents an instant in which the dichotomy between transport research and social research is being problematised, with increased attention given to the way social ties are shaped by (and shape) networks which transmit flows of goods, people, ideas and money. Accordingly, Urry notes scalar claims are being brought into question and that many commentators have moved beyond an imagination which regards territories or identities as spatially-fixed and bounded (see also Hannam et al 2006). Regarding each and every place as tied into ‘at least thin networks of connections that stretch beyond each such place’ (Urry and Sheller 2006 p210), the implications of the ‘mobilities paradigm’ are apparent in many different aspects of research into transportation and movement, with, for example, commercial aircraft increasingly theorized not just as a technology for moving people from A to B, but recognised for their role in the making of new social practices, formations and spaces.

Following other commentators in arguing that social scientists have tended to focus on the sedentary and fixed, Urry thus presents an argument for exploring the imbrication of culture and technology in practices of movement, with an explicit focus on the social spaces that orchestrate and organize different forms of physical and virtual mobility. Suggesting mobility is not just about things and people moving between fixed places, there is a case for addressing the complex networks and topologies linking the immobile and mobile; for example, the connections between air travel and the infrastructure of airports, navigation beacons and air traffic control (an issue explored in detail in Chapter Five). This notion that mobility involves the co-evolution of technological and social systems, as well as the creation of self-organising systems, owes much to the perspectives of Actor Network Theory as well as non-representational theories that focus on social practices (Lorimer 2004). It also serves to problematise the idea the world is always and inevitably ‘speeding up’ for everyone, and argues for a nuanced understanding of the production and consumption of different mobilities (Hubbard and Lilley 2004).

Urry’s argument for a mobile sociology is a persuasive one, not least because it promises to open up the ‘black box’ of travel. Nonetheless, Urry’s claim that social scientists have largely overlooked the social and cultural dimensions of travel is perhaps overstated, especially in the context of globalization debates, where the social rituals which adhere to spaces of air travel have been widely commented upon. For
recognizable land forms and places in favour of a mathematical representation of navigation and capital'. As such, Pan Am's logo neatly encapsulates debates surrounding the extent to which globalisation has necessitated the rethinking of traditional geographic conceptions of space and place in an increasingly interdependent world of mass mobility, and the degree of cultural homogenisation this has, or has not, effected (see Sassen 2000; Amin 2002; Castree 2003; Jackson 2004; Jones and Jones 2004; Ley 2004). Like other global networks of mobility, including transcontinental railways, the Internet, and satellite television, air travel binds together ostensibly 'global' and 'local' scales in unpredictable and often unexpected ways. As Bruno Latour (1993 pp 117-119) pertinently asked, "Is a railroad local or global? Neither. It is local at all points, since you always find sleepers and railroad workers, and you have stations and automatic ticket machines scattered along the way. Yet it is global, since it takes you from... Brest to Vladivostok". He continues, "There are continuous paths that lead from the local to the global... Networks, as the name indicates, are nets thrown over space... They are connected lines, not surfaces... [that] can be extended almost everywhere... spread out in time as well as in space, yet without filling time and space".

My intention in this chapter is not simply to provide an historical commentary on the development of aviation, as a wealth of publications detailing the 'triumphs' and 'disasters' of the early days of aviation make additional accounts superfluous ¹, but to explore the unfolding spaces and landscapes of flight that were created. The geographical implications of these new (air)spaces are discussed in Chapter Two.

1.1 The dawn of human flight
As Goldstrom (1930) astutely observes, it impossible to accurately determine where tradition leaves off and precise historical documentation concerning the chronological development of aviation begins, as aspirations toward flight are evident in ancient myth and legend. However, the French social philosopher and writer, Jean-Jacques Rousseau (1712-1778), firmly believed in the possibility of flight. "At first", he declared, "we will only skim the surface of the earth like young starlings, but soon, emboldened by practice

¹ See Wohl (1996, 2005), Crouch (2003), and Van Riper (2003), among others.
and experience, we will spring into the air with the impetuousness of the eagle, diverting ourselves by watching the childish behaviour of the little men crawling miserably around on the earth below us"².

While the history of heavier-than-air powered flight only dates back as far as 1903, evidence indicates that humans have been trying to ‘conquer’ the air since before the middle of the third century BC, when Aristotle began to think seriously about the practicalities of flight (Launay 1967). While gravity proved an insurmountable obstacle for centuries, the idea of flight has hence shaped the development of human civilization since ancient times, with many cultures containing mythical or quasi-religious accounts of flying deities carrying people up into the heavens³. As a consequence of our apparent inability to emulate birds, flight was deemed magical and supernatural, and winged creatures came to assume deep religious and spiritual significance.

However, while many understood the sky to be the sacred realm of the Gods, and viewed any attempt to join them as sacrilegious, a small minority were tempted to incur the wrath of their neighbours (and possibly their Gods) by trying to fly. In 1500BC, evil spirits were said to have tempted the Persian King, Kai Kawus, to invade Heaven by chaining ravenous eagles to his throne and tempting them to fly with the lure of meat, a feat similarly attempted by Alexander the Great with four winged Griffins (Gibbs-Smith 1970). In Greek mythology, Icarus and his father Daedalus infamously attempted to escape exile in Crete by attaching feathers to their arms with beeswax. While Daedalus eventually made it to Sicily, Icarus ignored his father’s warnings and flew too close to the sun, melting the wax that held his feathers in place causing him to plunge to his death (Launay 1967).

³ Excavations at sites in ancient Egypt, Minoa and Mesopotamia uncovered images of winged deities; the Old Testament book of Ezekiel describes God manifesting himself to the Prophet as a winged creature with a human face; and Muslims believe that Muhammad was raised into heaven for a night by a winged horse (www.scientcemuseum.org.uk/on-lineflight).
Despite this warning, imitating birds remained popular with early would-be aviators who fastened ‘wings’ to their arms, launched themselves from high platforms or hillsides and flapped desperately. John Damian, a physician at the Court of James IV of Scotland, “took in hand to fly with wings, and to that effect caused to make a pair of wings of feathers, which being fastened upon him, he flew off the castle wall of Stirling, but shortly he fell to the ground and brake [sic] his thigh-bone” (cited in Sykes 1922 p10). Notwithstanding the high failure and alarming death rates of these ventures, they fuelled further aerial experimentation. One particularly intriguing proposal involved harnessing a chariot to a large flock of geese in the hope they might be encouraged to pull it through the sky (Coutts Clay 2003).

It was not until the 13th century that the English Franciscan philosopher, Roger Bacon, postulated that, under the right conditions, flying was theoretically possible if air could be made to support a craft in the same way that a boat floats on water (Blatner 2003). After studying Aristotle’s theories, he declared in 1256 that ‘it is possible to make an instrument for flying if a man sits in the midst thereof, and do turn an engine which moves artificial wings made to beat the air after the manner of a flying bird’ (cited in Launay 1967 p1). However, it was not until the 16th century that the Italian inventor, Leonardo da Vinci, attempted to realise Bacon’s vision by designing an ‘ornithopter’, a
contraption that bears remarkable similarity to the physiology of a bird’s wing (Blatner 2003).

In 1678, Besnier, a French locksmith, tried to fly using wings like the webbed feet of a duck, which were moved through the air by an elaborate system of ropes, pedals, and pulleys, but feathers and flapping wings were eventually abandoned as practical means of flying, and attention was directed to hot-air balloons (Nahum 1990). In 1709, a Jesuit priest, Laurencio de Gusmao, demonstrated his hot-air powered balloon to the King of Portugal. Unfortunately, the prototype caught fire, damaging the King’s Palace and destroying Gusmao’s hopes of gaining Royal assent to construct a passenger-carrying version (Walters 1979). Meanwhile, in 1738, a Swiss mathematician, Daniel Bernoulli, promulgated the theorem that would eventually enable man to construct powered flying machines. However, while his theory was sound, he had no means to test it, and on 4th June 1783, Joseph and Etienne Montgolfier succeeded in launching the world’s first hot-air balloon. Building on their work on the effects of heat on air, they deduced that if they enclosed enough hot air inside a container they could get it to float. On November 21st that year, Francois de Rozier and the Marquis d’Arlandes became the world’s first aeronauts, as a Montgolfier’s blue and gold silk and paper balloon floated into the air over the Jardins de Tuileries in central Paris (Figure 1.3).

During the 19th century, it is reported certain members of Parisian society became ‘balloon mad’, and flying developed into a fashionable spectator sport, with well-to-do gentlemen competing for distance and height records (Lecornu 1913; Kim 2004). The craze was quickly exported to England, where aviators marvelled at the new aerial perspective afforded to them. As Hartwig (1886 p496) eulogised, ‘The discovery of the balloon has opened to man the portals of a new and wonderful world, and enabled him to enjoy scenes of beauty hidden from the gaze of all preceding generations’. This ability to gaze down on the landscape from above revolutionised geographic imagination and cartographic practice (see Chapter Two), and a new discipline of detailed climatological observation of the physical properties of the atmosphere emerged to support the amateur aviator (Hartwig 1886).
While lighter-than-air craft continued to develop, proponents of heavier-than-air machines were refining ideas of their own. Sir George Cayley proposed that heavier-than-air flight could be achieved ‘by making a surface support a given weight by the application of power to counter the resistance of air’ (cited in Walker 2003 p64). In 1853, he launched his terrified coachman across a valley, making the reluctant aviator the first person to fly in a heavier-than-air machine. However, as Cayley’s granddaughter diplomatically noted, “it came down in rather a shorter distance than expected” (cited in Blatner 2003 p190). Cayley realised that one method of prolonging flight was to fit a motor to his glider so the craft would propel itself through the air, but Henson and Stringfellow’s experiments with steam-powered aircraft in England in 1845 had proved disappointing in this regard (Davy 1931). Meanwhile, throughout the 1890s, Otto Lilienthal and his brother were experimenting with gliders in Germany, and Octave Chanute was doing likewise in America (Williamson 1996). The Lilienthal brothers declared it was their aim to ‘artificially imitate what nature demonstrates to us daily in birdflight’ (Lilienthal 1911 p2), and their methodical studies of birds forced them to conclude that ‘the only possibility of attaining efficient human flight lies in the exact imitation of birdflight with regard to aerodynamic conditions, because this is probably the sole method which permits of free, rapid flight, with a minimum of effort’ (ibid. 1911 p128, see Figure 1.4).
1.2 The beginnings of powered flight

Despite some notable successes with hot-air balloons and gliders during the 19th century (see Hartwig 1886; Valentine and Thompson 1902; and Lilienthal 1911), heavier-than-air powered flight remained an elusive goal, and its scientific potential dismissed (Canby 1962; Gibbs-Smith 1970; Hart 1972). In remarkably defeatist terms, the British Government declared in 1902 that "light by machines heavier than air is impractical and insignificant, if not utterly impossible" (cited in Blatner 2003 p4). However, on the morning of 17th December 1903, on the windswept sand dunes of Kill Devil Hills, near Kitty Hawk, North Carolina, brothers Orville and Wilbur Wright, two bicycle mechanics from Dayton, Ohio, proved such claims unfounded (Anderson J P 2004). Though only airborne for 12 seconds and barely flying 120ft, Orville accomplished the world's first recorded powered heavier-than-air flight (Walker 2003), a feat that, in his own words, marked "the first in the history of the world in which a machine carrying a man had raised by its own power into the air in full flight, had sailed forward without reduction in speed, and had finally landed at a point as high as that from which it started" (cited in Anderson J P 2004 p2). However, despite photographic evidence (Figure 1.5), the media were sceptical of their claims, and political and scientific establishments dismissed the existence and future potential of human powered flight (Blatner 2003; Grant 2003).
Nevertheless, news of the Wright brothers’ flights reached Europe and wealthy members of the European aristocracy strove to emulate their success (Walters 1979). In France, the French aviator, Louis Blériot, began building - and crashing - numerous aircraft in an attempt to be the first person to fly the English Channel in a powered heavier-than-air aircraft, a feat he achieved on 25th July 1909 (Berget 1909; Jukes 2004). In Continental Europe, and Paris in particular, Blériot’s flight was greeted with unbridled joy and enthusiasm. In Paris, Le Corbusier (1935 p7), recounts his assistant bursting into the room brandishing a copy of the ‘Intransigeant’ exclaiming, “Blériot has crossed the Channel! Wars are finished; no more wars are possible! There are no longer any frontiers!” and during celebrations in Venice, one reveller was heard to comment; “[h]ow useless... are frontiers when any plane can fly over them with ease, how provincial and artificial are customs-duties, guards and border patrols, how incongruous in the spirit of the time which visibly seeks unity and world brotherhood” (Zweig 1964 p196 cited in Pascoe 2001 p46).

However, amid the excitement, Blériot’s pioneering flight had inadvertently raised some difficult geopolitical questions concerning the rights of aircraft from one state to use the airspace above another (see Brittin and Watson 1972). While Claxton (1914 p256) welcomed the arrival of a new era in transportation where ‘the ocean’s barriers are broken down and the nations of the world become linked into one’, his Utopian vision did
not take into account the depth of Anglo-French cultural animosity. Indeed, while Bleriot’s flight had succeeded in making the two countries ‘closer’ in time and space, his flight revealed Britain lagged far behind its continental neighbours in the field of aeronautics, and it was undoubtedly a source of embarrassment that the first flight to take off in Britain (at Farnborough aerodrome in 1908) was piloted by an American (Walters 1979). Furthermore, Germany’s success with passenger airships transformed the acquisition of aeromobility into a tool of nationalistic propaganda (see Fritzsche 1994; Williamson 1996).

In Britain, many commentators believed transnational aviation had the potential to be an important instrument fostering international peace and global unity, for it made ‘the world grow smaller, lessening the distance between the nations and giving the peoples of the world better opportunities of ready and frequent contacts that should sweep away ancient hatreds and remove the jealously and suspicion that thrive on ignorance and misunderstanding’ (Finch 1938 p224). However, Berget (1909 p215) prophesised that ‘the perpetual tendency among nations...to destroy one another by the most perfected means [will result] first and foremost in the application of aerial navigation to warfare’.

1.3 Aviation and warfare – the military geographies of flight

Less than a year after the Wright brother’s first flight, Leopold Amery (1904 p440), in response to Halford Mackinder’s “The Geopolitical Pivot of History” argued that:

‘both the sea and the railway are going in the future...to be supplemented by the air as a means of locomotion, and when we come to that...a great deal of this geographical distribution must lose its importance, and the successful powers will be those who have the greatest industrial basis. It will not matter whether they are in the centre of the continent or on an island; those people who have the industrial power and the power of invention and of science will be able to defeat all others’.

Although he could not have foreseen how aviation would develop, his prediction that the conquest of the air would enable technologically advanced countries to ‘defeat all others’ proved astute. From their very inception, aircraft were ‘conceived, designed, tested, developed and sold...not as a vehicle for tourism, but as an instrument of destruction’
which, ironically, could be used as ‘a means of civilising uncooperative peoples’ (Monbiot 2003 p19 my emphasis; though see also Veale 1945; Walters 1979; and Anderson J P 2004). Aircraft were first employed as an aerial destructive force by Italian forces during a campaign in what is now Libya in 1911 and, since then, aircraft have fulfilled a variety of military roles, from surveillance and reconnaissance, to troop conveyance, logistical distribution and, of course, destructive bombing (Grant 2003).

Following the outbreak of war in August 1914, aerial raids by both Allied and German forces revealed the importance of maintaining absolute control over airspace and stimulated a rapid development in aeronautical technologies and expertise, knowledge that ultimately facilitated the post-war growth of passenger aviation (see Davy 1941; Bonser 2001; Spode 2004; and Chapter Five). The relative technological proficiency of European and North American nations vis-à-vis the rest of the world secured their global aerial supremacy, conferring pre-eminence in subsequent international power struggles. Military dominance of the skies, to borrow Allen’s (2006) phrase, literally confers ‘power over’ other nations. In the 19th century, Jules Verne talked excitedly about a time when a global aerial police force would bomb ‘barbaric races’ into civilisation, and Stanley Waterloo eagerly anticipated ‘the future annihilation of inferior races from the air’ (Monbiot 2003 p19). As Le Corbusier (1935 pp6-7) noted,

‘What an unexpected gift to be able to set off at night under cover of darkness, and...sow death with bombs on sleeping towns...What an unexpected gift to be able to come from above with a machine-gun...spitting death fanwise on men crouched in holes’.

The development and widespread military application of aircraft during the 20th century meant that future global disputes would be contested in the air, as airspace became the new battleground (Butler 2001; Monbiot 2003). This fundamental shift in the spatial geographies of conflict highlighted the obsolescence of old geopolitical paradigms that were literally ‘grounded’ in the conventions of Euclidean territorial geometry (see Graham 2004). Indeed, the current utilisation of ‘hi-tech’ computerised weaponry in the United States’ ‘War on Terror’ demonstrates the strategic importance of (literally) maintaining ‘power over’ ‘hostile’ nations and their airspace. To that end, U.S. military
strategy relies on global networks of spy satellites, unmanned surveillance drones, and targeting systems that enable them to kill ‘at a distance’, effectively changing notions of geographical distance and proximity (ibid. 2004 p12).

1.4 Aviation after the Great War – the ‘Golden Age’ of commercial flight

In the immediate post-WW1 years, British aviation experienced ‘a time of innovation and experiment without the benefit of experience’ (Walters 1979 p16). Yet, despite only having rudimentary navigation equipment and primitive aircraft, demobbed pilots were keen to use their newly-developed aeronautical prowess for peaceful purposes and began to form small private companies to operate airmail and parcel services (Grant 2003). Ironically, defeated Germany was among the first to recognise the potential of civilian air travel in fostering post-war national economic development, and the first true passenger airline, Deutsche Luftreederei, began flying between Berlin, Leipzig, and Weimar on 5th February 1919 (Walters 1979). In France, the widespread destruction of road and rail communications along the Western Front necessitated the rapid development of aviation as a means of transportation and, by 1919, six airlines had begun operations using converted Goliath bombers (ibid. 1979). A similar pattern emerged in Britain as ex-military aircraft were pressed into commercial service. However, many of these machines were wholly unsuited to their new role, and passengers were understandably wary about committing their lives to the unproven technology (Voigt 1996). Such fears were partially allayed in June 1919, when Captain John Alcock and Lieutenant Arthur Whitten Brown became the first aviators to successfully fly across the Atlantic. By metaphorically ‘shrinking’ the distance between the old and new worlds by safely navigating across the ‘pond’, the aviators demonstrated the feasibility of future transatlantic passenger flights (Alcock and Brown 1919; Beaty 2003), which would surmount ‘the only barrier which remains between two democratic peoples who should be one’ (Davy 1941 p165).

Vigorous international competition on the short cross-Channel routes between Britain, France, Belgium and the Netherlands began in earnest in 1920 but, unlike their continental competitors, British carriers received no state subsidy and received scant official encouragement (Porter 1991; Crewe 2002). Indeed, the then-Secretary of State
for Air, Winston Churchill, famously declared, "civil aviation must fly by itself" (cited in McCormack 1989 p377). Such official expressions of parsimony hindered the growth of the fledgling industry and many pioneering British carriers quickly declared bankruptcy. In 1921, in an effort to highlight this unequal regulatory environment, Britain’s Handley-Page Transport and Instone Air Line suspended operations on the London-Paris route (Instone 1938). The strike forced a change of Government policy and, with the promise of state support, services were resumed within a month on a mutually cooperative basis (Walters 1979). Yet despite the injection of state subsidies, both carriers struggled to become viable commercial enterprises, as inclement weather over the Channel often disrupted flights forcing passengers to desert them in favour of the relative comfort and safety of the railways and shipping companies (ibid. 1979).

Nevertheless, European Governments firmly believed aviation was a socially progressive force that would foster better international relations and cultural understanding (Burney 1929; Cole 1930; Finch 1938; Taylor 1945). This utopian ideal was promoted through international air meets, and the week-long Grande Semaine de l’aviation de la Champagne, held in August 1909 at the Betheny racetrack near Reims, where 35 pilots showcased their aeronautical skills to 500,000 enthusiastic spectators, became one of the earliest examples of a new genre of international air show that helped engender public enthusiasm for flight (Voigt 1996; Williamson 1996). Like major sporting events today, Reims was a highly-mediated and commercialised event; over the course of the week over one million words were telegraphed around the world (Wallace 1958), and the show featured a 600-seat restaurant, a beauty parlour, post office, barbers shop and, something that was to become a key feature of many airports throughout the 1930s, a grandstand for spectators (Pearman 2004). Furthermore, the need to separate the skilled work of the pilots and mechanics from the mass hysteria of the crowd was responsible for establishing the division between airside and landside areas and activities, something that continues to dictate the architectural layout of airports to this day (ibid. 2004). In Britain, the editor of the Daily Mail, Lord Northcliffe (who subsequently did much to encourage the growth of British aviation through the provision of prize money and sponsorship), took it upon himself “to convince our readers that a new age has dawned, to rouse them
to action...and to kindle a living interest in flight among all our citizens" to make British society more “airminded” (cited in Wallace 1958 p138).

Impeccable timing, following Bleriot’s Channel crossing, ensured Reims was a social and commercial success, and the format was quickly copied at other venues across the continent where daring pilots would woo crowds with dramatic manoeuvres while claiming relatively substantial sums in prize money and sponsorship which was used to fund research into ‘better’ (i.e. faster) aircraft (Walker 2003). In America too, the spectacle of flight had a firm grip on the public imagination. Pilots were going further, faster and higher than ever before, and the media were there to cover the event, ensuring national, and even international fame, for the pilot of the hour. Air races quickly became one of the great spectator sports of the 1920s with ‘exploits, meetings, races, competitions and demonstrations’ staged to ‘meet the new public demand to see aeroplanes’ (Gibbs-Smith 1970 p152). At Hendon and Farnborough airfields, enthusiastic pilots took this one stage further by accepting paying passengers for aerial ‘joy rides’ (Walters 1979). Flying quickly developed into a stylish sport, fostering an image of social sophistication, excitement and danger, which Curry (2004) believes is responsible for contemporary nostalgia for these early days of passenger flight.

In a bid to capitalise on aviation’s popularity and stress its public utility to the development, maintenance, and policing of empire, the Baird Committee, reporting to Lloyd George in 1918, recommended the inauguration of a Cairo to Cape Town air service (McCormack 1989). During the 1920s and 1930s, Britain sought to demonstrate its technological prowess and expand its sphere of territorial influence through the medium of flight, and many daring aeronautical events were staged for this purpose (see Cobham 1925, 1926a, 1926b). In 1919, Sir Ross Smith successfully flew from London to Australia via the Middle East and declared that his epic 20-day flight had helped ‘bind closer the outposts of empire through the trails of the skies’ (James 1994 p438), but the infrastructure, finance, and expertise did not yet exist to enable his feat to be replicated on a regular basis. The then Air Minister, Sir Samuel Hoare, enthusiastically embraced aviation’s imperial potential however, formulating a futuristic vision of a British ‘Empire
of the Air', in which distance, that 'great enemy of imperial solidarity', was conquered (McCormack 1989 p378). British politicians and aviators gave impassioned speeches as to the importance of securing and maintaining aerial supremacy (see Grahame-White 1919; Salt 1930), for it was believed, 'The nation that controls the air will control the earth' (Lowell Thomas 1927 p90). Following his appointment as Secretary of State for Air, Sir Philip Sassoon emphasised the 'supreme importance of air power to the British Empire', but reiterated such power could 'only be enjoyed by an air-minded nation'.

The revolution in air transport regulation after the 1919 Versailles Treaty (see Chapter Five) enhanced prospects for a more closely-connected British empire, and the realisation that air travel could 'liberate the empire from the fetters of its geography' (James 1994 p438), caused the British to combine air sovereignty, which would protect their domestic industry, with a liberal formula that would facilitate the expansion of British air services overseas (Millichap 2000; Butler 2001). However, by 1922, the few surviving British passenger airlines were in serious financial difficulties, and a Civil Air Transport Subsidies Committee was appointed in 1923 to investigate the feasibility of their nationalisation through compulsory purchase and amalgamation. Following the Committee's recommendations, a new airline, Imperial Airways, was formed on 31st March 1924 to develop air routes to and between British dominions, possessions and mandates in the Middle East, India, Australasia, the Far East, Africa and Canada (Veale 1945; Porter 1991; Chant 2002). To finance this operation, the new airline was given £1 million in Governmental capital and awarded a £1 million subsidy payable over the next 10 years (Walters 1979).

The new national airline, the 'chosen instrument' of British imperial development, created to 'carry aloft the banners of imperial prestige and power', began flying later that year, initially linking London with destinations in Continental Europe before expanding into Africa and the Middle East (McCormack 1989 p374). On January 7th 1927, it took over the RAF's mail and personnel flights between Cairo and Basra, a route that was

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4 cited in Gordon (2004 p74)
5 cited in Salt (1930 pp1-2)
extended two years later to include Karachi, Jodhpur and Delhi, although 'Italian intransigence in air rights negotiations' meant the 950-mile sector between Paris and Brindisi had to be undertaken by rail (Pirie 2004 p63). Egypt and Central Africa were added to the network in 1931, Cape Town was reached in January 1932 (routing via, Paris, Brindisi, Alexandria, Cairo and Khartoum), while Calcutta, Rangoon and Singapore were incorporated soon afterwards (Samler Brown 1932). Services to Australia (in partnership with QANTAS) followed in 1934; Hong Kong received a direct air link in 1935, while Kano was reached in 1936 (Pirie 2004), generating a rush for passengers and routes that was not unlike the 'scramble' for territory in the late 19th century (McCormack 1976).

By the middle of the decade, Imperial flew over fifty-nine thousand miles of interconnecting airways linking over five hundred airfields around the world (Gordon 2004 p76), and by the time passenger flying boats were launched in 1938, Imperial Airways offered seven flights a week from England to Egypt, four to India, three to East Africa and two respectively to South Africa, Singapore, Hong Kong and Australia (James 1994). By the end of 1938, British airlines flew 3,267,000 passenger miles, carrying 147,500 passengers and 1,200 tons of freight (Veale 1945 p162). However, while performing a valuable political function in extending a "sphere of influence" over smaller nations (Crouch 2003 p11), the services were both expensive and a test of endurance for both aircrews and passengers alike (Samler Brown 1932). The weekly service from London to Johannesburg (a distance of 6,653 miles) took three and a quarter days, with intermediate stops at Tripoli, Cairo, Khartoum and Nairobi; flights between London and Sydney (12,428 miles) took over eight days (Cole 1950), and, in 1936, it took three and a half days to reach Baghdad (Porter 1991).

Yet, despite the speed with which these services were inaugurated, the operational difficulties pilots encountered were considerable. As W F Willis, the official charged

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6 'Queensland and Northern Territories Aerial Service', the Australian national carrier
7 For example, London-Johannesburg cost £130 pounds in 1932, meaning only social elites, including military officials and colonial administrators, could afford to fly (Samler Brown 1932).
8 These intermediate stops were unavoidable as the limited range of the early passenger aircraft restricted them to a maximum of three or four hours in the air before they needed to land and refuel (Quinn 2003).
with finding suitable landing grounds in Southern Sudan after 1918 noted, “Climatic and atmospheric conditions in equatorial Africa are most unfavourable for flying; sandstorms...travelling at a terrific speed, more dense than the thickest London fog and changing the whole face of the ground, occur frequently...electric storms are particularly violent...[and]...terrific “bumps” are encountered owing to the high hills, extreme heat, and sudden changes of temperature between night and day” (cited in Samler Brown 1932 p364). The Sahara desert also presented unique challenges to navigation, as settlements and roads were sparse. To this end, a network of 12 Marconi wireless stations were erected in British territory between Cairo and the Cape Colony to enable aircraft to stay in touch with the ground throughout their journey9 (ibid. 1932). George (1949 p125) spoke of the ‘immense value’ of these radio aids to aerial navigation as they enabled aircraft to remain ‘in contact with the land even when distance, darkness or the weather have hidden both landmarks and dangers from...sight’.

In the Middle East, the Arabian Desert prevented the installation of any navigation equipment and so convoys of motor vehicles were dispatched to dig trenches in the sand to aid navigation and mark out safe landing grounds (Blake 1923a). Fortunately, ‘the winds blowing over this part of the Arabian Desert are not very strong, so the track remains visible for a considerable time’ (Salt 1930 p130). Nevertheless, such terrain was overflown with trepidation, as the equipment navigators had at their disposal – sextants, compasses, and astrodomes - were not far removed from those used by Elizabethan mariners (see Bennett 1941; Hughes 1946).

Practical difficulties aside, the development of this aerial network was vitally important in maintaining contact with the colonies and promoting Britain’s ‘worldliness’ and technological capability. As Lissitzyn (1942 p56 my emphasis) noted, ‘[t]he possession of well-developed air transport, especially...international traffic, is a factor enhancing the prestige of a nation at home, in its colonies and abroad. The very existence of such air transport seems to indicate that the nation is progressive, efficient and highly civilised,

9 In addition, 43 aerodromes were built between Cairo and Cape Town to accept scheduled (or crippled) aircraft. 24 of these had refuelling capabilities (Salt 1930).
and that it is contributing its share to the *progress of mankind*. Three years previously, Charles Lindbergh, expressed the view that, "aviation...[is] a gift from heaven to those western nations who were already leaders of their era, strengthening their leadership, their confidence, [and] their dominance over other people" (cited in Crouch 2003 p11).

However, some Middle Eastern and African peoples did not appreciate being overflown and/or colonised, and ‘[t]aking pot-shots at passing airlines [became] the custom for rifle-toting tribesmen who had no desire to enjoy the ‘benefits’ of an alien civilisation’ (Walters 1979 p19). Indeed, French airmail pilots flying between Casablanca and Dakar ‘frequently drew fire from camel-riding nomads’ (Crouch 2003 p113).

1.5 Aviation and modernity

Despite the dangers, airlines gradually stretched their networks across time and space. The introduction of new engines, aircraft control systems, and navigation techniques also resulted in rapid advances in speed and range, as well as making air travel an increasingly safe mode of transportation (Crouch 2003). Although limited passenger flights had operated in (and from) Europe and North America in the inter-war years, it was not until after World War Two that commercial aviation began in earnest10. The ready availability of airfields, aircraft and demobbed pilots, combined with improved aeronautical expertise and superior navigation and air traffic control technologies, provided ideal conditions for the resumption and rapid expansion of commercial passenger aviation. In allied Europe and North America, a vision of a future in which aviation would play a key role quickly emerged. In Britain, former Royal Air Force bases were rapidly converted for civilian use; runways were lengthened; passenger terminals replaced Nissan huts; and high explosives swapped for paying passengers. As Sykes (1922) had done after the First World War, commentators postulated excitedly about a global aerial future, which would bind the nations of the world together in a post-war utopia of peace, tolerance, and understanding (Finch 1938; Davy 1941; Taylor 1945).

10 The technical contribution of military aviation in World War Two to the development of commercial passenger services (particularly in respect to new technologies like radar) is discussed in Chapter Five.
However, the destruction of European economies and infrastructure during World War Two enabled the U.S. to take the lead in the post-war development of commercial aviation. In 1944, a conference in Chicago hoped to establish the administrative foundations and political agreement needed to foster “open skies” but, owing to the complex geopolitical reasons discussed in Chapter Five, this rhetoric was never realised, and individual nation-states jealously guarded access to their airspace, and heavily-subsidised their national airlines, stifling competition and causing aviation to become an expensive and elitist mode of transportation (Grant 2003). However, over time, the introduction of larger and more economical aircraft, combined with regulatory reform, ‘opened up the skies’, ushering in an era of unprecedented mass aeromobility from the 1960s onwards.

While the first generation of long-range, pressurised, jet-powered aircraft of the 1950s and early 1960s (including Britain’s Comet and, later, Boeing’s 707) had revolutionised flight by dramatically reducing journey times and stimulating passenger demand, it was the launch of the Boeing 747 (and other wide-bodied jets including the McDonnell Douglas DC-10 and Lockheed Tristar) that brought air travel to the masses, though arguably not in the way the airlines or aircraft manufacturers had anticipated. As Pan Am and others soon discovered, their latest investments were simply too big (they could accommodate up to three times as many passengers as earlier models) and too expensive to operate (delivered as they were amid deep economic recession and financial uncertainties surrounding the 1973 oil crisis) (Petzinger 1995). In response to their worsening financial plight, the US Civil Aeronautics Board (CAB) sanctioned a limited programme of regulatory reform, yet while this allowed airlines to offer a restricted number of discount fares to young travellers, families, and military service personnel (aimed at filling seats), many strict tariff-setting regulations remained (ibid. 1995). With aircraft flying half-empty and airlines unable to compete on price, in-flight service and amenities became key marketing tools. To entice passengers aboard, American Airlines

11 In 1956/1957, the number of passengers flying across the North Atlantic exceeded those travelling by ship for the first time (Spode 2004), and Pan Am’s Director, Juan Trippe, proclaimed that the introduction of B707s on transoceanic routes meant that in “In one fell swoop” his airline “have shrunken [sic] the earth” (cited in Crouch 2003 p386).
installed Wurlitzer pianos in their jumbo jets, live musicians were employed to entertain travellers, and food became a key product differentiator (Lovegrove 2000). The increased range, speed, and relative comfort of the new aircraft did however present a more attractive proposition for flight than the aircraft they replaced. As Le Corbusier noted, ‘Before 1930 you vomited in an aeroplane...for four hours...it was quite simply unbearable’ (cited in Pearman 2004 p74). In comparison, post-war flying was an altogether less arduous experience, and was promoted as a glamorous way to travel. Images of at-seat meal services and ‘suit-wearing passengers enjoying drinks and cigarettes’ promoted the ‘normalisation’ of flight, suggesting it was analogous to a ‘cocktail party in a comfortable Park Avenue apartment’, albeit ‘one travelling at six hundred miles per hour’ (Leslie 2005 p72). (See Figure 1.6.)

Figure 1.6 Comfort aloft – a 1960s postcard of the coach (economy) class cabin of a Pan Am B747 promoted the idea that aeromobility was a normal, routine, and comfortable activity for everyone, young and old, male and female, and black and white alike.

The new corporeal experience of jet flight, where passengers could be in New York one evening and London the next morning, transformed the practice and experience of air travel. The new “jet set” generation were depicted as young, affluent and fashion conscious, and airline advertisements spoke to the developing worldview of this demographic, emphasising the consumability of exotic destinations by air (see Remmele
2004 and Figure 1.7 overleaf). Pan Am, as both the premier travel brand of the 1960s and the USA’s chosen instrument of international aviation policy, did much to influence public perceptions of flight; not only did their extensive transoceanic network let Americans travel the world (Figure 1.8), it also brought the world to America, fundamentally changing patterns of human migration and settlement (see Leslie 2005). Indeed, it is reported Pan Am’s San Juan-New York route alone accounted for the vast majority of the five million Puerto Ricans who emigrated to the US in the early post-war period (Petzinger 1995).

Figure 1.8 An aeromobile world—By 1968, Pan Am’s passenger network covered 80,000 miles, connecting the United States to 84 different countries in five continents, yet geopolitical reasons prevented services to the Soviet Union or China.

Source: www.airhive.com

In an effort to stimulate custom, Pan Am also pioneered increasingly affordable round-the-world air tickets, which allowed passengers to make multiple stopovers on a single ticket thereby enabling them to experience more of the world for less, increasing contact between ‘western’ and ‘non-western’ cultures (see Figure 1.9).
Pan American advertising copy in the mid-1960s emphasised the varied charms and easy accessibility of exotic destinations and stimulated a dramatic growth in demand for aeromobility, with passenger miles rising from 3.1 billion in 1958 to 17.1 billion by 1969 (Crouch 2003).
The introduction of these larger, higher-capacity, long-range jet aircraft necessitated the expansion and redevelopment of airport infrastructure, and passenger terminals (together with the aircraft they served) became icons of jet-age design (see Pearman 2004). Pan Am’s redesigned facility at New York’s Kennedy airport, built between 1957-60, with its elliptical terminal building and sweeping four-acre concrete roof, became the centrepiece of the airline’s campaign to present itself as the world’s most sophisticated, fashionable and technologically-advanced carrier (Leslie 2005 and Figure 1.10).

The Pan Am brand quickly permeated the (inter)national public consciousness and became an integral part of popular culture. James Bond flew Pan Am in From Russia With Love, a spaceship in the movie 2001: A Space Odyssey featured the airline’s trademark, and when the Beatles landed in America thousands of fans watched them deplane from a Pan Am jet (Petzinger 1995; Grant 2003). As such, the airport became a perfect place to celebrate star status and show off an airline’s celebrity endorsements and
even watching the mundane practices of aircraft servicing and refuelling became a popular pastime among the non-flying public (see Chapter Two).

Figure 1.10 Flights of fancy or visions of modernity – Pan Am’s passenger terminal at New York’s JFK airport was designed as an amphitheatre of flight, a stage that projected and reflected the glamour and excitement of long-haul flight (see Pearman 2004).

Paralleling wider trends in 1960s popular culture, flying was portrayed as a fun, fashionable and sexy way to travel, and flight attendants (variously termed ‘hostesses’ or ‘stewardesses’) were used to embody this notion. Though ‘cabin boys’ had been employed by Britain’s Daimler Airways since 1922 to weigh and load passengers and mail and, later, provide a rudimentary form of in-flight service, women did not enter the profession until May 1930, when Ellen Temple, a young American nurse, persuaded Boeing Air Transport (later United Airlines) that her medical training would enable her to reassure nervous passengers (Grant 2003). The airline’s (predominately male) clientele responded enthusiastically to her presence, and stewardesses quickly became a common sight in aircraft cabins. The initial rhetoric, though never explicitly stated, was if women dare fly, men should have no fear.12 However, a new genre of ‘mile high’ novels, epitomised perhaps by Baker and Jones’ semi-autobiographical “Coffee, Tea, or Me?” (1967), which typically contained tales of drunken debauchery and the sexual adventures of cabin crew, arguably undermined the ‘caring’ nature of the profession. Southwest Airlines of Texas admitted that ‘sex sells seats’ and dressed their stewardesses in orange

12 An American Airlines advertising campaign of the early 1950s reinforced this notion, equating the aircraft cabin with ‘your home’ in which ‘your mother’ (the stewardess) would look after you (Omelia and Waldock 2003).
hot-pants and white knee-high boots (Lovegrove 2000), while Braniff International introduced the ‘air strip’, which required stewardesses to progressively shed a layer of clothing as the flight progressed (Entwistle 2004 and Figure 1.11). However, the introduction of larger aircraft, seating in excess of 400 passengers, arguably altered the experience of flight from one of novelty and excitement to one of routine and boredom (Leslie 2005).

Crucially however, the launch of the supersonic Anglo-French Concorde into commercial service in 1976 generated renewed enthusiasm for the spectacle and experience of flight (Pascoe 2001). Despite operational controversies (Wilson 1971; Wiggs 1973), Concorde came to epitomise the glamour, sophistication and excitement of air travel. Until their retirement in October 2003, British Airways’ and Air France’s Concorde fleets whisked celebrities, honeymooners, and businesspeople across the Atlantic in just over three hours, well under half the time taken by conventional subsonic aircraft. Travelling a mile every 2.75 seconds, faster than a rifle bullet leaving the barrel of a gun, at an altitude from which her 100 or so passengers could admire the curvature of the earth while consuming champagne and caviar, Concorde symbolised both the accomplishments and aspirations of an increasingly aeromobile world. The aircraft’s sleek lines, speed, expense, and exclusivity won her many admirers, even among those who professed to have no interest in, or knowledge of, commercial aviation (Milmo 2003). More importantly, however, Concorde’s speed and range not only fostered increased transatlantic connectivity but demanded new ways of conceiving, structuring, and representing global timespace (see Figure 1.12 and Chapter Five). Supersonic flight thus raises important questions concerning not only the relative speed/slowness of different forms of aeromobility but also how individuals perceive them (c.f. Hubbard and Lilley 2004).
Figure 1.11 Sex in the sky and fashion in flight - the sexual commodification of flight attendants in the 1960s and 1970s was a global phenomenon designed to encourage mass aeromobility.

Introducing the Air Strip 'We had a girl go through the motions to show you just what's coming off at Braniff International...'

Yet, while Concorde shrunk the world to new extremes for a privileged few, the majority of passengers endured subsonic journey times. This, however, did not stop Pan Am and others stressing the timesaving effect of their machines (Figure 1.13). Leslie (2005 p78) asserts that wide-bodied jets resulted in the stylish ‘sophisticated elegance’ of the early jet-age being traded for the ‘wholesale systematisation’ of the Jumbo Jet era. Whereas passengers had previously walked across a windy, noisy, slippery and smelly apron to board their flight, aircraft were now attached to their departure lounges via enclosed boarding bridges, while their passengers gazed impassively down on the activity below. In Leslie’s words (2005 p79), this resulted in a ‘sense of insulation from the sensations of flight and an anaesthetizing of our awareness of motion, translation, and position within the grids of airports and airspace’ as physical contact with the hardware of air travel was reduced. The popularity of air travel, coupled with the use of larger aircraft to satisfy demand (that took longer to service and load), increased passenger dwelltimes,
stimulating a growth in airport retailing (Crawford 2003; Freathy 2004). Huge terminal extensions turned the departure areas into giant shopping malls and passengers were distracted by the lure of duty free products, leaving many travellers with a sense of disorientation and dislocation (see Kaplan 1994; Gottdiener 2001; and Chapter Two).

Figure 1.13 'Just Hours to Anywhere' - Pan Am’s first B747 went into service in 1970 and, by dramatically lowering seat costs, brought the world to more people, more cheaply and more quickly, than ever before (see Millichap 2000).

Since 1960, global air passenger traffic (expressed as revenue passenger kilometres) has increased 9% per annum (Upham 2003). The United Kingdom, a country that has long been recognised as the ‘aerial crossroads’ of the world, processed 200 million passengers in 2003, a figure expected to treble by 2030, a rise directly attributable to the changing institutional environment in which the industry operates (DIT 2003a).

Following the deregulation of the American domestic aviation market in 1978, European nations introduced policies of economic liberalization in the 1990s, abolishing tariff-fixing legislation and removing restrictions on market entry, thereby encouraging competition (see Balfour 1994; Button et al 1998; Barrett 1999; Hakfoort 1999; Pitelis and Schnell 2002; Goetz and Graham 2004; and Chapter Five).

N.B similar policies are now being adopted in some Middle Eastern, Asian, and Australasian countries.
A number of European entrepreneurs exploited this new regulatory freedom, setting up low-cost carriers to challenge the monopoly previously enjoyed by subsidised flag-carrying airlines (Creaton 2004; Franke 2004; Jones 2005). Unlike their full-service counterparts, low-cost carriers typically eschew congested major hubs and complimentary in-flight service in favour of cheaper, less congested regional airports and a ‘no-frills’ service product, allowing them to develop untapped markets and reduce costs (see Bonnassies 1998, 1999; Doganis 2001; Graham and Guyer 1999, 2000; Barrett 2000; Gillen and Lall 2004). In response, incumbent carriers streamlined their operations and set up low-cost subsidiaries of their own (Cassani 2003; Solon 2004; Harrison 2005; Keeley 2006). This strategy has bolstered European aerial connectivity by incorporating new destinations into the continental airline network (Bowen 2002), but has exacerbated the industry’s negative social and environmental externalities, spreading airport-related pollution and noise blight into previously undisturbed areas (CPRE 2003a). Nevertheless, the lure of low airfares appears to be irresistible, and, despite concerns from environmentalists that current growth trends are unsustainable (Sewill 2003, 2005), the current enthusiasm for low-cost flying shows no sign of abating (Calder 2002; Cohen 2003; Green 2004; Beckett 2005). As such, aviation futures are being contested both internationally, on economic, ecological and resource grounds, and locally, between pro-aviation lobby groups and airports keen to expand and neighbouring communities concerned about pollution and deteriorating quality-of-life (Freedom to Fly 2002; Webster 2002; DfT 2003a; May and Hill 2006; Barkham 2006). Furthermore, the use of commercial aircraft in the 9/11 attacks and subsequent terrorist threats or attacks on aviation targets have created a new discourse of aviation (in)security that has fundamentally reshaped the practices of aeromobility.

1.6 Flying into the future – aeromobility in the 21st century

‘Air travel has ‘shrunk the planet, destroyed distance and vastly expanded human mobility...[The] conquest of the skies has liberated us from the bonds imposed by geography, terrain and water. Air routes are the highways of the global economy, transporting people and goods over vast distances at great speeds. Aviation has massively multiplied and facilitated leisure and business opportunities, cultural exchanges and the development of international institutions and political relationships’

European Commission (2001 p8)
instance, anthropologists and social commentators often propose that airports are emblematic ‘non-places’ of speed and mobility, devoid of any local interest or cultural connection (Rosler 1998; Gottdiener 2001; Pascoe 2001; Lloyd 2003; Wood 2003). The term ‘non-place’, famously coined by Marc Augé (1995), captures the sense in which airports need to be considered as a kind of placeless space; a site that has been bleached of social interaction and significance. For Augé, the contemporary world is characterised by a global esperanto of signs, symbols and instructions that script and mediate relationships between people and place. The international airport, replete with its global chainsstores, similarly-dressed business travellers and security-scapes is thus cited as a (global) social space where social interaction adheres to an international standard of civility and inaction. The spaces of the departure lounge and arrival hall, in particular, are written of in parallel with the fast-food restaurant, retail mall and multiplex cinema as symptomatic sites where place has been sacrificed in the name of mobility; a prime example of the ‘world of places’ being replaced by ‘spaces of flow’ bereft of meaning and vitality (Castells 1996; Fulller and Harley 2004). Arguably this is due, in part, to the globalisation of the construction industry, the transnational ownership of airports, and the assumption that, in airports, ‘everyone’s from somewhere else, and so in need of something he [sic] can recognize to make him feel at home’ (Iyer 2000 p43). As Fuller (2003 p3) remarks, ‘For all the speed and radical heterogeneity of global air travel, a refrain of aviation aesthetics has emerged in the contemporary architecture of airports – the beep of metal detection, the expanses of glass overlooking the apron, the international pictograms, the slick retail space’.

However, such accounts can be criticised as lacking nuance and glossing over the variegated socialities of air spaces. Merriman (2004 p152), in particular, takes issue with accounts that posit airports as bereft of sociality, arguing ‘frequent flyers, baggage handlers, flight crews, first-time flyers, first class passengers, refugees, air traffic controllers, police officers and the homeless are likely to have very different experiences of movement, dwelling, security, familiarity and belonging in these places’, while Leslie (2005 p63) suggests that some terminals, including Pan Am’s now-abandoned facility at New York’s JFK airport, were important icons of jet-age design, showpieces of a nation’s aeronautical ingenuity that heightened the experience of air travel for passengers and non-traveling users alike. Nevertheless, the idea that airports are solely functional spaces remains persuasive and encourages the majority
of commentators to present a simplified and empirically unsustainable claim about the social practices played out in them. Moreover, the focus on the terminal building means that other spaces of air travel – the air traffic control tower, the apron, the aircraft themselves - are largely ignored, and their social geographies undocumented, seemingly reinforcing Stephen Graham’s (2000) observation that transportation infrastructures have been metaphorically ‘sunk’ by academics, reflecting their sunk physical reality beneath pavements, homes and cities. In a similar way, the alleged normalisation and banalisation of air travel as a means of global transportation means its infrastructures have ‘sunk’ below the realm of society and space to the extent that air transport is rarely considered to be any more than what it does.

By isolating air transport to a realm imagined solely (and incorrectly) in terms of its economic and functional rationality, there is arguably a danger that the socio-cultural dimensions of air travel will become marginalised within debates seeking to understand how different forms of transport and mobility are given meaning. Indeed, it could be argued that some of the vital dimensions of aeromobility have been ignored, with geographers studying the network characteristics of air traffic flows but rarely noting the social and technical practices which produce and support them. Different ways geographers might elicit the social dimensions of air transportation are thus explored in the remaining sections. The first (section 2.3) explores ways aeromobility is implicated in the making of new global imaginations. This leads into a discussion of the unequal geographies of airspace production in terms of access and passenger profiling (see section 2.4), before section 2.5 explores the role of airspace in the formation of national identities. Sections 2.5 and 2.6 then respectively introduce themes of airspace contestation and practices of producing and enacting airspace.

2.3 Imagining aeromobility: cultural geographies of flight

‘The airplane’, declared the French aviator and author Antoine du Saint-Exupéry (1939 p57) ‘has unveiled for us the true face of the earth’. Whilst the precise nature of what constitutes the earth’s ‘true face’ is eminently questionable, cultural geographers have certainly hinted at the ways air travel has ushered in new ways of conceiving of the world. Despite a lack of work on the visceral geographies of flying, there is a body of work considering the visual pleasures associated with seeing from above,
emphasising that air travel is implicated in certain cartographic and geopolitical imaginations.

As Kaplan (2006 p397) notes, while ‘[m]oving through the air is a relatively new experience in world history’, powered flight has quickly generated new and distinctive views and practices of mobility. The gradual spatialisation of the sky as a territory that could be exploited, bounded and controlled as a sovereign unit was a product of colonial expansion, in which European nations sought to develop aerial transport links to connect the imperial power with the far reaches of empire (Pirie 2003). As a consequence, ‘the air, as well as water and land, became a form of national property’ and increasingly sophisticated aeronautical technologies ‘encouraged the belief that air space could be imagined as part of the nation’ (Kaplan 2006 p398). As such, it may be instructive to:

‘think through aerial space as an historicised zone – a place in the world that is connected to the earth and yet apart. It is not dissimilar to oceans and other large bodies of water (and even vast tracks of land) but it also has its own set of histories, discourses, and meanings – all contested and unevenly produced by diverse groups. In particular, the area above the earth – the sky and the first layers of outer space – has histories of representation that are, to a significant degree, constructed around military and national intentions and interests. Space is believed to be a zone of freedom. But like all aspects of freedom...that zone is structured by property relations and contests between states and corporations for dominance and wealth.’

Kaplan (2006 p400)

As introduced in Chapter One, the development of hot-air balloons and, later, powered aircraft, resulted in the emergence of new forms of spatial consciousness. Though balloon flights had been conducted in Europe from the mid-eighteenth century for reasons of scientific research (Hartwig 1886), early aeronauts were largely unaware of the profound effect being able to see the earth from above would have on both scientific and popular imaginations by enabling mankind to visually examine their world from a hitherto unobserved and unknown perspective (Kaplan 2006).

Holt-Thomas (1920 p236) eulogised there is nothing ‘more impressive, or at the same time more interesting’, than ‘see[ing] the earth with which we are familiar from an entirely new aspect’, and this new aerial perspective arguably facilitated a mode of representation that ‘unified’ the disparate elements of landscape, presenting it as a
totality that could easily and immediately be comprehended and, by implication, bounded, ordered, controlled, and managed (Scott 1998; Kaplan 2006). Here, questions of power and pleasure entwine, with the pursuit of totalising visions of the earth encouraging the powerful to survey and map landscapes from the air, from the earliest surveys by hot-air-balloons in the late eighteenth-century, to contemporary forms of remote satellite imaging (Vidler 2006).

'Aerofilms' began systematically photographing British territories in 1919, and a new discipline of aerial surveying developed (Weatherhead 1949). The value of this comprehensive photographic archive was quickly recognised by archaeologists and urban planners (see St Joseph 1949; Black 1997), while imperial administrators found it allowed the 'colonial occupation of the landscape to be realized as a kind of infinite apotheosis of technical space' (Vidler 2000 p39). Thus, in addition to education, aerial photography became implicated in exercises of territorial control and ordering3. For example, while Le Corbusier (1935 p11 and p5) expressed 'abhorrence' at the 'chaos' and 'poor planning' of existing urban settlements, he recognised the value of the aerial perspective in planning the urban morphologies of future cities (Pascoe 2001).

In the context of Britain's colonial project, the 'view from above' was a prized asset that enabled high-ranking military officials and administrators to survey the land and peoples under their command while simultaneously promoting Britain's worldliness and technological capability. Moreover, the human eye, liberated from its usual viewpoint on earth, could, for the first time, comprehend and order land and societies that had appeared too complex from the ground, thus leading to an intensification of colonialism, economic globalisation, and forms of cultural dependence. The British Government, in particular, framed flying as an educational experience that promoted spiritual well-being and educational achievement. "Air travel", declared Sir Philip Sassoon in the mid-1920s, "is the most enjoyable way of seeing the world. That we can see the Pyramids, Palestine, the Nile, the Jordan, the Tigris, and walk the streets of Baghdad in one day is one of the wonders of our civilisation that modern speed in travel has brought us" before remarking that "[o]n an Imperial air route not an hour

3 During World War One, the British War Office (1929 p9) discussed the importance of a new aerial viewpoint that afforded the allied powers a privileged, distanced instrument from which to gather intelligence and plan military strategy, enabling them to 'discover hostile battery positions, entrenchments, and other ground organisations' that threatened allied positions.
passes which does not bring something new or strange, beautiful or intriguing to our notice” (cited in Salt 1930 pp220-221). Such experiences of ‘strange’ foreign lands (with their exotic people, sights, and customs) profoundly altered British perceptions of ‘Self’ and ‘Other’, making the sky an arena of spectacle as well as mobility (see Daniels and Rycroft 1993).

The experience of seeing the earth from the air was as much in evidence at home as abroad. During World War Two, Daniels and Rycroft (1993 p400) comment on how Alan Sillitoe’s experiences of flying over Nottingham revolutionised his perception of his hometown, as ‘the oblique panorama of the topographical observer gave way to a broader, more penetrating vision’.

‘This bird’s-eye snapshot appeared to be just as valuable as the dense intricacies that came with lesser visibility on the ground...It was easy to pick out factories and their smoking chimneys, churches, and park spaces, the Castle and the Council House, as well as the hide-outs and well-trodden streets that had seemed so far apart but that now in one glance made as small and close a pattern as that on a piece of lace. From nearly two thousand feet the hills appeared flat, and lost their significance, but the secrets of the streets that covered them were shown in such a way that no map could have done the job better’.

Sillitoe 1975 p70; 1987 p10 (cited in Daniels and Rycroft 1993 p401)

Immediately after the war, ‘progressive experts, including professional geographers, hoped that increased flying experience and familiarity with aerial photography would reorder ordinary people’s perceptions of the world and their place in it’ (Daniels and Rycroft 1993 p401). In Vidler’s (2000 p39) words, the ‘eye of the bird’ was transplanted into the ‘head of a man’, and the imperial ‘God-like’ gaze allowed passengers to survey (and, by implication, comprehend) vast areas of land from a privileged elevated vantage point (Harley 1992).

‘As we leave the ground our visual and mental horizon expands, and we have direct perception of the space-relations over an ever widening field, so that we may see successively the village, the town, the region, in their respective settings. The mobility of the aircraft makes our range of vision universal...We may fly to the ends of the earth’

Linton 1947 p5 (cited in Daniels and Rycroft 1993 p401)
This expanding field of vision promoted notions of international citizenship in a new post-war world of aeromobility where the local and global became increasingly intertwined (Taylor 1945). The key point here was one of power: the pleasure of viewing the landscape from the air was intimately connected to feelings of power, as looking down from an aircraft emphasised the literal elevation and (perceived) cultural superiority of passengers over those they observed (Figure 2.6).

Figure 2.6 The view from the air - a KLM advertisement of 1949 emphasises the ‘unique experience’ of looking down on the world from an aircraft window where the ‘earth’s most beautiful places are unrolled for your enjoyment’. 
While Hudson and Pettifer (1979 p6) claimed that ‘by looking out of aeroplane windows’ airline passengers ‘come to understand...what the world’s geography is all about’, reading the landscape from the air evidently required education and the development of a new visual vocabulary (Dicum 2003). Even Le Corbusier, flying over the Atlas Mountains in 1935, remarked that he ‘did not feel attuned to the enjoyment of those spectacles from above’ on account of the fact he had not yet learnt to ‘read’ the landscape from the air (Le Corbusier 1935 p24). To facilitate the recognition of features deemed interesting or culturally significant (and to mitigate against boredom on long-distance flights), Imperial Airways began publishing route companions to international services in the mid 1920s (Imperial Airways 1924), installed ‘promenade decks’ in their Empire flying boats, and provided passengers with binoculars to encourage them to look out of the window4 (Lovegrove 2000; Figure 2.7). One stewardess recalls, “People would gather on the promenade deck as we flew over Africa to watch the animals below...We cruised at about seven hundred feet...and the clear air above the desert meant you had a wonderful view” (cited in Quinn 2003 pp82-85).

Figure 2.7 Looking down. Passengers on the promenade deck of an Empire flying boat enjoy the spectacle of viewing the ground from the air

Source: Lovegrove 2000 p84

4 Dicum (2003) provided a contemporary take on this phenomenon of window gazing, or ‘reading the landscape from the air’ by decoding 70 aerial photographs of physical and human landforms that an airline passenger might see when flying over North America.
This new act of looking, informed in no small part by the airline’s carefully scripted cartographic, pictorial, and written commentaries about the physical and cultural landscape below, created new ways of seeing the world, with Europe’s ‘modern’ aerodromes, ‘outstandingly geometrical’ fortifications, and ‘magnificent’ palaces juxtaposed against Africa’s ‘vast’ swamps, ‘dark’ jungles, ‘ancient’ tombs, ‘stampeding’ game, and ‘parched’ plains (see Figures 2.8 and 2.9).

Figure 2.8 Extract of the Imperial Airways London-Cologne air route guide (1934)

![Figure 2.8](image)

Source: Quinn (2003 p37)

Figure 2.9 Extract of the ‘Air Route Cairo-Cape Town’ (Imperial Airways, 1934-35)

![Figure 2.9](image)

Source: Quinn (2003 p88)
The popularity of these guides encouraged other airlines to copy Imperial’s lead and, in the mid-1930’s, passengers on KLM’s prestigious Amsterdam-Batavia service were presented with a 100-page route companion ‘Wings Across Continents’ (Blitz 1935). Such guides were ‘well illustrated and described the attractions of the route in considerable detail. There were maps of the towns chosen for overnight stops and the text was obviously intended to interest intelligent, educated people’ (Hudson and Pettifer 1979 p7). (See Box below).

Extract of the Imperial Airways’ guide to the Gaza-Baghdad air route

‘After England had become the mandatory power over Iraq, British, French, American, and Iraqi interests founded the Iraqi Petroleum Company. The spirit had to be brought from the oilfields near Mosul to a Mediterranean port of shipment, and some difficulty was experienced at the commencement of deciding which port was to be used. Great Britain wanted a pipe line from Mosul to Haifa in Palestine, also a British mandated territory. French interests demanded a pipe line to Tripoli on account of their Syrian mandate. Agreement was reached laying a double pipe line from Mosul to Haditha on the Euphrates, whence the English line goes via Rutbah to Haifa, the only port in Syria and Palestine capable of accommodating ships of big tonnage at its quays. From Haditha, the French pipe line makes for the port of Tripoli in Syria. The air route from Gaza to Baghdad owes much to these activities, for it runs for hundreds of miles parallel with the pipe lines and the motor road...through the desert’
(reproduced in Hudson and Pettifer 1979 p70)

Upon reading this commentary at the appropriate point in their journey, the passenger ‘looked out the aeroplane window, saw the pipeline and the road and understood what it was all about. He [sic] was educating himself as he flew, with never a dull mile’ (Hudson and Pettifer 1979 p70 my emphasis). Views of foreign lands thus came to structure European understandings of empire, and such scripted visions created airspace as a masculine, racialised, nationalised, and propriety territory. To ensure staff could answer passengers’ questions concerning what they might see en-route, many airlines instructed their stewardesses to review the air route in an atlas prior to take-off, a practice some maintained into the 1960s (Figure 2.10). Szerszynski and Urry (2006 p118) contend the promotion of such specific forms of visuality play an important role in the construction of citizenship, where an individual’s sense of self is ‘brought to presence through specific ways of seeing and being seen’ and suggest the practice of watching plays ‘an important role in people’s sense of themselves as citizens’ (ibid. 2006 p118-119).
An ability to overfly landscapes - viewing them from afar and above - has hence been thought of as one of the best ways of comprehending space: yet inevitably the aeromobile gaze has its blindness and occlusions, and ignores many vital aspects of the lived and practised landscape. Significantly, a number of national Governments disliked the idea that geopolitically sensitive military and naval installations could be seen and photographed from the air, and they threatened to revoke over-flying rights unless passengers’ cameras were confiscated. Although the airlines resented this blackmail attempt, they had ‘no alternative but to take their passenger’s eagle-eyed Kodaks away from them’: on KLM’s Jakarta-Amsterdam flights in the mid 1930s, all cameras were impounded at Singapore and only returned upon arrival at Schiphol (Hudson and Pettifer 1979 p66). Such restrictions could not, of course, prevent the aeromobile classes of the 20th century from gazing down upon the colonial or Oriental ‘Other’ from their aerial vantage point. Yet while passengers were free to feast on the spectacle of foreign lands, flightcrew had to maintain constant vigilance, scanning the sky for other aircraft to avoid collision while ensuring they did not veer off course.

Significantly, in addition to transforming the ways in which the world could be viewed, the view from the air also created new corporeal experiences of flight. While recognising the paradigmatic importance of Urry’s (1990) ‘tourist gaze’ in understanding touristic vision, Larsen (2001) proposes a related concept, the ‘tourist glance’ (where corporeally immobile spectators experience moving visions of the
landscapes), could usefully be employed to explain the changing forms of sensing the visual landscape from moving vehicles. Just as the occupants of horse-drawn carriages, trains and cars had experienced ‘mobilised sightseeing’ by catching fleeting glimpses of the landscape outside their vehicle, aircraft represented the latest platform from which the landscape could be visually experienced and consumed (see Larsen 2001). But, as Holt Thomas (1920 p90) remarked, ‘with an aeroplane you are moving generally too fast, and too high, to feel that indolent yet observant pleasure which is one of the joys of a motor-tour through beautiful country’ and concluded that:

‘aeroplane flying is rather a dull business. You are removed entirely from the life and incident of earth-bound folk. The traffic and distractions of a main roadway, the ever-changing vista, are absent when you fly in an aeroplane. You just go up and up until the land below becomes like a huge flat map; and then you whirl on, the map-like stretch of earth slowly changing beneath you, and nothing around you but empty air...The ordinary countryside, when seen from an aeroplane, is just like the coloured chalk-board; and...the general colour scheme is rather drab and neutral. The beautiful spots you cannot see properly...[for] height seems to roll the country flat. You cannot tell the valley from the hillside; and those beautiful slopes which charm the eye when you view them from terra firma might just as well not exist at all when your vantage point is several thousand feet aloft. These facts...conspire to make a journey by air, when once the first novelty has worn off, a matter of business expediency rather than a “joy-ride”.

Holt Thomas (1920 pp89-90)

Benjamin (1985 p50) similarly remarked that: ‘the airline passenger sees only how the road pushes through the landscape, how it unfolds according to the same laws as the terrain surrounding it’, before adding that ‘only he who walks the road on foot learns of the power it commands.’ As such, early experience of flying, before the introduction of pressurised airframes enabled aircraft to operate at higher altitudes, were analogous to Urry’s (2000b p392) description of the view from double-decker buses, where passengers enjoy a view that is ‘in but not of the crowd’, connected yet distanced from the dangers and unpleasantness of the ground below. Such aerial voyeurism, where the viewer is elevated above the bustle and contamination of the observed - near them, but not with them (literally out of reach and thus out of harm’s way) – manifests itself in some contemporary aerial photography (see Figure 2.11).
However, as technological developments enabled aircraft to fly increasingly faster and higher, passengers gradually lost this terrestrial spatial attachment. Ingold (2000) would, no doubt, describe this transformation in terms of moving from an active sensory engagement with space to one of passive detachment and control, yet the view from the window remained crucial. In 1953, BOAC (British Overseas Airways Corporation), under the direction of their Chief Photographic Officer, published ‘Comet Highway’, a pictorial record of a selection of air routes served by Comet jetliners. From a vantage point eight miles high, passengers ‘may gaze with selective interest in the cloudscapes and landscapes beneath them. They may examine the surface of the earth and appreciate the complicated pattern created first by Nature and then by man’ (Herusser 1953 p7). Refuting Benjamin’s (1985) assertion the only way to experience the land was to walk it, Herusser (1953 p26) argues the Comet ‘gives us a new view of the world we live in’, which enables the air traveller to ‘survey the country more broadly and deeply than is possible in any other way’ and see ‘patterns that cannot be perceived by the crawlers over the earth’s surface’ (ibid. 1953 p31 and p26). The idea of technical achievement fostering cultural superiority also featured in the guide. Accompanying an aerial view of Everest, Herusser writes ‘here – warmed, oxygenated, pressurized – the passenger looks down in comfort at those naked heights which, to the very limit of human endurance, men have aspired – and which, at last, they have conquered’ (ibid. 1953 p19).
While ‘Comet Highway’ painted an evocative picture of the experience of jet flight, Boorstin (1987 p94 cited in Larsen 2001 p85) lamented modern aircraft fly ‘far above the clouds, too high to observe landmark or seamark’ resulting in ‘[n]othing to see at all [because]... The airplane robbed me of the landscape’. Indeed, as the eye of the observer was drawn ever further away from the land it observed, aerial skyscapes of space replaced terrestrial landscapes of place, and the curvature of the Earth became more apparent than the height of the terrain below, enabling passengers to consume images of the landscape more normally associated with satellite photographs (see Cosgrove 1994). At 35,000ft, individual landscape features diminish in importance as forests, motorways and cities subsume individual trees, cars, and buildings, yet the type of aircraft, route, time of day, season, a passenger’s position relative to wings and engines, weather conditions, and air traffic control restrictions, continually disrupt or reconfigure this “view” from the window (see Falconer 2006). Nevertheless, on a clear day, the elevated vantage point ‘lends order and logic to the landscape: roads curve to avoid hills, rivers trace paths to lakes, pylons lead from power stations to towns, streets that from earth seemed laid out without thought emerge as well-planned grids’ (de Botton 2002 p41), while the varying agricultural, settlement, communications, and industrial practices of different countries (together with their local topography and climate) produce very different land-use patterns (Dicum 2003).

However, it was not merely the spectacle from the air that was prized, but also the spectacle of flight itself, and what one could see as a result of travelling by air. ‘A mere day’s travel by jetliner offers the air traveller unlimited variety of scene and incident’, for ‘here, in sight of the air-conditioned and up-to-date restaurants of an international airport...ancient and curious local customs continue to be practised’ (Herusser 1953 p54). Air travel is thus clearly implicated in issues of colonial development and the formation of conceptions of ‘Britishness’. The systematic recording and reporting of British imperial aviation ‘firsts’ during the 1920s and 1930s, including aircraft naming ceremonies, races, passenger embarkations, and route inaugurations, was both a matter of factual record and nationalistic propaganda, informing public understandings about empire while engendering enthusiasm for the colonial project (Pirie 2003). 16mm films, such as Imperial Airways ‘The Key to Empire’ (1936), ‘The Future’s in the Air’ and ‘African Skyway’, were shot to satisfy ‘considerable public appetite for consuming civil aviation achievement and spectacle’
Non-commercial films, including 'Blazing the Airway to India' (1923), and 'Contact' (1932) similarly told of British aviators 'Blazing New Highways Between Sun and Earth, Making Fresh Contact Between the Nations and the Empire' (ibid. 2003 p122). Such films helped entrench a popular vision of imperial achievement and grandeur, conveying upbeat messages about how the 'white man's initiative' was conquering hostile (African) lands and 'civilising' her indigenous people (ibid. 2003 p120). Written tales of daring encounters involving aviators ploughing ever deeper into the 'Dark Continent' helped propagate this discourse of excitement and adventure. Recollections, such as those of Lord Remenham\(^5\) during the First World War in East Africa, perpetuated the image of aviation as a modernising, progressive force:

>'On a steamingly hot day...I stood ankle-deep in foul, black-cotton mud and watched my armoured car visibly sink up to its axles...until we could get a span of oxen we were well and truly stuck. Overhead, a gleaming shape against the now deep blue sky, a...biplane calmly flew across...Its image of cool, clean serenity contrasted so strongly with the sweaty immobility of our earthbound state' cited in Jones (1977 p.viii)\(^6\)

Such romantic images, contrasting the technological capability and social mobility of (white) European travellers with the perceived 'backwardness' of indigenous groups, were used to appeal to passengers who wanted to reach the outposts of empire (Pirie 2004), while advertising posters reinforced the idea the 'Other' was a spectacle to be overflown and consumed by white British travellers (see Figure 2.12 overleaf).

Recent interpretations of such visual 'place-myths' (see Lash and Urry 1994) or 'imaginative geographies' of empire conceive of them as powerfully encoded ideological media (Ploszajksa 2000), in which air travel was portrayed as a means to reach deeper into colonial empires and establish control over both ground and airspace (see c.f. Remmele 2004). Such images conditioned public understandings of empire and encapsulated assumptions about British technological and cultural supremacy and her conquest of foreign lands and peoples. Like other European

\(^5\) BOAC's chairman from 1948-1956
\(^6\) As Morley (2000) notes, to be immobile or incapable of movement implies failure or defeat.
carriers\(^7\), British airlines employed a panoply of highly stylised ‘exotic’ images to represent the colonial ‘Other’, with an emphasis on rich ‘earthy’ hues, herds of exotic animals, warrior tribes, and young women in various states of undress (Remmele 2004). Significantly, the marketing strategies of overseas (i.e. non-European) carriers also perpetuated this dominant European vision of the Orient: during the late 1940s and early 1950s, a cartoon ‘Maharajah’, complete with outsized moustache, striped turban, and flying carpet, was the centrepiece of Air India’s marketing strategy (Lovegrove 2000).

Figure 2.12 Imperial Airways ‘Africa’ poster by Hal Woolf, early 1930s

![AFRICA BY IMPERIAL AIRWAYS](Source: www.imperial-airways.com/advertisements_africa.html (2005))

Such juxtapositions of ancient and modern, savage/civilised, primitive/advanced, black/white, and exotic/European, were common themes and served to create a discourse of colonialism where the native Other was cast in a disparaging light (see Said 1978; Lester 2000; Ploszajska 2000 among others). Indeed, it was increasingly considered the duty of well-educated Europeans to travel (by air) to ‘civilise’ primitive peoples. However, such ventures were not without their risk, and the perceived genetic and social ‘deficiencies’ of African tribes were explained as a product of the natural environment in which they lived. Brown (1932 p202A)

\(^7\) Principally the Belgian national carrier SABENA (*Société aérienne belge d’exploitation de la navigation aérienne*), Air France and Spain’s Iberia (see Fitzgerald 1955).
remarked, in a section advocating agricultural cultivation of African lands by British farmers, that ‘as a worker, the Bantu is not of the highest standard. He has neither the patient application not the manual dexterity of the Oriental, and the ease with which his simple requirements have been met from the genial soil and sunshine and the great game herds of past centuries has bred in him a natural indolence’. More tellingly perhaps, in a section on female immigration to South Africa, women were warned, ‘while there are undoubtedly openings...in lighter occupations on the land...to live isolated without protection, is to run serious risk of molestation by natives’ (ibid. 1932 p201).

In much the same way European settlers in America justified their incursion into native Indian lands as bringing the light of knowledge and civilisation to the ignorant, so too the discourse of British colonial aviation was couched in terms of progress and social advancement. However, some groups clearly did not appreciate being part of this world community, and ‘[t]aking pot-shots at passing airliners [became] the custom for rifle-toting tribesmen who had no desire to enjoy the ‘benefits’ of an alien civilisation’ (Walters 1979 p19). Major Blake’s encounter with a Bedouin tribe in Iraq was typical of the ‘frontier’ spirit of the age:

‘As we approached, the tribesmen scattered in all directions, galloping off on camels and horses... A good many of them fired at us as we passed over and we heard the whistle of bullets, though none of them actually hit the machine...We were tempted to empty our automatics at them but no good would have come of it so we just continued along the trail’.

Blake (1923a p118)

Such stories reinforced the notion that flying was an adventurous and exciting way to travel, enabling imperial rulers to literally and metaphorically ‘look down’ on their subjects while suppressing revolts against their imperial authority (see Crouch 2003). As the 1930s progressed, colonial administrators, high-ranking military personnel and Government officials increasingly found themselves sharing the airways with well-to-do civilians who were taking advantage of the expansion of air services to visit far-flung and exotic-sounding destinations. To those who could afford it, air travel offered a portal into a streamlined, luxurious, and fashionable global future, and, since every aircraft that flew in British colours was considered to be a piece of Britain abroad, the aircraft were meticulously maintained and passengers offered sumptuous
levels of in-flight service, often analogous to first class railway dining cars or top restaurants (Eisenbrand 2004; Figure 2.13).

Figure 2.13 Dinner aloft – a steward serves food onboard an Imperial Airways Armstrong Whitworth AW.15, 1930s

Throughout the 1910s and 1920s, the spectacle of flight developed a progressively firmer grip on the public imagination and public enthusiasm for air races, ‘barn-storming’ flights, and ‘flying circuses’ continued unabated (see Voigt 1996; Walker 2003). The widespread development of passenger aviation during the 1930s also generated considerable interest in ‘normal’ airside activities, and airports increasingly became important social spaces where people gathered to watch aircraft and experience the excitement of take-offs and landings in ever-increasing numbers (Adey 2006). From their inception, European airports were designed and developed as fashionable spaces of spectacle and spectatorship and, unlike today, visitors were actively encouraged (see Pearman 2004). Airports were often promoted as places for a curious and potentially ‘air-minded’ population to visit and admire (see Wohl 1996 and Adey 2006) as the cost of flying often meant the ‘closest ordinary people could get to the magical world of air travel, was to visit an airport as a family outing’ (Dierikx and Bouwens 1997 p79).

In Britain, Frais (1955) published a companion guide for visitors explaining different facets of airport operations, while ‘I spy at the airport’, an edition of the popular ‘I spy’ educational book series first published in the 1950s, encouraged children
to spot different airport features, from baggage trucks to control towers, and awarded points according to their rarity. Aircraft were undoubtedly the principal attraction, and visitors flocked to gaze at the 'wondrous technology' on display (Dierikx and Bouwens 1997 p79). Brittain (1933 p35) suggested, 'the take-off or arrival of...giant air-liners, [with] their silver wings and glistening metal bodies' makes 'the modern aerodrome a place of never-ending interest and delight', and such images of modernity, innovation and progress arguably helped foster a spirit of air-mindedness among the general public (see Adey 2006). At Heathrow, the Queen's Building (now part of Terminal Two) was constructed primarily as a site of spectatorship, and incorporated a viewing balcony that could accommodate up to 10,000 (non-flying) visitors, as well as catering facilities, a news cinema, exhibition hall, pleasure gardens, playgrounds, and souvenir shop. Uniformed guides were employed to show people around, and a live commentator described scenes of interest to the assembled crowds (Chandos 1956). In the first six months of 1955, 600,000 people visited Heathrow, while in the same year, the viewing pavilion at Amsterdam's Schiphol airport welcomed over one million visitors, making it the country's leading tourist attraction (Chandos 1956; Dierikx and Bouwens 1997). At both airports, 'sightseeing trains' drove out onto the airport to allow curious visitors to 'inspect at close quarters what you have seen from above' (Chandos 1956 p57 and Figure 2.14).

Figure 2.14 The airport as spectacle: Motorcades take visitors out onto the apron at Schiphol in the 1950s (left) and (right) 'I spy at the airport' encouraged children to look out for interesting airport features and record where and when they saw them.

Source: Dierikx and Bouwens (1997 p82) and (right) author's collection

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8 In the US too, schoolchildren were introduced to the 'magic' of flight through educational slide shows like United Air Lines 'Seeing the Airport' of 1950 that that illustrated 'exciting' aspects of airport operations including aircraft turnarounds and take-offs.
Though perhaps not enjoying the popularity it once did, aircraft spotting remains a popular past-time for many; indeed, Manchester Airport claims its dedicated viewing park is the most popular visitor attraction in the north-west of England. However, new security concerns have been used as a excuse to curtail the opportunities open to aircraft enthusiasts as viewing balconies have been closed and harsh penalties introduced for anyone caught photographing aircraft or recording aircraft registrations (Dixon 2004; Lord 2006). In this way, changing attitudes towards airspace have served to continually reshape the landscapes of flight as, over time, airports have been remodelled from all-inclusive places of spectatorship to spaces of exclusion for many.

2.4 The unequal geographies of airspace

While Lash and Urry (1994) claim that the paradigmatic modern experience is that of rapid mobility over long distances, Tomlinson (1999) argues this is only applicable to a relatively small number of people and cannot be considered to be a truly global experience. In recognition that not all members of the globe are equal participants in mobility, Doreen Massey (1996) advanced the notion that time-space-compression and associated mobility exhibit a distinctive ‘power geometry’ through which individuals and groups are emancipated or marginalized. As she explains: ‘Different social groups have distinct relationships to this differentiated mobility; some people are more in charge of it than others; some initiate flows and movement, others don’t; some are more on the receiving end of it than others; some are effectively imprisoned by it’ (ibid. 1996 p239). The social effects of time-space-compression are thus highly differentiated, both in terms of the degree of movement/stasis and in the extent to which individuals initiate and control them. In the context of air travel:

‘Jumbos have enabled Korean computer consultants to fly to Silicon Valley as if popping next door, and Singapore entrepreneurs to reach Seattle in a day. The borders of the world’s greatest ocean have been joined as never before. And Boeing has brought these people together. But what about those they fly over, on their island five miles below? How has the mighty 747 brought them greater communion with those whose shores are washed by the same ocean? It hasn’t, of course. Air travel might enable businessmen to buzz across the ocean, but the concurrent decline in shipping has only increased the isolation of many island communities...Pitcairn, like many other Pacific islands, has never felt so far from its neighbours.’ Birkett (1991 p38 cited in Massey 1996 p238-239)

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9 Manchester Airport corporate website (2005)
As Fuller (2003 p3) also notes, we must acknowledge the experience of flying is highly variegated, for the ‘world of transit doesn’t operate at the same velocity, or in the same mode in every place’. As Massey (1997 p205) explains, the mobility of affluent Europeans is ‘quite different from the mobility of the international refugee or the unemployed migrant as a social experience’. Thus, high levels of personal mobility by some has emphasised the spatial inertia of the less affluent (see Maspero’s (1994) study of the juxtaposition of the relative immobility of the immigrant communities living near Paris’s Charles de Gaulle airport with the hyper-mobility inside the terminals). Here, factors of class, race, ethnicity, gender, and mental/physical (dis)ability conspire to restrict individual mobilities, leading Morley (2000 p14) to suggest that despite talk of increased mobility, many individuals live a life of relative sedentarism. Creswell’s (2001) belief that we need to explore issues of stasis versus mobility, or speed versus slowness, is thus crucial to furthering the debate. As Adams (1999 p97, original emphasis) pertinently remarks, ‘Increased mobility is liberating and socially progressive up to a point. Beyond this point it becomes socially destructive – especially when accompanied by increasing disparities in levels of mobility’. The resulting social inequalities are thus reinforced by ‘hugely uneven forms of access to, or the effects of, various kinds of mobility’ (Urry 2000a p195), with pensioners, children, the less well-off, and the car-less generally bearing the brunt of this unequal access (Graham and Marvin 1996; Sheller and Urry 2003).

Underlining Merriman’s (2004) arguments about the differentiated experiences of airspace, Cresswell (2006) also provides numerous vignettes of the social rituals played out in airports, noting passenger terminals provide a focus for some forms of sociality which have little to do with air transport per se. Amsterdam’s Schiphol Airport is thus represented as one of the city’s important meeting sites, a gathering place for a number of ‘local’ and ‘international’ tribes (including, on occasion, academic conference travellers).

Viewing air transport through the lens of cultural and social theory alerts us to some of the key issues of power and identity that adhere to different spaces of aeromobility. In the current epoch, it could be argued commercial air travel provides one of the most highly visible articulations of global power. Whether one considers the intensification of security and surveillance regimes, the separation between business and economy classes, interrogation and/or deportation of would-be immigrants or
asylum seekers, or terrorist insurrection, air transport has become a space of incredible inequality:

'The airport exposes people to what the average Westemerer regards as either a nuisance or a reassurance – drug-sniffing dogs, X-ray machines, metal detectors, mandatory searches, restrictions on movement, security inspections, and intense screening. Staring customs officers, sharp questioning, bio-identifiers, computerized facial recognition and other technological marvels are meant to produce an environment in which people's intentions are 'revealed' and suspicious behaviour is recognized'  

Aaltola (2005 p263)

The airport is thus a place of constant and intrusive surveillance, with signs and recorded announcements reiterating that passengers are being perpetually watched and classified, sorted and screened, and where certain groups or individuals may be subject to more intensive scrutiny. Research by Woodfield et al (2007) at London's Heathrow and Gatwick airports discovered a disproportionate number of 'non-white' travellers were stopped by immigration officers: black passengers were 17 times more likely to be questioned than their "White Northern" counterparts, while non-white South Africans were 10 times as likely to be stopped as their white countrymen (ibid. 2007; Younge 2007). While denying ethnicity was 'relevant' to the decision making process, and emphasising the importance of a 'passenger's presentation of self' in the immigration hall, the report discovered immigration officers often assessed passengers according to generalised understandings about certain nationalities being "devious", "difficult", "muddled", "naïve", "friendly", "pushy", or "arrogant" (Woodfield et al 2007 p15).

Geographers are arguably well placed to examine such issues, particularly in light of the increasing and intensifying security measures that have been introduced since 9/11, where passengers are frisked and ordered to remove outer clothing and shoes in front of security staff at search areas, while screeners and police unceremoniously rifle through their possessions. Following an alleged terrorist plot to blow up passenger aircraft mid-Atlantic in August 2006, this security sorting increased in intensity. Hand luggage was banned and essential items transferred to clear polythene bags, rendering prescribed medication and sanitary products on public display (Lewis 2006). Such humiliation and indignity, while exceptional, arguably reveals the extent
to which passengers have become subordinated to a global system of surveillance in which fear is used as a psychological tool of compliance.

Borrowing from the work of surveillance theorists, several geographers have remarked on some of the security techniques implemented in airports, exploring issues of personal privacy and questioning how airport surveillance systems actively conspire to affect people’s life chances by reproducing inequalities and differences based on class, race, and religious identity (Adey 2004a, 2004b). Stephen Graham’s work has been of paramount importance in this field, exposing airport security as yet another mechanism by which the world is becoming increasingly splintered between the spaces of the kinetic business elites who buy and enjoy unparalleled access to services and transport, and those who cannot afford to or are disqualified from using them (Graham S 1998b; Graham and Marvin 2001). As Fuller and Harley (2004 p82) note, ‘It is not about where you are on a global grid or in a social hierarchy. The important thing is the networks you have access to’.

‘Airports do what they can to segregate the privileged from the rest of us (indeed, the whole point of Business Class... is that, if you pay two thousand dollars more, you can separate yourself from the riffraff for every step of your fifteen-hour trip, checking in at a separate line from them, waiting for your flight in a separate lounge, and then eating your nuts without being bothered by their cries...)’ Iyer (2000 p54)

In the context of airport security, these trends are manifest in programs that employ biometric technologies to allow those who can afford the annual subscriptions and consent to having their face, fingerprints, or iris scanned and stored on a computer, to bypass immigration queues and enjoy certain ‘known user’ privileges in the terminal (Taylor R 2004; Cacciottolo 2006). Curry (2004) investigates the way Computer Assisted Passenger Pre-screening (CAPPS) systems have been utilised by US airlines to identify passengers that are considered to pose a greater security risk than others, while Taylor R (2007) discussed the implications of the biometric ‘MiSense’ system at Heathrow:

‘If an American Airlines and an Air India flight landed at virtually the same time... US passengers armed with their biometric data would no longer have to tap their feet impatiently while the higher-risk Indian passengers were scrutinised by immigration staff. They could pass through immigration without even having to speak to an officer.’ Taylor R (2007 p6)
Specific narratives concerning identity and belonging clearly underpin such systems and certain signifying characteristics become tied to narratives reproducing particular ideas of who and what is a threat:

‘In a world of control access systems people are no longer ‘interpreted’ by moral standards but are ‘authenticated’ at a series of thresholds. Flesh, body and name are matched simultaneously to info-body and database – a body of electronic traces, image archives and credit card purchases, social security information, and travel itineraries, each hooked into another body (of information). Thus, on one hand, we are dealing with flesh bodies, while on the other, we are concerned with pattern match...In a world where communities are not necessarily formed by shared blood or soil...it’s difficult to know someone by their physical outline. It is easier to know them by their patterns’. Fuller and Harley (2004 p83)

These assumptions, according to Curry, serve to reproduce themselves upon the life-chances and mobilities of those they are modelled upon – becoming self-fulfilling prophecies. Amoore (2006 p342) also suggests these programmes ‘annex’ patterns of behaviour, affording some smooth movement across borders, but retarding others who are then sorted and searched. ‘Anyone who resists patching their body into a global network of tracking and control will simply not gain access...Biometrics... streamline the flow for those with the right password’ (Fuller and Harley 2004 pp83-84). As Beaverstock et al (2004) note, this results in a world increasingly polarised between superrich and mobile elites, whose lifestyles are truly global, and a world of economy class travellers who toil in check-in queues and are subject to repeated security checks. Thus, in stark contrast to the ‘wretched test of endurance’ of low-cost flying, ‘typified by delays, crowds, the flatulence of your fellow passengers and the cold, hard stares of cabin crew’ (Duerden 2006 p24), executive and business aviation offers passengers enhanced standards of service, comfort, and mobility (Brown 2006). Unashamedly targeting the higher end of the market with slogans such as ‘You flew Concorde – now it’s time for an upgrade’, fractional jet ownership schemes enable wealthy travellers to bypass the discomorts often associated with flying in addition to giving them the flexibility to choreograph flight arrangements to personal schedules (Maslen 2004).

Though highlighting different issues, Crang’s (2002) reading of airports also stresses the social inequalities and class differences evident in air travel; something that
geographers have not always been quick to highlight. For example, in David Linton's 1946 speech to the Geographical Association he stated that: 'the air view of the ground ... has become a familiar thing to us all' (cited in Daniels and Rycroft, 1993 p465), indicating that air transport has often been taken for granted by geographers, effacing the incredibly unequal access to this form of mobility. In opposition, Crang posits that airports are the domains of the privileged, buildings constructed for use by the transnational capitalist class. His critique of Castells' (1996) and Gottdiener's (2001) work on airports stems from their lack of reflexivity and blinkered perspectives, which leads them to suggest that everyone who visits airports is seduced by their consumerist possibilities. Hence, while many accounts of airspace resonate with the experiences of the global elite, who are whisked through business lounges and enjoy their wider seats and complementary bar service, that luxuriant experience is not open to all:

'While air transport might speak to a globe-trotting semiotician, [it] says little to the family with overtired children delayed by lack of connecting buses in Majorca. As the most inequitable form of travel it is vital to keep a sense of the occasional as well as the frequent flier. It is though the latter that tend to figure in accounts of spaces of flows, positioning airports as hubs for a new ‘transnational class’ Rosler (1998 p62)

As Crang (2002 p571) argues: the ‘singular ego-ideal’ of an airline passenger ‘is sutured into the image of the forty-something, healthy male business traveller to the exclusion of other identities’, occluding the possibility some experience these spaces as exclusionary. For ‘far from being spaces of mixture or openness these are heavily hierarchical spaces’ (idem).

Air transportation, according to these investigations, demonstrates powerful processes that go beyond the airport terminal and surpass the edges of the aircraft seat, illustrating a possible future where mobility becomes the key marker of identity. Hence, air transportation may usefully provide a microcosm of society differentiated by the way people move (Wood and Graham 2006). Accordingly, Sparke (2006) suggests such inequitable mobilities provide the springboard from which to understand important contemporary social issues— not least the making of a seriously under-privileged ‘kinetic underclass’ subject to intensive forms of security control, both within and beyond the airport:
Club-class passengers still move with significant speed in the comfy cosmopolitan circuits created by international conference trips, international tourism and international family get-togethers. For the world's working classes and for those subject to ‘security risk’ codification, by contrast, being in the kinetic underclass has altogether more oppressive and more unpredictable outcomes including, not least of all, much more volatile mixes of movement and immobility. The experience of immobility in these cases means something entirely different to the petty class resentments that come with seeing business suits and Lexus cars speed by in NEXUS lanes.

Sparke (2006 p169)

Breaking down the assumption that speed necessarily equals wealth and freedom, Sparke (2006 p151) suggests the deportation of suspected terrorists by extraordinary rendition for ‘torture by proxy’ in countries with questionable human rights records is an extreme example of the ‘expedited exclusion’ associated with aeromobility. For Cresswell (2001), some of these differences are most evident at the airport, particularly among the visible homeless population who temporarily inhabit the terminal at Schiphol. But such inequalities can also be hidden. Elsewhere, Cresswell recounts erroneously alighting at a service floor from an elevator in Changi Airport, Singapore, and finding himself directly confronted by these inequalities:

‘Changi Airport is also the space of immigrant labour from the Indian subcontinent brought in to build the new terminal and then asked to leave. Further it is the space of the people who work there – the people who staff the check-in desks and the people who clean the toilets and empty the bins who come in from the city on a daily commuting cycle’

Cresswell (2001 p23)

As Yeung et al (2005 p60) note such staff may be charged with performing repetitive and hazardous cleaning rituals, and often work irregular shifts, resulting in sleep disturbance, social isolation and ‘other undesirable psychosocial consequences’. Here, there are important links to be made with emergent literatures on the repression of the ‘servicing class’ and the rituals of cleansing which concomitantly reproduce elite spaces as free of visual pollution and ‘dirt’ (Brody 2006; Tominc et al 2006). In this sense, ‘it might be argued spaces of air transportation are becoming paradigmatic public spaces where the presence of the kinetic underclass is increasingly regarded as disturbing the leisured ambience of consumption and hypermobility carefully
cultivated by coalitions of airport managers, airlines, retailers and global travel companies’ (Adey et al 2007, forthcoming).

2.4.1 Place and placelessness at the airport

‘What is specifically absent from major airports is any sense of place: An airport is a no-place on the way to someplace’ Kaplan (1994 p22)

The increased mobility and interconnectedness of contemporary life has resulted in certain sections of the population spending a growing proportion of their time in airports, railway stations, motorway service stations and other characteristic sites of mobility (Iyer 2000). To geographers influenced by phenomenology, these ‘look-alike landscapes that result from improved communication and increased mobility’ would be condemned as ‘placeless’ (Relph 1976 p79), whereas postmodern theorists like Chambers (1990 p57), view these sites as a ‘contemporary symbol of flow, dynamism and mobility’. Augé’s conceptualisation of travelling spaces as ‘non-places’ losess the negative connotations of Relph’s description yet vividly encapsulates the experience of being in a space marked by the ‘fleeting, the temporary and ephemeral’. However, moving beyond the myopic perspectives espoused by Augé and others, several commentators have further examined the multiple ways in which airports can be understood as spaces of civic identification where rituals of belonging may be played out (Merriman 2004; Barranda 2005).

As Vidler (1998) and Tomlinson (1999) explain, sites that some people perceive as places may be non-places for others and vice versa depending on personal experience and suggest that the apparent dichotomy between place and non-place is misguided. As Gottdiener (2001 p60) notes, place and non-place are not diametrically opposed polarities as there ‘are always elements of both in any milieu’. Augé too cautions against conceptualising a place/non-place dichotomy, acknowledging that ‘the first is never completely erased, the second never totally completed’ and that individual experiences of place mean liminal travelling spaces ‘are like palimpsests on which the scrambled game of identity and relations is ceaselessly rewritten’ (Augé 1995 p79). However, while the economic and environmental impacts of airport expansion have been well documented (Doganis 1992), the human experience of aviation and travel in

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10 Which Augé (1995 p85) defined as a ‘negative quality of place, an absence of place from itself’. 
general has received surprisingly little academic attention (Aitchinson et al 2000). Where people have investigated social aspects of the airport, they have done so within conventional philosophical frameworks, highlighting the apparent paradox that to some categories of people, including airport employees, international airports are very local places (Morley 2000). As such, airports can be understood as ‘a new kind of space that provides portals to the realms of both place and placelessness’ as the transiting passenger and the employee experience them in remarkably different ways (Gottdiener 2001 p61). Cresswell (2001 p23) arrived at a similar conclusion, discovering that the individual mobility patterns displayed by travellers, airport workers and migrants were highly significant, and lamented the fact that academia had stopped at ‘the general observation that the world is a more mobile place’ and thus had failed to investigate the richness and diversity he had uncovered. Vidler (1998 p15) too adopts this perspective, suggesting that the traditional notion of airports as ‘empty, sterile, non-spaces, determined more by mathematical calculation of times of arrival and departure than by any regard for the human subjects’ ignores the sociological aspects of international air travel.

Other writers focused on the airport built environment as a timeless and placeless liminal transition space that represents a ‘pause’ between arriving and departing (Rowley and Slack 1999). Iyer (1995 cited in Thrift 1997 p207) considers airports to be ‘the new epicentres and paradigms of our dawning post-national age’ as they are self-contained cities with their own rules, customs, language and performance codes and their perceived universality advances the notion of cultural homogenisation. Urry (2000a p63) does not wholly subscribe to this perspective, arguing that airports are characterised by a ‘dichotomy between the intense sameness resulting from global networks of the aviation industry and of intense hybridity as mobile people and cultures unpredictably intersect’, thus in this ‘odd twilight zone of consciousness... people are between lives and between selves’ (Iyer 1995 cited in Thrift 1997 p208).

‘With its shopping malls, restaurants, banks, post offices, phones, bars, video games and security guards, it [the airport] is a miniaturised city... a simulated metropolis ... inhabited by a community of postmodern nomads: a collective metaphor of cosmopolitan existence where the pleasure of travel is not only to arrive, but also not to be in any particular place.’

Chambers (1990 p58)
While artists (Rosler 1998), philosophers (de Botton 2002) and writers (Kaplan 1994; Iyer 1995, 2000) have all been attracted by the ‘peculiarly seductive anonymity’ of airports (Bradiotti 1994 p19), geographers have shown a strange reluctance to engage with debates surrounding the human experience of international airports. This reluctance is understandable given the dynamic nature of the aviation industry, but rather unfortunate, as the non-place of the airport has the potential to engage with wider geographical debates surrounding the public/private dualism. These include debates on performative spaces, concerns with security and surveillance, postcolonial debates on representation of empire and emerging concerns with emotional geography. As Vidler (1998 p9) explains;

‘As part of long-distance air travel, people find themselves...while they are in airports and airplanes in a middle realm between the private world of home and the foreign goal of that travel. The alienation from accustomed surroundings and the rapid transition from one place to another that are characteristic of airplane travel call forth a particular set of emotions – particular fears, desires, associations and images – which not only are the result of travel itself, but which also stems from the experience of enduring stopovers – both long and short – in airport terminals’.

Thrift (2004a) has also remarked that air travel is undoubtedly an uneven intensifier of affects, emotions, feelings and sensations that are inseparable from relations of surveillance and control. Here, it is important to realise the technologies and practices that create these inequalities bequeath particular emotional attachments for different airport users. As Iyer (2000 p44) notes, airports may be the scene for ‘the most emotional moments in our public lives’, where our ‘intimate encounters...are played out in a maze of...shops...public address announcements and crowds...’

The supposedly ‘placeless’ realm of the airport may, therefore, be variously experienced as exciting, banal, stressful, overcrowded, disorganised, regimented, thrilling or soporific, triggering a remarkably diversified range of inhabitation:

‘Airports would be rather mundane places if they were not populated by swarms of passengers...[who] wait in front of counters, sit in restaurants and lounges, make their way to the boarding gates...Others take a look round, stroll, are relaxed, indeed almost euphoric, they shop, consume, find time for all kinds of activities. Latecomers are in a rush, they panic at security controls then continue to hurry along until they reach the safety
of their seat in the aircraft cabin and can finally relax. One can also see loneliness at airports, only a few steps aside from the streams of humanity, the pain of leaving, the joy of arriving, as well as boredom and ill-humour. Airports without people are like an empty stage’

Hackelsberger (2004 p26)

However, refuting suggestions that airports are contemporary non-places par excellence, Cosgrove (1999) argues contemporary airports are replete with representations of local identities and cultures, both to remind visitors where they are, and to theme these apparently placeless places. In the UK, many airports have renamed and/or rebranded themselves in an attempt to emphasise their ‘local’ connections: Liverpool became ‘Liverpool John Lennon’, and Belfast City, ‘George Best International’, while the former RAF base at Finningley is now called ‘Robin Hood Doncaster-Sheffield International’. BBC Radio One even ran an (unsuccessful) campaign to get Cornwall’s Newquay airport (re)named after one of their presenters (Ward 2006). No ‘reincarnation’ has been without incident (BBC news 2004), but arguably the most controversial was the decision to prefix East Midlands Airport (in northwest Leicestershire) with ‘Nottingham’ in early 2004, in the hope of stimulating inbound tourism and investment (see Chapter Three). Crucial to the (re)naming, iconography and design of airports is undoubtedly the increasing confrontation between traditional full-service and no-frills airline business philosophies.

Though often derided as spaces devoid of any local interest or cultural connection, Simmons and Caruana (2001) have demonstrated that airports are infused with both national and local identities. Using the example of Manchester’s Ringway Airport, opened in 1938, they demonstrate airports engender considerable civic pride and are important objects of municipal peacockery. Humphrey (1999) and Humphrey and Francis (2002) likewise suggest local authority ownership of many UK airports encouraged their civic-minded owners to develop airports as objects of regional prestige. In the East Midlands, the Joint Airport Committee firmly subscribed to the belief local airports provided an opportunity to project the aspirations and identity of the East Midlands onto the national and international stage (Metcalfe 1972), while cultural and discursive formations of ‘airmindedness’ encouraged citizens to believe that if their city did not have an airport, it was surely backward (Adey 2006). Old city rivalries were hence invoked in airport development programmes, a phenomenon
especially pronounced in the case of Manchester and Liverpool airports in the North West of England, where each city vied for the most successful and modern aerodrome.

2.5 Airspaces and national identities

The debate surrounding the role of ‘place’ in contemporary air travel opens up important debates about how ‘local’ or national identities are projected onto the global stage. One of the most important is the corporate identity of individual airlines, which is developed and carefully managed by brand consultants to stand proxy for a carrier’s network and service offering. Very often, particularly in the case of traditional full-service carriers, airline brands (and hence commercial fortunes) are bound up in senses of national identity. In today’s world of deregulation and low-cost airlines, such issues become increasingly important as flag-carrying incumbent airlines have been challenged, and even put out of business, by ‘nationless’ low-cost companies such as easyJet, who eschew national affiliation in favour of transnational appeal in which cost is considered more important than ‘Britishness’ as a marketing device (significantly, only the registration marks on the aircraft identify the airline as British).

The importance of corporate identity to practices of air travel was recognised by Fleming in 1984 in his exploration of the cartographic strategies employed in airline advertising, which, as Cosgrove (1994) also confirms, often relies on highly seductive projections of the world. As both writers appreciate, the cartographic equivalent of ‘artistic licence’ is frequently employed in an effort to communicate the ‘worldliness’ and prestige of an airline’s route network (see Figure 2.15 overleaf). As Wood (1993 p73, original emphasis) observes:

‘Delta’s Domestic Route Map, that is, the United States, and parts of Canada, Mexico and the Caribbean...[is] all but obscured beneath a thick weave of blue lines symbolising not merely Delta’s routes, but the embarrassing abundance of Delta’s routes. What does the map say? It says ‘we blanket America’, that is, ‘we will keep you so warm you will never want to go to bed with another carrier’... The point is merely to dissuade you – through the exploitation of age-old rhetorical devices (emphasis, exaggeration, suppression, metaphor) – from thinking of American or TWA or USAir next time you want to fly’.
Figure 2.15 Mapping the world (clockwise from top left) American Airlines (1938), CP Air (1971), China Airlines (1992), All Nippon Airlines (2004) Air India (2003), Air Canada (1980) (Source: www.archive.com)
Such visual branding also extends to timetables and adverts, which typically feature images of a globe shrunken by flight (Figure 2.16). These images, Cosgrove (1999) argues, manipulate the geographical dimensions of personal identity by invoking notions of global or cosmopolitan citizenship (c.f. Szersaynski and Urry 2006). In the United States especially, it was hoped such projections would help overcome ‘American isolationism and provincialism’ and induce understandings of ‘the consequences of the daily shrinking process of time and space on our globe’ (Cosgrove 1994 p281).

Figure 2.16 Out of this world? The front cover of a 1998 Aeroflot timetable implies the carrier has conquered the globe and is expanding into space. The message is clear – fly Aeroflot to the future.

![Aeroflot Timetable](image)

Source: www.airchive.com

Though working from a background in sociolinguistics, Thurlow and Jaworski (2003 p579) similarly report that the use of ‘metonymic repertoires’ of world cities, ‘celebrity’ lifestyles, and designer brands in in-flight magazines reinforce a discourse of (inter)nationality or globality that espouses the benefits of a ‘global’ (i.e. ‘western’ or capitalist) identity (c.f. Billig’s 1995 work on ‘banal nationalism’ and the widespread circulation of ‘global’ imagery). Presenting ‘the best of...culture, food, entertainment, luxury and lifestyle’ (Byrne 2006 p8), typically in English and the carrier’s ‘home’ language, these publications not only reinforce familiar cultural narratives of home and the utopian notion of one big global family sharing in the
delights of homogenised global products, but actively 'facilitate cultural, emotional and moral encounters with various global others' (Szerszynski and Urry 2006 p122), i.e. those not yet fully integrated into the global consumerist society, through articles detailing 'daring' travel explorers and adventures in some of the most remote or inhospitable places on the planet. Such accounts suggest the endless possibilities of global aeromobility and reinforce the notion that 'wherever you want to go, you may be sure to get there by air' (Johnson 1939 p233). Indeed, Star Alliance, a major international airline code-sharing and marketing consortium, promotes itself as 'The Airline Network for Earth', and many carriers' identities feature stylised representations of the globe (Figure 2.17)

Figure 2.17 The world aloft: the stylised globes of (l-r) Atlas Air (USA), Continental (USA), Eva Air (Taiwan), and World Airways (USA) invoke particular notions of international aeromobility, but arguably lack national connotations.


The importance of national affiliation and a strong corporate identity was revealed by the failure of British Airways 'World Images' livery to deliver customer growth and achieve widespread acceptance. Launched in 1997 at a cost of £60 million, British Airways hoped to appeal to a growing international clientele (it was estimated at the time that 60% of its customers were not British) and portray BA as a progressive, modern, cosmopolitan airline (Harper 1997). Unlike other carriers, the airline chose to adorn their aircraft, ticketing counters and stationery with fifty different global images, including Scottish tartan, Japanese calligraphy, Dutch Delft work, Native North American woodcarvings, and Egyptian wall hangings (Figure 2.18). Though popular with aircraft enthusiasts, the new identity was heavily criticised (with detractors decrying BA's 'corporate confusion', it's 'wallpaper chart', patronising 'ethnic technicolours', and decision to 'abandon' the Union flag (Walters 1999;

11 Star Alliance website (2005).
Yarwood 2000)) and, in May 2001, a more recognizably ‘British’ identity was restored. In this case, ‘Britishness’ became an essential commodity in establishing and retaining BA’s global presence and reputation (Thurlow and Aiello 2005).

Figure 2.18 Going global. In May 2001, four years after their launch, British Airways was forced to replace their colourful ‘World Images’ (of which a selection appear below) with a more recognisably ‘British’ identity based on the red, white, and blue of the Union flag.

Clockwise from top left - ‘Animals and Trees’ (Botswana), ‘Water Dreaming’ (Australia), ‘Nami Tsuru’ (Japan), ‘Koguty Lowickie’ (Poland), ‘Waves of the City’ (USA) and ‘Grand Union (England). Source: Manipulated from originals in Yarwood (2000)

2.6 Contested aeromobilities

One of the most widely-noted characteristics of air transport is its inexorable expansion. Despite occasional ‘scars’ (such as the threat of global terrorism or the SARS viral epidemic) denting passenger numbers, the number of flights is increasing year-on-year, generating new demand for airports, runways and air routes. Despite growing concern about the implications of such expansion on the global climate, May and Hill (2006 p438) note that ‘aviation futures are...being increasingly contested at the local level’ by those concerned with the environmental rather than social ramifications of aeromobility. One notable phenomenon is the widespread occurrence of NIMBY-style campaigns of opposition to new airspaces. For example, the
proposals contained in UK Department for Transport’s ‘Future of Air Transport’
white paper (2003) prompted the formation of several new pressure groups - including
‘SBAE’ (Stop Bristol Airport Expansion) and ‘SLAP’ (Stop Luton Airport Plan) - to
counter specific regional threats. As Chapter Four explains, anti-airspace NIMBY
disputes are often prompted by the perceived encroachment of air transport into
peoples’ everyday lives, prompting exclusionary discourses and claims that airspace
expansion should not be permitted at the expense of residential amenity and quality of
life.

By definition, NIMBY campaigns against airspace expansion are based on the belief
that a particular facility, while necessary, could be better located elsewhere. However,
the specific nuance of this argument varies from place to place, with campaigners
citing a variety of reasons why airspace expansion is inappropriate in their locality.
Some protestors emphasise the potentially deleterious impact of an airport
development on local house prices, and emphasise the issues of blight that might be
associated with living alongside an unsightly airport (Griggs and Howarth 2004).
More normally, however, attention is drawn to the potentially negative impacts of an
airport on the surrounding community’s health and well-being, whether related to its
initial construction or its day-to-day operation. A common rhetorical strategy is to
highlight the alleged risk airports pose to children, who are frequently portrayed as
‘innocent’ parties caught up in a conflict not of their making (see Chapter Four). The
idea that aircraft noise prevents children sleeping or studying properly is thus a
widespread trope in the rhetoric of protestors, with concerns that aircraft pollution
may cause physical and mental health populations also frequently cited (Hume and
Watson 2003; Banatvala 2004). Further, it is often contended that, irrespective of the
quantity of noise emitted, air transport creates soundscapes which are often highly
disturbing, their sonic geographies being given meaning in the subjective and
emotional realms of everyday life (Smith 2000 and Chapter Four).

Airports also challenge (and often encroach) upon normative constructions of
community space. Thus, while protestors typically acknowledge the demand for
flying, and concede airports ‘have to go somewhere’, they reject the idea their
community (and children) should bear the brunt (Griggs and Howarth 2004). In the
face of such public hostility, politicians and planners typically emphasise the
scientific rationality and progressive nature of their proposals and, since science and technology are accorded a higher status in legal, political and media arenas than public opinion, proposals are rarely rejected (Hansen 1991). This tendency for 'national interest' to prevail over local concerns demonstrates a lingering form of political universalism, which Owens (2004) believes is responsible for generating local hostility towards, and decreasing confidence in, the democratic planning process. Sherwood (1999) and André (2004) likewise characterise airport NIMBY protests as underpinned by mistrust, as campaigners feel they are never told the 'full story' by the authorities. The belief that normal channels of opposition are generally ineffectual in preventing airspace expansion has hence encouraged some NIMBY protestors to pursue forms of direct action, bringing together those who are opposed to development in a specific locale with 'eco-radicals' opposed to development in principle, as the increasingly acrimonious disputes over the second runway at Manchester airport illustrated (see Griggs et al 1998; Vidal 1997a, 1997b, 1997c; Farrell 1997; and Chapter Four). As such, airport anti-expansion movements often involve complex actor-network spaces with national as well as local dimensions. As Woods (2003a) demonstrates, the definition of the 'local' is rarely clear-cut in cases of NIMBY opposition.

However, community opposition to the siting or expansion of locally unwanted land uses is not solely confined to objecting to transport developments and, as Chapter Four will show, studies of opposition to airspace expansion draw parallels with geographic debates surrounding the location of a multitude of facilities, from asylum reception centres (Hubbard 2005) to windfarms (Woods 2003a, 2003b). A key theme throughout this literature is that NIMBYism inevitably arises from the 'constant spatial mismatch between the geography homeowners want and the geography they actually experience' (Purcell 2001 p178), the suggestion being that NIMBY campaigners are motivated by a desire to protect their financial and emotional investment by opposing developments that threaten the residential amenity and hence value of their home. Such assertions, however, raise challenging questions surrounding the extent to which the home-less can engage in NIMBY debates. Irrespective, in order to avoid the negative connotations of NIMBYism, many anti-airport protest groups now harness the rhetoric of 'social justice', stressing the economic futility and environmental degradation of any such proposal (Griggs and
Howarth 2004). For example, anti-Heathrow expansion group HACANClearskies are adamant they are ‘not in the business of exporting our misery to someone else’ and ‘do not want to move Heathrow’s problems elsewhere’ (www.hacan.org.uk 2006). Furthermore, many local pressure groups have become affiliated to the ‘AirportWatch’ and ‘Greenskies’ alliances, which raise public awareness of the social and environmental consequences of airport expansion on a national and international scale. Nonetheless, Griggs and Howarth (2004 p199) recognise there remains ‘a great temptation, indeed a structural necessity, for campaigns to pursue their own interests at the expense of the collective’.

In this regard, it is interesting to note that many instances of opposition to airspace expansion occur in rural locales, being couched in terms of an imagined boundary between rural tranquillity and urban despoilment. For example, the Stop Stansted Expansion group have made themselves self-appointed custodians of both the Essex countryside and local cultural heritage, highlighting the possible sociological and ecological effects of expansion on local environments (Akbar 2003). In both cases, campaigners have made reference to a Council for Protection of Rural England report which calculated the equivalent of five new airports the size of Heathrow will be required by 2030 to meet predicted demand in air travel, potentially destroying 2800 hectares of greenbelt land; two villages, 44 Sites of Special Scientific Interest (SSSIs), seven Areas of Outstanding Natural Beauty (AONBs), eight registered parks and gardens, 49 ancient monuments and 319 listed buildings in the process (CPRE 2003a).

Such examples suggest the need to complement accounts considering the ‘rational’ economic roots of opposition to airspace expansion with study of the instinctive reactions people have when faced with the prospect of living in the proximity of ‘Otherness’. While such ideas have been mainly worked through in studies of reactions to human service facilities used by stigmatised groups (e.g. Hubbard 2005), there are grounds for suggesting they are highly relevant in the context of airspace expansion too. For instance, Wolsink (2006) argues anxieties about ‘strangers’ are not incidental when considering opposition to infrastructure developments (such as airports) and it is interesting to note these developments are often described using a terminology that stresses they are incongruent and ‘out of place’ (Cresswell 1997). Indeed, opposition to over-flying is often couched in xenophobic terms, with
campaigners both drawing attention to the poor safety record of foreign-owned airlines and questioning the need for flights delivering food, goods and tourists from overseas (see Chapter Four). This suggests opposition to airspace expansion is intimately connected to urges to defend the boundaries of the body, home, locality or nation against the incursion of threatening – and (aero)mobile - Others.

2.7 Enacting aeromobility

In the final section of this chapter, I explore the geographic literature on the way that airspace is (re)produced and maintained through practice. Owing to the work of Dodge and Kitchin (2005), Graham (2005), Thrift and French (2002) and others, geographers are becoming increasingly attuned to the notion that computer software (code) is deeply embedded within the infrastructure of contemporary capitalist societies and thus central to the spatial formation of everyday life. I argue that nowhere is this phenomenon more evident than in modern aircraft and Air Traffic Control centres that continually mediate the (re)production of safe flight. For example, Graham S (1998b) estimates it takes 50,000 electronic exchanges to get a B747 airborne, an Airbus A320 is powered by 94 separate computers (Laming 2000), and Boeing’s 777 has over 2.6 million lines of software code incorporated into its avionics and entertainment systems (Norris and Wagner 1996). The UK’s National En-Route Air Traffic Control facility at Swanwick, Hampshire, meanwhile relies on over two million lines of software code, which collectively support 3300 separate functions, 23 subsystems, and over 200 workstations (NATS 2005c).

Taking their cue from Castells (1996), Dodge and Kitchin explore how specialist computer software mediates the production of different ‘code/spaces’ of aviation, from check-in counters, security checkpoints, departure lounges and aircraft cabins, through to baggage reclaim and retail areas. Through the presentation of selected case studies, they argue these various code/spaces collectively create a totalising aviation environment that has a similar form and function regardless of physical location, and provocatively suggest that the pervasive use of automated security and surveillance systems at every stage of every flight means the practice of travelling by air has become virtualised to the extent that corporeal aeromobilities are totally reliant on the safe, efficient, and routine functioning of a multitude of different virtual networked computer systems (including reservation databases, flight planning software and
electronic passenger manifests). For the most part, these systems are taken for granted and passenger dependence on them only exposed when a computer breakdown at air traffic control grounds flights or a malfunctioning baggage system misroutes luggage (see Clark 2004b and Clement 2004a, 2004b, 2005b; and Rudebeck 2004 and Taylor R 2005 respectively).

The central tenet of the ‘code/space’ thesis suggests contemporary airspaces are qualitatively different from the more familiar ‘coded spaces’ of the built environment. In the latter, ‘code matters to the production and functioning of a space, but if the code fails the space continues to function as intended, but not necessarily as efficiently, safely, or with as little cost’ (Dodge and Kitchin 2004a p198). Thus, in a ‘coded space’, the role of software is ‘one of augmentation, facilitation [and] monitoring...rather than control and regulation’ (idem). Conversely, in a ‘code/space’ the relationship between code and space is dyadic - i.e. mutually constituted and reinforced - so that ‘if one half of the dyad is put out of action then the entire code/space fails’ (Dodge and Kitchin 2004a p198). For example, security alerts may close an area of the terminal, computer errors can delay check-in, or technical system failures can ground aircraft. Unlike in a ‘coded space’, when the technology producing a ‘code/space’ fails, there are no alternatives, as manual methods cannot perform the role of the failed systems as efficiently or safely. In this situation, a software failure leads to a complete ‘breakdown’ of the space, as it cannot function as intended - the consequences ranging from mild inconvenience to utter catastrophe.

Extending such perspectives, Dodge and Kitchin (2004a) propose that the sophistication of electronic avionics systems in producing virtual geographic representations of airspace mean that aircraft increasingly fly through physical space virtually. Indeed, pilots now rely on a plethora of digital instruments and electronic sensors, including flight management computers, artificial horizons, internal reference systems, radios, data links, ‘fly-by-wire’ controls, traffic alert and collision-avoidance systems (TCAS). Furthermore, individual aircraft are fitted with integrated internal pneumatic, hydraulic, and fuel systems that are intimately connected to external networks of global positioning satellites, air traffic control computers and ground-based navigation beacons - as well as computers on other aircraft - creating complex ‘networks within networks’. Together, these technologies enable aircraft to carefully
negotiate their way through an ever-more complicated aerial labyrinth of control zones, airways, and manoeuvring areas.

However, while geographers are beginning to consider the technically-infused production of airspace, there remains much more that could – and should – be said about the relations between these technologies and the social practices which animate them. After all, code only produces airspace through its incorporation in an aeromobile assemblage which includes cabin crew, air traffic controllers, ground crew, airport managers – as well as numerous other forms of ‘software’ and ‘hardware’ (e.g. flight plans, flight progress strips, aeronautic charts, satellite images, in-flight displays, warning systems, jet engines, life support systems etc) (see Peters 2006 on airport logistics). Although it is possible to argue these assemblages are less and less mediated by human discretion, this is to underline that code does not determine the contours of global airspace. The question of agency, therefore, is an important one. Given the complex and heterogeneous array of agents and mediators in the aviation industry, geographers need to trace the spatial distribution of agency through these networks and ask how agency comes to be performed in the production of code-mediated airspaces.

Furthermore, there remains a pressing need for studies of how commercial airline pilots develop and communicate situated understandings of airspace, for example, through the interpretation of flightdeck displays and the routine sequential practice of completing flight-phase related activities. Consequently, scholars could usefully explore how aircraft personnel are able to comprehend space as it takes shape - a geography that is continually ‘beckoned’ into being through the generative relationship of technology and human practice (Dodge and Kitchin 2005). Likewise, a survey of the literature reveals no consideration of situated decisions made by air traffic controllers as they seek to ‘order’ the sky according to internationally-agreed protocols. Such lacunae are perhaps not surprising in a post 9/11 world where security protocols mean the access necessary to conduct such research is difficult to obtain. Aviation’s technical language and unique operating procedures render it an intimidating prospect for study. Yet the absence of academic research into the spatial awareness and wayfinding of pilots/controllers is nothing short of remarkable given that many tragic accidents have been attributed to their misinterpretation of flightdeck
displays or their unquestioning trust in malfunctioning instruments (Norris 1981; Prince 1990; Beaty 1991; Cushing 1994; Faith 1996; Strauch 2002), for rarely is the interpretation and use of space more critical than on the flightdeck of a commercial airliner or in an air traffic control centre. Understanding how these social practices interact with code-producing and mediating technologies is vital, as is studying the fallibility of these relations. Speaking 'across the divide' (Massey 1999), geographers may find sustenance in areas such as complexity theory, which provides a possible way to comprehend the emergent geographies of aviation accidents when code/spaces break down. Accidents are thankfully rare, but it is now clear that the vast majority result from the unpredictable interplay of the distributed agencies and technologies involved in the production of airspace. By shedding light on the highly contingent nature of airspace production, the following chapters will demonstrate how airspace must be thought of as more than simply hubs and flows (airports and airlanes) and as the desired outcome of highly refined processes of mediation and attendance.

2.8 Summary
Geographers have consistently identified the expansion of airspace as one of the key drivers of globalization, and a key enabler of social distanciation. They have used data on aircraft movements to map out the morphologies of air transport networks and have identified a space of flows that seamlessly binds global cities together but leaves many other spaces only loosely connected. Yet, significant gaps in the existing work on geographies of air transport have been identified. Inspired by the rise of a putative 'mobilities turn' in the social sciences, and a heightened interest in the social production of movement, this chapter has highlighted other issues that demand attention, alighting on key questions of how airspace is produced, contested, and practised. 

12 I appreciate, however, that these topics are far from exhaustive and other dimensions of aeromobility also require serious consideration by geographers, including, for example, the emotional geographies of air-rage (Thomas 2001) or the scripted performances of cabin crew who are understood to embody particular national values and corporate cultures (see Hochschild 1983; Tyler and Taylor 1998; Taylor and Tyler 2000; Bolton and Boyd 2003; Whitelegg 2003).
Chapter Three

Nottingham East Midlands Airport, 1916-2006
– ninety years of airspace production

Despite adopting often diverse philosophical standpoints and utilising a variety of methodological techniques, Anglo-American geographers have generally concurred that airports, and the airspaces between them, have induced new forms of global mobility, social activity and cultural etiquette\(^1\). Some of these, including check-in and security searches, are common, visible, and collective, whereas others, such as smuggling, air-rage, or joining the ‘mile-high’ club, are more obscure and illicit. While airports and airlines do express the inevitable influence of global standardisation in very material ways, the alleged resulting geographical homogeneity, so derided by critics, is highly questionable. Sociological accounts often depict airports as ‘sites of excessive policing and simulation, where consumers are enmeshed in a hyperreal, spectacular landscape that promises fantasy, escapism and freedom, but delivers sameness, blandness and placelessness’ (Merriman 2004 p153; see also Gottdiener 2001 and Chapter Two). While many scholars still assert that spaces and landscapes of travel and mobility, including motorways, railway stations and airports, are indeed emblematic of the contemporary franchised-built global environment, recent studies have shown such accounts often overlook the complex and continually evolving histories, geographies and materialities of individual sites, which are encountered and experienced by different people in

\(^1\) See Chapter Two for a full discussion
different ways over time (Gottdiener 2001; Crang 2002; Edensor 2003; Delalex 2004; Adey 2006). Indeed, while many still criticise the 'placeless' environment of airports, others have begun to suggest how their functional and aesthetic similarities may, paradoxically, both reassure travellers by providing them with proof that efforts have been made to diminish the risks associated with air travel by enabling them to identify with 'home' through cultural affinity with various global brands regardless of physical location, but also unsettle those unaccustomed to the prescriptive and permitted routines of the terminal (see Wood 2003; Fuller and Harley 2004; Aaltola 2005). Airports can usefully be conceptualised both as hubs of mobility and places in their own right, neither local nor global spaces, but the complex conjunction of both (see Chapter Two).

This concept of mobility spaces being 'placed' and conceived in different ways through time helps inform the present research on airspace, for in the same way that Merriman (2004) demonstrated how specific landscapes of automobility are 'placed' through extraordinary events and everyday traffic flows, this thesis posits that airspace can be similarly situated in social and cultural contexts of practice. As such, the experience of contesting airspace/airport expansion, the routine practices of air traffic control, and the representations of airspace on the flightdecks of commercial aircraft, can all similarly be understood as contributing to the 'placing' of aviation in British society. While individual flights may routinely depart at set times of the day, delays, atmospheric conditions, and the volume of traffic in the surrounding airspace, as well as on-board emergencies and changing military training requirements, all serve to continually reconfigure the daily landscapes of flight above the UK. All these movements are accommodated and regulated through a distinctive three-dimensional aerial geography of airspace sectors, airlanes and control zones, which is socially produced and maintained in distinctive ways.

While sociologists and geographers have begun to appreciate the importance of examining the nuances of different landscapes of automobility (e.g. the traffic characteristics of congested motorways vis-à-vis residential streets or gated rural roads) (see Urry 2004), the equally diverse and socially significant landscapes of aeromobility have yet to be systematically investigated. Yet, on the flightpaths of major international airports, increasing numbers of aircraft can be seen to move in
highly choreographed processions toward and away from the runways, while in Lincolnshire and the Welsh valleys, local ‘landscapes of flight’ continually reverberate to the sound of low-level military training sorties. The increasing popularity of private aviation is also causing a rise in the number of light aircraft that are seen and heard in the skies around the UK’s smaller airfields, and aeronautical sports, including gliding, parachuting and micro lighting, are increasingly popular pastimes (Pulford 2004). The local geographies and variegated landscapes of flight are thus long overdue.

**Aim**

Accordingly, this thesis explores how the airspace associated with one specific airport, Nottingham East Midlands (hereafter NEMA), a busy regional airport in northwest Leicestershire, UK (see Figure 3.1) is situated both within the geographical fabric of surrounding communities, ecologies, politics, and regional economies, but also within wider ‘globalised’ spaces of air travel. To these ends, this chapter will examine the long and complex historical geography of aviation at the site, before exploring the ongoing controversy surrounding the reorganisation of controlled airspace in May 2005.

In doing so, it examines how the development of an ostensibly ‘local’ place of air travel is intimately, yet problematically, tied into ‘global’ spaces of air traffic flows, and how the commercial imperative to attract more flights has required the restructuring of local airspace, creating a spatial controversy of great complexity. Unlike other UK airports of comparable size, which specialise in handling one particular type of air service (be that full-service scheduled, low-cost, charter, or freight), NEMA fulfils all these different roles, serving ‘local’ passenger markets during the day with a range of European scheduled, low-cost, and charter flights, as well as private and general aviation clients at the weekend and longhaul flights by global logistics companies at night. While the expansion of services has been welcomed in some quarters for increasing trade and travel opportunities, the proliferation of night-time cargo services has stimulated debate into the ‘right’ of neighbouring communities to enjoy ‘a good night’s sleep’ versus the needs of pilots and air traffic controllers to use the safest and most efficient approach and departure procedures (see later this chapter). The following discussion thus provides an
Figure 3.1 The location of Nottingham East Midlands Airport

1 kilometre = 0.6214 mile
1 mile = 1.61 kilometres

Source: Ordnance Survey (2005)
interpretation of the developing ‘airscapes’ of Nottingham East Midlands Airport from 1916 to 2006, considering its evolving role and its changing space in time over ninety years of airfield operations.

3.1 From airbase to airport: aviation at NEMA in time and place
The origins of aviation on the site of the present-day airport can be traced back to 1916, when Castle Donington airfield was established to serve the needs of 38 Squadron in their defence of Midlands’ airspace during World War One. During the evening of 31st January 1916, a raid by a German Zeppelin LZ-20 airship on Loughborough killed 10 people, injured 12 others, and caused extensive property damage, highlighting the acute need for such a protective aerial deterrent (Bonser 2001). To support these defensive operations, nine landing sites were established in Leicestershire, and one, near the village of Castle Donington, eventually became the site of the present-day commercial airport (Chorlton 2003). As at other sites, aircraft dispersals, administration buildings, and barbed wire fences quickly displaced agriculture, which had, up to then, been a stabilising influence on the landscape of northwest Leicestershire. Although the location was not as archeologically significant as Heathrow (see Sherwood 1999), the creation of the airfield showed how local space was being re-appropriated to serve the geopolitical objectives of a national Government fighting a ‘world’ war. Castle Donington opened in the late summer of 1916, but it was primarily used as a training base and emergency landing ground rather than a front-line fighter base, and was abandoned in 1918 (Bonser 2001).

3.1.1 The inter-war years
Unlike other districts, a lack of archival evidence suggests Leicestershire was not a particularly ‘air-minded’ county. A flying club that had been formed in 1919 disbanded a year later owing to a lack of interest, and it was not until Sir Alan Cobham, Britain’s self-appointed ‘Air Ambassador’, held a meeting in Leicester in 1926 as part of his ‘Municipal Aerodrome Campaign’ to encourage every city to build an airport that any enthusiasm for flight emerged (Bonser 2001). The Leicester Chamber of Commerce was keen to establish an Aeronautical Society to stimulate interest and enthusiasm for aviation among the local populace, educate the city’s

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2 The others were at Blaston, Breningby, Burton-on-the-Wolds, Loughborough Meadows, Peckleton, Queniborough, Scalford, and Welham (Bonser 2001).

This galvanisation of aeronautical interest represented a local expression of a national programme to promote aviation as a means to economic prosperity, and led directly to the formation of Leicestershire Aero Club in 1928, which began commercial operations from the city’s new municipal airport at Braunstone in 1935 (Bonser 2001). However, while the expense and danger associated with this new form of travel negated widespread commercial development, private aviation fared better, and touring airshows and ‘flying circuses’ quickly became popular forms of entertainment, helping condition positive public perceptions of flight (Bonser 2001 and Chapter Two). As Walker (2003) notes, the spectacle of flight had a powerful impact on the public imagination, as aviators flew progressively further, faster and higher, wowing crowds with their daring acrobatic manoeuvres and offering, for a modest fee, the opportunity to experience flight – the original ‘joyride’.

However, developments in Continental Europe were soon to have a profound impact on the development of flying in the county. The potential applications of military aircraft to Nazi geopolitical programmes led Hitler’s regime to publicly support the growth of German aeronautical know-how and promote aviation as a symbol of modernity and national identity (Fritzische 1993, 1994). In 1927, the director of the German national airline, Lufthansa, was quoted as saying that the Germans were a “people without space” and that “air travel shows us ways to new space” (cited in Spode 2004 p16). This expansionistic rhetoric so alarmed the British Government that they initiated a re-armament programme and the RAF Expansion Scheme of 1934 sought to strengthen British military aviation in anticipation of future conflict (Bonser 2001).

3.1.2 The Second World War
By the middle of the 1930s, private aviation in Leicestershire was thriving, but the declaration of war in 1939 abruptly halted its development. Nationally, all personal and club flying was banned, and municipal aerodromes quickly requisitioned for military use. As in World War One, aerial combat was to play a significant role in the evolution of the conflict, and despite its relative distance from the front line,
Leicestershire was not immune to aerial attack. Indeed, a series of German bombing raids over Leicester in November 1940 left 122 people dead, a further 284 injured, and over 5000 buildings damaged or destroyed (Bonser 2001). These raids necessitated a fundamental shift in military strategy; the domination of landspace was no longer sufficient to ensure victory; domestic airspace had to be defended, and hostile skies conquered.

Under Churchill’s ‘Set Europe Alight’ Directive, 13 airfields were built or redeveloped in Leicestershire between 1940-1944 (Figure 3.2). Some were designated front-line roles in ‘Bomber Command’, whereas others, including Castle Donington, were training bases, designed to alleviate chronic shortages of aircrew (Bonser 2001). A new Operational Training Unit (OTU) was established at Wyameswold on 14th April 1942, and an advanced party arrived at nearby Castle Donington in May 1942 to develop the airfield as a satellite station and a home for 28 OTU and their fleet of Wellington aircraft, which were used for pilot training and propaganda drops over occupied Europe (Hunt 1966; Chorlton 2003).

In common with many other Second World War airfields, Castle Donington was designed with one main east-west runway (that was destined to become the alignment of the future civilian runway) and two shorter crosswind runways, the position of which are still discernable from the modern air traffic control tower and airport perimeter3 (Figure 3.3). The first paved runway was laid in late 1942, and the airfield officially re-opened on January 1st 1943 (Chorlton 2003). However, celebrations proved premature, as cracks in the concrete meant the runways were condemned, and no flying was possible for the first 10 days of 1943 until they had been resurfaced (Bonser 2001).

3 Personal observation and communication with Nigel Fairbaim, NEMA ATCO 2005.
Figure 3.2 Location of the major airfields in Leicestershire and Rutland

KEY
- Military airfields constructed during World War One that were also used in various capacities during the Second World War
- Civilian airfields constructed in the inter-war years
- New airfields constructed immediately before, or during, World War Two

Of these 19 sites, three were still active in 2006. The RAF have maintained a base at Cottesmore, Leicester East is home to Leicestershire Aero Club, while Castle Donington is now Nottingham East Midlands Airport.

Source: derived from an original in Bonser (2001 p4) with author's annotations
28 OTU operated from Castle Donington for 20 months, clearing many British, Canadian, and New Zealand pilots for front-line duty⁴, yet, despite not taking part in active fighting, four aircraft and 13 crewmembers were lost in training accidents (Bonser 2001). On June 3rd 1943, a Castle Donington-based crew, returning from a propaganda drop over France, developed engine trouble and ditched in the English Channel. After spending eight hours in a life-raft, five of the six crew were rescued, highlighting the value of the dinghy drills undertaken in Loughborough baths in saving lives (Hunt 1966; Bonser 2001). Although Wymeswold, as the principal airfield, saw the most intensive use, Castle Donington crews flew for 2307 hours in February 1945, a base record (Hunt 1966). In addition to crew training, the airfield was also used as an emergency landing ground, and crippled RAF and USAF aircraft could often be seen occupying the concrete dispersals⁵ to the southeast of the runway triangle undergoing maintenance (Bonser 2001).

In many ways, the present-day civilian airport still resembles a military installation, with security checkpoints, CCTV, fences, ditches, and gates, while on the windswept embankment of the M1 motorway and in villages surrounding the airport, weathered anti-expansion and anti night-flight posters proclaim interminable local struggles

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⁴ Sadly there is little archival evidence of these operations, but Wilkes (1997) provides a rare account of life at the airbase.

⁵ A military term used to describe the (often circular) aircraft parking areas built on RAF bases.
against the airport, whose perimeter is defined by a heavily-patrolled chain-link fence and barbed wire (Figure 3.4).

Figure 3.4 The perimeter fence at NEMA separates the global ‘airscape’ of the airfield from the local landscape outside, providing both a physical and psychological barrier to mobility.

This fence, first erected during World War One to protect aircraft and their crews, has been extended and reinforced as the airport had grown but, since its inception, has effectively sealed off the site from its environs, creating an island of aeromobility that is simultaneously embedded in the landscape of northwest Leicestershire, yet effectively removed from it, as access to the airfield (and, by association, the airspace above it) is determined by the possession of correct documentation and/or the validity of security passes. International safety directives have modified the local ecology and physical structure of the airfield to such an extent that the juxtaposition of the manicured ‘sterilized’ monoculture of the airfield with the richer bio-diversity that is found in the surrounding copses, hedgerows, and fields, could not be more apparent. Abutting, but now outside, the northern perimeter fence, long-abandoned wartime hard-standings are gradually being reclaimed by nature, but their (albeit decaying) presence alludes to how the skies over Leicestershire were once a place of danger, terror, and uncertainty (Figure 3.5).

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6 For example, the grass inside the perimeter is kept 8-inches tall to discourage birds from settling, and no other vegetation is permitted in case it attracts animals and/or provides a source of foreign object damage yet outside it, tree planting schemes aim to increase the environmental value of the adjacent land for wildlife.

7 However, this relationship was complex: on the one hand, the sky was a place of fear, yet news reports of vicious dogfights over southern England simultaneously promoted the ‘glamour’ and ‘excitement’ of flight (Spode 2004).
3.1.3 From fighter training to holiday flights; aviation after the war

Following Allied victory in World War Two, the provision of airfields in Leicestershire changed virtually overnight. Bases that were superfluous to requirements were abandoned, and only four survived. Of those, Castle Donington was used to fly British military commanders over the devastated Ruhr region to allow them to assess the effectiveness of Allied bombing strategies (Hunt 1966). However, this aerial voyeurism only lasted a couple of months and the airfield quickly became home to 108 (Transport) Operational Training Unit, who flew personnel and equipment to and from the Far East until victory in Japan led to their disbandment and the airfield’s closure in September 1946 (Wright 1991). In late 1947, the site was acquired by the Ministry of Civil Aviation as part of their National Airport Plan (1947), which sought to centralise airport planning and concentrate scheduled passenger services at a few chosen airports by restricting regional airfield development, and left to fall into a state of disrepair (Sealy 1976).

Although military aviation in Leicestershire had virtually ceased by this time, commercial aviation was in the ascendancy. In line with new post-war Government policy on regional airport development, which rejected the recommendations of the 1947 National Airport Plan (Sealy 1976), the existing municipal airport serving the East Midlands, which had opened in 1938 at Burnaston near Derby as a result of
active encouragement given to the provision of airports by the then-Minister of Aviation, Sir Kingsley Wood, underwent incremental expansion during the early 1950s to serve the needs of resident carrier Derby Aviation⁸ (Rowley 1965). However, by the end of the decade, it was apparent that the existing facilities were rapidly becoming obsolete. The grass runways frequently became waterlogged, and could not support the weight of the new generation of passenger aircraft that were being introduced (Chorlton 2003).

The need for a replacement facility was first articulated by the Corporation of Nottingham, who, together with a consortium of local authorities (including Leicestershire, Derbyshire and Nottinghamshire County Councils and the Corporation of Derby), formed a ‘Joint Airport Committee’ (JAC) and employed a firm of consultant engineers to assist them in selecting a suitable site for a new municipal airport (Walker 2005). The prospect of a new airport for the East Midlands region was now in line with Government policy, for the 1961 White Paper emphasised the importance of towns and cities getting directly involved in the provision of local airports and advocated that individual airports be relinquished from state control and run as commercial enterprises (Sealy 1976).

As in the United States 20 years previously, British civic competitiveness encouraged local authorities to ‘outdo’ neighbouring air facilities in terms of scale and scope (see Brodherson 1996), and airport design became highly competitive (see Sudjic 2005). However, post-war economic hardship dictated that no British unitary authority could support the capital investment and financial risk associated with developing their own airport (Fullerton 1982). Nevertheless, the JAC subscribed to the rhetoric that airports provided a gateway to socio-economic prosperity as well as an opportunity to project the aspirations and identity of the East Midlands onto the national and international stage (Metcalf 1972).

After careful consideration, the JAC selected the abandoned airfield at Castle Donington as Burnaston’s successor. It was thought the site had significant development potential, as it lay roughly equidistant between the region’s three major

⁸ Who later became British Midland and then bmi british midland.
cities, boasted favourable flying conditions, and, most importantly, was immediately adjacent to the proposed London-Leeds M1 motorway extension. From its inception, the facility was promoted as a ‘Motorway Airport’, with the supporting authorities demonstrating an early appreciation of the future strategic importance of automobility to the airport’s commercial future. As Rowley (1965 p41) noted, ‘In an age when road transport plays a dominating part in the lives of most people, the planners of East Midlands Airport chose a site that would be hard to beat for air-surface connections’.

The construction of the new motorway and airport were promoted as exciting modern developments that would connect Leicestershire, quickly and efficiently, to domestic and international markets. As an official publication recorded, ‘Until recently, the geography of Leicestershire had altered little over the centuries. But now the M1 motorway and a modern international airport...[are] changing the face of a significant area’ (EMA 1976 p65).

Furthermore, the site’s situation between Derby, Leicester, and Nottingham, was deemed to confer significant locational advantages (and thus commercial opportunities) over rival airports. In terms resonant of Central Place Theory, the Airport authority stressed the facility was ‘equidistant from anywhere’ and that ‘[t]he radial inflow and outflow of cargo to and from a central point must...be more promising than that to an airport peripheral to an industrial conurbation’ (ibid. 1976 p29). Indeed, in 2006, NEMA estimated that 10.6m people live within a 90-minute drive (representing one of the largest population catchments of any UK regional airport), while excellent road links mean HGVs can reach 89% of mainland England and Wales within four hours (NEMA 2006).

The initial planning application, submitted by the JAC in 1960 for a new 6,000ft runway and passenger building, was initially granted in November 1961, but the choice of site was controversial and local residents (unsuccessfully) challenged the validity of the decision in the High Court (Rowley 1965)10. Following further consultation, planning approval was finally upheld in December 1962, and the derelict

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9 Significantly though, there was no rail access so all passengers and cargo had to arrive by road, a factor that was to have severe implications in terms of pollution and congestion as the airport grew.

10 Unfortunately, little archival evidence of the extent or the motivation for this early opposition has survived but, although impossible to verify, one could speculate that military operations were tolerated as they were in the national interest, but commercial operations were considered unnecessary.
airfield purchased for £37,500 the following year. The site was formally handed over to the contractors, Richard Costain (Civil Engineering) Ltd, to begin work on March 9th 1964 (Rowley 1965). The development necessitated moving 630,000 cubic yards of earth to level the site, breaking-up the old landing strips, constructing a new east-west 5,850 x 150ft runway (originally designated 10/28)\(^\text{11}\), a 235,000sq ft aircraft apron complete with five aircraft stands, an air traffic control room, several maintenance hangers, a 722ft x 364ft passenger terminal (Figure 3.6), 1½ miles of internal roads, and a car park for 850 vehicles (Rowley 1965). This required laying 172,000 sq yards of concrete (enough to surface 12 miles of standard two-lane dual carriageway) and cost £1,375,000 which was shared between the supporting Councils in the proportion of two-ninths each, with the exception of Leicestershire who only paid one-ninth of the total (ibid.1965).

Figure 3.6 Original artist’s illustration of the passenger terminal at EMA. The facilities were erected quickly and cheaply using the ‘CLASP’ system, a construction technique originally developed for building schools during the 1960s, which facilitates future expansion (Rowley 1965).

\[\text{Figure 3.6 Original artist’s illustration of the passenger terminal at EMA.}\]

Source: Industrial Nottingham (July 1965 p5)

\(^{11}\) Along the alignment of the main wartime strip.
The new ‘East Midlands Airport’ (EMA), the first municipal air facility to have been constructed since the end of the war, opened on 1st April 1965\textsuperscript{12}, but the acquisition of the necessary operating licence was delayed by 24 hours as, in their haste to complete the project, a contractor’s bulldozer severed the main runway lighting cable (Walker 2005). Consequently, the first passenger service, a British Midland Airways (BMA) flight from Glasgow, landed the following day (Rowley 1965). Channel Airways, Skyways, and Coach Air soon joined BMA and, in the first year of operations, collectively flew to 15 different domestic and European destinations (Figure 3.7 overleaf). It was hoped the airport would attract c85,000 passengers a year; however, over 118,300 people passed through the airport in its first 12 months of operation (EMEPC 1966). Furthermore, over 100 different airline companies, 81 different types of aircraft, and over 12,400 aircraft movements from places as diverse as Bahrain, Algeria, Milan, and Zurich were recorded as visiting EMA in its first year\textsuperscript{13} (Hunt 1966). The subsequent introduction of a twice-daily service to Heathrow meant passengers were soon able ‘to fly from the East Midlands Airport to any part of the World’ (Rowley 1965 p49), entwining EMA into a network of global air services (Figure 3.8).

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{image.png}
\caption{BMA advertisement, 1965 - promotes services to domestic destinations and London Heathrow, from where passengers could transfer to long-haul flights.}
\end{figure}

\textsuperscript{12} Although the official opening by HRH Prince Philip did not occur until 21st July 1965.
\textsuperscript{13} Significantly, this figure was 3,400 higher than anticipated and comprised 5,653 passenger movements and 6,749 executive/freight/private flights (Hunt 1966).
Figure 3.7 Scheduled services at EMA, 1965
Derived from flight data in Rowley (1965)
Initial freight traffic was encouraging too, as uplift increased from 77,000kg in the first six months of operation to 545,000kg by the year’s end (EMEPC 1966). The airport authority considered these figures a vindication of their choice of site and a firm foundation from which they could realise their aspiration of becoming ‘a sort of Clapham Junction’ for UK airfreight (Wraith 1966 p279). Much of the early freight traffic was fresh agricultural produce from the Channel Islands, reflecting Robinson’s (1972 p35) belief that air transport is ‘best suited for the carriage of commodities which are low in bulk but high in value...or commodities of a perishable nature which require speedy transport and careful handling’. The economic benefits conferred by ‘shrinking time’ were enthusiastically embraced by the region’s businesses and, to cater for this new appetite for aeromobility, airlines at EMA quickly expanded their network portfolios to offer direct flights to 18 domestic and European destinations in 1966 (Hunt 1966).

The safe and efficient flow of these aircraft was coordinated from the new air traffic control (ATC) room situated on top of a dedicated operations building west of the passenger terminal. Although post-war financial constraints dictated functionalism was prioritised over opulence, the tower was nevertheless considered a significant architectural feature in its own right, and was set apart from the passenger terminal, physically and psychologically separating the technical work of air traffic controller officers (ATCOs) from the bustle of the terminal (Figure 3.9). This placement communicated the importance of the tower to the safe operation of the airport, and its visibility from the approach roads arguably reassured nervous travellers.

Figure 3.9 EMA’s original ATC facility, 1965

Source: manipulated from an original in Walker (2005 p22)
At EMA, as at other airports, the control tower and the communications equipment installed therein, served to define and visually render the airport’s jurisdiction and control over the surrounding aerial territory, a space structured by notions of invisible boundaries in the sky and the perpetual threat of their transgression by unauthorised aircraft. World War Two had had significant implications for the future of commercial aviation and the structure and management of UK airspace (see Chapter Five). Technological innovation at Bawdsey Manor in Suffolk led to the development and refinement of radar, while the Chain Home Network of airfields, air defence radar stations, and a network of 53 radio beacons, ultimately formed the basis of a civilian air traffic control system that enabled Allied nations to continually monitor their airspace for signs of aerial invasion (NATS 2005d, 2005e). The peacetime application of these surveillance technologies meant ATC towers became local markers of a national control system, which structured and maintained a distinct aerial territory by broadcasting instructions and continually ‘sweeping’ the sky with radar beams. In this way, EMA’s tower anchored localism, yet simultaneously connected the immediate airspace above the airport with national control networks (see Metcalfe 1968). ATC towers are thus impossible to disassociate from Foucauldian notions of surveillance, ordering, and political control, a theme that will be developed in Chapter Five.

The original function of EMA’s tower was to orientate aircraft and their pilots within the space surveyed by the airport’s radar, but as traffic levels increased, the role of controllers switched from basic navigation and reassurance to sequencing flows of inbound and departing aircraft to ensure they safely and efficiently integrated with, or departed from, the corridors of air traffic flying along the en-route high-altitude airlanes above the airport14. The tower was thus a place of power, as radio transmissions from the ground provided auditory confirmation or denial of a pilot’s right to fly. However, the power vested in the tower affected not only individual pilots, but also the communities they overflew. This ‘potential to deafen’ gradually made the control tower symbolic of public dissatisfaction with aircraft noise, and its iconic image, a focal point for resistance15.

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15 Personal experience and observation of anti-NEMA expansion campaign rhetoric.
Local concern over aircraft noise began to be articulated soon after the airport’s opening, as the number of air traffic movements (ATMs) nearly trebled in the space of three years (Table 3.1). One of the largest recorded increases was in airfreight, and Rowley (1965 p49) accurately foresaw that ‘if freight business continues to increase as rapidly as it is at present…a…separate fleet of aircraft will [ultimately] be devoted solely to airfreighting’. Like today, finances dictated that these early fleets of cargo aircraft included elderly airframes that had been converted from passenger configuration meaning they were often considerably noisier than newer models, a factor that further intensified the controversy surrounding night-time operations.

Table 3.1 EMA traffic statistics, 1965-1967

<table>
<thead>
<tr>
<th></th>
<th>1965 (Apr-Dec)</th>
<th>1966</th>
<th>1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passengers</td>
<td>103,966</td>
<td>170,595</td>
<td>236,604</td>
</tr>
<tr>
<td>Freight (kg.)</td>
<td>357,601</td>
<td>1,782,609</td>
<td>2,021,863</td>
</tr>
<tr>
<td>Total ATMs</td>
<td>9,901</td>
<td>18,548</td>
<td>26,075</td>
</tr>
<tr>
<td>(of which commercial)</td>
<td>4,753</td>
<td>6,511</td>
<td>8,674</td>
</tr>
</tbody>
</table>

Source: derived from Metcalfe (1968)

In 1968, EMA handled 250,000 passengers and 2.5 million kilograms of freight (Metcalfe 1970). The growing popularity of these services led the airport authority to hope that EMA would quickly develop into ‘a major international airport with services extending beyond Europe’ (EMEPC 1966 para.317). However, to achieve this aim, it was necessary to extend the runway and increase circulation space in the terminal. Thus, four years after opening, passenger facilities were enlarged, the runway lengthened to 7,480ft, and taxiways widened to 75ft to accommodate more passengers and ‘enable the operation of most of the modern generation of jet airliners’ (Metcalfe 1970 p13).

The runway extension cost £500,000 and necessitated the closure of the B5401 Castle Donington to Diseworth road, and the diversion of the B5400 1½ miles to the east, changes that arguably did little to endear the airport to the local community (Metcalfe 1970 and Walker 2005). The works involved ‘filling-in…the natural valley with approximately 90,000 cubic yards of pulverised fuel ash’ sourced from local power

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16 These developments led to EMA being included in the ‘long-list’ of possible sites for the Third London Airport however, the site failed to warrant inclusion in subsequent lists, and Stansted was eventually selected (Roskill 1971; McKie 1973).
stations, the laying of almost 70,000 square yards [14½ acres] of reinforced concrete, and the installation of precision approach lights to bring the runway up to international standards (EMA 1974 cited in Walker 2005 p54). Today, the former B5401 now ends abruptly at a crash gate, and the original alignment of the road across the airfield is obliterated. However, the relative remoteness of the site from the terminal and the apparent disinclination of security personnel to police it means it has become an unofficial site for spectators to congregate (Figure 3.10).

Figure 3.10 Alternative land uses. In addition to being designated an emergency access route, the former B5401 is also used as a place from which aircraft spotters can pursue their hobby.

Photographs: author (grid reference SK444263)

The extensive earthworks this runway extension necessitated represented another effort to reconfigure the landscape and ecology of the area that had begun over 50 years previously, and were described as the latest expression of a ‘continuous development programme [that] has been vigorously pursued [at EMA] since its opening’ (Metcalfe 1970 p13). Indeed, EMA’s corporate mantra throughout the 1970s pursued ‘progress’ at all costs, yet the modification of natural drainage patterns resulted in recurrent flooding problems, a concern that was first articulated by a wartime veteran of the airfield who allegedly advised the airport’s management team against concreting over the existing natural ponds as the area was prone to waterlogging.¹⁷

¹⁷ However, the airport did not heed the advice and has had to spend substantial sums on enlarging the network of balancing ponds and storm drains, and bulrushes still obstinately grow around the airport’s perimeter. Terry Fitchett, NEMA Aeropark Volunteers Association, personal communication (2006).
Such recurrent infrastructure developments bore out Banham’s (1962 p252) thesis on the ‘obsolescence’ of airports, where he observed that they are ‘never up to date, never completed, always inadequate, always sprawling slumishly into their surroundings’ and invariably superseded before their completion. Nevertheless, EMA’s larger terminal offered ‘a 150-seat restaurant...two well-stocked bars, a lounge, a cafeteria capable of seating 80 people, a spacious conference room...and a viewing balcony overlooking the apron’ (EMA 1974 cited in Walker 2005 p54). All essential passenger functions were located on the ground floor, enabling travellers to enter the check-in hall directly from the kerbside before proceeding towards security control and into the departure lounge. This straightforward procedural logic led the Airport Authority to claim ‘the entire airport permeates efficiency’ (Hunt 1966 p63).

Along with improvements to runway and terminal infrastructure, the airport’s navigational aids were substantially upgraded. A new state-of-the-art Instrument Landing System (ILS)\(^{20}\) was installed in 1970 to enable aircraft to land at night and in bad weather, and the airport’s eastern non-directional navigation beacon was moved to enable aircraft to use new holding and approach procedures (Walker 2005). As pilots passed over the village of Kegworth, 1,020 metres from the runway threshold, they picked up the high-intensity lighting system that guided them onto the runway (ibid. 2005). In 1971, owing to rising volumes of air traffic flying over the Midlands, EMA was given its own area of controlled airspace (CAS). This comprised two control zones and 15 contiguous control areas, all of which were effective between different altitudes. This gave EMA “absolute power over all aircraft in the locality” as pilots had to request authorisation from EMA’s air traffic controllers to use the airspace and had to adhere to their instructions (cited in Walker 2005 p61).

The longer runway, protected airspace, and improved navigation aids enabled higher-capacity aircraft to operate without any payload penalties in all but the worst weather conditions, day and night, and these improved operational capabilities attracted new cargo operators (see Walker 2005). Given its central location, good road links, and efficient customs, the airport boasted that ‘[g]oods for export can leave EMA after 8pm and be in Brussels or Copenhagen in the early hours of the following morning’

\(^{20}\) ILSs transmit two radio beams from the end of the runway threshold up to 25 miles away from the airport that indicate the location of the runway’s centreline and the correct angle of approach.
(Anon 1965 p19). According to Metcalfe (1970 p43), such speedy delivery ‘impresses customers everywhere’ and enabled EMA to ‘assist all [businesses] who want to meet the deadlines on delivery and so help their prestige’.

### 3.2 Spectacle and spectatorship at NEMA

Like many other European airports during the late 1960s and 1970s, EMA actively encouraged public spectatorship and the visual consumption of aviation activities and provided ‘spotters’ with a viewing balcony and an open-air terrace that offered uninterrupted views across the airfield (Figure 3.11). Hunt (1966 p63) eulogised that ‘there is rarely a dull moment [at EMA] and a visit as spectator or restaurant-user is almost certain to enthuse the most hardened “penguin” into getting airborne’. The airport authority also undertook a public education programme during the late 1960s and early 1970s to stimulate interest in air travel and make the population of the East Midlands more ‘air-minded’ (Metcalfe 1972). Back in 1934, St John Sprigg (p123) observed that ‘nothing is so instructive and entertaining than a day spent at Croydon watching the air liners of five countries arriving and departing’, and it was hoped that a day spent ‘spotting’ at EMA would be similarly informative. Hunt (1966 p63) praised the fact that ‘aircraft enthusiasts are welcomed’ at EMA and congratulated the airport on providing spectators with their own viewing terrace and dedicated car park close to the terminal. It was hoped this space of spectatorship would allow both passengers and non-travelling members of the public to enjoy ‘the daily routine of aeroplanes landing and taking off’ (Smith and Toulire 2000 p22). For as Adey (2006 p13) notes, people ‘came to watch, record aircraft and enjoy the sensory encounter of the noise and vibration the aircraft produced’ in ever-increasing numbers.

Figure 3.11 EMA - the view from the terminal, early 1970s.
However, like at other British airports, the provision of spectator facilities was not entirely altruistic and (non-travelling) visitors were expected to contribute to the airport’s financial viability by purchasing items from concessionary stands, including newsagents and refreshment kiosks, while they absorbed the excitement of the view from the terminal (see Veale 1947; Greif 1979). The popularity of the site meant that on weekend summer afternoons the viewing balcony was frequently crowded (Figure 3.12) and the Airport Authority took the decision to develop a larger viewing area on an 11-acre site east of the terminal building (Walker 2005). The new facility afforded spectators a good view of the runway, and a car park, toilets, and refreshment stand were provided (Metcalfe 1972). However, while ostensibly providing better facilities, it represented the first stage in a programme whereby the airport progressively ostracised spectators from the terminal to the airport margins. As Adey (2006) notes, until their voluminous presence began to interfere with the smooth and efficient flow of passengers through the terminal, spectators were considered an integral part of the airport experience and actively encouraged.

Figure 3.12 Watching 'planes - spectators on the viewing balcony at EMA observe the activity below.

Although public interest in spotting aircraft at EMA never reached the level of that at Berlin Tempelhof or London Croydon, where hundreds of people regularly abandoned traditional weekend pursuits to watch aircraft (Greif 1979; Pearman 2004), several thousand people turned up on June 3rd 1971 to see an Eastern Airlines Lockheed Tristar, fitted with locally produced Rolls-Royce RB211 engines, perform a fly-past prior to landing at EMA on a publicity tour21 (Walker 2005). Though records

21 The level of public support almost willed the project to succeed, as the commercial future of the engine-airframe combination was by no means assured, yet the health of both Derby's and the wider East Midlands’ economy was dependent on securing international certification and utilisation.
of the public response to this event are sparse, the opportunity to see the giant jetliner close-up undoubtedly represented 'an exhilarating afternoon' and presented 'an exciting spectacle for the modern mind', just as the first generation of passenger aircraft had done in the 1930s (Brittain 1933 p36). Curious onlookers, who did not have a security pass to go out onto the apron, blocked approach roads, crowded onto the terminal’s viewing balcony, and besieged the enthusiast’s viewing area (Walker 2005), while passengers boarding other flights were seen to admire the massive tri-jet (Figure 3.13). Ironically, though this engine would ‘shrink the world’ for thousands of passengers, it was only fitted to the largest long-haul aircraft that flew transcontinental routes from Heathrow, leaving passengers at East Midlands flying on smaller, slower, older aircraft.

**Figure 3.13 Flying to the future.** Passengers boarding a BMA 1-11 admire the latest addition to Eastern Airways’ fleet.

![Image of BMA 1-11](source: author's collection)

Visits by the supersonic Anglo-French Concorde also drew vast crowds but, increasingly, visitors came to absorb the glamour and celebrity of aviation, as ‘airport scenes became customary ingredients in stories depicting the life of the rich and famous’ (Dierikx and Bouwens 1997 p79). Later that decade, EMA welcomed Prince Charles, Prime Ministers Callaghan and Thatcher, Senator Edward Kennedy and his wife, and the victorious Nottingham Forest Football Club (complete with European Cup), along with numerous local sports and media personalities (Walker 2005). Press coverage of these arrivals promoted the ‘glamour’ of the airport and helped bring national recognition to the region, just as the controlling Councils had hoped (ibid. 2005).
However, a new national airports plan written by the newly formed Civil Aviation Authority (CAA) expressed concern that the close proximity of so many airports in the English Midlands was, ironically, damaging to competition and sweeping rationalisation was advocated (CAA 1972). The Central England Air Study concluded that in order to achieve maximum efficiencies, Blackpool, Leeds-Bradford, Liverpool, Manchester, East Midlands, and Birmingham should be closed and replaced by two new facilities in North Cheshire and the West Midlands, while the ‘next best’ solution would involve the closure of all facilities except Manchester and Birmingham (Sealy 1976). However, fortunately for EMA, these proposals were never effected.

3.3 EMA in the 1970s and 1980s
Throughout the 1970s, the growth in demand for foreign inclusive-tour (package) holidays stimulated further growth in flights and passengers at EMA and, to keep track of the status of individual services, a ‘flutterboard’ was installed in the terminal in the middle of the decade. Although its electromechanical components were prone to failure, this new technology arguably epitomised the excitement of air travel (Walker 2005). Lodge (1984 p339) captures the thrill of this new equipment in his description of Heathrow’s flight announcer, ‘Every few minutes the board twitched to life, and the names flickered and chattered and tumbled and rotated...like the components of some complicated mechanical game of chance, a gigantic geographical fruit machine, until they came to rest once more’. A NEMA employee similarly recounted, “if you stood and watched the board being updated you could be taken on an amazing whistle-stop tour of the world. Dozens of airports would click briefly into view as the board flapped between Amsterdam and Zurich, passing all alphabetical points in-between” (cited in Walker 2005 p65). Even if flights didn’t serve all these destinations at present, the very fact they were on the board implied a possibility of doing so in the future (c.f. de Botton 2002). By 1976, 38 different destinations were served (EMA 1976).

On EMA’s 10th anniversary, the Airport Authority eulogised that ‘East Midlands Airport [has] blossomed into one of the country’s leading provincial airports and a worthy representative of the large industrial area from which it takes its name’ (EMA 1976 p22). Indeed, despite the global economic downturn following the 1973 Oil Crisis, annual passenger numbers rose from 288,150 in 1970 to 593,500 in 1979, and
cargo throughput increased from 1,586 to 6,283 tonnes (Walker 2005). Unsurprisingly, the local impact of the airport was officially couched in terms of tangible economic benefits to the region, but as aircraft got bigger and jet engines replaced propellers, an alternative conception of the airport’s deleterious anti-social elements began to emerge. In early 1974, British Midland Airways was contracted to train Sudan Airways’ B707 pilots at EMA and the resulting training flights so incensed local residents that the airport received 200 letters of complaint in the first nine months of that year compared with just 300 in its first eight years of operation (CAA 1974). Opposition was particularly acute in the villages of Kegworth and East Leake, which lay to the east of the airport under the final approach paths, but local concern was largely dismissed as the majority of letters came from a few individuals (ibid. 1974).

The first official public recognition of the worsening acoustic climate at EMA took the form of a full-page advertisement for Britannia Airways in the 1976 edition of the airport’s official handbook, which emphasised the carrier’s commitment to reducing the acoustic impact of their services on neighbouring communities by investing in new airframes (Figure 3.14).

Figure 3.14 Britannia Airways advertise their environmental credentials. Significantly, the aircraft that is illustrated is now banned from European skies on account of it breaching European noise legislation (Johnson 2003).
The annual report of 1979/80 revealed a 13.9% year-on-year increase in cargo passing through the airport\textsuperscript{22}, and reiterated the management's intentions to extend the runway further to ensure EMA stayed 'ahead of comparable airports', to enhance the region's competitiveness (EMA 1976). Councillor Marshall argued that "[t]he further extension of the runway is vital for the future economic growth of the area, particularly at a time when there is talk of world recession and our businessmen are having to travel further afield and more often in search of orders" (cited in Walker 2005 p67). These 'aerial ambassadors' of East Midlands-based manufacturing companies hoped to bring the World (or at least Europe) back to the region to bolster flagging sales. The Airport Authority argued EMA 'ensured the region a place on the world map and an influential and often outspoken voice in the world councils of civil aviation. The East Midlands, its people, their products, and their leaders are known from Los Angeles to Nairobi, from North Cape to Cape Town through the airport's representation on international bodies', arguing 'this can only enhance the reputation of the East Midlands as a progressive region and may help to attract foreign investment to the area' (EMA 1976 p21), but stagnating traffic figures at the end of the decade indicated the rest of the World was largely ignorant of where the airport or the 'East Midlands' were (Walker 2005).

In an attempt to raise the region's profile and generate inbound tourism, the second edition of the Official Airport Handbook included a section entitled 'out and about near the airport', which promoted regional tourist and leisure opportunities in Leicester, Derby, Castle Donington, and Nottingham (Hunt 1966). This feature was expanded in future editions to include sites in Rutland, Burton-on-Trent, Lincolnshire, and Northamptonshire (Metcalfe 1970) and was an attempt to engage airport users with 'local' attractions, of which (realising there was revenue potential in attracting the non-travelling public) the airport progressively marketed itself as one (Figure 3.15).

\textsuperscript{22} Part of this increase was attributable to the success of the RB211 programme and the need to ship engines and components around the world, and the other due to a tunnel collapse on the west coast mainline which forced the Royal Mail to transfer overnight delivery services to the airport.
Figure 3.15 The airport as tourist attraction, an advert for the Aeropark (left) and a marketing postcard (right), both from the mid 1980s. Interestingly, the name on the postcard is at odds with that on the terminal.

However, airside expansion necessitated the closure of the original viewing facility in late 1983 and its relocation to a new site near the threshold of runway 27. The new ‘Aeropark’ opened six months later at a cost of £300,000, and featured a number of static aircraft exhibits, a Visitor Centre, play area, and viewing mound (Walker 2005), the latter of which afforded excellent views of the runway (Figure 3.16).

Figure 3.16 The aeropark as a tourist destination. A large crowd watch the arrival of a British Airways Concorde

Yet, despite local recognition as the region’s ‘home’ airport, and a tourist destination in its own right, EMA began its third decade of operation amid something of an identity crisis and £10,000 was spent on market research into the effect of prefixing the airport’s name with ‘Nottingham’. However, the idea caused consternation in Leicestershire and Derbyshire and, in 1983, a compromise was reached whereby the
facility was renamed ‘East Midlands International Airport’ (EMIA) to emphasise the global reach of services. However, the qualification ultimately proved superfluous, and the original name was reinstated 11 years later (Bonser 2001).

In 1985, the airport handled one million passengers a year for the first time and was ranked the 4th busiest cargo airport in the country with an throughput of 27,779 metric tonnes, representing the largest growth among all UK regional airports (Walker 2005). In December 1986, 21 years after her father, Prince Philip, had officially opened the original terminal building, HRH Princess Royal opened a further £3.8m terminal extension, which would allow the airport to handle 1.5m passengers a year, as demand for charter flights continued unabated (ibid. 2005). However, Public Sector Borrowing restrictions prevented the Airport Authority from making any further substantial investments in infrastructure (Humphreys and Francis 2002).

In 1987, under the then Conservative Government’s 1986 Airport Act, EMIA (along with 15 other municipally-owned UK airports that had met the criteria of having a turnover in excess of £1m in two of the previous three years) was privatised (Humphreys and Francis 2002), and the resulting ‘Public Airport Company’ (PAC) operated at ‘arms length’ by the controlling Councils, much to the annoyance of local (Labour) Councillors (Department of Transport 1986). One wrote, ‘I find it disgraceful that local government, after years of bearing the financial risk of the airport, should now have the benefits of their enterprise reduced by central government which has borne no risk in the past and will not in the future. The legislation is only a means to allow the Treasury to dip their fingers into the local government till’, whereas proponents of privatisation argued the PAC could attract the private investment needed to finance further expansion (cited in Walker 2005 p83). Indeed, the ability to secure private investment was cited by five of the seven regional UK airports that were privatised in 1987 as the most important benefit (Humphreys 1999). The imperative to become financially self-sufficient through the generation of additional revenue placed new emphasis on developing non-aeronautical activities (including hotels, business parks, and retail outlets). At EMIA, freedom from Public Sector Borrowing regulations released the capital needed for the construction of the

Without doubt, the most tragic event in EMIA’s history occurred in January 1989, when a British Midland B737-400 en-route from Heathrow to Belfast crashed onto the embankment of the M1 just short of the runway while attempting an emergency landing (see Figure 3.17 and Chapter Six). While official investigations concentrated on determining the cause of the crash and apportioning ‘blame’ for the accident, no research was published into whether the ‘Kegworth Air Disaster’, as it later became known, changed local attitudes towards the airport.18

Figure 3.17 The Kegworth crash, Sunday 8th January 1989. The remains of the British Midland jet on the M1 embankment (left), and the memorial to the 47 victims (right).

Source: http://www.news.bbc.co.uk and http://www.kegworthvillage.com/history/air_disaster.php

3.4 The 1990s – recession, privatisation, and gradual expansion
The airport’s 25th anniversary came at a time of deep recession, with high interest rates and soaring oil prices reducing passenger demand (Walker 2005). In 1990, passenger numbers fell 12% on 1989 figures, and rumours began circulating that the controlling Councils were planning to sell their shares to the private sector (ibid. 2005). Owing to the uncertainty surrounding EMA’s future commercial viability and ownership, the first few years of the 1990s were characterised by a period of ‘make do and mend’, and no substantial investment was made until 1992, when EMIA became the first municipal airport to install the necessary landing aids and runway lighting.

18 However, research conducted in the aftermath of the December 1994 Air Algérie crash at Coventry, revealed high anxiety levels among the local population, who feared further accidents (see Cheung et al. 2000).
and be approved for Category II (CAT II) operations, allowing it to remain open during times of relatively low visibility and poor weather.

Rumours of a sell-off proved accurate and, on 6th August 1993, EMIA became the first major UK regional airport to be privatised when the National Express Group purchased the site for £24.3 million (EMIA 1993). During their eight years of ownership, investments totalling £77m, including £20m on a further runway extension24, £8m on redeveloping the terminal, and £3.5m on a new air traffic control tower, were made (Walker 2005). One of the most significant developments was in the airport’s ATC department, and EMIA became the first airport to obtain approval from the Civil Aviation Authority to use colour radar displays, which ‘decluttered’ the image and made it easier for ATCOs to interpret (EMIA 1993).

With this in place, the new Board of Directors expressed a desire ‘to move the Airport from being one of high cost and low throughput to a low cost, high throughput passenger interchange’ and they took the unprecedented step of reducing landing fees to tempt existing carriers to increase flight frequencies and to encourage new operators to the airport (EMA 1994 p2). By the end of 1994, EMIA was among the world’s top 100 airports and was the second fastest-growing cargo hub in the UK. Passenger, freight, mail, and air traffic movements increased 18%, 92%, 19% and 20% respectively on 1993 figures25, and the airport made pre-tax profits of £6.4m on a turnover of £19.5m (ibid. 1994). The 1993-94 financial year was the first time the airport had been run purely as a commercial enterprise, and the annual report recognised that the changing regulatory and economic environment in which they were operating meant that a ‘successful modern airport is [now] much more than an aerodrome. It is a complex intermodal transportation centre; a commercial entity and responsible partner in the economic development of its region’ (ibid. 1994 p1), and, as such, the management team actively looked at expanding airfreight operations as a way of bolstering local economic development.

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24 As a result, the runway is now the sixth longest in the UK, allowing wide-bodied freight aircraft to operate without any payload penalty (Shaw 1999b).
25 Passenger services to Aberdeen, Edinburgh, Paris CDG, Palma and Ibiza saw the most dramatic growth, increasing 26, 27, 20, 53 and 65 per cent respectively (EMA 1994).
In late 1994, the airport succeeded in persuading the American logistics firm UPS to join DHL (who had began operating from the airport in 1989) in centralising their operations at East Midlands (EMA 1994; Dixon 2001b). However, while this generated new employment opportunities, the commercial imperatives of UPS and DHL's business dictates that the majority of flights occur at night to satisfy client’s demanding next-day delivery requirements, an operating characteristic that has led to considerable resentment among local residents who claim the noise from such flights deprives them of their ‘right’ to sleep (see Chapter Four).

As a condition of purchase, National Express agreed not to change the airport’s name for at least 12 months, but market research carried out during 1994 identified over 40 possible future names for the site, ranging from the obvious – Leicester, Derby, Nottingham – through ‘regional’ names – Central England, Air Centre UK - to the more esoteric – Robin Hood (now used by Doncaster airport), Sherwood Forest, and even Ivanhoe International (EMA 1994). Furthermore, the research indicated that ‘if any one city name were to be chosen, it should be Nottingham’, but it determined that ‘there was no great desire for a change amongst our passengers, our airlines, or our tour operators’, although business leaders and local politicians apparently supported the change (ibid. 1994 p7). Unsurprisingly, ‘whilst everybody in Nottingham appeared to want it called Nottingham, those in Derby and Leicester wanted it to stay as it was’ (idem.). A new corporate identity was eventually unveiled on December 20th 1994; the airport’s name reverted back to ‘East Midlands Airport’, and a new logo featuring a stylised yellow bow and arrow that alluded to the airport’s location in ‘Robin Hood Country’ while proving a visual indication of flight was adopted. In recognition of their ‘tri-city’ status, the airport created three sub-brands to promote each city as having its own airport26, an opportunity that was reportedly ‘seized upon with alacrity’ by the individual cities (EMA 1994 p7).

3.5 Building for the future

The new identity was launched alongside a Strategic Development Plan (SDP), which outlined how the airport ‘can grow to meet increasing demand whilst remaining environmentally sound and living in harmony with its neighbours’ (EMA 1994 p7).

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26 Unimaginatively called ‘East Midlands Airport-Derby’, ‘East Midlands Airport-Leicester’ and ‘East Midlands Airport-Nottingham’.
The SDP foresaw a long-term need for a second terminal and a boarding pier, complete with direct-access airbridges (EMIA 1993), but the arrival of low-cost carriers later in that decade, who actively eschew such facilities, meant the airbridges were never constructed and passengers still access aircraft via steps from the apron. The SDP also anticipated the need for larger cargo facilities, and, in 1996, the ‘aeropark’ was again evicted from its site as the land it had occupied was earmarked for future cargo development. While the outdoor exhibits were eventually relocated to the northwestern side of the airport in August 2001 (Figure 3.18), the exhibition has yet to be replaced, indicating that global commercial forces have long taken precedence over local leisure and historical interests.

Figure 3.18 The new Aeropark, spring 2006

![Image of the new Aeropark]

Photographs: author

Nevertheless, the relocated facility remains popular, welcoming its 50,000th paying visitor in July 2005 (Flightscene 2005). Local residents, dog walkers, and visitors also make use of the ‘Airport Trail’, a six-kilometre long perimeter path around the airport that affords views over the runway and features aeronautically themed sculptures (Figure 3.19).

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27 Steve Gensler, Manager of the NEMA Aviation Hobby Shop, personal communication (2006).
Extensions were also made to the passenger buildings, with an £8m terminal enhancement programme (approved in January 1995) becoming operational in 1996 (Walker 2005). The enlarged facilities, combined with the commercial management strategy of National Express, stimulated the growth of both cargo and passenger services. By 1995, EMA was the UK’s largest pure cargo airport\(^{28}\) (a position it has maintained to the present day) and supported a range of scheduled European services and seasonal charter flights.

In March 1999, construction began on a new 62-acre ‘Pegasus’ business park on land to the east of the main terminal, while the new air traffic control tower became operational the following month (Walker 2005). Built by Christiani Nielsen at a cost of £3.5m, the new tower represented the latest stage in the airport’s transformation into a serious competitor in the regional airport market. Indeed, its completion arguably did more than provide the airport’s Air Traffic Services Department with a more modern and higher working platform, as its design symbolised power and aspiration, interlocking issues of regional pride and esteem. This ‘one-upmanship’ was reflected in the fact that, on completion, the airport boasted that it was ‘the second tallest ATC tower in the country’ (EMA 2000 p15), implying that this alone was sufficient to confer respect and admiration. Barry Thompson, NEMA’s Finance Director, deemed it “symbolic of the ambition of the airport” and believed its presence had a fundamental affect on perceptions of EMA (cited in Walker 2005 p123) (Figure 3.20).

\(^{28}\) ‘Pure cargo’ refers to freight that is carried on designated cargo aircraft. ‘Belly hold’ cargo refers to freight that is carried in the hold of scheduled passenger services.
As will be discussed in Chapter Five, the tower prescribes an invisible, yet highly regulated and controlled, aerial space that serves to produce a particular notion of territoriality, reinforcing the divisions between inside and outside, ‘us’ and ‘them’, permitted and prohibited, where the authority of controllers to issue instructions and use radar to monitor individual aircraft reflects the tower’s actual domination of the aerial space within its jurisdiction and range. In an effort to satisfy local curiosity, local residents were invited to climb the tower to appreciate the view before it became operational (EMA 2000).

3.6 Flying into the Millennium, the Airport in the 21st century

By the end of 2000, National Express put East Midlands and Bournemouth airports up for sale and sold both facilities to Manchester Airports Group (MAG) in March 2001 for £241m (www.nottinghamema.com 2005). MAG’s experience as a privatised airport operator helped attract new carriers and services to the airport, but there was concern that being owned by a group of local authorities geographically distant from EMA would have profound impacts on its future development, ‘as the interests of airline and airport shareholders may not necessarily coincide with regional and national economic interests’ (Humphreys and Francis 2002 p257).

On December 13th 2001, EMA joined the low-cost revolution when ‘go’ announced EMA would become its third UK base after Stansted and Bristol, flying to Alicante, Faro, and Malaga from £59 return, and Edinburgh and Glasgow from £25 return (Cassani 2003). The confirmation that go was entering into direct competition with British Midland caused the resident incumbent carrier to establish bmibaby, a wholly-
owned low-cost subsidiary (Harper 2002). Go began operations on 15th March 2002
and based two B737-300s at the airport, enabling them to offer 56 flights a week,
while bmibaby began flying later that month with three B737s to Malaga, Barcelona,
Dublin, Faro, Murcia, Nice, Palma and Prague (Flightscene 2002). To promote their
services, go released 10,000 free seats while bmibaby sold over 49,000 tickets in their
first month of operation, a fact that, according to a bmibaby spokesperson, reflected
the extent of the “pent-up frustration” for low-cost travel in the East Midlands
(Flightscene 2002, Cassani 2003). Following a £374m take-over of rival go, easyJet
began flying from EMA in late 2002 (Jones L 2005).

The inauguration of these low-cost services to major European cities arguably
changed public perception of EMA, transforming it from a ‘bucket and spade airport’
into a preferable low-cost local alternative to Luton and Stansted, and passenger
numbers increased by two million in two years (Walker 2005). This, coupled with
continued strong growth in the cargo sector (see Figure 3.21) resulted in the number
of air traffic movements increasing from 27,000 to 51,000 per annum between 1993-
2003 (CAA 2004a).

Figure 3.21 Passenger and cargo throughput at NEMA, 1993-2003

Source: Derived from Tables 2.2b and 2.2c, CAA (2004a).
However, while passenger numbers ostensibly appeared buoyant, there was concern EMA was not generating sufficient levels of inbound tourism. Bmibaby’s then-Managing Director, Tony Davis, thus decided in late 2003 to market the airport as ‘Nottingham East Midlands’ in all his company’s advertising copy, including the website, bmibaby.com, and actively lobbied MAG to change the airport’s name (Martin 2004b). As he explained, “Travel agents in Europe really didn’t know where or what the East Midlands was. It isn’t marked on any maps and we were having to give people a geography lesson before selling them a seat...The East Midlands has no natural capital but Nottingham, because of its history and association with Robin Hood, is the place foreign travellers recognise and want to visit” (cited in ibid. 2004b p8). On January 20th 2004, EMA was officially renamed ‘Nottingham East Midlands Airport’ (NEMA) with the then-Managing Director of MAG, Graham Keddie, asserting that the decision was based “purely on commercial imperatives” to “ensure the continued success of the airport and our airline partners at a time when increasing numbers of people are rightly choosing the more personal service and convenience of smaller regional airports over major international terminals” (cited in Walker 2005 p157). While many business leaders and politicians welcomed the change, it caused much consternation among residents of Derbyshire and Leicestershire who considered it a slight on their counties and vowed not to use the airport in protest (Fletcher 2005). Amid the controversy, Ryanair, another key player in the low-cost airline sector inaugurated services to Dublin, Murcia, and Barcelona (Girona) in April 2004 (Figure 3.22). In August 2004, bmibaby reported it flew 25% more passengers into the airport (representing an increase of some 50,000 people) since it was renamed (Martin 2004b), although the extent to which that increase can be attributed to the name change alone is questionable.

29 This raised the question of importance of local place in an otherwise apparently ‘spaceless’ realm of international air travel, especially as the airport is in Leicestershire, but has a Derbyshire postcode and ‘Nottingham’ in the name.
Figure 3.22 Ryanair lands in the East Midlands, spring 2004. By 2006, the carrier’s NEMA-based network had expanded to 15 destinations, several of which (including Lodz and Wroclaw) had never previously been served from the airport.

3.7 The airport today

In 2004, NEMA handled 4,375,000 passengers and uplifted 227,000 tonnes of cargo on 54,000 separate flights, making it the 12th busiest passenger airport and the UK’s largest ‘pure’ cargo hub\(^{30}\) (CAA 2005c). In May 2005, NEMA processed 29% of the UK’s total pure cargo and 20.5% of the country’s pure mail. If belly-hold cargo\(^{31}\) is included, NEMA emerges as the second busiest cargo gateway in the country, with a market share of 10.7%, exceeding that of Stansted, Gatwick and Manchester (www NEMA 2005). Furthermore, NEMA is the 13th largest cargo airport in Europe and among the top 75 in the world\(^{32}\) (ibid. 2005). Depending on the operator, these aircraft are serviced on either the eastern or western cargo areas either side of the passenger terminal (Figure 3.23).

The airport currently supports a network of scheduled European routes, a range of charter flights to popular leisure destinations, and an integrated network of long-haul and European cargo services. As of May 2006, resident airlines included low-cost

\(^{30}\) ‘Pure’ cargo refers to freight and mail carried on dedicated aircraft.

\(^{31}\) Belly hold freight is carried in the hold of scheduled passenger flights.

\(^{32}\) As a result of repeated runway extensions, NEMA can handle the largest cargo aircraft with no payload penalty and is one of the few airports in the UK to regularly handle the Antonov-124F.
Figure 3.23 Annotated satellite image of NEMA, 2006
Source: adapted from Google Earth

- Aeropark
- Castle Donington
- Old military aircraft dispersals
- Runway 09-27
- New DHL sorting facility and western cargo apron
- Maintenance area and flying school
- Passenger Terminal and central apron
- Eastern cargo apron
- Nottingham, Sheffield, and the North (via M1)
- Pegasus business park
- M1 Motorway
- Loughborough, Leicester and the South (via M1)
carriers bmibaby, easyJet and Ryanair and scheduled full-service carriers bmi regional and Eastern Airways, while specialist cargo operators Atlas Air, Channel Express, DHL, Gemini, Kalitta, Lufthansa Cargo, UPS and Volga-Dnepr are all regular visitors\(^{33}\) (NEMA website 2005).

In December 2003, the British Government published the ‘Future of Air Transport’ White Paper, which recognised the importance of developing both passenger and freight services at NEMA. By 2030, it predicted the airport could be handling between 12-14 million passengers and more than 2.5 million tonnes of freight on 60,000 cargo flights a year (DfT 2003a). While it did not support the option of a second runway, it recognised the ‘particular importance of airfreight to the future national and regional economy’ and considered ‘the predicted expansion of air freight operations at East Midlands should be permitted’ \(\text{if this was ‘accompanied by stringent controls on night noise’} \) (ibid. 2003 p98).

In 1970, it was recognised that ‘the part played by freight movements in the success story of the East Midlands Airport \[will\] ... be considerable’ (Metcalfe 1970 p41), and substantial investment has been made to attract and retain cargo companies. In 2000, approximately 2000 tonnes of freight was flown around Europe every night, and demand for this type of service is expected to grow (Dixon 2001b, 2004). Unlike the majority of UK airports, NEMA has an unrestricted 24-hour operating licence and no restriction on night flying\(^{34}\), a feature that confers significant competitive advantage over rival facilities and makes it an attractive proposition for cargo operators who specialise in supplying time-critical components to customers who are reliant on rapid and flexible supply chains (see Gillingwater \textit{et al} 2003). NEMA has developed a significant night-time cargo operation, with up to 60 aircraft every night operating between the hours of 23:30 and 06:00 local, more than any other UK airport (Edwards 2005f).

\(^{33}\text{In particular, NEMA has developed a reputation for handling outsized or unusual cargo. In November 2005, the British clothing chain, Primark, chartered the world’s largest aircraft, the Antonov-225 to import a shipment of clothes from China after a warehouse fire destroyed the majority of their stock (Hanif 2005), while other aircraft have been chartered to fly emergency aid to victims of natural disasters.}\)

\(^{34}\text{The only other airports in the UK with no operating restrictions are Prestwick, Newcastle, Cardiff and Liverpool.}\)
NEMA’s operations thus exhibit a temporal profile unlike any other UK airport, with the majority of traffic operating in the late evening/early morning rather than the middle of the day (Figure 3.24). Furthermore, these night flights (those operating between 23:00-07:00 local) are not equally distributed during the week, with the majority occurring Tuesday-Saturday inclusive, a phenomenon which is explained by the fact that cargo carriers effectively operate ‘behind time’, with goods picked up Monday evening being dispatched early Tuesday morning (see Figure 3.25). The scale of the night flying operation is revealed by ATC figures that, when analysed, show nearly a third (31%) of ATMs in November 2005 occurred during the night.

Figure 3.24 Temporal distribution of commercial air traffic movements at NEMA during a week in November 2005

![Temporal distribution chart]

Source: data derived and extrapolated from NEMA’s ATS records and flight schedules by the author (2005)

While European legislation bans the noisiest aircraft from operating in European airspace, cargo carriers tend to operate older (and therefore noisier and less efficient) airframes (such as A300s, B757s, B767s and B747s) that have been converted from passenger use. Although DHL replaced their ageing B727 fleet with 26 ex-British Airways B757s during 2002/03, and UPS substituted newer B767s for DC-8s, the Campaign to Protect Rural England (2003d p20) expressed concern that EMA’s 24 hours operation creates a ‘significant night-time noise disturbance to residents across a wide area’ and that ‘an unconstrained increase in the volume of flights can only have an increasingly negative impact on tranquillity, and therefore on people’s...quality of life’ (see Chapter Four).
Figure 3.25 A graph showing the % night flights at NEMA during November 2005 by day of the week
(N.B. figures refer to the total number of movements in any given 24hr period)

Source: NEMA ATS records (November 2005)
NEMA recognises night noise is a highly contentious issue and, to reduce the numbers of people affected by it, introduced noise preferential routes (NPRs) in March 2001 to keep aircraft away from major settlements (Dixon 2004). Pilots are requested to ‘ensure that, as far as practicable, all acft [sic] are operated at all times in a manner calculated to cause least disturbance in areas surrounding the airport’ (AERAD 2003 C1), and instructed to follow all noise abatement procedures, including minimising the use of reverse thrust on landing and, whenever possible, adhering to the airport’s night noise policy (NEMA 2005b).

The NPRs are policed using a Noise and Track Monitoring System (NTMS) that was installed in 2001 at a cost of £250,000. Aircraft that deviate from these prescribed routes are identified and fined and the proceeds used to fund local community projects (Leicester Mercury 2006e). The NTMS automatically records all commercial and military flights up to 15,000ft within a 30km radius of the airport, enabling the Environment and Safeguarding Department to identify aircraft that cause complaints and penalise operators whose aircraft deviate from the tracks. As a result, NPR compliance averages around 98% across all operators (www.nottinghamemena.com 2006). To discourage the operation of noisier airframes at night, and mitigate against those that do, the airport has implemented differential landing charges for day and night-time operations, imposes restrictions on overflying local villages, and offers local property owners subsidised noise insulation (Dixon 2004).

However, despite these measures, the Labour M.P. for North-West Leicestershire, David Taylor, complained “night noise from the heavens has made East Midlands Airport the neighbour from hell” (cited in Hansard 09/02/2005 Column 427WH). Night noise is considered especially controversial in rural areas, as lower ambient noise levels mean sudden noise peaks are arguably more disruptive (CPRE 2003d). In 2000, an independent noise review report reported that NEMA’s night noise emissions were

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37 Both lateral and vertical tolerance criteria are applied. An aircraft is considered to have violated the NPR if it strays beyond + or - 10 degrees from the route centreline, and/or fails to achieve prescribed altitudes or climb rates (NEMA ACP EIA 2003 p4), and are effective up to 5000ft for northerly departures and 6000ft for southerly ones (Neil Robinson, NEMA Environment and Safeguarding Manager – personal communication, 2006).

38 For example, DHL’s elderly B727F fleet were responsible for 40% of all complaints in 1999/2000 and the airport worked with the operator to speed up their replacement (Jenny Saville, Environment and Safeguarding Officer NEMA, personal communication, 2006).
the equivalent to 15,882 units, compared with 9,750 at Heathrow and 4000 at Birmingham (Taylor 2001). In recognition of the extent of this night noise burden, local M.P.s are pressurising the Aviation Minister to designate NEMA under Sections 78/9 of the 1982 Civil Aviation Act, which would cap the number of night flights permitted but, as yet, there is no indication this will occur (see Chapter Four).

3.8 Crowded skies – airspace expansion at NEMA
The recent growth and anticipated future expansion in air traffic at NEMA has had significant implications on the way air traffic movements in and out of the airport are managed. Although the existing configuration of controlled airspace (CAS) had been adequate to accommodate previous volumes of traffic, concern about its ability to handle future air traffic flows prompted the airport to submit an airspace change proposal (ACP) to the UK’s Civil Aviation Authority (CAA) in November 2003 (NEMA 2004a). The timing of the application was significant, with the airport hoping to get approval for the changes in advance of the December 2003 publication of the DfT’s Future of Air Transport White Paper, which, it was hoped, would give NEMA the ‘green light’ for expansion. The rationale was that the proposed changes would ensure that ATC could continue to safely and efficiently handle rising volumes of air traffic while minimising the impact of airport operations on local communities by re-routing flightpaths away from densely populated areas (see CAA 2004c).

The ACP had three objectives,

1. To ensure the safe separation and management of air traffic.
2. To minimise the environmental impact of airport operations by reducing the number of people affected by aircraft noise.
3. To improve the efficiency of the air traffic control system to enable it to safely handle predicted increases in air traffic.

In order to achieve these aims, it was necessary to modify the existing airspace structure by altering arrival and departure procedures and re-siting the two holding areas or ‘stacks’ further away from the airport. This reorganisation was complicated

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39 These figures are based on ‘Quota Counts’ (QC), a method that awards aircraft different noise scores depending on their acoustic impact. The quietest aircraft receive a score of 0.5 units, and the noisiest, 16. These scores are added up over the year to calculate the annual noise quota at any given airport.
by the fact that NEMA lies beneath one of the busiest and most complicated sectors of UK airspace, which accommodates the diverse operational requirements of commercial, military and general aviation traffic. To the south is the notoriously busy London Terminal Manoeuvring Area (TMA), to the north is Manchester Airport’s controlled airspace, to the west, is Birmingham Airport, while large Military Air Traffic Zones (MATZs) lie to the east in Lincolnshire (see Figure 3.26 overleaf, a graphic depicting this aerial complexity).

The old airspace configuration, adopted in 1971, comprised 13 separate Control Areas (CTAs) and two Control Zones (CTRs), which were effective between different altitudes (Figure 3.27). This structure provided safe passage to and from the higher altitude en-route airways, and enabled ATC to ‘arrange early transfers from en route sectors so that separation can be provided sooner, and landings expedited’ (Graves 1993 p120). Under this regime, departing aircraft were required to fly one of four Standard Instrument Departure Routes (SIDs); ‘ASNIP’ or ‘WALLASEY’ (both to the northwest), ‘DAVENTRY’ (to the south), or ‘TRENT’ (to the north), while arriving aircraft flew one of three Standard Terminal Arrival Routes (STARs) according to whether they were approaching the airport from the north or south. The plans involved rerouting both easterly and westerly arrivals and all easterly departures (see Figures 3.28, 3.29 and 3.30), the latter of which, given the prevailing wind direction, only account for approximately 30% of take-offs. Although the proposals inevitably involved exposing new areas to aircraft noise, the airport believed this was offset by an overall reduction in the number of people affected (over 90% fewer in some cases - see Appendix 1). However, residents who found themselves under the re-routed flightpaths mobilised against the plans, believing they would cause unacceptable levels of noise pollution which would have a detrimental effect on their health and local property prices (see Chapter Four).

3.9 Summary
This chapter has explored the historical evolution of the airfield at Castle Donington from its construction in 1916 through to the present day. It has shown that local opposition to expansion and aircraft noise have been a feature of the commercial
Figure 3.26 NTMS radar trace for 25th May 2005 showing all the commercial and military aircraft that transited through the airspace above the East Midlands up to an altitude of 15,000 ft. NEMA is in the centre of the image, and the thick red lines indicate the position of the noise preferential routes. Note the concentration of military traffic over Lincolnshire (top right), the diagonal band of traffic aligned NW-SE going up to/down from Manchester and Liverpool, and the dense ‘swirl’ of aircraft going in and out of Birmingham (bottom left). The approximate position of navigation beacons can also be determined from the ‘starburst’ patterns.

Source: courtesy of Jenny Saville, NEMA Environment and Safeguarding Department (2006), using parameters and filters specified by the author.
Figure 3.27 The old configuration of controlled airspace above NEMA comprised two control zones (red) and 13 control areas (indigo) that were effective (Eff.) between the indicated altitudes.

Source: based on an original CAA aeronautical chart with additional author’s annotations.
Figure 3.28 CAS and easterly arrivals at NEMA before and after the airspace reorganisation

(as drawn and interpreted by the author)
Figure 3.29 CAS and westerly arrivals at NEMA before and after the airspace reorganisation

(as drawn and interpreted by the author)
Figure 3.30 CAS and easterly departures at NEMA before and after the airspace reorganisation

(as drawn and interpreted by the author)
airport since opening in 1965, but that complaints were typically restricted to a few individuals who lived in the immediate vicinity of the airport. The May 2005 airspace reorganization, however, meant that many more people believed they would be adversely affected by aircraft noise and associated pollution. The following chapter thus provides a detailed account of the resulting controversy and suggests the local community’s response to the airspace change demands an understanding and appreciation of how airspace is produced. Subsequent chapters then explore how NEMA’s airspace is produced through the regulatory regimes and spatial practices of air traffic control and practised on the flightdeck of commercial aircraft using its airspace.
Chapter Four

“30,000 jets coming soon!” – The community response to NEMA’s airspace expansion

‘Substantial development at East Midlands [airport] would have the...disadvantage of modifying the character of what is now essentially a rural neighbourhood...Airports are more compatible with an urban environment...than with the more sparsely populated...‘unspoilt’ environment of our countryside’

CAA (1975 p38)

Image sources (l-r): WAAG website, HACANClearskies website, author’s collection

4.1 The ‘curse’ of hypermobility

Commercial air travel is becoming an increasingly emotive subject. The debate surrounding who should benefit, and, perhaps more importantly, who should suffer the impacts of aircraft noise and airport development has had a long pedigree and given society’s current socio-economic reliance on, and apparent ‘addiction’ to flying, this controversy appears to be intensifying as the relative cost of air travel declines and the number of flights increases. UK passenger numbers have increased five-fold in the last 30 years to the point where half the population flies at least once every 12 months, and freight traffic at UK airports has doubled since 1990 (DfT 2003a). In 2003, 200 million passengers used UK airports and 20% of all international flights began or ended in the UK (Upham 2003). If current growth forecasts prove accurate, British travellers alone will take over half a billion flights per year by 2030 (Jowit 2006).
Globally, demand is also expected to increase, and while certain markets (principally the United States) are considered close to saturation by some, countries in the less economically developed world are actively expanding their aviation services, leading to a net increase in global flights and passenger numbers (Pulford 2004). As a result, commercial aviation is rapidly becoming a victim of its own success and is starting to suffer from an acute case of ‘hyper-mobility’ (see Adams 1999). Capacity constraints on the ground and in the air combine to cause delays that cost the global economy billions of US dollars every year in lost productivity (Jury 1998; Carr-Brown and Macaskill 2001), while climatologists warn of catastrophic atmospheric damage resulting from high-altitude aircraft emissions1 (Ahmed 2003; Brown C 2005a; Clement 2005a; Jowit 2004; Juniper 2005; McCarthy et al 2005; Webster 2005b). As Clark (2004a) melodramatically reports, ‘saturation point’ has been reached in the skies above London and the South East, as demand for flights outstrips the capacity of airports and ATC personnel to process them (Figure 4.1)2.

Figure 4.1 London’s crowded skies: ‘Looks like the Mayor has extended the congestion charge upwards’


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1 N.B. the European Union is debating introducing an emissions tax or a carbon-trading scheme for airlines to counterbalance or ‘offset’ aircraft pollution (Castle 2005; Simpkins 2005).

2 Passenger demand and public propensity to fly are not uniformly distributed around the country. Given London’s primacy as an alpha world city (see Beaverstock et al 1999), air travel demand is concentrated on London’s three airports. Heathrow is the world’s busiest international airport, handling 68 million passengers and 470,000 flights in 2005 (Hales-Dutton 2006), Gatwick is the busiest single-runway airport in the world, and Stansted returns year-on-year double-digit passenger growth, ranking it alongside the fastest-growing airports in Europe (Kosky 2000). That said, the continued expansion of low-cost carriers (that predominantly use smaller regional airports) has spread the problem of airspace and runway congestion across the country (see Chapter Five).
This mismatch between supply and demand is driving the development of new airports, runways and air routes. But this process is controversial, with many communities opposing airspace expansion. In terms of Castells’ thesis, such protests might be considered examples of how the world of places conflicts with a space of flows as authentic and bounded places are seen to be threatened by the expansion of global airspace. This chapter presents a case study of the ongoing controversy surrounding the reorganisation of controlled airspace around Nottingham East Midlands Airport (NEMA) to explore how the production of airspace involves a ‘turf politics’ in which communities ‘on the ground’ challenge the prescribed geographies of the sky above them. While May and Hill (2006 p438) suggest that ‘aviation futures are...being increasingly contested at the local level’ owing to aircraft noise, this Chapter suggests other concerns, including trust, rural tranquillity, property devaluation, health impacts, and third party risk, have broadened and deepened the resolve of protesters. Furthermore, it suggests that a lack of public appreciation of the complex processes and work involved in producing and maintaining airspace is responsible for generating much of the local opposition and hostility NEMA encountered.

The primary data for this chapter was derived from interviews with key airport personnel, analysis of airport policy documents and official press statements, e-mails and letters from community protest groups, personal observation of public meetings and airport ‘roadshows’, letters and articles in local newspapers, television documentaries and radio phone-ins, Hansard records, press releases of Parliamentary debates, and relevant academic literature during the period Winter 2004 to Summer 2006 (see Appendix 2). Together with examples of other anti-airport protests from around the world, this Chapter seeks to bring a depth of analysis to an issue that has often been dismissed as merely reflecting the attitudes of a group of middle-class ‘Not-In-My-Back-Yard’ NIMBYs (see André 2004). It is hoped that a geographical exploration of how airspace is represented, lived, experienced, and practised by NEMA’s airport communities will lead to a better understanding of the tension(s) that currently exists in the field of aviation policy between global commercial objectives and local socio-environmental concerns.
4.2 “Not in, over, or near My Back Yard”: tactics of community protest

Community opposition to the siting or expansion of locally unwanted land uses is not a new phenomenon, and campaigns are not solely confined to objecting to transport developments, as debates surrounding the location of asylum reception centres (Hubbard 2005), quarries (Hattersley 2005; McNeish 2000), landfill sites (Pushchak and Rocha 1998), reservoirs (Cosgrove et al. 1996), mobile telephone masts (Spurgeon 2001; Walton 2002), windfarms (Brittan 2001; Woods 2003b; Burall 2004; Kelbie 2005), and sites for waste incineration (Davies 2005) have shown. However, while proposals for ‘improving’ transport networks remain high on both domestic and European political agendas, the siting of any new or expanded facility is responsible for generating often-acorimonious exchanges between local residents, municipalities, industry, environmental groups, and government agencies.

During the 1990s, the UK Government sanctioned an ambitious and, to some, misguided, programme of transport construction. Tens of thousands of people, not satisfied with accepting decisions based on little or no public consultation, responded by forming community protest groups (Rootes 2000), including well-publicised campaigns against the M3 at Twyford Down (McNeish 2000), the M77 near Glasgow (Routledge 1997), the M11 southern extension in east London (Drury et al 2003), and the Birmingham Northern Relief Road (now M6 Toll) in the West Midlands (Cathles 2000), where protesters established material and symbolic sites of resistance, in the form of protest camps, in the path of construction workers.

While the national perspective inevitably conceives transport developments as economic necessities, local citizens may perceive them as sources of danger, disturbance and anxiety. As Lidskog (2001) notes, the background to conflicts concerning Locally Unwanted Land Uses (LULUs) arises from a fundamental and often mutually incompatible tension between national priorities and local amenity interests, which highlights the discrepancy between the value judgements of different social actors. Macnaughten and Urry (1995) suggested that these different value judgments were a function of the simultaneous operation of countless diverse lifestyle

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3 Plans to place six additional mobile phone masts on the roof of Elizabeth House, a residential tower block in Leicester, were rejected on safety grounds after tenants complained of dizziness, nausea and headaches (Oadby and Wigston Mail 2005).
and value systems, but Hubbard (2005) notes that opposition is often underpinned by nimbyism and a desire to exclude otherness. Public attitudes, interests, ideas, knowledges and experiences can be seen to exhibit a temporal dimension, with individuals or groups embracing certain concepts for different reasons at different points in time. In the context of planning applications, all these differing perspectives can be articulated, which makes the task of reconciling the inevitable conflict of interests deeply problematic (Lidskog 2001).

While it is recognised that locally-unwanted land uses (LULUs) ‘have to go somewhere’, for technical or political reasons, this ‘somewhere’ is often spatially restricted and the literature highlights the well-documented propensity for such developments to gravitate towards not only technically suitable, but also politically weak or acquiescent populations (Owens 2004). This tendency for ‘national interest’ to prevail over local community concerns demonstrates a lingering form of political universalism, which Owens (2004) believes is responsible for generating local hostility towards, and decreasing confidence in, the UK’s democratic planning process, as the impacts of major projects are seen to fall disproportionately on relatively ‘poor’ residents. Concerns over this apparent spatial inequity are often articulated in public inquiries, leading to accusations of community ‘nimbyism’ on the one hand, and autocratic Government planning decisions on the other (an issue which will be explored in greater detail later in this chapter).

In the face of public hostility, politicians and planners typically emphasise the scientific rationality and progressive nature of their proposals and, since science and technology are accorded a higher status in legal, political and media arenas than public opinion, proposals are rarely rejected (Hansen 1991). Environmentalists who ‘oppose’ or ‘challenge’ the dominant scientific paradigm are portrayed as selfish ‘nimmys’ and their claims are considered emotive or irrational, discredited as unscientific and worthless in the face of quantifiable ‘facts’ (Coleman 1991). In recognition of the primacy given to scientific information, local protest groups often employ independent ‘experts’ to advise them on technical issues in an attempt to bring
scientific credibility to their objections. In doing so, individual groups have begun to construct ‘alternative knowledges’ of transport expansion that challenge the dominant professional and political discourses.

While technical ‘experts’, national Government, and industry representatives often dismiss ‘local’ concerns as reflecting the irrational and narrow-minded attitudes of ‘NIMBYs’, the reality is often more complex. Anderson J (2004) observes that, in the context of development controversies, actors are often constructed in opposition to one another, and their different spatial perspectives configured dualistically, with one group portrayed as attempting to ‘dominate’ space while local residents try to resist this spatial ‘colonisation’. He suggests that every spatial practice, whether political, social, environmental or industrial, seeks to extend its sphere of influence, both simultaneously resisting and dominating those that may prevent it from doing so (ibid. 2004). As Boholm (2004) notes, attempts at spatial domination at any scale by any group will always be met with resistance, but the “risk imposers” have an advantage given they are in a relative position of power, both over geographical space and also the development of the political issues surrounding the planning application. Nevertheless, the repertoires of resistance employed by some local groups mean ostensibly ‘parochial’ issues have often come to assume national, or even global, importance.

In 1996-1997, as the legal avenues through which local residents could challenge the proposals for a second runway at Manchester Airport were gradually exhausted, the ‘Coalition Against Runway 2’ (CAR2) enlisted the help of a group of ‘radical’ serial protesters, who had gained public notoriety during the A30 road protests earlier in the

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4 Lowe and Morrison (1984) cite the success of the UK campaign group ‘CLEAR’ who, through scientifically challenging the rationale that placed mechanical efficiency, technological performance and commercial profit before human health, eventually succeeded in getting lead additives removed from petrol.

5 On 15th January 1997, following a 101-day Public Inquiry and despite the determined efforts of environmental protesters, Government approval was granted for the construction of a second runway at Manchester Airport, the first to be built in the UK for 20 years. The economic rationale was that the development would enable the airport to increase passenger capacity to handle 30 million passengers per annum by 2005, thereby challenging Gatwick’s position as the UK’s second biggest airport. The proposals, costing £172 million, involved the construction of a new 3050-metre long runway south of, and parallel to, the existing runway. This required the acquisition of adjacent agricultural land and extensive river management in the Bollin Valley SSSI, and was described by the protest group ‘Coalition Against Runway 2’ (CAR2) as ‘potentially the most environmentally damaging development in the North-West’ to date (Farrell 1997).
decade, to keep the campaign high on media agendas and stress the national implications of the development (Griggs et al 1998). At the height of the stand-off, 80 eco-activists occupied six camps adjacent to the A538 Wilmslow to Manchester road; living in tunnels under the proposed runway site and locking themselves to concrete blocks suspended in the tree canopy to resist eviction (Vidal 1997a, 1997b, 1997c; Streeter 1997). These camps, ‘an untidy collection of ragged tents, tree walkways and firepits behind makeshift drawbridges and barbed-wire-filled moats’, constructed in haste in the path of the bulldozers, became home to media-savvy ‘eco-warriors’ ‘Animal’, ‘Swampy’ and ‘Muppet Pete’ (Figure 4.2).

Figure 4.2 Opposition tactics - direct-action eco-protesters (left) and a ‘CAR2’ protest march (right)

Source: (l-r) Farrell (1997) and Noble (in Vidal 1997c p2)

In addition to such ‘mediagenic’ protest camps (see Cracknell 1993), other protesters were articulating their opposition through more conventional channels, including letter writing, lobbying MPs, and signing petitions (Griggs et al 1998). This local ‘subculture of resistance’ represented a fundamental change in the way local protests were constructed in media discourses – not only were young eco-radicals protesting, but ‘respectable’ middle-class homeowners were participating too. At Manchester, the contrast between the ‘women in Barbour coats and Hunter Wellingtons’ and the ‘dreadlocked and nose-pierced protesters’ was a constant source of fascination to the media, and the ‘Volvo and Vegan’ relationship that developed was considered a political revolution (Farrell 1997)7. As McLeod (1998 p357) notes in relation to the protests at Brightlingsea against live animal exports, ‘the activity of protesting has

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6 See Ball (1997); Farrell (1997); Wallace (1997); Paterson (2000).
7 As Farrell (1997) noted with wry amusement, ‘The middle classes...who would have imagined Vegans were characters from Star Trek until they met the eco-warriors, are now cooking macrobiotic picnics’.
become increasingly acceptable socially – as a mechanism which enables “ordinary” members of the public to communicate and register their concerns to governmental bodies’. Though such protests were often ultimately unsuccessful, they marked a new era of direct-action non-violent protest that stimulated public awareness that the ‘national interest’ could also be served by resisting construction, challenging the legitimacy of the dominant ‘predict and provide’ paradigm (see Routledge 1997; Grant 2001; Owens 2004).

The emergence of widespread and sustained anti-development campaigns during the 1990s marked ‘an important development...away from simple countryside and nature protection...towards issues reflecting the collision between the development of the capitalist economy and the preservation of valued habitat...[and] environmental justice’ (Rootes 2000 p50). As Purcell (2001 p178) notes, community activism is often a highly localised phenomenon, arising from residents’ desires to ‘defend and proactively realize their spatial vision in the material space of their neighbourhoods’.

In the context of aviation, airport communities have been found to have highly refined spatial visions of an idealised community based on romanticised and historicized rural ideals of human contentment and tranquillity, and residents configure their environs accordingly. At Heathrow, Sinclair (2002 p238) argues residents, ‘determined to ignore the incursion of an international airport’ by allowing the ‘rural rustic fantasy to thrive’, equipping their properties with ‘leaded panes, net curtains, white doors, beds of hardy perennials [and] carpet-sized lawns’ in apparent defiance of Heathrow’s noise and pollution.

Such ‘imaginative’ geographies carry many normative ideas about how residents envisage their local surroundings and what they believe ‘their’ space should look like and be used for. Thus, despite diverse expressions in terms of the scale, scope, motivation, longevity, location, demographics, tactics, and political impact of different campaigns, a central motivating force is the defence of place against an external threat.

4.3 Running out of runway? The 2003 Air Transport White Paper

In recognition that existing UK airport and airspace capacity (particularly in the southeast) was causing serious network diseconomies and was incapable of handling
predicted air traffic growth, the UK’s Department for Transport (DfT) published the ‘Future of Air Transport’ White Paper (ATWP) in December 2003. This document outlined a strategic framework for the development of air travel in the country over the next 30 years, and sought to clarify the Government’s position regarding future airport capacity on a region-by-region and a case-by-case basis. While it did not, in itself, ‘authorise or preclude any particular development’ (DfT 2003a p9), most commentators suggest the 173-page publication gave the ‘green light’ for large-scale airport expansion around the country, involving additional runways at Birmingham, Edinburgh, Glasgow, Heathrow and Stansted; runway extensions at Aberdeen, Bristol, Inverness, Leeds-Bradford, Liverpool, Newcastle and Teesside; terminal improvements at Aberdeen, Bournemouth, Bristol, Dundee, Edinburgh, Glasgow, Heathrow, Leeds-Bradford, Manchester, Newcastle, Prestwick and Teesside; and the expansion of passenger and freight services at NEMA, an airport which already handled the largest number of night-flights in the country (DfT 2003a; Clark 2003; Oadby and Wigston Mail 2004c).

Many of the capacity problems the ATWP sought to address were a legacy of highly conservative growth estimates by past Governments that routinely failed to anticipate future levels of air traffic growth (see Pulford 2004). In many respects, such underestimates are understandable – air travel represented a new mode of international mobility for which there were no precedents, and political and economic short-termism dictated that development rarely went beyond what was required for the ‘here and now’, with successive Governments unwilling to invest in expensive (and unpopular) developments. Such incoherent planning has been a feature of commercial air travel since its inception. In 1929, Burney (p2) expressed frustration that the development of air transport in Britain ‘has been treated throughout in a desultory, short-sighted, haphazard way, and without any clear appreciation of its far-reaching significance for this and future generations’. Seven decades later, the 2003 ATWP sought to bring a degree of clarity to national airport planning that previous generations had lacked.

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8 This is not to say that other countries have fared any better. Of the 15 global mega-hubs investigated by Fuller and Harley (2004), all were undergoing, or had just completed, major development projects to increase capacity.
While the airline industry praised the report, and the then-Transport Secretary, Alistair Darling MP, for being ‘bold, far-reaching and right’\(^9\), opponents of the ‘Fly Local’ policy were outraged, and vowed to challenge plans, which they believed were unsustainable and would cause irreparable environmental damage, in the High Court (see Boffey 2003; CPRE 2003b; Upham 2003; Harris 2004; Pulford 2004). While official Government discourse was couched in terms of commercial aviation’s ‘significant’ economic benefits (DfT 2003a), community opposition groups and ‘green’ coalitions argued such claims were at best optimistic, and at worst, deliberately misleading (CPRE 2003c; FoE 2005). Whereas the ATWP argued commercial aviation represents a valuable ‘engine of the economy’ that safeguards two million UK jobs, delivers 16 million foreign tourists a year, and generates significant export revenues (DfT 2003a p22), J Whitelegg (2005), working in conjunction with the Campaign to Protect Rural England (CPRE) and Friends of the Earth (FoE), refutes such claims, suggesting the industry represents only a small part of the national and regional economy and contributes little to job creation, inward investment, or the generation of tourist revenue.

While the ATWP made some concessions to the environmental implications of widespread airport expansion (controversial proposals for new airports in central England, South Wales, and the South East, along with additional runways at Luton and Gatwick were rejected)\(^10\), the Government’s favoured approach to environmental mitigation appears to rely on the industry regulating itself under the ‘polluter pays’ principle, whereby airlines are asked to respond ‘creatively’ to ‘the common challenge of global warming’ by limiting CO\(_2\) emissions (DfT 2003a p31)\(^11\). Opponents question whether this strategy is appropriate or effective and argue the ATWP metaphorically ‘opens the floodgates’ to creating an ‘airport state’ in Britain, where vast areas of land disappear under new terminals and longer runways (see Figure 4.3).

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\(^10\) See DfT (2003a), especially p92, pp112-113, and p129.

\(^11\) In a characteristically outspoken response, Ryanair’s chairman, Michael O’Leary suggested airline passengers could reduce air pollution by selling their cars and walking (Clark 2005b).
Figure 4.3 ‘Airport Britain’ – Austin’s cartoon (left), lampooning proposals in the ATWP for massive airport expansion appeared in *The Guardian* a day after the report’s publication. The central image is a contemporary take on a cartoon that first appeared in the late 1970s (right) portraying Britain as ‘Airstrip One’ or a runway to the continent, a phenomenon described by George Orwell in his novel ‘1984’.

The proposals contained in the ATWP gave the anti-expansion lobby newfound focus and fervour and new groups including ‘SBAE’ (Stop Bristol Airport Expansion) and ‘SLAP’ (Stop Luton Airport Plan) formed to counter specific regional threats.

However, the phenomenon of anti-airport protest is almost as old as the industry itself (see Griggs et al 1998). In 1924, people living near the UK’s first civilian airport at Croydon began to complain about the noise generated by arriving and departing aircraft (Learmouth and Nash 1977). On 3rd May 1928, a letter in the Wallington Times from a local resident read, ‘When are the local authority going to take some action to stop the intolerable nuisance of the nightly noise from the Aerodrome? … It is a simply hideous noise and…ought not to be allowed after 10pm. I cannot see…why a commercial company, subsidised with public money, should be allowed to spoil the whole district, and make sleep impossible for hundreds of people’ (cited in ibid. 1977 p65). Over 75 years later, residents living near major UK airports are still asking similar questions of their elected political representatives (see Barkham 2006).

Indeed, over 20 active UK-based anti-airport expansion groups could be identified in 2006 (Table 4.1)\(^{12}\), and personal communication with a former member of the British Gliding Association’s Airspace Committee indicated the phenomenon of anti-aviation protest exists at virtually all of the UK’s general aviation airfields.

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\(^{12}\) N.B. I do not claim this list is exhaustive.
Table 4.1 Active UK anti-airport campaigns (correct as of 12/09/2006)\textsuperscript{13}

\begin{itemize}
  \item AEF – Aviation Environment Federation (national)
  \item Airport Watch - (national)
  \item AXE – Against eXpansion at Eastleigh (Southampton)
  \item BANG – Birmingham Anti Noise Group
  \item CAECA – Campaign Against Expansion of Coventry Airport
  \item DEMAND – Demand East Midlands Airport is Now Designated (previously ELVAA – East Leicestershire Villages Against Airspace) (NEMA)
  \item GACC – Gatwick Area Conservation Campaign
  \item Greenskies – (national)
  \item HACANClearskies – (Heathrow)
  \item HARC – Horley Anti-Runway Campaign (Gatwick)
  \item LAAG – Lydd Airport Action Group
  \item LADACAN – Luton and District Association for the Control of Aircraft Noise
  \item MAEN – Manchester Airport Environment Network
  \item NOTRAG – No Third Runway Action Group (Heathrow)
  \item PAIN – People Against Intrusive Noise (NEMA)
  \item SANE – Swansea Airport No Expansion
  \item SASIG – Strategic Aviation Special Interest Group (national)
  \item Save Charlwood - (Gatwick)
  \item SBAE – Stop Bristol Airport Expansion
  \item SLAP – Stop Luton Airport Plan
  \item SOAR – Solihull Opposed to Additional Runways (Birmingham)
  \item SSE – Stop Stansted Expansion
  \item WAAG – Wolverhampton Anti Airport Group
\end{itemize}

4.4 Fighting the flights – the ELVAA protest examined

In an effort to pre-empt the publication of the ATWP by having the aerial infrastructure in place that would facilitate future expansion, NEMA submitted an airspace change proposal (ACP) to the CAA on 1\textsuperscript{st} October 2003 which sought to

\textsuperscript{13} Significantly, though less numerous, pro-expansion groups, including Coventry Airport’s Supporters group (www.supportcoventryairport.com), which had 1280 supporters as of 19/03/2005, and ‘F-L-A-G’ (Friends of Lydd Airport) which had 2000 supporters on 09/11/2005, actively welcome commercial flights and the job opportunities they create (see also Thomas and Lever 2003).
extend the area of controlled airspace around the airport and reorganise the way air traffic movements were handled in order to increase capacity (see Chapter Three). In addition to amending existing approach and departure procedures to the north of the airport, the plans also involved rerouting all aircraft arriving from the south to the east of Leicester, as well as re-siting one of the existing holding areas south to Market Harborough (see Figures 3.28-3.30). While the plans were broadly welcomed and applauded for lessening the acoustic impact of aircraft operations on major settlements in west Leicestershire and southern Derbyshire, a number of residents in east Leicestershire, who found themselves under the re-routed flightpaths, mobilised against the plans, believing they would cause unacceptable levels of noise pollution which would have a detrimental effect both on their health and local property prices (Edwards and Farmer 2004; Staples 2004).

Following a public meeting in east Leicestershire on 13th January 2004, attended by 500 residents, the campaign group ‘ELVAA’, or ‘East Leicestershire Villages Against Airspace’ was formed. ELVAA’s aim was to stimulate public opposition to new airspace expansion to ‘limit the noise blight resulting from [NEMA’s] commercial activities for the benefit of all residents in Leicestershire’; an objective they believed could best be served by preserving the existing airspace structure14. Following a committee meeting on 23rd January 2004, Steve Charlish, a self-employed businessman and commercial pilot licence holder from the village of Kings Norton, was formally elected chairman of the group15. Thus, under his leadership, ELVAA sought to raise awareness of the airspace change, energise public opposition against it, and act as a focal point of resistance, emphasising it was only through collective action that residents could favourably influence the outcome of the consultation (c.f. Stratford 1974).

While anxiety surrounding the acoustic impact of the airport’s operation was not a new phenomenon16, ELVAA disputed NEMA’s assertion that 75% fewer people would be subject to aircraft noise, and claimed over 100,000 new people would be

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15 Which also included the multi-millionaire property developer David Wilson, a university professor, and a practising solicitor (ELVAA Newsletter, Issue 1 19/01/2004). See also Martin (2004a).
16 ‘PAIN’ – ‘People Against Intrusive Noise’, a local Kegworth-based anti-noise group, though small in membership, was already a vociferous opponent to expansion (Oadby and Wigston Mail 2003).
affected. ELVAA quickly ‘learned the language’ of airport protest, lobbying local MPs, writing letters of objection both to NEMA and to Government departments, and inundating the local media with their concerns. As at Stansted and Heathrow, anti-flightpath posters and messages of defiance quickly appeared on lampposts, hedgerows, and noticeboards in local villages (Figure 4.4).

Figure 4.4 Manifestations of protest – ELVAA’s roadside poster campaign in east Leicestershire sought to energise local resistance to the airspace change. From left-right, posters in Burton Overy, Great Glen, and Illston-on-the-Hill.

ELVAA’s campaign was initially articulated in typical ‘not-in-my-back-yard’, or ‘NIMBY’, language, with spokespeople citing the inevitable loss of rural tranquillity and the detrimental effects on quality of life that would result from the skies over east Leicestershire being turned into a “24 hour motorway for planes”18. On 19th January 2004, the group published the first edition of their campaign newsletter, and the group website (www.elvaa.org) quickly became a key campaign tool where supporters could download anti-airspace posters, get advice on writing letters of complaint, and search the online newspaper archive. As Senior (2004) discovered at Stansted, the application of Internet technologies by anti-airport groups has been instrumental in challenging the Government’s pro-expansion discourse, enabling supporters to produce alternative knowledges of airport development, exchange ideas and/or tactics with other groups, publicise their campaign, and enable supporters to view and/or download protest posters and follow developments.

The decision to name the group ‘ELVAA’ carries clear geographical connotations; ‘East Leicestershire Villages’ denotes a specific locale and emphasises the rural nature of the area in which it is based, while the ‘Against Airspace’ suggests the group was not against aircraft noise or airport activities per se, but simply opposed to plans to use the skies above their part of the county for commercial flights (c.f. Griggs and Howarth 2004a). ELVAA’s main concern was the effect of night flights, as they believed “many of the aircraft using these paths will be heavy, noisy freight aeroplanes” which, given relatively low levels of ambient noise, would make sudden noise peaks more disruptive. As the Roskill Report into the Third London Airport noted in 1971, ‘loud noises in quiet rural surroundings are more disturbing than the same noises in noisy urban areas’ (cited in Adams and Haigh 1972 p664). In Steve Charlish’s words, “We are protesting about a measure which will have loud jets thundering over the quietest parts of the county at all hours of the night”.

In addition to developing a high media profile, ELVAA cultivated cross-party political support involving local MPs Edward Garnier (Conservative, Harborough), Alan Duncan (Conservative, Melton and Rutland), Stephen Dorrell (Conservative, Charnwood) and later Andy Reed (Labour, Loughborough), David Taylor (Labour, Northwest Leicestershire), Andrew Robathan (Conservative, Blaby), Parmjit Singh (Liberal Democrat, Leicester South), and Keith Vaz (Labour, Leicester East). On June 8th 2004, nearly 90 protesters travelled to College Green, Westminster, to demonstrate their objections to the ACP during a Parliamentary debate on transport, an event ELVAA publicised as a ‘golden opportunity to make a strong media point for all...NEMA campaigners’ which, they claimed, represented ‘your last chance to do anything’ before the period of public consultation ended on 21st June. ELVAA stressed the importance of ‘a hearty turn out’ to impress the local media, but in addition to staging a serious protest, the trip was also marketed as a ‘fun day out’, with supporters encouraged to ‘bring some home made placards and a packed lunch’, ‘have a laugh’, ‘meet some MPs’, and possibly appear on television. Though Steve Charlish’s request for a papier-mâché specialist to make some ‘walking aeroplanes’

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21 Cited in Oadby and Wigston Mail (2004a).
22 See Leicester Mercury (2004g and 2005i).
23 ELVAA press release (30/05/2004 original emphasis).
24 ELVAA press release (30/05/2004).
was unsuccessful\(^{25}\), his call for home-made banners and placards yielded a colourful assortment of signs which formed a backdrop to the protest (Figure 4.5), reports of which appeared in local newspapers (Figure 4.6).

Figure 4.5 ELVAA protesters outside the Houses of Parliament, 8\(^{th}\) June 2004, pose for photographs (left), and give television, radio, and newspaper interviews (right)

![ELVAA protesters outside the Houses of Parliament](image)

Source: author’s collection

Figure 4.6 The demonstration, as reported in The (Oadby and Wigston) Mail

![The demonstration, as reported in The (Oadby and Wigston) Mail](image)

Source: Oadby and Wigston Mail 17/06/2004 p4

In addition to their own supporters, ELVAA invited the East Midlands branch of Friends of the Earth (FoE), the Leicestershire Campaign to Protect Rural England (CPRE), and the Kegworth-based anti-NEMA noise group, PAIN (‘People Against Intrusive Noise’) to join the protest, a decision which marked the start of ELVAA embracing other local and national groups opposed to expansion at NEMA\(^{26}\). As Griggs and Howarth (2004a p193-194) noted of the Heathrow-based HACAN

\(^{25}\) ELVAA press release (30/05/2004).

\(^{26}\) As a consequence, the FoE discussed the environmental implications of NEMA’s flightpaths at their annual conference in September 2004 (Leicester Mercury 2004f).
Clearskies campaign, such broadening of constituency appeals 'to the common interests and identities that exist between...residents living near airports and under their flight paths' and is characterised 'by the attempt to unify or join struggles, so that the campaign against airport expansion is equally the campaign of others.'

While John Arscott, the CAA's Director of Airspace Policy, accepted "having airplanes flying at 2am over your house can be socially quite intrusive" he reiterated the importance of balancing the noise impact with the economic benefits the airspace reorganisation was predicted to deliver (Edwards 2004f p2). On 29th July 2004, the ACP was approved, and implementation scheduled for November 200427. As part of the consultation process, NEMA was required to consult with all local authorities where the proposed base of the new airspace above them was 7000ft or lower or where residents might experience overflights for the first time (EMA 2003). However, on 3rd August, Oadby and Wigston Borough Council (Leicestershire) claimed they had not been consulted28 and, on August 26th 2004, the airport took the unprecedented step of asking the CAA to halt the implementation of the new airspace protocols to allow for a second 12-week period of public consultation, which ran from October 18th 2004 to January 10th 200529.

In an effort to improve community relations, NEMA printed 10,000 information brochures containing maps and information about the plans (Figure 4.7), and hosted eight community ‘roadshow’ events in local village halls and Council offices during November and December 2004 to disseminate detailed information about the proposals and give local residents an opportunity to discuss their concerns with airport personnel30. All eight events were well attended, and while a small number of individuals exhibited passionate opposition to the plans, curiosity rather than fervent resistance appeared to motivate the majority of attendees31. However, in an e-mail to

27 Oadby and Wigston Mail (2004a).
28 Indeed, of the 18 councils contacted by the Leicester Mercury, five claimed not to have been consulted (see Edwards 2004b, 2004c, 2004e, Leicester Mercury 2004e). In light of these findings, the CAA agreed to 'look again' at the decision if they received new objections (Edwards 2004g), while some Councillors called for a Government Inquiry (Leicester Mercury 2004c).
30 Oadby and Wigston Mail (2004e).
31 Source: personal communication with NEMA staff and personal observation of the community roadshows at Great Glen village hall (17th November 2004) and Judgemeadow Community College, Leicester (2nd December 2004).
supporters on 15\textsuperscript{th} November 2004, Steve Charlish criticised the brochures for their alleged typographic errors, maps which ‘avoid showing the full extent and width of flightpaths’, and the condescending way in which the information was ‘streamlined’ so as not to ‘give out a document which has too much technical information to confuse the public’\textsuperscript{32}. Unsurprisingly, relations between the two deteriorated; ELVAA accused NEMA of secrecy, while the airport alleged ELVAA was deliberately propagating ‘serious inaccuracies’ and ‘alarmist’ distortions about their plans\textsuperscript{33}.

Figure 4.7 Consulting the public. The eight-page community information booklet disseminated information about the proposals and was made widely available, both in print and on-line.

Throughout this second phase of consultation, emotive (and occasionally vitriolic) anti-NEMA letters were published in the \textit{Leicester Mercury}, the contents of which variously implored residents to officially register their opposition to the plans and/or ‘vote with their feet’ by refusing to fly from the airport (Table 4.2). That said, a number of letters \textit{were} supportive of the airport; one writer suggested that aircraft provide ‘a comforting background noise’ that proves ‘the world is still steadily going about its business’\textsuperscript{34}, while another encouraged NEMA to ‘carry on the good work’\textsuperscript{35}.

\textsuperscript{32} E-mail from Steve Charlish to ELVAA supporters 15/11/2004.
\textsuperscript{33} NEMA spokesman, cited in Whitaker (2004).
\textsuperscript{34} Letter to the Leicester Mercury by A. Stopford (12/10/2004).
Other letters variously accused the protesters of ‘hysteria’ or expressed boredom with the continual ‘blather’ about the flightpaths. Furthermore, despite a message from DEMAND’s webmaster saying there was ‘no point’ publishing pro-NEMA feedback, one message did slip past the censor.

**North Kilworth, south Leicestershire 27 July 2005 4:42:21 PM**

"I wonder, now that the new airspace is up and running, to the detriment of no-one’s sleep, or life quality, if you are ready to eat your words?"

- ‘Feedback’ submission on the DEMAND website

Table 4.2 A selection of anti-NEMA letters published in the Leicester Mercury, autumn-winter 2004

- ‘Fight night flights’ I. Sutherland, Tugby 18/09/2004
- ‘Aircraft issue hits everyone’ N. George, Tilton-on-the-Hill 09/11/2004
- ‘Night flight proposal has to be refused’ P. Beddoo, Castle Donington 11/12/2004
- ‘Consultation farce’ J. Bazely, Ratcliffe-on-the-Wreake 21/12/2004
- ‘Air Transport plans herald bleak future’ S. Young, Evington 28/12/2004

During these debates, the issue of NEMA’s designation (or lack of it) became a major issue for protestors. Under existing legislation, NEMA is administered under Section 35 of the 1982 Civil Aviation Act, which allows airports to self-regulate their noise emissions through the provision of voluntary noise controls. In comparison, London’s Heathrow, Gatwick, and Stansted airports are ‘designated’ under Section 78 of the same Act, which empowers the Government to set an annual cap on noise emissions and monitor their compliance. Other airports are subject to limited opening hours or other operational restrictions. Calls to designate NEMA had first been made in July 2002, but dismissed by the then-Secretary of State for Transport on the grounds that the airport could regulate itself effectively and that designation would risk stifling future traffic growth. However, David Taylor M.P. called the resulting

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35 Letter to the Leicester Mercury by B. Kirk (07/01/2005).
36 Letter to the Leicester Mercury P. Durran (01/01/2005).
37 Letter to the Leicester Mercury by R. Harpham (09/03/2005).
40 DT (2003b) and Garnier (2004b).
42 Leicester Mercury 2005d.
voluntary controls “cosmetic” and “unchallenging” as they included no safeguards on future increases in night noise. According to John Stewart, HACANClearskies’ chairman, “It defies logic that the airport with the greatest number of night flights in the UK [NEMA] is not a designated airport” as its acoustic impact is “felt way beyond its immediate boundaries.” Indeed, as Edward Garnier M.P. noted in a debate in Westminster on 9th February 2005, “the Government [has]...failed to understand that...aircraft that take off from...and come into the airport will damage the quality of life, not only of those who live in the vicinity, but those who live, work, and try to sleep further away.” While recognising a total ban on night flying would be “unrealistic and plain silly”, he implored NEMA to try to operate in harmony with its neighbours. But, as M.P. David Taylor reported, “night noise from the heavens has made East Midlands Airport the neighbour from hell.”

On 15th November 2004, ELVAA announced to supporters its intention to rejuvenate the campaign from January 10th 2005 (the end of the second consultation period) by focusing its attention on ‘putting night noise controls on NEMA’48. On 13th December 2004, a small group of protesters, local MPs, and reporters assembled outside the Houses of Parliament to witness ELVAA being re-named ‘DEMAND’ (‘Demand East Midlands Airport is Now Designated’) (Figure 4.8)49. In addition to being geographically more inclusive than its predecessor, embracing protesters from across the East Midlands, DEMAND sought to apply concerted political pressure, at both a national and a local level, to force the Government to designate NEMA. In so doing, they identified the airport, the Government, and the CAA as ‘enemies’ who, they claimed, were deliberately manipulating statistics and withholding information in a

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43 Cited in Hansard 09/02/2005 Column 428WH. See also Nottingham Evening Post (2005).
44 Cited in Martin (2005).
45 Cited in Hansard 09/02/2005 Column 421WH.
46 Cited in Hansard 09/02/2005 Column 421WH. See also Edwards (2005f).
47 Cited in Hansard 09/02/2005 Column 424WH and Column 427WH respectively. A NEMA spokesman subsequently expressed regret that “sensible dialogue has given way to emotive rhetoric” (cited in Leicester Mercury 2005b). Significantly, David Taylor did not reveal how many of his constituents work at the airport.
48 E-mail to ELVAA supporters from Steve Charlish, 15th November 2004.
50 See Leicester Mercury 2005a, 2005f, 2005g, 2005h, 2005i.
concerted attempt to effect the proposals “by stealth”\textsuperscript{51}, and rallied supporters for the ‘long battle’ ahead\textsuperscript{52}.

\textbf{Figure 4.8} (Left) Steve Charlish (DEMAND chairman) and Graham Stocks (Leicestershire CPRE) protest outside Westminster on 13\textsuperscript{th} December 2004. (Right) Edward Garnier MP and Steve Charlish publicise the protest, March 16\textsuperscript{th} 2005.

Issues of trust, transparency, and accountability were also raised by Edward Garnier MP who asked “Why does [NEMA] not, unless pushed and pushed and pushed, provide us with the raw data that we need? …Why are they reluctant unless made to do it? Why do they not behave with great candour and with frankness? It is much easier to deal with a person who tells the truth voluntarily than to have to extract the facts and information, like pulling teeth”\textsuperscript{53}. In exasperation, DEMAND resorted to using Freedom of Information legislation, which came into effect on 1\textsuperscript{st} January 2005, to try and discover who at the CAA had given authorisation and why some councils had been excluded from the first round of consultation (Edwards 2005e; Robins 2005). However, despite several requests, Steve Charlish remarked, “can I get any proper information out of anyone? Can I heck…”\textsuperscript{54}. One commentator suggested NEMA’s reluctance to disclose the required information was due to the fact that “we

\textsuperscript{52} Cited in Byers (2005).
\textsuperscript{53} Cited in Hansard 09/02/2005 Column 426WH.
\textsuperscript{54} Cited in Robins (2005 p8). See also Edwards (2005c).
live under a culture of state secrecy...based on the premise that those in authority don’t have to tell us [anything] because they know what’s best\textsuperscript{55}. In the context of the NEMA controversy, the Government’s ‘what’s best’ for the country (i.e. no controls on night flying), does not correspond with what DEMAND perceives as being ‘best’ for local communities.

In light of the volume of night flights using the airport, DEMAND sought to get the earlier ruling dismissing designation overturned. In this respect, they were undoubtedly encouraged by the ruling of a High Court challenge brought against the CAA and BAA Stansted by the Dedham Vale Society in 2005 (who alleged new flightpaths were ‘ruining the peace and tranquillity of the countryside’) that judged the new airspace procedures around Stansted were unacceptable and should be revoked\textsuperscript{56}. On 1\textsuperscript{st} January 2005, the new website (www.demand.uk.net), went live\textsuperscript{57}. In addition to an archive of news stories and background information about the airspace change, the site contained an online petition where residents could pledge their support for designation. By 10pm on January 10\textsuperscript{th}, the day the second phase of consultation ended, 484 people from five counties had signed up (Figure 4.9 overleaf)\textsuperscript{58}. However, despite this level of public and political support, the then-Aviation Minister, Charlotte Atkins MP, claimed, on February 26\textsuperscript{th}, that local MPs were ‘obsessed with [the] magic wand of designation’\textsuperscript{59} and reiterated that designating NEMA was not in line with Government policy\textsuperscript{60}. Two days later, following subtle refinements to the proposals\textsuperscript{61}, CAA approval for the airspace change was granted for a second time, and implementation scheduled for 12\textsuperscript{th} May 2005\textsuperscript{62}.

In explaining his decision, John Arscott wrote that ‘The effects of the ACP on safety and efficiency are unchanged from the original approval given in my letter of 27 Jul 04 <sic>’, and reminded critics that ‘matters of designation’ are ‘beyond the powers

\textsuperscript{55} Dr. Simon Bennett cited in Leicester Mercury 2004d (see also Edwards 2004d).
\textsuperscript{57} Edwards (2005a).
\textsuperscript{58} This map was derived from the address and postcode information published on the online petition.
\textsuperscript{59} Cited in Leicester Mercury 2005c (see also Edwards 2004j).
\textsuperscript{60} See DFT (2003b), Leicester Mercury (2005m), Edwards and Byers (2005).
\textsuperscript{61} The new ‘POLE’ departure route will now only be used during the day, and stricter noise controls will be introduced (NEMA press release 2005a).
\textsuperscript{62} NEMA press release ‘Airspace changes accepted by the CAA’ 2005a; CAA (2005a); and Walsh (2005).
Figure 4.9 Spatial distribution of signatories to the DEMAND petition, 10th January 2005
data derived from address and postcode information posted on www.demand.uk.net.
(N.B. one dot equals one address, not one protestor - often multiple signatories were living at one address)
of the CAA to effect and are matters for the Secretary of State. This provoked an angry response from DEMAND supporters. Edward Garnier MP claimed this admission left his constituents "with no other impression [than] that this second consultation process is a charade designed to fool them into believing that Nottingham East Midlands Airport and the CAA are acting in good faith, whereas in fact the whole thing has been stitched up to give the appearance of due process". Leicester East MP Keith Vaz agreed, articulating his distaste for the "crass arrogance" of what he believed was merely a "public relations exercise for the airport", while Leicestershire County Councillor and DEMAND supporter, Kevin Feltham, added "what is the point of having a consultation if you have already made up your mind that you want these routes?"

With official authorisation given, the Government unwilling to intervene, and NEMA publicly stating their intention to increase the volume of flights handled by 45,000 (or 50%) a year (Edwards 2005h) DEMAND stepped up their campaign, staging publicity events including presenting a 1000+ signature petition at Downing Street calling for NEMA's designation, printing 32,000 'DEMAND' postcards for supporters to sign and send to Tony Blair (Figure 4.10), and brewing a speciality 'Nightcap' ale to raise additional fighting funds and to bring some 'fizz' to their campaign.

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63 Letter from John Arscott, Director of Airspace Policy at the CAA, to NATMAC representatives and local County Councils 28/02/2005.
64 Edwards (2005g), Oadby and Wigston Mail (2004e). To monitor the public response to the new flightpaths, Leicestershire County Council set up an online questionnaire to monitor their impact (see Leicester Mercury 2005o, 2005r, 2005t). Of the 250 respondents, 70% indicated the aircraft noise caused them annoyance either “often” or “always” (Leicestershire County Council 2005).
68 Leicester Mercury 2005j, 2005s; and Edwards 2005d, 2005i.
Figure 4.10 Postcard politics – continuing the vein of non-violent action, DEMAND encouraged supporters to sign and send copies of this postcard, featuring a surreal image of an An-124 (one of the larger aircraft to fly into NEMA), to Tony Blair to highlight the issue of night-time aircraft noise and press for designation.

Edwards (2005h) reports that at the time of the announcement, NEMA had stated the new airspace structure would not be a ‘licence to grow’, but DEMAND claimed they were unaware of a clause in the consultation document that authorised air traffic to grow by 50% before further planning permission was required. As protesters had done at Heathrow (see Sherwood 1999 and Barkham 200670), DEMAND accused NEMA of employing sly incrementalist planning tactics to push through their proposals. As André (2004 pp43-44) explains, with reference to the expansion of Boston Massport, such anger results from that fact that ‘First, there may be a runway extension, then a new terminal building, then a new control tower and, before the citizenry is aroused, suddenly there is a major airport in their backyard and, given the cumulative investment in infrastructure, there is no turning back’. She continues, ‘It is one thing to buy into a community knowing that you are going to live near a busy commercial airport...[but] another thing to be surprised by the transformation of that modest general aviation facility into a potential La Guardia’ (ibid. 2004 pp50-51). In an effort to bring further political pressure on NEMA, Steve Charlish stood as an independent

70 For example, residents of Sipson, a village threatened by a third runway, claim that Heathrow has epitomised “Deception since its inception” (Barkham 2006 p10), whilst Sherwood (1999 p6) notes that while ‘Each proposed expansion...is claimed at the time to be the last...once permission is given, it inevitably leads to further demands’. 
candidate in the May 2005 local County Council elections with a mandate to fight for
night controls at the airport, but failed to get elected.

Nevertheless, the new airspace procedures went into effect on May 12\textsuperscript{th} 2005 and, to
monitor the public response, DEMAND established a ‘feedback’ page on their
website, on which people could chronicle the noise nuisance. For the first six months
of its operation, the names and place of residence of the authors were published
alongside each submission, enabling a detailed analysis to be made both of the spatial
distribution of complainants and the content of their grievances. From the day of the
first entry, 19\textsuperscript{th} May 2005, to November 9\textsuperscript{th} 2005\textsuperscript{71}, 98 submissions were received
from 46 different villages in Leicestershire, south Derbyshire, and south
Nottinghamshire, 10\% of which came from one settlement, Gaddesby, in northeast
Leicestershire.

In order to better appreciate the concerns articulated by DEMAND supporters, I
undertook an analysis of the content of these 98 ‘feedback’ submissions. As Hannam
(2002 p191) explains, content analysis is a quantitative empirical technique concerned
with ‘categorising and counting’ occurrences of particular themes in a text that are
assumed to be significant. The manifest content analysis of the DEMAND feedback
undertaken here was based on a coding frame comprising 22 elements, the suitability
of which were verified by two external researchers. The content analysis of the
DEMAND feedback revealed night noise and sleep disturbance were the two most
frequently cited complaints, mentioned in 60 and 42 of the submissions respectively
(Figure 4.11). Collectively, noise-related concerns accounted for 47\% of all recorded
anxieties, while other operational concerns, including aircraft deviating from
flightpaths, accounted for another 31\%. Concern about environmental degradation and
possible health effects only featured in 11\%, with the remaining 22\% variously
expressing anger at the consultation process and NEMA’s poor public relations (see
Box overleaf).

\textsuperscript{71} The last day when names and place of residence were recorded.
Figure 4.11 Content analysis of the “feedback” submissions on the DEMAND website (May-November 2005)

- Lack of noise controls
- Grudging support
- Intrusive landing lights
- Lack of accountability
- 3rd party risk
- Health impacts
- Air pollution
- Property devaluation
- Day flights
- Inadequate consultation
- Fears of future traffic levels/noise climate
- Calls for designation
- Poor PR
- A/c deviating from flightpaths
- Day noise
- Loss of tranquility
- Night flights
- Continuous noise
- Frequency of ATMs
- Low flying aircraft
- Sleep disturbance
- Night noise

Frequency
Gaddesby, northeast Leicestershire 26 May 2005 5:43:08 PM

I can hardly express how devastated I feel about the new flight paths. My haven of peace, quiet and retreat has been invaded, literally overnight. It is much worse than anticipated - the planes are more frequent, more intrusive and lower than I thought, and they are flying over my roof ... We did not choose to live under a flight path, and would never have chosen to do so in a million years. What we chose was peace, tranquillity and living off the beaten track. This has been taken away from us ... The truth is, I feel under siege and under attack.

- ‘Feedback’ submission on the DEMAND website

Great Glen, southeast Leicestershire 08 September 2005 1:32:17 PM

I deliberately moved to Glen for the peace and quiet. I am frequently awoken with low flying and extremely noisy aircraft. At night, you can actually see them coming in to land ... and there are so many of them. Had I wanted to be subjected to the constant noise and interruption, I would have bought a house under a flight path...

- ‘Feedback’ submission on the DEMAND website

Gaddesby, northeast Leicestershire 09 September 2005 10:58:58 AM

Yet again woken through the night by never ending aircraft noise ... It has totally ruined our lovely peaceful rural lives. We paid a premium to live in a conservation village were you can’t even fell a tree in your own garden without planning permission. However, our village is now polluted by 24/7 aircraft noise that is going to get even worse. How can this be right? If we had known that this was going to happen we would never have bought our home nine years ago. After all, the people who lived under the previous flight paths had the choice to buy homes there or not. Why have we not been given that right? Our homes must now be devalued by thousands and our lives are being blighted...it needs to stop.

- ‘Feedback’ submission on the DEMAND website

The prevalence of repeat submissions from a few individuals supports NEMA’s claim that it experiences a complainant (rather than a complaint) problem. Indeed, of the 854 complaints NEMA received in the three-month period immediately following the airspace reorganisation, 203 came from one individual. This phenomenon of multiple complaints from a dedicated core of objectors is particularly acute in east Leicestershire where, of the 1699 complaints registered in the period May-December

75 This claim is further supported by NEMA’s confidential reporting statistics, which (owing to data protection issues) the author was given access to but not authorised to reproduce.
76 BBC news online (2005b).
2005, 65% (or 1106) came from three individuals (Edwards 2006)\textsuperscript{77}. Such intensity of correspondence remains a key DEMAND tactic. A speaker at the DEMAND Public Meeting on 17\textsuperscript{th} March 2006 in Illston-on-the-Hill, implored supporters to protest “long, loud, and often” about the alleged noise nuisance\textsuperscript{78}. Nevertheless, the airport maintains the number of complaints they receive is small compared to the number of flights handled\textsuperscript{79}. Edward Garnier M.P. (2005b) nevertheless implored residents to ‘Complain if you are suffering from noisy low-flying aircraft that keep you awake at night and ruin the quiet enjoyment of your house and garden during the day. Do not accept the spin you are fed by these inanimate authorities who have no care for your quality of life and treat you as inconvenient hindrances to the completion of their aims...Let them know what you feel.’

Observation of public meetings revealed a collective feeling of resentment toward the low cost carriers, bmibaby, easyJet and Ryanair. The implication was that those who had paid a premium to fly business class from London had somehow bought the ‘right’ to pollute the (predominately poorer Labour-voting) neighbourhoods around Heathrow, while the use of airspace by people who had paid as little as 2p (plus taxes) for their flight, was considered unjust and “morally wrong”\textsuperscript{80} (see Box below).

\begin{table}
\centering
\begin{tabular}{|c|c|}
\hline
Oadby, suburb southeast of Leicester & 14 September 2005 9:12:57 PM \\
\hline
\end{tabular}
\end{table}

...I have been woken up by very loud plane noise at least every week or so since the new flight paths began...The true costs of the new flight paths need to hit NEMA somewhere it hurts. I find it disgusting that flights from NEMA are being advertised for as little as £5.99 a seat because (A) they don't pay any fuel duty and (B) they can wake up half of Leicestershire with their flights and pay nothing in the way of compensation for doing this.

- ‘Feedback’ submission on the DEMAND website\textsuperscript{81}

Will Self, writing in \textit{The Independent Magazine} on July 8\textsuperscript{th} 2006, picked up on this, noting ‘the airspace of today is not the airspace of yesteryear. That was a moneyed preserve, accessible only to the super-rich, who in a very important sense owned it.

\textsuperscript{77} Despite the high volume, NEMA was accused of ‘fiddling’ complaint numbers, as one letter was recorded as one complaint, regardless of how many incidents it referred to (Leicester Mercury 2005u).
\textsuperscript{78} Personal observation, DEMAND Public Meeting, 17\textsuperscript{th} March 2006, Illston-on-the-Hill.
\textsuperscript{79} Neil Robinson, General Manager, Environment and Safeguarding, personal communication (2006)
\textsuperscript{80} Field diary and personal observation of the DEMAND public meeting, 17\textsuperscript{th} March 2006, Illston-on-the-Hill village hall and ‘The Worricker Programme’ BBC Radio FiveLive (Broadcast 23/09/2005).
Now the sky belongs to all, and is like...an illimitable, blue moorland, across which
the masses have the inalienable right to roam’. According to John Thurso (M.P.
for Caithness, Sutherland and Easter Ross) “The industry would argue that everyone has a
right to fly and that people have an almost unfettered freedom to fly wherever they
want, whenever they want, but that is not the case. There are two kinds of freedom;
the freedom to do things and the freedom to be protected from the adverse effects of
whatever other people have the freedom to do. There should be a balance between the
rights of those who want to do things and the rights of those who need to be protected
from them”\(^2\). In this respect, a submission from Great Glen is interesting as the
author argues ‘important’ professionals, who consider themselves vital to the
economic prosperity of the region, should not be subjected to aircraft noise. Just as
estate owners often seek to restrict access to their land by intimidating walkers or
challenging legal rulings (see Verkaik 2006), it appears certain residents would like to
similarly restrict access to the sky above their property to preserve their (high) quality
of life, which they have ‘earned’ and have a ‘right’ to (see Box below).

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**Great Glen, southeast Leicestershire  30 August 2005  8:26:07 AM**

...We have friends in Gaddesby, a vet, a plastic surgeon (NHS) as is
also the case in Great Glen - businessmen/women, Doctors, Dentists,
Lawyers, all walks of life important to the economy and the region,
in public service. I just fail to understand why NEMA changed the old
flight path, a routing which may have received complaints but nobody
"bought" into those areas without the knowledge that they were under
a flight path. Since May, it seems in the rural areas, we have to
take the serious noise and consequent loss of life style.

- ‘Feedback’ submission on the DEMAND website\(^3\)

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Such statements raise both interesting geopolitical questions surrounding the
territorial claiming of aerial space above private property and the desire to exclude
social ‘Otherness’. As Hubbard (2006 p93) has suggested, campaigners often attempt
to justify their actions in terms of ‘the negative externalities associated with a
development...rather than concerns about the presence of others in their midst’ to
shift the debate away from accusations of racism, xenophobia, or class-based
prejudice. In DEMAND’s case, aircraft, and all that is carried in them, whether

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\(^2\) Cited in Hansard - Transcript of a debate at Westminster Hall on 09/02/2005 on NEMA (Column
437WH).
businesspeople or ‘bucket-and-spade’ tourists, imported foodstuffs, or just-in-time industrial components, are unwanted ‘others’, and supporters express resentment that the reordering of airspace serves the urban economies of the East Midlands (in which they claim to play no part and, in many cases, deliberately moved out into the countryside to avoid) by destroying the rural nature of surrounding areas.

However, such feelings are not universal. While DEMAND perceives flights as unwanted acoustic and visual intrusions, others see them as a normal part of daily life. Following the airspace change, several letters appeared in the *Leicester Mercury* from residents who liked seeing aircraft flying over their houses. One wrote, ‘We miss watching the planes at night, landing lights on, heading for the airport. We used to count them – not any more’, while another called on the protesters to ‘Stop moaning...My children used to like watching and naming the carrier’s planes that flew over. Please redirect [them]’.

By the end of 2005, DEMAND was being hit by repeated accusations of NIMBYism, that ‘narrow, particularist self-interest which...seeks to shift the spatial location of development to another community/area’ (McNeish 2000 p187). Sir Digby Jones, Director-General of the Confederation of British Industry, implored DEMAND’s “influential” supporters to abandon their opposition and “put the prosperity of the region ahead of self-interest”, to which Steve Charlish countered that a lot of “normal” people were protesting too (cited in Griffin 2005). However, in an effort to broaden the campaign’s appeal and bolster public support, DEMAND began portraying the number of flights at NEMA as an attack on the livelihoods of British farmers and domestic tourism (c.f. Griggs and Howarth 2004a). According to the CPRE (2003d p22), aviation undercutts local farmers by importing cheaper goods from abroad and undermines domestic tourism by ‘encouraging people to holiday abroad’, but, as long as it remains ‘cheaper to fly from London to Perpignan...than it is to travel by train from London to Bath’, the temptation to fly will remain (National Trust 2003 p29). At NEMA, despite claims prefixing the airport’s name with

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84 Letters to the Leicester Mercury - ‘Missed planes’ 24/06/2005 by A. Gamble, and ‘Stop moaning!’ 17/06/2005 by A. Hatwell.

85 See letters to the Leicester Mercury by D. Atkinson ‘This is progress’ (07/03/2005), R. Harpham ‘Stop bleating about airport’ (09/03/2005), G. Murmann ‘Defending EMA’ (25/05/2005), and E. Sentance ‘Time to ground airport protests’ (04/01/2006).

86 Including Leicestershire’s richest man, David Wilson (Martin 2004a).
'Nottingham' would lead to increased inbound tourism, local residents and MPs believed not enough was being done to promote the region and support local economies (Beddoe 2005; Leicester Mercury 2006c).87

Building on the themes of anti-expansion protest identified in the DEMAND content analysis, the following sections will explore why some residents of East Leicestershire villages opposed the airspace change so vehemently. Each issue will be discussed in turn, drawing on a range of subjective observations and scientific research to inform the debate.

4.5 Aircraft noise - a 'right' to tranquillity?

"Tranquillity is a quality of life issue, and everyone has a right to it"
Graham Stocks, Leicestershire CPRE (cited in Edwards 2004h)

'What avails [air travel] to promote rapid communications between distant places, if those places themselves are in the process rendered uninhabitable?'

The Chelsea and Kensington Action Committee on Aircraft Noise (1968 p30)

It has been claimed the deficit between the amount Leicestershire residents spend abroad and the amount foreign tourists spend in the county was £1.6 billion in May 2006 (up from £1.2bn the year before) (Mack 2006b).
Aircraft noise has long been recognised as one of ‘the most socially objectionable aspects’ of air transportation, and numerous studies have demonstrated that airport communities are becoming increasingly sensitive to noise disturbance (Tomkins et al. 1998; André 2004). Buchanan (1981) traces the origin of anti-airport noise groups to the introduction of ‘Super Constellations’ on flights to New York in the early 1950s. By 1958, the acoustic climate around Heathrow had deteriorated to such an extent that the British Government imposed take-off restrictions and introduced limitations on night flying and permissible departure and arrival routes (KACAN 1968). However, the progressive introduction of larger and heavier jet-powered aircraft during the 1960s and 1970s increased community opposition to airport operations, as ‘the high-pitched squeal of jet engine turbines was far more uncomfortable to the human ear than the growl of conventional piston engines’ (Dierikx and Bouwens 1997 p128).

In 1966, the UK’s first anti-noise group ‘KACAN’ (Kew Association for the Control of Aircraft Noise) was formed with the aim of reducing Heathrow’s acoustic impact (Griggs and Howarth 2004a). Other groups were also established at Luton, Birmingham and Manchester under the auspices of ‘BACAN’, the ‘British Association for the Control of Aircraft Noise’ (an organisation related to ‘LAANC’, the ‘Local Authorities Aircraft Noise Council’) (Hothersall and Salter 1977). By 1973, it was estimated that 2-3 million UK residents suffered from ‘the distinctive roar and high-pitched whine of jet airliners landing and taking off’, a ‘peculiarly oppressive sound, which has to be lived with to be truly resented’ (Pearman 1973 p23).

Following Concorde’s introduction into commercial service, vociferous anti-noise and anti-supersonic transport groups formed on both sides of the Atlantic and a new discourse of acoustic geopolitics developed whereby Britain tried to develop ‘reciprocal booming rights’ to allow Concorde to fly supersonically over other countries (see Wiggs 1971; Adams and Haigh 1972; and Wilson 1973). The resulting debate surrounding who could boom and who could be boomed developed into a highly contested moral and geopolitical issue (see Adams 1974). Since then, the issue of aircraft noise has been a recurring feature of anti-airport campaigns around the

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89 In the 1970s, KACAN became HACAN (Heathrow Association for the Control of Aircraft Noise) which, in turn, amalgamated with the south London based group ‘Clearskies’ to form HACANClearskies in 1999 (Griggs and Howarth 2004a).
world, including Canberra (May and Hill 2006), Madrid (Tremlett 2006), Tokyo Narita (Fuller and Harley 2004), Frankfurt (Dierikx and Bouwens 1997), Boston Massachusetts (André 2004), Amsterdam (Dierikx and Bouwens 1997), Sydney (Fitzgerald 1998), Denver (Leib 2005), and Heathrow (Sherwood 1999), and an anti-airport campaign even featured in Arthur Hailey’s (1968) novel ‘Airport’.

Aircraft noise is governed through international, European and national legislation. At the International level, ICAO sets progressively tighter noise certification standards for sub-sonic civil aircraft as stipulated in Annex 16 of the 1944 Chicago Convention. Aircraft certified before 1977 are designated as either ‘Chapter 1’ or ‘Chapter 2’ (depending on their acoustic impact), while those meeting more stringent post-1977 standards are designated as ‘Chapter 3’ aircraft90. Chapter 1 and 2 aircraft are already banned from EU airspace on account of being unacceptably noisy, while Chapter 3 airframes are being progressively phased out (Johnson 2003). The EU has more limited powers to regulate noise emissions, and legislative disparities exist between member states. In an attempt to harmonise policy, from 2007, Directive 2002/49/EC will compel Member States to publish detailed noise maps from which the acoustic impact airport operations on local communities can be more accurately assessed (DfT 2003a)91.

At a national level, Section 9(1) of the UK’s Air Navigation Act of 1920 protects the airline industry from anyone wishing to take action against it for nuisance resulting from aircraft noise (Roskill Commission 1971 p57; Johnson 2003), a policy reaffirmed in Section 76(1) of the Civil Aviation Act (1982),

“No action shall lie in respect of trespass or in respect of nuisance, by reason only of the flight of an aircraft over any property at a height above the ground which, having regard to wind, weather and all the circumstances of the case is reasonable, or the ordinary incidents of such flight, so long as the provisions of any Air Navigation Order...have been duly complied with.” cited in Taylor (2000 p5)

90 N.B. ‘Chapter’ refers to the relevant section of Annex 16 of the 1944 Chicago Convention.
91 Such data is already collected at certain UK airports including Heathrow (CAA 2004b) and Stansted (Monkman et al 2004).
While Local Authorities have the power to impose noise controls on some transport infrastructure, including railway stations, wharves, and garages under Section 63 of the Control of Pollution Act (1974), noise from aircraft in flight ‘could probably not be regarded as noise from premises’, and so these powers have never been applied (Taylor 2000 p5). Residents are, therefore, effectively denied any legal redress against aircraft noise, but certain administrative mechanisms do enable an airport to be ‘designated’ under Section 78 of the Civil Aviation Act 1982 ‘for the purpose of avoiding, limiting or mitigating the effect of noise and vibration’ connected with aircraft operation (see earlier this chapter). Designation empowers the Secretary of State for Transportation to impose a cap on the number of flights that can operate during certain hours and enables night noise quotas to be introduced. However, such powers are used sparingly and, to date, only Heathrow, Gatwick, and Stansted have had night-noise curfews introduced.

Airport operators are, however, increasingly mindful of the need to be ‘good neighbours’, and have introduced a number of noise mitigation schemes, including the provision of discounted house insulation, community funds and noise and track monitoring systems, which fine operators if they deviate from specified flightpaths. At NEMA, any aircraft that exceeds the maximum permitted noise limit of 85dB is fined £500 plus an additional £150 for every decibel thereafter (UK AIP EGNX 2003). Since the scheme began in July 2002, 114 fines totalling over £125,000 have been administered, with the proceeds funding local community projects (Martin 2006a). Additional targets (including maintaining the current night noise contour until 2016 and ensuring all scheduled night flights are chapter 4 compliant by 2012) have also been set (NEMA 2006). However, given at as many as 60 aircraft routinely operate between 23:30 and 06:00 local time (see Edwards 2005f) such schemes fail to placate opponents in east Leicestershire who continue to complain about aircraft noise (see Box overleaf).

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92 N.B. Other UK airports are subject to different forms of noise regulation (see Taylor 2000).
93 See, for example, NEMA’s 10 point ‘Night Noise Policy’ (NEMA 2004c).
At 4.35am this morning my sleep was shattered by the now hated roar, then fading drone of a low flying aircraft. Once awake you just lie there waiting for the next intrusion. What rights do these bureaucrats have to take away our peace & quiet, disturb our sleep and ultimately damage our health?

- 'Feedback' submission on the DEMAND website⁹⁴

In February 2004, anti-airport campaigners rebranded NEMA 'Keep you awake airport', highlighting the airport's acoustic impact on local communities⁹⁵ as DEMAND campaigners echoed well-established critiques of air transport as producing excessive and intrusive noise:

Woken by low flying, noisy aircraft at 1.45am...between then and 3.15am no fewer than 6 low flying aircraft passed over my house. It is bad enough during the daytime but is totally unacceptable at night bearing in mind that I chose to live in Hungarton for peace and tranquillity...

- 'Feedback' submission on the DEMAND website⁹⁶, my emphasis

Noise is a highly subjective phenomenon to which individuals exhibit different degrees of tolerance, but, on a scientific level, exposure to aircraft noise is known to cause both psychological and physiological effects, the severity of which is influenced by general health, social conditions, and lifestyle characteristics (Thomas and Lever 2003). Physiological responses include quantifiable cardiovascular effects (including increased blood pressure and heart rate caused by elevated levels of stress hormones in the blood, which increases the probability of heart attacks or strokes), and there is some evidence that continued exposure to high levels of noise has a detrimental effect on mental health (Postnote 2003), yet the DEMAND feedback reveals the most resented impact is noise-induced sleep disturbance.

- 'Feedback' submission on the DEMAND website⁹⁷

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⁹⁵ Friends of the Earth (2004).
A recent study of residents living near five large UK airports found between 1 in 5 and 1 in 10 people often had difficulty getting to sleep or were prematurely woken-up by aircraft noise (Diamond et al 2000), while a 1992 report by National Air Traffic Services (NATS) into the effect of aircraft noise and sleep disturbance concluded that outdoor noise events under $80\text{dB(A)} L_{\text{max}}$ were unlikely to cause any increase in the normal rate of sleep disturbance and that between $80-95\text{dB(A)} L_{\text{max}}$ the likelihood of the average person being woken by noise was between 1 in 60 and 1 in 100 (Taylor 2000 p8). However, Franssen et al’s (2004) study of airport populations reported an association between aircraft noise events and increased levels of self-medication for sleep disturbance/insomnia. In the absence of medico-scientific ‘proof’ of their alleged suffering, anti-NEMA protesters regularly wrote to local newspapers reporting regular sleep disturbance. Hume et al (2003) suggest that this circadian component to complaining is expected, as medical studies have established most psychological, physiological and behavioural variables express circadian variations on account of the internal ‘body clock’ and domestic/work routines. However, the acoustic effects of aviation can also cause disturbance during the day. Aircraft noise has been shown to interfere with normal domestic activities by making conversation difficult. Krog and Engdahl (2004) report aircraft noise discourages people from using open spaces, even when they live away from the immediate environs of the airport (c.f. Stratford 1974). Some evidence also suggests high levels of aircraft noise can have a detrimental effect on child health and academic attainment (see Figure 4.12 overleaf).

While noise features prominently on DEMAND’s agenda it is notoriously difficult to measure its impact, as there are 18 different methodological techniques for quantifying it (Janic 1999). Until 1990, the official technique for measuring aircraft noise in the UK was the ‘Noise and Number Index’ (NNI), which calculated the number of noisy events and the maximum sound level at any given location but failed

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98 $L_{\text{max}}$ refers to the maximum noise level experienced during any single noise event.
99 However at Denver, Fidell et al (2000) reported no major differences in noise-induced sleep disturbance during changes in night-time noise exposure.
100 See letters to the Leicester Mercury: I Sutherland (18/09/2004) ‘Fight Night Flights’; E McIntosh (11/06/2005) ‘We need sleep!’; G Stocks ‘Night flights are morally wrong’ (26/05/2005); and Britten (2005).
101 Stansfeld et al’s (2005) cross-sectional study of 2800 9-10 year olds near Amsterdam, Madrid and Heathrow airports discovered that chronic noise exposure had deleterious effects on reading and comprehension. See also Haines et al (2001); Haines et al (2002); and Rabinowitz (2005).
to take into account the duration of individual noise events. Given its limitations, the NNI system was superseded by the more sophisticated, but still controversial, WHO-approved technique for quantifying noise which assesses the frequency and timing of aircraft movements, the maximum sound level (in decibels), and event duration. Aircraft noise is thus measured with reference to the logarithmic A-weighted decibel scale, dB(A), in recognition that the human ear cannot detect all sound frequencies equally efficiently (Tomkins et al 1998). At NEMA, an automated monitoring system records noise levels over time and plots $L_{eq}$ ‘footprints’ which indicate the area of land subjected to different noise levels\(^\text{102}\) (e.g. a $L_{eq24hr}$ of 57dB(A) indicates that the sound energy produced is equivalent to a constant sound level of 57dB(A) over 24 hours).

**Figure 4.12 The perceived effects of aircraft noise on schoolchildren at Stansted**

![Image of children and adults discussing noise]

Source: www.stopstanstedexpansion.com (2005)

The 57dB(A)$L_{eq}$ noise contour is used by the UK Government to indicate the onset of ‘significant community annoyance’ between 07:00-23:00 hours after a 1985 study indicated a strong correlation between this noise level and the onset of community disturbance (ATWP 2003 p34). Porter et al (2000 p15) define annoyance as ‘a feeling of depression, resentment, anger, displeasure, agitation, discomfort, dissatisfaction, distraction, helplessness, or offence which occurs when an environmental factor interferes with a person’s thoughts, feelings, or activities’. The Government

\(^{102}\) In much the same way as isobars delimit areas of equal atmospheric pressure.
acknowledge the relationship between aircraft noise and annoyance is inexact and that 'the mix and types of aircraft, their frequency of overflight, the social and economic circumstances of affected people and general levels of environmental awareness and sensitivity' will determine the extent of disturbance (Postnote 2003 p1)\textsuperscript{103}.

Currently, 600 dwellings fall within NEMA’s 57dB(A)\textsubscript{Leq} daytime noise contour, a figure forecast to increase to 1400 by 2016 (NEMA 2006). 600 dwellings are also subject to night-time noise above 55dB(A)\textsubscript{Leq8hr} (see Figure 4.13), a level at which residents are likely to suffer ‘significant’ sleep disruption. Given the anticipated growth of night flights, this could increase to 1800 by 2016 (ibid. 2006). While aircraft noise can be quantified and mapped to help identify properties entitled to SIGS (Sound Insulation Grant Scheme) funding to help finance insulation and double-glazing costs, it is impossible to map how people will react to noise. As Leicestershire County Council discovered (LCC 2005), annoyance, sensitivity, and disturbance, cannot easily be quantified. In this respect, it would be salient to refer to Porteous’s (1990) research on ‘soundscapes’.

Given many protesters regard methods for measuring noise disturbance as deeply flawed and suggest disturbance is in the ‘ear of the beholder’, NEMA’s management remains sensitive to the acoustic impact of aircraft operations. Indeed, the airport’s noise abatement procedures stipulate ‘Every operator of aircraft using the aerodrome shall ensure at all times that aircraft are operated in a manner calculated to cause the least disturbance to the area around the aerodrome’\textsuperscript{104}. This includes avoiding the use of reverse thrust on landing between 2200-0700hrs in winter and 2100-0600hrs in summer when ‘consistent with the safe operation of the aircraft’, not overflying local villages, and restricting the operation of the noisiest aircraft at night. Furthermore, throughout the consultation periods for the airspace change, the acoustic benefits to

\textsuperscript{103} The 2003 ATWP defined a ‘high’ level of noise as an exposure over 69dB(A)\textsubscript{Leq} and ‘medium to high’ exposure as over 63dB(A)\textsubscript{Leq} (DIT 2003a), whereas 10 years earlier, Whitelegg (1993) identified a daily \textsubscript{Leq} of 65dB(A) as an absolute acceptable upper limit of human noise tolerance. Although the aviation community stress that the spatial extent of aircraft noise footprints has declined despite increased air traffic movements, public tolerance of aircraft noise, particularly in more affluent areas is also diminishing (Upsham \textit{et al} 2003). Thomas and Lever (2003) suggested that sensitivity to aircraft noise is especially acute in Europe owing to high population density, the fact that the airline industry is relatively mature and the fact that Europe has a comparatively affluent and well-educated population with a high quality of life and a low tolerance to environmental disturbances.

\textsuperscript{104} Source: UK AIP AD-2 EGNX-1-10(18/04/2002) ADMT 4/02.
Figure 4.13 Nottingham East Midlands Airport 55dB LA_{eq} 8hr night noise contour, 2003
(Source: NEMA Environment and Safeguarding Department, reduced scale)
local communities were continually emphasised (NEMA 2003, 2004b). However, opponents report that:

**Ragdale, northeast Leicestershire 22 June 2005 10:05:52 AM**

It is now miserable living with the constant distant drone and then loud overhead noise of aircraft over our home all day and into the night. On Monday 20th June we were woken in the night by seven flights from 12am through to 6.20am. The same happened again last night to the point where you dread the next one coming over. It's impossible to get a decent night's sleep since the new flight paths were introduced. We are now very tired!

- 'Feedback' submission on the DEMAND website

In addition to debates about the health implications of aircraft noise, it is commonly believed that properties near airports or beneath flightpaths command lower prices than similar properties elsewhere (Espey and Lopez 2000). Past research had suggested that for a 1dB(A)\(L_{eq}\) change in noise exposure there was a 0.5-1% decrease in residential property prices. However, Tomkins et al’s (1998) study near Manchester airport discovered that the advantages of airport proximity offset the negative externality effects of airport operations\(^{106}\). Nevertheless, anxiety about potential property devaluation continues to be articulated, and the website ‘blightsite.com’ (2004) details how homeowners can claim compensation from airport operators for alleged property depreciation resulting from aircraft noise and vibration. The contemporary challenge facing the aviation community is thus how to meet increasing demand for air travel while simultaneously reducing the number of people who are exposed to high levels of aircraft noise. Thomas and Lever (2003) identified seven ways in which aviation can reduce the number of people exposed to aircraft noise, many of which have been adopted at NEMA (see NEMA 2006):

- **Technological improvement** – make engines quieter and more efficient.

- **Introduce noise charges and penalties** – encourage NPR compliance by monitoring the noise and tracks of individual aircraft, enabling noisy or inconsiderate operators to be identified and fined (see Hume et al 2003).

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\(^{106}\) McMillen (2004) also noted this phenomenon around Chicago’s O’Hare airport.
Operational improvement – use of noise abatement procedures, runway alternation\textsuperscript{107}, noise preferred routes (NPRs)\textsuperscript{108}, and continuous descent approaches (CDAs)\textsuperscript{109}

Infrastructure improvements – construct engine test bays and blast deflectors to reduce primary jet noise (see Pascoe 2001).

Introduce operating restrictions and limitations – ban the noisiest aircraft from using the airport and encourage operators to invest in quieter aircraft by offering them preferential landing/handling fees (see also Taylor 2000).

Better land use planning – create a ‘buffer zone’ between the airport and residential areas by prohibiting the construction of housing in areas that are subjected to high noise levels (i.e. over 57dB(A)).

Offer compensation and sound insulation – to those severely affected by noise.

Yet, for all these schemes, the fundamental fact remains that DEMAND do not want flights going over their property at any altitude or noise level. In this respect, Schafer (1980 cited in Wood 1993 p86) summarises the conflict;

‘A property-owner is permitted by law to restrict entry to his private garden or bedroom. What rights does he have to restrict the sonic intruder? For instance, without expanding its physical premises, an airport may show a dramatically enlarged noise profile over the years, reaching out to dominate more and more of the acoustic space of the community...At the moment, a man may own the ground only; he has no claim on the environment a metre above it and his chances of winning a case to protect it are slender. What is needed is a reassertion of the importance, both socially and ultimately legally, of acoustic space as a different but equally important means of measurement’.

\textsuperscript{107} See Thomas and Lever (2003) and HACANClearskies (2003) for discussion of the use of this policy at Heathrow and how, while operators claim it limits expansion and stifles competition, local residents describe it as a ‘lifeline’ to a bit of peace and quiet (Mangan 2005).

\textsuperscript{108} NPRs route aircraft away from major settlements to reduce noise (NEMA 2003).

\textsuperscript{109} CDAs involve aircraft making a continuous descent from 6,000ft at a 3-degree angle rather than descending through a series of intermediate flight levels with steeper descents. CDAs should facilitate low power, low drag operations, and prevent changes in engine tone, thereby lessening the noise footprint (Clarke 2003).
4.6 Air pollution/health impacts of aviation

‘While the benefits of the growth and development of an airport are spread over a large geographical area, the costs are borne by the residents of its neighbouring communities.’

Upham et al (2003 p14)

Studies have shown that commercial flight poses a unique set of health issues for pilots (Barnett 2006a, 2006b), cabin crew (Pollard 2000), and passengers (Newnham 1998; Hodson 2002; Laurance 2003; Hilpem 2004). Concerns about Deep-Vein Thrombosis (DVT)\textsuperscript{110}, the transmission of infectious diseases (see Mangili and Gendreau 2005), and exposure to cosmic radiation have also been noted (Leney and Burney 1990) but for protestors, it is the health implications of overflying aircraft that cause concern. Significantly, Diamond et al (2000) discovered the proportion of people who perceived their health to be ‘very’ or ‘extremely’ affected by aircraft noise was higher at NEMA than at Heathrow:

\textbf{Gaddesby, east Leicestershire 18 June 2005 1:07:02 PM}

…I have noted that after some of the flights have passed directly overhead there is a smell of fuel. What about pollution and health?

- ‘Feedback’ submission on the DEMAND website\textsuperscript{111}

In March 2006, a Chartered Society of Physiotherapy report discovered many UK airports did not meet EU-recommended limits on nitrogen dioxide of 40 micrograms per cubic metre of air\textsuperscript{112}. At NEMA, ‘Airport bosses believe they are bucking a national trend’ as ‘measurements of nitrogen dioxide...are well below EU guidelines’ (Mitchell 2006).\textsuperscript{113} However, nitrous oxides (NO\textsubscript{x}) are just one of a long list of aviation-related atmospheric pollutants, which also includes carcinogenic volatile organic compounds (VOCs), sulphur dioxide (SO\textsubscript{2}), ground-level ozone (O\textsubscript{3}), carbon monoxide and dioxide (CO and CO\textsubscript{2}), and particulate matter (PM\textsubscript{10}) (Hume and Watson 2003). While the majority of these pollutants originate from aircraft engines, aircraft turnarounds (via fuel spillage and evaporation and/or leaks from septic tanks

\textsuperscript{110} See Hickman (2005).
\textsuperscript{112} Source: ‘Airports fail air pollution test’ BBC news online (2006c).
\textsuperscript{113} NEMA began monitoring nitrogen dioxide levels in 2000 via a network of seven permanent air quality monitoring stations. However, the airport’s proximity to major roads makes it difficult to differentiate airport-related air pollution from vehicle emissions. Source: NEMA (2006) and Neil Robinson, Environment and Safeguarding Manager, NEMA, personal communication (2006).
and hydraulic systems), simulated fire and emergency exercises, routine maintenance, and access traffic all contribute by 2016, NEMA predicts that while the volume of PM10 emissions will remain at 2004 levels, the quantity of NOx and VOCs will have increased to 5029 and 935 tonnes per annum respectively (Table 4.3).

Table 4.3 Summary of NEMA’s emissions (tonnes per annum)

<table>
<thead>
<tr>
<th></th>
<th>NOx</th>
<th>PM10</th>
<th>VOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>4123</td>
<td>181</td>
<td>728</td>
</tr>
<tr>
<td>2016</td>
<td>5029</td>
<td>181</td>
<td>935</td>
</tr>
</tbody>
</table>

Source: data derived from Figure 3, Appendix 4 (NEMA 2006 p6)

Respiratory, cardiovascular, oncological and mental health problems are also alleged, but epidemiological studies into the incidence of certain conditions close to airports have been unable to conclusively prove a link between health complaints and aircraft pollution. Nevertheless, biochemical studies have enabled the physiological effects of exposure to the principal pollutants to be predicted.

114 N.B. only pollution emitted during the landing and take-off cycle (which includes taxiing, take-off, climb, approach and landing phases of a flight) is considered to impact on local communities (and even then it isn’t deemed to be a problem when the aircraft reaches 1000 metres). On take-off, engines emit more NOx while the lower power settings on landing mean more VOCs, unburnt hydrocarbons, and CO is released (Hume and Watson 2003). Whitelegg and Williams (2000) report NOx and VOCs emissions from airports are comparable with those from chemical factories, oil refineries and power stations and local residents often complain of a distinctive smell that makes breathing difficult (Demand feedback May-November 2005; Mangan 2005).

115 Due to variations in lifestyle (including diet, occupation, weight, and drinking habits), medical history, and the lack of comprehensive monitoring systems. I would like to thank Professor Stewart Petersen, University of Leicester, for pointing this out to me.

116 Nitrous oxides have been shown to affect lung function by impairing respiration and damaging small thoracic blood vessels, exacerbating asthma and prolonging respiratory infections, while long-term exposure is thought to damage the immune system and increase the risk of bronchitis. Volatile organic compounds (VOCs) are known carcinogens and are believed to cause skin irritation and, at high concentrations, respiratory distress, while ground-level ozone (O3) reduces lung function, exacerbating respiratory complaints including asthma and bronchitis. At low concentrations, carbon monoxide (CO) impairs concentration, causes headaches and nausea, and affects the functioning of the central nervous system. Patients suffering from coronary heart disease are especially susceptible as CO reduces the efficiency at which oxygen is transported around the body, causing chest pain and, at high concentrations, death. Particulate matter (PM10) is easily inhaled, and becomes imbedded in the lining of the lungs causing sinusitis, chronic wheezing, breathing difficulties, bronchitis, emphysema and eventual loss of lung capacity. They are believed to contribute to increased rates of heart disease and have the potential to chemically interact with NOx and SO2 in the body, increasing their toxicity, while exposure to sulphur dioxide (SO2) causes bronchitis and reduces lung function. (see Holzman 1997).
At NEMA, local councillors have demanded NEMA supply information on rates of respiratory disease around the airport vis-à-vis the ‘population at large’\(^{117}\), and David Taylor M.P. has alleged a link between congenital malformations and airport-related pollution\(^{118}\). However, as Banatvala (2004 p647) observes, while ‘[e]ver 150 epidemiological studies report associations between [atmospheric pollution] and ill health...What the major culprits are and whether a threshold exists below which damage to health is unlikely is unknown’. Despite the uncertainty, André (2004) remains convinced that airport communities experience real health effects from aviation pollution, but Hume and Watson (2003 p70) stress that, ‘however plausible the sequence of cause and effect seems theoretically, it has proved very difficult to demonstrate, objectively, physical or mental health impairment’ due to aircraft operations. Until money is invested in comprehensive clinical trials, the human health implications of prolonged exposure to these various chemicals will be unknown and the accuracy of the WHO’s recommended maximum exposure limits will remain ‘guestimates’. There is clearly a need to thoroughly assess the medico-social and environmental effects of aircraft emissions, yet at present, there is neither the political pressure nor the commercial will to fund such studies.

Closely related to health concerns are anxieties about the environmental impacts of flying. Globally, aviation represents the fastest-growing source of CO\(_2\) emissions (Lee and Raper 2003; Juniper 2005)\(^{119}\). In the UK, greenhouse gas emissions attributable to air travel have doubled in the past 13 years to 39.5m tons in 2004 (McCarthy et al 2005 p2)\(^{120}\). In recognition of rising public awareness and concern surrounding this issue, passengers are encouraged to make voluntary contributions to organisations, including the Carbon Neutral Company and Atmosfair, who fund schemes that aim to offset carbon emissions (Brown A 2005; Brown C 2005a)\(^{121}\). While aircraft emissions

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\(^{117}\) Which, given patient confidentiality and data protection laws, is neither collected nor collated.

\(^{118}\) Hansard debates (30/06/2004 Column 114WH) and Neil Robinson, personal communication (2006).

\(^{119}\) Globally, aviation is thought to be responsible for 13% of transport-related and 2% of all anthropogenic CO\(_2\) emissions, though these figures are expected to rise dramatically (Upham 2003).

\(^{120}\) When cruising, aircraft emit a mix of CO\(_2\), nitrous oxides, sulphurous oxides, water vapour, and various particulates, where they are thought to cause 2.7 times the environmental damage of similar emissions at ground level (Edemarian 2005; McCarthy et al 2005).

\(^{121}\) Other companies allow travellers to estimate the atmospheric impact of their flights, while the EU has proposed an emissions trading scheme (Castle 2005). The ‘air travel calculator’ at www.chooselclimatemore.org computes that a flight from London to Dublin (a distance of 288 miles) uses approximately 48kg of fuel and emits 891kg of CO\(_2\) per passenger, while a trip to Sydney (10,557 miles) uses 1,196kg and emits 11,149 kg CO\(_2\) (Brown C 2005).
In March 2006, residents claimed that a block of ice fell from an aircraft going into NEMA, damaging a car\textsuperscript{123}, while in August that year, a mother alleged her toddler narrowly missed being killed after a roof tile fell off their house in Kegworth after being dislodged by the wake vortex of a landing aircraft (Martin 2006b). Local residents had previously raised the issue of third-party risk in relation to the safety record of American cargo operator, Kalitta Air (that regularly flies into NEMA), after an engine on one of their B747Fs detached itself mid-flight over lake Michigan\textsuperscript{124}. Thus, in addition to the potential long-term health implications of airborne pollutants, airport proximity has been found to generate substantial levels of anxiety among airport communities (Chung et al 2001)\textsuperscript{125}.

Although air travel is statistically the safest form of transport, the death of 43 residents of the Bijlmermeer complex near Schiphol, Amsterdam, in 1992 when an EL Al B747F crashed into blocks of apartments, and the death of 13 people on the ground near Paris owing to the Concorde crash of July 2000, has kept the issue of third-party risk high on public and political agendas and highlighted the hazards associated with routing aircraft over populated areas (Hume and Watson 2003)\textsuperscript{126}. Though without third-party fatalities, the Air Algerie crash at Coventry in December 1994 (Elliott 1995), the British Midland accident at Kegworth in January 1989 (see Chapters Three and Six), and the Korean Air crash at Stansted in 2000 (CAA 2003), demonstrated that the UK was not immune to hull-losses involving large commercial aircraft. More recently, on 26th June 2003 near Reigate, Surrey, a 6 x 4ft access panel weighing 701bs detached itself from a British Airways B777-236B that had just taken off from Gatwick airport, narrowly missing people on the ground (CAA 2005d).

On the rare occasions when aircraft encounter problems on take off (such as engine failure or fire) and need to return to the airport, they either have to jettison fuel or

\textsuperscript{123}See Mack (2006a), Harborough Mail (23/03/2006), BBC news online (2006b) and the Leicester Mercury (2006b).

\textsuperscript{124}Source: letters to the Leicester Mercury by S Bacon - 'Ageing cargo aircraft threat' (17/03/2005) and 'Airport traffic - a question of safety' (16/02/2005) and G Stocks (2005a).

\textsuperscript{125}Chung et al's (2001) study of the Coventry crash recorded high levels of post-traumatic stress disorder among local residents, with many reporting severe and debilitating stress responses to the sound of aircraft passing overhead.

\textsuperscript{126}In comparison, the wreckage of the mid-air collision that killed 71 people above Überlingen, Germany, between a DHL B757F and a Russian TU-154, fell into woodland and open fields between local villages (see Bennett 2004 and the Bundesstelle für Flugunfalluntersuchung Report 2004).
circle overhead in the vicinity of the airport to lose weight before they can land. In the summer of 2006, an Air Scandic flight at NEMA suffered technical difficulties soon after take-off, which required it to circle in the PIGOT holding stack to burn off fuel until the airframe was light enough to make an emergency landing back at NEMA. The crippled jet did not go unnoticed:

Great Glen, southeast Leicestershire 30 August 2005 8:22:43 AM

...we were treated to a flyby of what appeared to be the same elderly plane no less than six times... - apparently because the plane had a technical fault. Nice to contemplate as it passes over your house for the nth time! Why was this plane not routed further away from residential areas? Do you have no respect for the people who now have to live with your lack of social responsibility?

- ‘Feedback’ submission on the DEMAND website

DEMAND protesters also alleged fuel jettisoned from a DHL B757F over a field in northwest Leicestershire caused a herd of cows to become sterile, a theory that has failed to reassure the public about the possible health and safety implications of flightpaths.

4.8 The conservation of rurality. Contesting (air)space in the countryside

Geography has become increasingly sensitised to the significance of rurality as a cultural construct. As Cosgrove et al (1996) explain, the pastoral 18th century English rural landscape ideal remains a powerful symbolic image and associations between rurality, agrarian productivity, domesticity and social stability remain very strong. Gray (2003 p93) agrees, suggesting that living in the countryside is a ‘culturally intimate experience’ that creates distinctly local ‘English’ identities, while Phillips et

127 To enable significant weight reductions to be achieved quickly, fuel is jettisoned via nozzles in the trailing edge of the wings at a rate of two tons per minute (Stewart 1992). Owing to the toxicity of kerosene, this procedure should ideally be carried out over the sea, but the nature of the emergency may demand fuel is dumped over land. According to Bristol Airport’s website (www.bristolairport.co.uk 2005), the chance of this happening are 1 in 30,000 take-offs.


130 Concerns about fuel dumping have also been articulated by Wolverhampton Airport Action Group, WAAG (www.waag.uk.com). A further risk comes from would-be asylum seekers who try to enter foreign countries illegally by hiding in the landing gear bays of aircraft. Given these spaces are neither heated nor pressurised, the majority of stowaways perish in the cold rarefied air of the troposphere, falling to earth when the landing gear is lowered as the aircraft nears its destination (see Harding 2006 ‘Someone just dropped in’ p318).
al (2001) argue the production and consumption of mediated representations of rurality through British television programmes creates and perpetuates just one socially dominant (and dominating) way of conceiving rural space. However, Newby (1987 p3) suggests portrayals of the English countryside as a ‘green and pleasant land’ full of grazing sheep and rustic crafts presents a ‘sentimental and idyllic evocation of a rural past which never existed’ Haines (1973 p79) reminds us that the ‘countryside’ is ‘as man-made as Euston station, the Bull-Ring in Birmingham and the spoil heaps of Aberfan’ and suggests fallacious nostalgic conceptions of English rural life actually say more about public dissatisfaction with urban living than they do about the countryside. He is critical of the hypocrisy of a ‘new class of ruralists’ or ‘countryfied commuters’ (see Sinclair 1991 p4) who, ‘having sought their rustic retreat’ are ‘disinclined to favour further ‘intrusive’... development’ that would further ‘urbanise’ the countryside (Newby 1987 p232)131. Hence, Woods (2005 p210) notes, ‘There are...many different representations of the rural mapped over the same physical space, informed by different social constructions of rurality...and by different economic and ideological interests’, creating a multitude of ‘rural’ places.

Gaddesby, northeast Leicestershire 30 May 2005 4:48:22 PM

I will have lived in rural East Leicestershire for 30 years this August. Over that time I have witnessed many changes that have altered the very quiet and rural “backwater” atmosphere of the area. Inevitably it has become busier and more built up. Increases in traffic, infilling... in villages and the erosion of green spaces have all contributed to this. But I can honestly say that no single thing has worked faster to despoil, decimate and even desecrate this area, in the 3 weeks since they were introduced, than the new flight paths. How to ruin something in 3 weeks!

- ‘Feedback’ submission on the DEMAND website132

DEMAND also argues aircraft noise is wholly inconsistent with the maintenance of the rural idyll, and they express anger that ‘the noise of the city’ has followed them to the countryside133. Opposition to NEMA’s flightpaths can thus be understood as an attempt to protect their ‘financial and emotional investment by opposing developments and activities that threaten the perceived ‘rurality’ of their new home’ (Woods 2003b p312).

131 See also Senior (2004) on the Stop Stansted Expansion Campaign.
133 Leicester Mercury (2005b).
Gaddesby, northeast Leicestershire  20 July 2005  11:32:07 AM

...I am deeply upset by this intrusion upon what I considered my own peaceful world...[we] spent large amounts buying our houses to obtain this lifestyle

- ‘Feedback’ submission on the DEMAND website134

Frisby on the Wreake, northeast Leicestershire  06 September 2005  11:40:29 AM

...We moved away from the St Albans area to escape the motorway and aircraft noise only now to find it is worse than ever here...Our village used to be so peaceful...Whilst writing this email 5 planes have passed over spoiling an otherwise beautiful morning with clear blue skies...It seems to me that the flight path has already affected the ability to sell property in the Wreake Valley - this was previously such a sought after area carrying premium prices that we have all already paid!!

‘Feedback’ submission on the DEMAND website135

Woods (2005) suggests such urban-to-rural migration has led to the ‘commodification’ of the countryside, where culture and lifestyle are considered more important than the physical exploitation of the land. Thus ‘redundant agricultural buildings never intended for habitation’ command ‘six-figure selling prices’ if they possess ‘the combination of charm, age and view considered the ideal qualities of the contemporary ‘country home’” (Sinclair 1991 p4). Thus, arguably, ‘the more urbanized society has become, the more ruralist it has pretended to be’ (ibid. 1991 p147).

Six months prior to the ATWP’s publication, a CPRE report calculated that the equivalent of five new airports the size of Heathrow would be required by 2030 to meet predicted demand in air travel, and argued the Government’s expansion plans would threaten up to 2800 hectares of greenbelt land; two villages, 44 Sites of Special Scientific Interest (SSSIs), seven Areas of Outstanding Natural Beauty (AONBs), eight landscaped parks and gardens, 49 ancient monuments and 319 listed buildings136. The report also warned that an undetermined quantity of land would be required for new roads, ancillary facilities, and housing (including 83,000 new homes

136 This represented a worse case scenario and the unrealised proposal that new airports could be built at Cliffe and Rugby (CPRE 2003a).
1971; Bromhead 1973; McKie 1973; Kimber and Richardson 1974; Hall 1980; Buchanan 1981; and Hamlin 1997, for details), SSE framed themselves as custodians of the English countryside and English cultural heritage, highlighting the possible ecological effects of expansion on Hatfield Forest\textsuperscript{139}, the loss of rural tranquillity, the 'rape' of the countryside, and destruction of 54 listed buildings, 200 homes and two ancient monuments\textsuperscript{140}. SSE expressed concern about the inevitable urbanisation caused by the construction of new housing estates to accommodate increased numbers of airport workers (Spake 2004). Even the leader of Essex County Council, Lord Hanningfield voiced concern that the plans "could effectively turn Essex into another London borough"\textsuperscript{141} (cited in Clark 2003).

Thus, accompanying the celebration of the countryside as a site of peace, tranquillity, and contentment is the fear of it being destroyed or despoiled by processes of change, whether through military conflict or by unwelcome development projects, including reservoirs, new housing estates, airports, electricity pylons, roadside advertising, sewage farms, retail parks, park and ride sites, or roads (see Cosgrove \textit{et al} 1996). As was the case in the Stansted protest, the language, imagery and associations employed by the media in their coverage of the NEMA flightpath controversy perpetuate a sense of a rural 'crisis' while accentuating the alleged existence of a rural-urban divide\textsuperscript{142}. Sinclair's (1991) belief that accounts of rural protest are dominated by sentimentality, nostalgia and hysteria can be observed in television documentaries and newspaper reports of the ELVAA/DEMAND campaign: 'Cotton wool clouds drift through a blue summer sky above brightly painted cottages – the scene is a perfect country idyll. Sunlight glints from the ancient church's weather vane, children pick blackberries from the hedges and the only noise is an occasional car' (Edwards and Farmer 2004). At Stansted, SSE developed a webpage entitled 'From the Heart', a repository of personal topophilic recollections of summer picnics under cloudless skies and golden wheat fields swaying in the breeze\textsuperscript{143}. All the accounts construct a discourse of rural peace, contentment and tranquillity, while conveying their anger, resentment, and frustration about airspace expansion (Figure 4.16 overleaf).

\textsuperscript{139} Which is designated both a Site of Special Scientific Interest and a National Nature Reserve.
\textsuperscript{141} This remains a sensitive issue, as parts of Essex did become London Boroughs in 1965.
\textsuperscript{142} see Taylor (2000) and Kettlewell (2004).
\textsuperscript{143} As of 16/02/2005, this page contained 28 submissions.
SSE also portrays BAA as a malevolent force out to ‘bulldoze’ local heritage, destroy local communities, and desecrate ‘prime’ Essex countryside (Figure 4.17).

As Sinclair (1991 pp129-130) notes, ‘every time an important building project is suggested, every time a new trunk road or even a by-pass is planned, almost every time planning permission is even hinted…there is an outcry that the countryside is being raped or pillaged…Of course, development and modernization are necessary, just so long as they take place somewhere else’. The militancy with which communities respond to airport development proposals was demonstrated in October 2002 when residents of Church Lawford and surrounding Warwickshire villages
mobilised against a suggestion to construct a new ‘super-airport’ near Rugby (Clark 2002). Resident Don Barnard articulated his opposition in the form of a protest poem, which employs the familiar rhetoric of landscape despoliation and heritage destruction, while conveying the strength of local feeling: 144

'A runway, where Green Lane had been?  
Instead of roses, kerosene?  
A drain, where Avon runs?  
No “Last Orders!”, final calls?  
Not cottages but baggage halls  
And only planes, no swans?  

St Peter’s to be “Duty Free”?  
“Departures” where our graves should be?  
Ring out, wild decibels?  
Give up our five good Domesday hides,  
Our homes and livelihoods besides,  
So planes can make life hell?  

No bloody fear! No bloody thanks!  
No Blairport! He can send in tanks  
Or even send his pals the Yanks,  
Rugby still won’t play.  
We've just declared a no-fly zone –  
In the heart of England. Hear that, Tone!  
In Warwickshire, we hold our own!  
We mean it when we say:  
No bloody planes, no way!'  

During the controversy surrounding the decision that ultimately led to Stansted being selected as the preferred site as London’s Third Airport, Anthony Crosland (then Economic Secretary to the Treasury) declared, in 1971, that the anti-airport brigade is ‘hostile to growth in principle and indifferent to the needs of ordinary people. It has a manifest class bias, and reflects a set of middle-and-upper class value judgements. Its champions are often kindly and dedicated people…[but]…They are highly selective in their concern, being militant mainly about threats to rural peace and wildlife and well-loved beauty spots’ (cited in McKie 1973 p127). In the context of the NEMA airspace controversy, the CPRE (2003d p45) similarly noted the difficulties of balancing increased air traffic growth with the preservation of the ‘beautiful countryside’ and ‘peaceful environment’ in parts of the East Midlands.

4.9 Summary: contesting airspace

This chapter has shown how DEMAND has ‘learned the language’ of airport protest and highlighted how supporters have used their lived experience of the flightpath reorganisation to produce alternative knowledges of airspace that contest the dominant economic arguments employed by pro-aviation lobbies. While the majority of concerns surrounding airport expansion – aircraft noise, land grab, air pollution, third party risk, and urbanisation – are not new phenomena, the DEMAND protest is unusual in that it objects not to a nodal development, such as new runways or terminals, but to airspace itself.

The rerouted flightpaths have undoubtedly changed the acoustic environment of east Leicestershire, and the emotional upset this caused helped create a territorial identity for ELVAA, where acceptance into the group was determined by the ability to hear aircraft noise and a willingness to protest against the perceived injustices of authority. While the majority of complaints ostensibly employed the familiar rhetoric of rural landscape despoliation and feelings of being ‘overwhelmed’ by noise, it can be argued that DEMAND’s unwillingness to accept the airspace change was also due, in part, to their supporters not appreciating the complex spatial process that go into producing and maintaining this aerial space of flows, and thus failing to appreciate how and why these uneven acoustic geographies are created. While this chapter has explored how NEMA’s airspace is produced ‘on the ground’ by those who oppose its use, the next examines how it is produced ‘from above’ by practices of air traffic control.
In the context of the ongoing controversy surrounding the reorganisation of controlled airspace at NEMA, this chapter contributes to extant geographical understandings of spaces of global mobility and flow by exploring how standardised operating procedures, navigation aids, software systems, and the commanding gaze of human controllers collectively (re)produce the airspace above the airport. Through a comprehensive investigation of the historical evolution of global aeronautical geopolitics (and the resulting institutional and regulatory frameworks that govern the use and management of British airspace), the development and utilisation of specific Air Traffic Control (ATC) technologies, and the embodied practice of controlling air traffic, this chapter will demonstrate that the form and function of NEMA’s airspace is firmly connected to, and dictated by, the geopolitical and socio-economic and topographical characteristics of the ground beneath it, and the related atmospheric and conditions above it. This chapter thus suggests geographers should be aware of the practical spatial complexities of this ground-to-air(space) relationship, and alert to how the constantly (re)produced aerial network through which aircraft fly is intimately connected to earth-bound socio-economic and geopolitical spatialities, before its contemporary (ab)use, management, and control can begin to be understood.

This chapter begins by reviewing the significance of key international agreements governing the use of airspace. This is followed by a discussion of the role of different artefacts, technologies, and procedural discourses of ATC to explain how they enable ATCOs to ‘order the sky’ above the NEMA. Special attention is directed towards the use of radar, radio, and flight progress strips in ‘producing’ airspace routinely, safely, and efficiently. Original empirical material, obtained during personal observation of, and in-depth interviews with, air traffic controllers at four different Air Traffic Control Centres (ATCCs) in the UK provides an original and innovative insight into
how the embodied practices and complex visualities of controlling air traffic at a variety of spatial scales combine with the technical procedural discourse of ATC to 'create' four-dimensional space in flexible ways according to weather conditions, traffic demand, and the performance characteristics of individual aircraft. The chapter concludes with a discussion suggesting how an appreciation of the spatially discursive practices of air traffic control at NEMA can contribute to extant geographical understandings of the formation and maintenance of different types of social space.

5.1 An introduction to global airspace management. The international regulation of UK airspace.

The development of global airspace management may be understood both in terms of the organisations responsible for formulating international airspace policy and the geopolitical climate in which these decisions were taken. Historically, airspace management has grown in parallel with technological advances in aircraft design, propulsion and navigation, and the continued globalisation of trade and tourism throughout the 20th and 21st centuries. As the number of passenger flights increased, official spatial aerial allocation was required to meet the needs of a diverse body of airspace users, including military, civilian and private clients. Contemporary airspace planning thus necessitates the functional integration of a complex network of airlanes and control zones with areas of military or otherwise restricted airspace, a system that has become more dense and complicated over time.

The following section details how the institutionalisation of airspace management on a variety of spatial scales, from international agreements to national and, increasingly, local protocols, continues to shape the use and the regulation of UK airspace.

5.1.1 The development of early legislation

Airspace administration borrows from maritime law, although it is only in the last one hundred years that systematic international accord regarding its regulation has been required. As a consequence of early cross-Channel services, the need to draw up national and international aerial legislation became increasingly urgent. As Dargon (1919 p146) noted, ‘[w]hereas other vehicles...are compelled to keep to existing tracks, aircraft are free to manoeuvre in space and can rapidly and easily surmount all obstacles which have hitherto constituted effective barriers to other forms of'
locomotion'. Given that aircraft threatened the integrity of national borders, individual states felt compelled to defend themselves against uninvited or hostile 'winged visitors' though a collection of hastily formulated aerial legislation (Brittin and Watson 1972).

So long as a pilot took off, flew within a state’s navigable airspace and landed within its national borders there was no problem, but the challenge international services posed to the territorial integrity of individual states produced one of the longest and most acrimonious debates in aeronautical politics, with each nation-state seeking to cede as little and seize control of as much airspace as possible, manipulating international agreements governing economic regulation for their own commercial advantage, while seeking to maintain control over their borders for reasons of defence and national security (Petzinger 1995; Aharoni 2002). As such, individual nation-states have long maintained a vested interest in regulating how aircraft technology and aeronautical regulations governing access to airspace have evolved (see Hayward 1983; Butler 2001). The first tentative attempts at airspace regulation had occurred in 1900, when the French Government suggested that a code governing international air navigation should be formulated after German balloons made a series of unauthorised flights over French territory (Millichap 2000). The most pressing issue concerned the right of access to airspace and, as such, was similar to questions that had been debated in maritime law, which had sought to reconcile seaspace as a site of international transport, recreation, and resource-harvesting, with the territorial aspirations (and defence) of nautical nation-states (see Pearcy 1959, 1967; Prescott 1975; Bull 1976; Churchill and Lowe 1983; Glassner 1986, 1996; Glassner and de Blij 1989; and Johnston 1988, among others).

Countries with rapidly developing aviation interests, including the UK and US, advocated complete freedom of the skies, cautioning against any bureaucratic intervention (other than that which helped secure their aerial hegemony), arguing ‘[t]he road of the air is a free and universal thoroughfare for all mankind. As wide as the world, and almost everywhere navigable, it is unhampered by any barrier, obstacle or limitation...Any restriction to its usage will be an arbitrary restriction imposed by the will of man’ (Burney 1929 p167). One of the main obstacles to agreement was that while national claims to land, lakes, rivers and adjoining seas had been common
since Roman times, claims to airspace were entirely new concepts. Nevertheless, it was agreed that some form of transnational regulation was required, and the first coherent attempt to bring international air services under unified control occurred at Paris in 1910. However, the mutually incompatible visions held by the representatives of different aerial nations meant that unanimous agreement on the use and regulation of airspace was not forthcoming (Veale 1945; Cheng 1962). On one side, the French and German delegations argued for complete freedom of the air above all territories, employing similar arguments to Hugo Grotius who, in his seminal work of 1609, *Mare Liberum* (freedom of the seas), stated that the ocean “is common to all, because it is so limitless that it cannot become the possession of anyone...[and]...can neither be seized nor enclosed” (cited in *Time Magazine* 1974 p34). However, the British representative at the conference disagreed, citing John Selden’s *Mare Clausum* (closed seas) arguments of 1635, which contended that the sea (and therefore the sky) was capable of private dominion and ownership, like the land (Churchill and Lowe 1973; Bull 1976; Butler 2001). The British position was thus summarised; “*Cujus est solum ejus debet esse unisque ad coelum*” [He who possesses land possesses that which is above it to the sky] (cited in Matte 1981 p54).

In 1911, the British Parliament passed the ‘British Aerial Navigation Act’, which declared that Britain’s airspace (including that of her colonies and dominions) was sovereign territory and therefore inviolable (Brittin and Watson 1972; Butler 2001). Though recognising the economic and geopolitical objectives behind the legislation, Burney (1929 p161) fundamentally disagreed with national partition and sovereign ownership, maintaining that ‘[t]he air, unlike the land and the sea, cannot be parcelled out among the nations. It does not admit of propertied possession, national frontiers, administrative zones of control...It is indivisible and universal, the common property of all’. He was scathing of such nationalistic policies, cautioning that they would ultimately hinder the establishment of an efficient system of air communications in Europe as, once obtained, individual nation-states would refuse to relinquish sovereignty of ‘their’ airspace. Furthermore, he considered it ‘absurd to conceive of air travel and air transport in terms of national boundaries and local systems of control. Indeed, Air Power practically demands a World-State for its free and systematic development, and...the national divisions of mankind are so many irritating obstacles in the path of progress’ (ibid. 1929 p142).
By the end of the First World War, the need to enshrine the miscellany of national air transport regulations into a series of international agreements became increasingly urgent, as the major aeronautical nations, Britain, France, Germany and the United States, all vied for aerial hegemony (Butler 2001). In January 1918, the British Government established an Air Ministry to coordinate British airspace policy and oversee the country's aviation interests, while the scope of the Air Council was extended to cover all matters concerned with international air navigation (see Cheng 1962). With serviceable aircraft again becoming surplus after the declaration of the Armistice, the organisation of airlines to operate these machines on a scheduled basis over regular European routes was attempted (Porter 1991). In Britain, the conditions under which this could be achieved were set out in the Air Navigation Regulations of 1919, which became effective on May 1st that year (Crewe 2002). However, despite their newfound role as instruments of peace, individual European nations were wary of allowing foreign aircraft into their airspace, and an attempt at resolving this impasse, while creating the economic conditions that would foster the industry's growth, was attempted in Versailles in 1919.

5.1.2 The Versailles Treaty, 1919

The right of individual countries to claim sovereignty over their aerial territory was formally enshrined in Chapter One of the Paris Convention of 13th October 1919, and signed by delegates of 26 Allied and Associated Powers (Veale 1945). Article One stated that 'The high contracting parties recognize that every power has complete and exclusive sovereignty over the air space above its territory... including...both that of the mother country and of the colonies, and the territorial waters adjacent thereto' (cited in Lissitzyn 1942 p366), on the understanding that '[e]ach contracting State undertakes in time of peace to accord freedom of innocent passage above its territory to aircraft of other contracting States' (Article Two cited in Butler 2001 p91). This condition was further emphasised in Article 15, which guaranteed 'Every aircraft of a contracting state has the right to cross the air space of another state without landing' although, and here was the caveat, '[t]he establishment of international airways shall be subject to the consent of states flown over' (cited in Lissitzyn 1942 p366). This degree of regulation disappointed those delegates who believed aviation had the

1 N.B. Pagination refers to the electronic version of this paper.
potential to become a universal globalising force that should not be subject to restrictions imposed by 'selfish' national politicians (Hershey 1943). Britain's relative aerial technological prowess after 1945 encouraged support for Article Two, ostensibly allowing open airspace access to foreign airlines belonging to contracting nations to promote international trade, while preserving aerial sovereignty. This apparent contradiction ensured the British Government could protect the commercial viability of domestic airlines by insulating them from foreign competition, while simultaneously exploiting the technological distinction of civilian air transport as a valuable instrument through which to exert national and international political influence (Dobson 1990).

Even during World War Two, bureaucratic attention was directed at developing a system of air traffic control that could efficiently and safely handle predicted post-war volumes of traffic. While Johnson (1939 p233) admired the fact that 'Europe to-day is criss-crossed with airways' and that 'wherever you may want to go...you may be sure to get there by air', increasingly busy skies were causing concern. In 1943, an Independent Committee on the Future of Civil Aviation in the United Kingdom (para.6.24 p18), recommended that 'A rigid system of control of flying should be instituted and enforced in the vicinity of all air routes' for the purposes of expediting traffic flows and by protecting life and property by preventing mid-air collisions (see also Wilson and Bryan 1949). Yet, while the UK remained at liberty to formulate national aviation policies, British politicians realised the peacetime development of air services required full international cooperation and an important step in formulating the necessary international agreements was taken at a conference in Chicago in 1944 that was attended by the representatives of 52 states (Cole 1950).

5.1.3 The Chicago Convention, 1944
By the end of World War Two, it was apparent that the then-leading global aviation superpowers, Britain and the United States, held radically different views on how the industry should develop. While the majority agreed that every Contracting State 'has complete and exclusive sovereignty over the airspace above [their] territory'² (cited in Prescott 1987 p26), attending states were not prepared to grant other countries

² Including that above all land, territorial waters, colonies, dependencies and mandates.
extensive access rights to their airspace, and the US’s proposals for ‘open skies’ across the Atlantic and unrestricted competition, while supported by the Netherlands and Sweden, were flatly rejected by Britain and other European nations who advocated a system of strict bilateral regulation and believed there should be ‘order in the air’ (Pillai 1969 p85). 3 Despite the inherent incompatibility of these two geopolitical strategies and the inevitable stalemate that resulted, the conference produced two important documents in the form of the ‘International Air Transport Agreement’ and the ‘International Air Service Transit Agreement’, and created a consensus which directly led to the formation of the ‘International Civil Aviation Organisation’ (ICAO), a United Nations body that was given responsibility for regulating technical competence and safety standards around the World (Crewe 2002). Furthermore, much to the consternation of the French 4, English was adopted as the international language of aviation in recognition of the extent of the English-speaking world and its emerging role as the language of global commerce (Tajima 2004).

The 1944 International Air Transport Agreement was based on Canadian proposals to establish a series of ‘freedoms’ of the air (described in Table 5.1 overleaf) that would enable states to reciprocally negotiate traffic rights through bi- and multilateral air service agreements (Brittin and Watson 1972; Prescott 1975; Millichap 2000). Unlike ships, it was assumed that aircraft had no automatic right to ‘innocent passage’ through sovereign airspace and individual access agreements had to be negotiated, while failure to comply with the stipulated conditions could result in access being denied.

The majority of delegates expressed concern that prevailing post-war market conditions would favour the development of the US’s air transport industry to the detriment of other nations, and consequently only the first two ‘freedoms’ were officially adopted by the time the conference ended (Janic 1997; Millichap 2000). Nevertheless, the exchange or denial of these bilateral navigation agreements had very significant implications on the development of global airline networks, as the lack of overflying rights forced aircraft registered in certain countries to fly lengthy (and costly) circuitous routes to avoid overflying ‘unfriendly’ countries (Glassner 1996).

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3 See also Cheng (1962) and Millichap (2000).
4 As, up until then, French had been the lingua franca of aviation (Crewe 2002).
Table 5.1 The eight freedoms of the air. N.B. the final three ‘supplementary rights’, though agreed in the wake of the Chicago Conference, were not introduced until the late 1970s/early 1980s in the US and the early 1990s in Europe (Millichap 2000).

<table>
<thead>
<tr>
<th>Freedom</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Freedom to overfly the territory of another state without landing</td>
</tr>
<tr>
<td>Second</td>
<td>Freedom to land for technical reasons in another state without picking up/setting down commercial traffic</td>
</tr>
<tr>
<td>Third</td>
<td>Freedom to carry commercial traffic from the home state to a foreign state</td>
</tr>
<tr>
<td>Fourth</td>
<td>Freedom to carry commercial traffic from the foreign state to the home state</td>
</tr>
<tr>
<td>Fifth</td>
<td>Freedom to carry commercial traffic between two foreign states on a route to or from the home state</td>
</tr>
<tr>
<td>Sixth</td>
<td>Freedom to operate commercial services between two foreign states via the home state</td>
</tr>
<tr>
<td>Seventh</td>
<td>Freedom to operate commercial services directly between two foreign states</td>
</tr>
<tr>
<td>Eighth</td>
<td>Freedom to operate commercial services between two points within a foreign state</td>
</tr>
</tbody>
</table>

Source: Based on Doganis (1991 p257) and Millichap (2000 p40)
As such, Pearcy (1967 p484) maintained ‘[e]ach mile in the air denied to commercial aircraft...offsets...the great advances made by the aeronautical industry’. In the 1960s, aircraft belonging to the Israeli national carrier, El Al, were prohibited from overflying Iraq or Syria (which added 245 miles or 30 minutes flying time to the service between Tehran and Tel Aviv, making it uneconomic) (ibid. 1967), while in August 1983 the USSR Air Force shot down a South Korean-registered Boeing 747, killing 269 people, after an incorrectly set internal navigation system caused the airliner to inadvertently stray 365 miles off course into Soviet airspace (Hawkins 1994). ICAO subsequently amended the Chicago Convention to decree that States ‘must refrain from resorting to the use of weapons against civil aircraft in flight’ (Martin et al 1985 cited in Prescott 1987 p31). Significantly, the revision does allow sovereign states to intercept rogue aircraft flying illegally in their airspace providing the safety of the passengers and crew are not endangered, but in the context of the United States’ ongoing ‘war on terror’ and threats of aerial hijack, ICAO’s ability to enforce this regulation is in jeopardy, as armed warplanes have been dispatched from French, British, American, and Greek airbases with orders to intercept and shoot down passenger aircraft that are considered to pose a threat to national security (Beaumont et al 2004). Furthermore, the ongoing controversy surrounding the alleged use of British airports and airspace by the CIA for ‘extraordinary rendition’ flights without Ministerial approval, demonstrates that even in an a supposed ‘globalised’ world, national control (or perceived lack of control) over sovereign aerial territory remains politically contentious (see Brown C 2005b; Cobain 2005; Cobain and Harding 2005; Norton-Taylor 2006a, 2006b; Norton-Taylor and Cobain 2006).

5.1.4 Liberalising European skies

European nations began tentatively discussing the possibility of liberalising the continent’s air transport operating environment in the mid-1980s in an attempt to emulate the economic success of the US’s 1978 Airline Deregulation Act (see Button 1996; Lawton 2002). At this time, the European airline industry was deemed ‘incurably oligopolistic’, a situation incompatible with effective competition (Pryke 1996; Lawton 2002). States are however entitled to force rogue aircraft to land and charge the crew with espionage. Doganis 1994; Williams 1994; Petzinger 1995; Taaffe et al 1996; Caves 1997 also provide details of the reasons for, and impact of, American air transport deregulation.
However, increased public dissatisfaction with high airfares combined with the rise of free-market neo-liberal economic ideologies and pressures on public spending, encouraged European Governments to embark on liberalisation and privatisation programmes (Balfour 1994). However, the sheer number of autonomous European states (each possessing their own language, history, and administrative procedures) and the predominance of international services, made the formation of a unified policy highly problematic (Pryke 1991; Williams 1994; Button 1996).

The UK, under the conservative leadership of Margaret Thatcher, was the most enthusiastic advocate of reform (Farrington 1985; Graham 1992), and an open market bilateral agreement was signed with the Netherlands in 1984 to stimulate competition on the London-Amsterdam route by removing capacity constraints and dissolving the British Airways/KLM duopoly (Farrington 1988; Uittenbogaart 1997). Other bilateral agreements were also subjected to varying degrees of liberalisation, but there was no coherent pan-European air transport policy and individual countries pursued their own idiosyncratic interests (Kassim 1997). In 1987, British Airways became one of the first major European flag carriers to be privatised and the new company immediately withdrew from some of the less profitable (but politically significant) routes (Ashworth and Forsyth 1984; Marriott 2000). To prevent further market fragmentation, the European Community adopted a coherent policy of aviation liberalisation that took the form of three ‘packages’ of measures. The first, ratified in December 1987, allowed airlines to increase their capacity shares on a route and sell a limited range of discounted fares (Janic 1997). The second, approved in June 1990, removed constraints governing market access, increased fifth freedom flying rights, and allowed airlines to sell discounted fares without governmental approval, while the third and final package, ratified in 1993, created a single regulatory structure and granted full freedom flying rights (or cabotage) to all member-registered airlines from 1st April 1997 (Table 5.2).

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7 That were up to 26% more expensive than the World average (Barrett 1997).
Table 5.2 Key features of the Third Aviation Liberalisation Package

1) Free pricing regime for all fares (with the exclusion of business class)
2) Open market access, but
   a) some restrictions may be imposed to
      - prevent environmental or congestion problems from occurring
      - safeguard island routes
      - facilitate intermodal coordination
      - maintain public service obligations on routes vital for economic development
   b) domestic cabotage rights granted only as an extension of an ‘international’ service and then only for 50% of seats
3) Harmonisation of the criteria for awarding and recognising Air Operator’s Certificates. In addition, all new and renewal applications from carriers must:
   a) show they are Community-based and controlled
   b) fulfil financial fitness requirements
   c) fulfil national technical requirements until JARS (Joint Airworthiness Requirements) come online
4) There is to be no distinction between scheduled and charter services: same rules apply to both type of operations

Source: Adapted from Doganis (1994 p16)

'Cabotage' originally referred to the maritime transport of goods and passengers between ports within the same territory by a non-national shipping line, but in the context of air transport describes a flight between two points within the same territorial unit (see Cheng 1962). Yet, despite being considered revolutionary, cabotage had occurred in the early days of passenger aviation. In 1934, the Dutch carrier KLM was permitted to pick up and set down passengers in certain English towns on the company’s Amsterdam-Liverpool service (although this concession was quickly withdrawn when British airlines began serving the cities concerned) (Veale 1945). Likewise, contemporary cabotage enables any EU-registered airline to treat all EU countries as a domestic market for the purpose of operating services (Jennings 1990; Trent 1993; Hanlon 1996), thus Ryanair (an Irish carrier) and easyJet (a British company) can operate domestic flights within other European nations. The creation of this single aviation market was arguably 'one of the most important developments in aviation' (Kassim 1997 p212) as it ended the use of traditional bilateral agreements to organise air services within the continent (DETR 2003).

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9 Including European Union members and members of the European Free Trade Association (Iceland, Norway, Switzerland and Liechtenstein).
10 This has not been without its problems though, and in April 2006, Italian authorities prevented easyJet from launching a new Milan-Sardinia service that would have placed in direct competition with Italian carrier Meridiana (Harrison 2006).
Full European liberalisation deprived national governments of the regulatory instruments they had previously used to pursue overtly nationalist protectionist policies (Kassim 1996). Some flag-carriers adapted well to the changing regulatory environment, whereas others found the transition to commercial enterprises highly challenging. The newly liberalised operating environment was conducive to increased competition, and European entrepreneurs responded by creating a new genre of low-cost airlines (LCAs), which began frequent flights to a multitude of new destinations, dramatically undercutting the fares charged by incumbent carriers (Calder 2002). Unlike conventional full-service carriers (FSCs), LCAs operate to a low-cost business model that identifies and eliminates all unnecessary expenditure, and the introduction of a homogenised, streamlined, reduced-service airline product, centred on a number of smaller ‘secondary’ airports, revolutionised the industry, integrating new destinations into the European air service network (Doganis 2001; Partridge 2003). The UK’s Civil Aviation Authority (CAA) recognised LCAs as a significant long-term development, resulting in a ‘substantial stimulation of new air traffic without serious detriment to incumbents’ operations’ (CAA 1998 p.ix). However, their formation and rapid expansion has had significant implications for the management of both European and British airspace.

5.1.5 EUROCONTROL: the European regulation of UK airspace

On a European level, the UK is a member of EUROCONTROL, the European Organisation for the safety of air navigation, which was founded in 1960 to harmonise the air traffic control procedures of member states to maximise airspace capacity, coordinate pan-European air traffic flows, and fund research and development into new technologies (Dixon 2001a; Eurocontrol 2005). However, EUROCONTROL has created both political and organisational hierarchies of great complexity. European airspace comprises a number of discrete, but interfacing, zones of sovereign control, each of which is subdivided into individual sectors that themselves contain dangerous (or otherwise restricted) areas of airspace. ‘Freedom’ of the sky is thus largely an illusion, for while (theoretically) airways can be laid anywhere, European political fragmentation has hindered the development of an efficient and coordinated airspace.

11 In particular, Aer Lingus, Alitalia, Sabena and Olympic (the flag-carriers of the Republic of Ireland, Italy, Belgium and Greece respectively) struggled financially and were either declared bankrupt or kept solvent through large subsidies, many of which are now illegal under European law (see Lynn 1999; Glover 1995; Milner et al 2001; Mortishead and Leidig 2001; Calder 2005a).
system (Barnford and Robinson 1978). Military air traffic zones (MATZs), while derided as an ‘outdated aeropolitical concept’ and relics of the cold war (Majumdar 1994 p167), still occupy large sections of sky, forcing civilian flights to route round them (Figures 5.1 and 5.2). As Majumdar (1994 p168) notes, ‘The tortuous air routes caused by following national borders rather than logical routes, coupled with military restrictions, cause the average flight to be 10% longer than it need be’, or, the case of Brussels-Zurich, up to 45% longer. Currently, some 29,000 flights use European airspace in any 24-hr period, generating over ~€5.6bn a year in service charges (Carstens 2004). Airspace is thus increasingly considered a ‘cash cow’ and the EU is keen to install the infrastructure that will be capable of handling traffic that is predicted to double in volume by 2020 and quadruple by 2037 (ibid. 2004; Clark 2004a). However, the liberalisation of European skies ‘faces a huge technical barrier to any benefits that may accrue from the freer market’ because it comprises ‘a fragmented patchwork of national airspaces, each with their [sic] own systems, standards and working practices’ (Majumdar and Ochieng 2004 pp165 and 162).

In February 2004, EUROCONTROL received formal backing from EU Governments to develop a ‘Single European Sky’ (SES) to increase capacity and harmonise the continent’s fragmented airspace structure (whose 49 ATC centres, 31 national authorities, 18 hardware suppliers, 22 operating systems and 30 programme languages were causing severe delay diseconomies and costing the European economy nearly €2bn a year in lost productivity) (Jury 1998; Carstens 2004; Majumdar and Ochieng 2004). In anticipation of the formal launch of the SES initiative, ‘Reduced Vertical Separation Minima’ (RVSM) procedures were introduced in European airspace in 2001. By halving the vertical separation distance between aircraft to 1000ft, six new flight levels could be introduced and airspace capacity increased by 15% (see Figure 5.3). Critics, however, voiced concern at the increased risk of mid-air collision (computed at an ‘acceptable’ rate of one collision every 150 years under present traffic volumes) (Markes 2003). However, the boundary between RVSM airspace in Europe and non-RVSM compliant airspace of Turkey, Russia, North Africa, and the north Atlantic requires constant policing to maintain the integrity of these boundaries and the safety of the system12.

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Figure 5.1 Theoretical civilian traffic demand using direct routes (areas of restricted airspace are indicated in red)

Source: Eurocontrol (2005 p47)

Figure 5.2 Actual civilian traffic routings and major constraining points

Source: Eurocontrol (2005 p47)
Figure 5.3 Diagrammatic depiction of the difference between non-RVSM (left) and RVSM airspace (right)

Diagram: author
Eurocontrol also operates the pan-European CMFU ('Central Flow Management Unit') at Brussels where sophisticated European-wide computers continually monitor flow patterns, opening and closing sectors of airspace and issuing take-off slots in an attempt to keep the system moving. Thus, while controllers at NEMA are responsible for safely dispatching flights to Europe, they can only do so when they have received clearance from the CMFU. Thus, even if there was sufficient airspace capacity around NEMA and London to accommodate these services, capacity constraints in continental airspace would cause Belgian controllers to ground individual flights until such a time that it could fly to their destination relatively unimpeded\textsuperscript{13}. This system often causes frustration for both passengers and flightcrew alike, as missing an allocated slot puts the flight to the back of the queue, often leading to considerable delays (Carr-Brown and Macaskill\textsuperscript{2001}). Furthermore, even when flights do obtain clearance, they often receive less-than-optimal routings, increasing fuel costs, flight time and emissions\textsuperscript{14}.

To facilitate the formation of a SES above central Europe, a new Central European ATS (CEATS) facility will become operational near Vienna between 2007-2010 to coordinate air traffic above Austria, the Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Bosnia and parts of Italy, just as Maastricht ATCC is responsible for high-altitude airspace above the Benelux countries (Carstens\textsuperscript{2004}). However, the geographical decoupling of sovereign airspace from national territory, and the handover of its control to another country, has again raised challenging geopolitical questions concerning 'ownership' and authority over airspace, a debate that is likely to intensify if, as planned, four or five privatised ATS providers ultimately assume responsibility for European airspace (Eurocontrol\textsuperscript{2005}).

The accession of eastern European states to the EU has further increased the urgency of the SES initiative (Eurocontrol\textsuperscript{2005}), as both existing and start-up airlines (especially LCAs) take advantage of the larger liberalised market (Capell\textsuperscript{2006}; Browne\textsuperscript{2006}). Indeed, traffic figures revealed growth rates exceeding 20% between 2003-2004 in some sectors of eastern European airspace, while medium-term

\textsuperscript{13} Nigel Fairburn and Barry McInnes, ATCOs NEMA, personal communication (2005).

\textsuperscript{14} Colin Andrew, London FMP, Swanwick ATCC, personal communication (2005).
forecasts anticipate sustained annual traffic growth of over 6% against a base rate of 3.7% (see Figures 5.4 and 5.5 overleaf)

While political intransigence may hinder the development of a single European sky, European regulators did agree on a ‘blacklist’ of carriers that are prohibited from entering European airspace or using European airports owing to perceived inadequacies with their training, maintenance, and/or financial fitness. Previously, the prohibition of airlines was pursued on a country-by-country basis, but in recognition of the need for a pan-European directive, regulators from the 25 EU states, plus Norway and Switzerland, banned 93 (predominately central African) airlines from European airspace from 22nd March 2006, making the continent a ‘no-fly’ zone for these carriers (Morris 2004; Cendrowicz 2005; Phillips 2005; Mortished 2006).

5.2 Boundaries in the sky: The contemporary structure of UK airspace

While liaising with her European neighbours on issues of airspace policy and aviation safety, and incorporating certain pan-European airspace directives into her regulatory regime, the UK (unlike some Eurocontrol countries) maintains ‘in house’ control of her airspace. Owing to the UK’s historical importance as a centre of colonial administration, its strategic location between Europe and North America, and London’s continued status as an ‘alpha’ world city (see Beaverstock et al 1999), UK skies have always been among the most densely trafficked sectors of airspace in the world and, like European airspace, have been progressively divided into ever-smaller blocks (or sectors) in an attempt to manage rising traffic volumes (see Wise 1964; Sealy 1970; Fullerton 1982; Gates 1989; Paylor 1993)\(^\text{16}\).

\(^{15}\) Although North Korea’s Air Koryo, Ariana Afghan Airlines, and Thailand’s Phuket Air are also included (Castle 2006).

\(^{16}\) The British capital was empowered as a site of international aeromobility at the expense of the colonial hinterland (Cole 1950) (c.f. Scott’s 1998 fascinating account of how the centralisation of surface transport links conferred economic supremacy on Paris at the expense of the provinces). London’s Heathrow and Gatwick airports thus developed into important international hubs, supporting an unrivalled network of domestic and international air services, a legacy that still influences contemporary air transport links. Indeed, the quickest Harare-Accra and Harare-Cairo flights still route via Gatwick (Calder 2005b; Selva 2005).
Figure 5.4 Traffic variation in sectors of European airspace, 2003-2004

Source: Eurocontrol (2005 p24)

Figure 5.5 Average annual traffic growth forecasts, 2005-2011

Source: Eurocontrol (2005 p32)
As Metcalfe and Ferguson (2001 p240) note, space without boundaries can evoke ‘a terrifying condition of endlessness and pointlessness’ while delimitation can make space ‘useable’ and ‘knowable’. For this reason, UK airspace is divided into two geographical regions, the London FIR/UIR and the Scottish FIR/UIR. FIRs (Flight Information Regions) extend vertically upwards from mean sea level (MSL) up to, but not including, flightlevel 245 (the equivalent of 24,500ft with an altimeter calibrated to the standard atmospheric pressure setting of 1013.2 millibars), while UIRs (Upper Flight Information Regions) are effective at, and above, FL245. In order to make the control of large volumes of air traffic more manageable, the London and Scottish FIRs are further divided into a number of sectors (defined by latitude, longitude, altitude, and occasionally time), which creates an invisible aerial patchwork of different control areas, each of which are subject to different degrees of surveillance and policing, and have their own operating procedures, airways and radio frequencies. Usually the names of these sectors have some basis in terrestrial geography, the ‘Daventry’ sector is located over the East Midlands, and ‘Clacton’ over the Essex coast (see Figure 5.6). Some London FIR/UIR sectors interface with French, Dutch, Irish or Belgian airspace, while controllers working Scottish airspace continually liaise with their Canadian colleagues in Gander Oceanic Control, Newfoundland.

Figure 5.6 Diagrammatic representation of airspace sectors in the London FIR

Source: www.aviate.flyer.co.uk (2005)
N.B. Lakes and Wirrel [sic] transposed in original
The responsibility for controlling traffic in these sectors rests with three air traffic control centres (ATCCs). The London Area and Terminal Control Centres (LATCC) at West Drayton (Middlesex) and Swanwick (Hampshire) control airspace over England, Wales and Scotland up to 55 degrees North. The Scottish Oceanic and Area Control Centre at Prestwick covers airspace over Scotland, Northern Ireland, and the eastern half of the Atlantic Ocean, while the Manchester Area Control Centre (MACC), based at Manchester Airport is responsible for airspace between the ground's surface (SFC) and FL195 (approximately 19,500 feet) in an area bordered by the Irish Sea, the Humber estuary, Birmingham, and the Scottish Border\(^\text{17}\). MACC also has responsibility for the 'open' airspace above Yorkshire, designated 'Pennine Radar'.

Like any transport network, there are constant fluctuations in flow depending on season, day, and time\(^\text{18}\) so, to separate and manage this traffic, UK airspace is additionally categorised as being controlled (CAS), or uncontrolled, depending on the density of traffic flowing through it. Areas characterised by high traffic volumes (such as those near major airports and navigation beacons) require strict monitoring and regulation, while areas peripheral to major traffic flows require less surveillance, and pilots are relatively free to fly where they want providing they adhere to basic aeronautical regulations. As traffic volumes have grown, the volume of airspace designated as 'controlled' has increased progressively (see Figure 5.7).

The institutional framework regulating UK airspace was established in 1991, when the International Civil Aviation Organisation's (ICAO) sliding seven-tier airspace classification system was introduced throughout Europe (Duke 2001b). Class A airspace comprises the network of airways between 3000 and 24,500ft where air traffic flows are at their densest and most complicated, with aircraft continually climbing out from and descending into major airports. Aircraft are not permitted to enter Class A airspace unless they are equipped with certain identification and navigational features, have filed a flightplan with ATC indicating their intended route,

\(^{17}\)N.B. MACC is due to be relocated to a new Oceanic centre in Prestwick by 2010 (Source: Graeme Ford, ATC supervisor Manchester ATCC, personal communication, 2005).

\(^{18}\)For example, routes used by 'business' flights are busiest on weekdays, while 'holiday' routes to the Mediterranean and Aegean are busiest at weekends (Source: Colin Andrew, London FMP personal communication, 2006).
Figure 5.7 Diagrammatic representations showing the growth of controlled airspace in the UK from 1950 to 1988.

Source: Ogilvy (1989 pages 27, 28, 29 and 31)
and are piloted by individuals holding valid Instrument Flight Rules (IFR) certification\(^{19}\). In these five nautical mile-wide channels of aeromobility, pilots can expect a high standard of service and safety thanks to continuous radar coverage and constant communication with controllers.

Class B airspace is also subject to high degrees of control, but only applies to airspace above FL245. Although air routes in upper airspace often follow the tracks of lower-altitude airways, upper air routes don’t have predefined widths and aircraft can fly the shortest distance between two navigational beacons or ‘significant points’ defined by geographical coordinates. Unlike her European neighbours, the UK does not have any Class C airspace at present, but large areas of Class D airspace surround large civilian and military airports, usually extending from the surface (SFC) to a specified altitude (usually the base of Class A airspace). Pilots are not permitted to enter Class D airspace unless they make contact with the relevant ATCC and obtain permission to enter the sector, but unlike Classes A and B, both commercial IFR and private VFR\(^{20}\) (Visual Flight Rules) traffic can use it, creating a range of problems (that will be discussed later in this chapter). Classes E and F are subject to fewer controls still - the former existing only around large commercial airports in Scotland and Northern Ireland, while the latter describes less frequently used ‘advisory routes’ that do not have comprehensive radar coverage (Duke 2001b). Class G airspace falls under none of the aforementioned categories and is considered ‘open’, ‘free’, and uncontrolled. Pilots using Class G airspace still have to adhere to basic aeronautical regulations (the equivalent of a highway code for the air), but they are otherwise free to fly wherever they want in accordance with their licence restrictions. Figure 5.8 provides a simplified diagrammatic representation of the vertical structure and classification of UK airspace.

\(^{19}\) This means pilots have been successfully examined in their ability to fly using only flightdeck instruments without visual reference to the ground, and are thus certified to fly at night and through cloud. All commercial pilots in UK airspace have to possess valid IFR licences (Jerram 1988).

\(^{20}\) VFR describes the basic stage of pilot certification where pilots are only allowed to fly in daylight conditions where they have good visibility into surrounding airspace and are able to maintain visual contact with the ground at all times and must not fly into cloud, whereas commercial pilots fly according to IFR (Instrument Flight Rules), the highest stage of qualification.
Between 3,000ft and 24,500ft\textsuperscript{21} UK airspace is structured like a lattice, with protected corridors of aeromobility (variously termed air lanes or airways) linking major airports and navigation beacons. Above 24,500ft, there are no airways, and aircraft can fly the shortest distance between two navigation beacons (although in reality this often coincides with the trajectories of airways, albeit at a higher altitude). Closer to the ground (between the surface and c3000ft) are areas of uncontrolled airspace that can be used by private pilots flying under VFR conditions.

Figure 5.8 Diagrammatic representation of the vertical structure of UK airspace

![Diagram of UK airspace vertical structure](image)

Source: based on an original in Graves (1993 p17) with additional annotations by the author

5.2.1 Demarcating the sky – Beacons, beams, and the geographies of aerial navigation

One of the most important means of mediating and maintaining the (re)production of UK airspace is the network of radio beacons that delimit and define the extent of airlanes, the position of airports, and the airspaces within which air traffic services are provided. Despite the introduction of increasingly sophisticated satellite navigation systems, the network of ground-based radio beacons developed shortly after World War Two remain fundamentally important to contemporary aerial navigation. The most ubiquitous radio transmitters are Very High Frequency (VHF) Omnidirectional Range (VOR) beacons. These transmit a signal on a specific radio frequency (which is indicated on navigation charts and programmed into aircraft’s internal navigation systems), along each one-degree radial of a 360-degree circle. Receivers on the

\textsuperscript{21} 19,500ft from late 2006 to harmonise European airspace classification.
flightdeck capture these signals and determine the aircraft’s bearing from the beacon, allowing it to ‘home in’ on them from any direction and ‘turn corners’ at the intersection of two or more beams, marking the aeronautical equivalent of ‘junctions’ in the sky. The beacons are identified by a name and three-letter abbreviation, which, like the airspace sectors above them, have a basis in ‘real world’ geography. Major en-route UK VORs include ‘Trent’ (‘TNT’) in the Peak District, ‘Midhurst’ (‘MID’) Kent, and ‘Honiley’ (‘HON’) Warwickshire. Usually, VORs operate in conjunction with Distance Measuring Equipment (DME), which enable pilots to determine how far away they are from the beacon along a specific radial of that facility.

Given the large distances involved, airways have a number of reporting points and/or waypoints are located along them to help pilots and controllers monitor a flight’s progress, the locations of which are defined by geographical coordinates as their position is not demarcated by ground-based installations (Duke 2001b). Waypoints are identified by a five-letter name, which, unlike a VOR, is not necessarily related to cultural features on the ground. Some of the older en-route waypoints do have a basis in ‘real world’ geography, including ‘LESTA’ in the English Midlands, ‘BOGNA’ near the famous south-coast resort, and ‘FORTY’ above the eponymous North Sea shipping area. However, as traffic volumes have grown, and additional routes have been introduced, new names have emerged which bear no relationship to ground-based features below. Some are named after British flora and fauna (e.g. ‘WESUL’, ‘FERIT’, ‘HERON’, ‘SAMON’, ‘KIPPA’, ‘ELDER’, ‘LOREL’ and ‘WILLO’), or female names (e.g. ‘LINDA’ and ‘MARGO’), whereas others are altogether more curious. Whilst the CAA and NATS officially insist that software alone determines waypoint names, some local humour invariably creeps in. In British airspace, pilots variously encounter ‘BEENO’ and ‘DANDI’, ‘NEDUL’ and ‘THRED’, and ‘CRANK’ and ‘SHAFT’, while a reporting point over the Irish Sea en-route to Dublin is called ‘GINIS’22. Furthermore, a suggestion to rename a reporting point over the D-Day beaches ‘OMAHA’ was fiercely resisted by the French23. Some (newer) waypoints do, however, have implicit ‘local’ connotations, including ‘ABBOT’ and ‘ADNAM’ near Stansted airport (which are named after local Essex beers), and ‘UPDUK’ a few miles southeast of NEMA over rural east Leicestershire. Though it

23 Thanks to Martin Weir at bmi’s Navigation Services Department for drawing my attention to this.
was officially denied that the latter had any meaning, most pilots interpret it as a cultural reference to (and light-hearted dig at) the county’s regional accent\textsuperscript{24}. Many of these reporting points exist in either upper or lower airspace only, and so there is an invisible vertical geography of striated layers of airlanes and reporting points, whose positions are irrelevant for those aircraft not operating between those flight levels.

Just as roads are classified and given numbers and/or names, airlanes are similarly identified by a combination of letters and numbers, and their bearing clearly marked on aeronautical navigation charts (see Chapter Six). Above 24,500\textit{ft}, air routes are identified as ‘U--’ (i.e. ‘Upper Alpha One’- UA1), whereas below FL245 they are simply known by their designator (‘Alpha One’). Thus, just as a car driver might plan a route involving the M1, the A50(M) through Stoke-on-Trent to the M6 and the north, flightplans similarly structure the aerial ‘roads’ pilots must use (see Chapter Six for details). Thus, southbound flights from NEMA departing along the DAV2 SID variously route ‘DTY-A47-WOD-BIG-UL9-DVR’, ‘DTY-CPT-U321P-EPIS-UR4’, ‘DTY-M189-OLNEY-P166-BAN’, or ‘DTY-UR41-CO-WLY-UT71’, while northbound aircraft fly via ‘ASNIP-L28-PENIL-L70-BAG’, ‘TNT-N57-POL-N601-MARGO’, or ‘WAL-L975-LIFFY-LIFFY1R’ depending on their destination\textsuperscript{25}.

These strings of coded information identify the individual navigation beacons, waypoints and airways a flight must follow. Thus, ‘DTY-A47-WOD-BIG-UL9-DVR’ informs controllers the aircraft will fly south to the Daventry beacon, take airway A47 as far as Woodley (WOD) VOR, before flying towards the beacon at Biggin Hill (BIG). From there, it will fly east along ‘Upper Lima Nine’ to Dover (DVR), where it will cross the English Channel and enter French airspace. Similarly, ‘DTY-CPT-U321P-EPIS-UR4’ takes aircraft south via Daventry to the Compton beacon, then on upper airway 321 to ‘EPIS’ near the south coast and on ‘Upper Romeo Four’ into French airspace. Figure 5.9 demonstrates how this spatial information can be superimposed over IFR navigation charts to visually indicate the route of individual flights.

\textsuperscript{24} As in the colloquial phrase, “hey up me duck” (Captains Paul Hills and David Tarrant, and Martin Weir, personal communication (2005)).

\textsuperscript{25} This data derives from the author’s Flight Progress Strip database that was complied from original flight progress strips from NEMA ATC (see later this chapter).
Figure 5.9 Next stop, continental Europe. The route of two southbound departures from NEMA superimposed onto an IFR navigation chart to show how, after reaching the Daventry VOR beacon, the routes diverge to join different airways.
(Note, however, both are convoluted and indirect)

Initial route common to both flights
Route of WW5683 to Prague
Route of EZY6547 to Malaga

Base chart source: Aerad IFR navigation chart UK(L)2.
Flight routing data derived from original flight progress strips.
5.2.2 UK airspace – vertical geographies of the sky

Traditionally, geographers have described and understood the World using the conventions of two-dimensional Cartesian logic, and do not routinely operate in three or four, dimensions. ATC demands the extension of this traditional spatial logic to comprehend aircraft movements in four-dimensional space. In addition to using longitude and latitude to determine lateral position on the ground, altimeters measure vertical distance above it, and universal coordinated time (UTC) quantifies temporal progress.

Altimeters work by measuring changing atmospheric pressure. As an aircraft climbs, atmospheric pressure falls, and this change is measured on a scale by the altimeter, which is calibrated to indicate hundreds and thousands of feet. However, fluctuating atmospheric pressure can give erroneous height indications, and as it is both impracticable and dangerous to continually adjust altimeter settings, a universal atmospheric pressure setting of 1013.2 millibars is used when aircraft reach a specified ‘transition level’ (typically 3000-6000ft in the UK), irrespective of the actual local barometric pressure. As all aircraft above the transition level will be operating on the same pressure setting, any variation in the actual barometric pressure is common to all aircraft, ensuring safe vertical separation is maintained. Above the transition level, the vertical distance of aircraft above the Earth is expressed in terms of Flight Levels (or FLs), which describe the approximate altitudes in thousands of feet using two or three-digit codes (e.g. FL350 is equivalent to 35,000ft and FL75, 7,500ft).

Below the transition altitude, vertical distance is described by two related, yet distinct, terms, QNH and QFE, both of which rely on the actual barometric pressure for the area in which the aircraft is operating. QFE represents the local atmospheric pressure setting which, when set, will cause the aircraft’s altimeter to read ‘0’ when the aircraft is on the runway. When this setting is in use, the term used to describe vertical distance is ‘height’ (above the runway). However, it is only used by light aircraft flying in and out of small airports, and not by commercial jets. In comparison, QNH describes the aircraft’s position in feet above mean sea level (MSL), i.e. its

26 The equivalent of 29.92 inches of mercury (the unit of pressure used in the USA).
27 Captain David Robertson, bmi, personal communication.
‘altitude\textsuperscript{28}. Unlike QFE, QNH ensures that aircraft avoid ground obstructions, such as mountain ridges, chimneys and skyscrapers. When set, it causes the aircraft’s altimeter to read the height above MSL when sitting on the runway (e.g. at NEMA, an aircraft’s ‘altitude’ at the threshold of runway 27 is 282ft)\textsuperscript{29}. The accuracy of this measurement is critical, as an erroneous reading will either cause the aircraft to metaphorically ‘land’ above the runway (by misleading the autopilot into thinking the aircraft has reached the runway when it hasn’t), or cause it to bury itself in the tarmac. As such, the QNH reading is constantly and automatically broadcast on dedicated weather information frequencies and is reiterated by controllers when they issue take-off or landing clearances (see Exchange 5.1).

Exchange 5.1 - Negotiating space. bmibaby38E to NEMA tower

Aircraft: "East Midlands tower good morning. Baby three eight echo with you inbound"

ATCO: "Hello Baby three eight echo, you are cleared to land runway two seven, surface wind seven knots, QNH one zero one two" [1012 millibars]

- field diary extract, 2005

Here, the controller was able to issue an immediate landing clearance, but when two or more aircraft are on the approach, or several are queuing for take-off, the importance of the fourth, or temporal, dimension becomes apparent. In exchange 5.2, the transmitting aircraft is held on stand to allow other aircraft to manoeuvre behind it.

Exchange 5.2 Negotiating groundspace through the management of time – the case of a crowded apron

Aircraft one: East Midlands good afternoon. This is Ryanair one nine two four request push and start please.

ATCO: Negative Ryanair one nine two four, you’ve traffic behind you. Break. Baby five one mike proceed to stand seven.

Aircraft two: Proceed to stand seven Baby five one mike, thanks.

\textsuperscript{28} N.B. One millibar represents approximately 28ft in height, therefore the difference in millibars between the QFE and QNH setting multiplied by 28 will give the airfield elevation above mean sea level (MSL).

\textsuperscript{29} AERAD EGNX aerodrome booklet (2004).
ATCO: Ryanair one nine two four push back approved. Give way to taxiing company seven thirty seven on your left and proceed to alpha one.

Aircraft one: Roger, push back approved. Give way to taxiing company seven thirty seven and proceed to alpha one Ryanair one nine two four.

<Silence – Ryanair 1924 nears holding point to runway 27>

ATCO: Ryanair one nine two four hold short of runway two seven and contact tower one two four decimal zero.

Aircraft one: Hold short runway two seven and contact tower one two four decimal zero Ryanair one nine two four. Thanks.

Here, three separate aircraft are on the move and under the jurisdiction of the Ground Movement Controller. Once the inbound aircraft (Baby 51M) is clear, the controller authorises Ryanair 1924’s pushback, instructing it to give way to the Company B737 on the taxiway behind it, before proceeding to the threshold of runway 27 ready for departure. This vignette illustrates how the occupation of airspace indelibly links space and time (see Taylor 2003 p152), as one aircraft cannot move (in time or space) until its path is clear. ATC thus effectively ‘parcels up’ pockets of space and time and allocates them to particular aircraft or objects on the airfield. Peters (2006 p100) remarked that at an airport ‘everything revolves around time’, as numerous diverse processes including loading, refuelling, crew scheduling, maintenance, and ATC, are synchronised to facilitate on-time departures and the efficient use of airspace, yet the temporal significance of air travel (beyond airline punctuality figures) is rarely discussed.

5.3 The temporal geographies of airspace

‘Far out above the cold North Atlantic Ocean...time suddenly jumps from 2.45 to 3.45 as the Lockheed Tristar slips through the invisible interface of two time-zones. Few of the three hundred and twenty-three souls are aware of the change. Most of them still have their watches adjusted to Chicago local time, where it is 11.45pm on the previous day...and most of them are asleep’ Lodge (1984 p88)

Time has long been understood as a cultural construct ‘designed to give order to everyday events by identifying them as coexisting or successive’ (Parkes and Thrift 1980 p36). However, the development of long-haul aviation, where aircraft cross
numerous time zones in one flight, had profound implications for the way time is perceived and structured. Circadian rhythms, while still implicated in the physiological effects of air travel through jet lag (Pollard 2000; Hilpern 2004), are, if one subscribes to the arguments advocated by Castells (1996), increasingly subsumed under a universal logic of global 'timeless' time. The speed and range of passenger aircraft, particularly the now-retired Concorde, which flew faster than a rifle bullet leaving the barrel of a gun, or twice the speed of sound, required new ways of recording, measuring, and understanding global time (Calvert 1989).

Accordingly, the creation of 'global time' in 1928 through the introduction of Coordinated Universal Time (UTC) and the designation of 24 hour-long time zones - the 'most pervasive and possibly the most important time for the ordering of human actions in advanced industrial societies' (Parkes and Thrift 1980 p37) - provided the temporal basis on which international commercial aviation was based (Peters 2006). By synchronising the actions of people all around the world, its use both assists scheduling and reflects the need for global temporal standardisation in an increasingly networked society. However, there is a danger hyperbolic assertions proclaiming the 'acceleration' of time and the alleged 'death of distance' (Cairncross 1997) can obscure patterns of spatio-temporal restructuring. As May and Thrift (2001 p12, original emphasis) appreciate, 'Rather than a simple picture of speed and acceleration...[what] emerges is...a growing awareness of living within a multiplicity of times, a number of which might be moving at different speeds and even in different directions'. Thus, 'the picture...is less that of a singular or uniform social time stretching over a uniform space, than of various (and uneven) networks of time stretching in different divergent directions across an uneven social field' (ibid. 2001 p5).

Hubbard and Lilley (2004) develop this theme, proposing a new research agenda to examine the social significance of relative speeds and 'slowness' (see also Honore 2005). Using the example of the mid-20th century redevelopment of Coventry, which privileged vehicular traffic over other forms of mobility, Hubbard and Lilley (2004 p273) illustrate how these policies 'bequeathed a city that sped up for some, but

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30 UTC replaced Greenwich Mean Time in 1928, but like its predecessor, it reflects the time of the Greenwich meridian located at 0 degrees longitude (Peters 2006 p100).
slowed down for others’. In showing how road networks, while undoubtedly supporting increased mobility for some don’t herald a simple shift to a utopian world of unhindered mobility, they show how space and time get reconstituted and reformed within wider geographies of flow, incorporation and exclusion (see also Swyngedouw 1993 and Graham S 1998a for interesting discussions surrounding the alleged ‘tunnel effects’ of mobility networks which simultaneously bring physically distant places together while pushing physically adjacent places apart). In the context of commercial aviation, Maspero (1994) highlighted this differential ‘speed politics’, juxtaposing the intense hypermobility of international airline passengers using Paris Charles de Gaulle airport with the social immobility of the poorer (predominately immigrant) communities living around the airport’s perimeter. As with Hubbard and Lilley’s (2004) research, Maspero’s localised account shows how different mobility technologies produce highly uneven socio-economic geographies of space and time, demonstrating that while aeromobile groups benefit from the time saving (or ‘time shrinking’) effects of flying, airline schedules are often divorced from natural ‘local’ time, meaning carriers neither engage with the social world outside the airport nor appreciate the local temporal regimes that structure life under the flightpaths.

On a global scale, international logistics companies increasingly ‘manage world time’ for their customers (Gillingwater 200631). FedEx’s logistical ‘hypercoordination’ (Thrift 2004b), involving 43,000 vehicles, 638 aircraft and 63 million daily electronic transmissions, guarantees the ‘World on Time’ for the recipients of some 3.1 million packages a day (www.FedEx.com 2006), while similarly integrated networks of transport and e-communication technologies help competitor UPS deliver ‘synchronized global commerce’ (www.UPS.com 2006). Such demands often necessitate temporal manipulation, with many carriers flying ‘backwards’ across the International Date Line to ‘gain a day’ by ‘beating’ cultural conventions of temporal organisation (Gillingwater 200632). Thrift (2004b p186) considers such adaptive yet repetitive communication strategies are a form of ‘roving empiricism’, which is simultaneously controlled yet open-ended, continually reorganising itself ‘in a search for the most efficient ways to use the space and time of each moment’. Indeed, it has been alleged that pilots fly ‘aggressively’ to save time (Clement 2005c) and often

31 Personal communication (2006).
32 Personal communication (2006).
request 'short cuts' from ATC\textsuperscript{33}, while controllers 'pack' aircraft closer together to make better use of the airspace (Walters 2000). However, while UTC increasingly structures western time-space, it could be argued that, in the context of aviation, its use is often problematic, as global temporal restructuring has significant implications for passengers, operations staff, and local communities (see Chapter Four).

5.4 Crowded skies – situating UK airspace in wider traffic flows

In 2001, Eurocontrol reported UK airspace was the most crowded in Europe, with seven of the 12 most congested sectors in the continent (Harper 2001)\textsuperscript{34}. Owing to the UK's position on the eastern edge of the Atlantic Ocean and the fact the curvature of the earth means the shortest distance between Europe and North America is over Britain, the majority of transatlantic flights between Europe and North America use UK skies. Depending on the season, day of the week, and time of day, up to 90\% of the capacity of certain UK airspace sectors can be taken up by transatlantic operations, leaving little space for flights departing from (or arriving in) Britain\textsuperscript{35}. Worryingly for air traffic planners, the decision by LCAs to set up (often substantial) operations from secondary regional UK airports\textsuperscript{36}, has both exacerbated airspace congestion \textit{and} dispersed it across the UK, meaning congestion is no longer the preserve of the southeast\textsuperscript{37}. In April 2005, 30\% more low-cost flights flew in and out of the UK than in the previous April, while the overall number of flights rose 7\% (Akbar 2005). Between 1993-2003, international scheduled air traffic movements in UK airspace increased 5.8\% per annum (equivalent to a doubling of traffic every 12 years) (DETR and Credit Suisse 2000; Majumdar and Ochieng 2004), while as many as 600 million passengers could be using UK airports and millions more passing through British airspace by 2030 (DfT 2003a). At present growth rates, Clark (2004a) estimates Europe's skies will be operating at their maximum capacity in little more than a decade thanks, in no small part, to the rise of LCAs (Figure 5.10).

\textsuperscript{33} Source: First Officer's cabin announcement, FR5733 Graz-London Stansted 12\textsuperscript{th} June 2006.

\textsuperscript{34} The Lakes/Wirral sector has now overtaken Maastrict as the most congested sector in Europe. Heathrow arrivals is in 6\textsuperscript{th} place, Seaforth (Sussex) is 7\textsuperscript{th}, Daventry (above the East Midlands) 8\textsuperscript{th}, Clacton West and East are 10\textsuperscript{th} and 11\textsuperscript{th} respectively and Tallon (near London) is the 12\textsuperscript{th} busiest sector in Europe (Harper 2001).

\textsuperscript{35} Thus the presence of overflights can inadvertently delay UK domestic or intra-European traffic that has no desire to go anywhere near North America. (Colin Andrew, London FMP, personal communication 2005).

\textsuperscript{36} Such as Teesside, Doncaster, and Blackpool, among many others.

\textsuperscript{37} Colin Andrew, London FMP, personal communication (2005).
Indeed, the demand for low-cost aviation has been so great, and expansion so rapid, that in 2001, approximately 10% of the 3500 aircraft that were airborne above the continent at any one time belonged to LCAs, meaning ‘the current pressure on UK airspace has not come from large intercontinental flights, but from the success of chartered flights…and from low-cost airlines’, including UK-based industry-leaders easyJet and Ryanair\textsuperscript{38} (Carr-Brown and Macaskill 2001 p12). In response, incumbent European full-service carriers have streamlined their cost structures and revolutionised their service products to compete with the successful low-cost formula\textsuperscript{39}, resulting in higher flight frequencies (Bennett S 2002).

\textsuperscript{38} Despite being registered in the Republic of Ireland, Ryanair’s Chairman Michael O’Leary asserted that they were, to all-intents-and-purposes, a British airline (Clark 2006a).

\textsuperscript{39} In an effort to avoid the bankruptcies that befell SABENA and Swissair (see Bennett S 2002).
While 20th century traffic growth had been accommodated using existing sectors and control technologies, a spokesman for the UK air traffic controllers’ union, IPMS, cautioned in 2001 that the UK “is reaching a point where there are not enough runways...terminals... and space in the sky to slot the planes...our skies are full...[and] air traffic controllers have more planes waiting to enter UK airspace than we can physically handle” (cited in Carr-Brown and Macaskill 2001 p12). Although Frankfurt, Paris Charles de Gaulle and Amsterdam Schiphol have long sought to divert lucrative long-haul transfer traffic away from London (see Smithers 1995), Heathrow remains the World’s busiest international airport accounting for 25% of all UK air traffic (DETR and Credit Suisse 2000). Indeed, London’s pre-eminence as an international air transport hub has been confirmed by the findings of numerous geographical studies that use indices of connectivity to evaluate the relative importance of individual airports to the global air transport network (see Smith and Timberlake 1995, 1998, 2002; Cattan 1995; Witlox et al 2004 for more). Indeed, Gibb (2000 p1) noted that at any given moment there could be ‘over 30,000 people strapped into their seats at various altitudes above London and the Home Counties’.

Already, a lack of runway capacity leaves aircraft literally ‘flying round in circles’ in holding stacks above major airports. Aircraft arriving at Heathrow are directed to one of four stacks, where they are condemned to fly on top of one another at 1000ft intervals around a racecourse-shaped holding pattern while waiting to land. Thus, “Hold at Biggin”, “Bovingdon”, “Lambourne”, or “Ockham” are words no Heathrow-bound pilot wants to hear, as this instruction potentially adds 15-30 minutes to the flight time and costs several hundred pounds in additional fuel. Unlike the fast ‘corridors of aeromobility’ in the upper atmosphere, stacks are airspaces where no one goes anywhere very quickly. They are the antithesis of free flight, a cylindrical space of spiralling frustration and immobility (Figure 5.11).

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40 Captains Russell Woodland and David Robertson, bmi Heathrow, personal communication (2005).
41 As with other forms of transportation, air travel depends on the appropriate allocation and maintenance of a network that integrates spaces of speed (air routes and runways) with spaces of slowness (airport terminals).
Figure 5.11 A diagrammatic representation of the flightpaths around Heathrow, showing departure routes (blue), and stacks and approach paths (red).


On a clear day, it is possible to see dozens of aircraft engaged in this complex aerial ballet above London, as they await their turn to land. On 28th January 2006, a photographer at West Ham’s Upton Park stadium captured an image of what, he thought, was going to end in a mid-air collision (Figure 5.12). Although subsequent investigations proved vertical separation minima were maintained, and the illusion of proximity a trick of perspective, the photograph dramatically illustrates both the need for official spatial regulation and attendance to this network, and the extent of aerial congestion (Clark 2006).

Figure 5.12 The ‘near-miss’ that wasn’t - a DHL A300 freighter (left) appears to get too close to a Japan Airlines B777 (right) in the Lambourne stack above East London, 28th January 2006

Source: www.news.bbc.co.uk (2006a)
Furthermore, rising delay and ‘airprox’\textsuperscript{42} statistics, combined with recurrent computer malfunctions, indicate the UK’s ATC infrastructure is struggling to handle the safe and expeditious flow of rising volumes of air traffic through an anachronistic three-dimensional labyrinth of airlanes (Clement 2004a, 2004b; Clark 2004b). Furthermore, ATC-induced delays and flight cancellations have reduced the efficiency and competitiveness of the UK’s ATC service and arguably eroded passenger confidence in the safety of the system (Jury 1998). To compound the problem, the environmental consequences of increased air traffic, in the form of noise, air pollution, and ground contamination from road vehicles, aviation fuel and de-icing compounds, are generating increased public concern (see Hume and Watson 2003).

5.5 National regulation of UK airspace - the part-privatisation of NATS

In a combined attempt to pre-empt future congestion diseconomies and anticipate a European Union policy to put the provision of European air traffic services to competitive tender, the Labour Government announced its intention in June 1998 to create a Public Private Partnership (PPP) for the UK’s air navigation services provider, NATS (formerly National Air Traffic Services) (DETR and Credit Suisse 2000). The idea of privatisation had been considered under the previous Conservative Government, and while these plans were not implemented, an internal reorganisation of the Civil Aviation Authority (CAA) in April 1996 created an organisation that (it was hoped) would be attractive to potential investors. NATS Ltd was thus established as a wholly owned subsidiary of the CAA to provide civilian air traffic control services, while ‘regulatory’ activities, including airspace allocation and administration, were transferred back to the CAA under the jurisdiction of the Directorate of Airspace Policy (DAP) (Goodliffe 2002).

Under the old regime, the responsibility for coordinating ATC and calculating airspace charges lay with the CAA, a public body formed in 1972 on the recommendation of the 1969 Edwards Committee to regulate the industry and provide air traffic services through its ‘in-house’ ATC provider, NATS (DETR and Credit Suisse 2000; NATS 2005b). This structure enabled NATS to liaise directly with the Government on issues of airspace policy. However, while this arrangement had

\textsuperscript{42} ‘Airprox’ (or ‘air proximity’) events describe situations where two or more aircraft breach separation minima owing to pilot or air traffic controller error.
fostered an enviable record of safety and accountability (Walters 2001), public sector
borrowing controls restricted investment opportunities in new equipment, and
concerns were raised that responsibility for service and safety should be carried out by
different organisations to prevent potential conflicts of interest (Goodliffe 2002). The
PPP thus sought to enhance aviation safety by separating these two objectives while
reinforcing national security through increased military/civilian cooperation and
encouraging the procurement of external contracts and sources of revenue (ibid.
2002).

From the outset, the plan to sell 51% of Britain’s ATS provider to private investors
was criticised by opponents as ‘airtrack’ in a pejorative allusion to the UK’s costly
and arguably misguided policy of railway privatisation, and air passenger groups
expressed concern about the future accountability of a new company motivated by a
commercial interest (Majumdar and Ochieng 2004). Yet, despite resistance from the
Air Transport Users’ Council, trade unions, and rebellious Labour MPs, the part
privatisation of NATS was completed on 27th July 2001, with the Government selling
46% of shares to the ‘Airline Group’, a consortium of seven UK airlines including
British Airways and Virgin Atlantic43 (ibid. 2004). Under the terms of the deal, the
Airline Group was given operational control of NATS for 30 years at a cost of £800m
on the understanding that the service be run on a not-for-profit basis to placate critics
who were concerned that safety standards would be compromised in pursuit of profits
(Harrison 2003)44. Indeed, the Government was so concerned that public fears over
safety could jeopardise the project they retained a 49% holding, keeping responsibility
for safety and economic regulation in the public sector under the jurisdiction of the
CAA, while the remaining 5% was distributed among NATS employees (Goodliffe
2002). By maintaining a majority share, the British Government sought to ‘protect
national security in the event of war and to prevent ownership of our skies falling into
foreign hands’ (Walters 2001 p5)45; however, they did not prevent the privatised

43 N.B. Other members include bmi british midland, easyJet, Monarch Airlines, Airtours (now
MyTravel) and Britannia Airways (now ThomsonFly) (Walters 2001)
44 The airlines beat three other bids from Serco, the UK facilities management group, a consortium led
by Lockheed Martin, and from New Zealand’s state owned ATS provider (Walters 2001)
45 Although not explicitly articulated, public concern about the country being ‘swamped’ by asylum
seekers and/or ‘floods’ of economic migrants owing to perceived inadequate immigration controls and
the increasing permeability of national borders, was perhaps responsible for the state maintaining a
majority shareholding as, significantly, the bid from New Zealand’s privatised ATS provider was
turned down (Walters 2001).
airport operator, BAA, being bought by the Spanish construction company, Ferrovial, in June 2006 (Morgan 2006; Warner 2006)

The Government considered that the PPP of NATS represented the best and most cost-efficient way to improve efficiency, increase airspace capacity (by 50% to three million air traffic movements by 2010) and encourage investment (the Airline Group was expected to provide £1 billion in capital for research and development into new technologies), without compromising the UK’s enviable safety record (Majumdar and Ochieng 2004). The part-privatised NATS is now the sole provider of en-route air traffic services in UK airspace, as well as providing approach and aerodrome control services at 15 UK airports, though not NEMA (see later this chapter)46. In 2000, NATS handled over two million flights, making it the third largest air traffic control provider in Europe behind France and Germany. However, the relatively small size of UK airspace, and the high proportion of flights that actually use UK airports (rather than simply overflying), makes UK ATC provision more complicated than in most other European countries. Indeed, the density and complexity of traffic patterns in the UK, combined with rising volumes of traffic, arguably requires continual capacity enhancements (DETR and Credit Suisse 2000).

On January 27th 2002 (5 years behind schedule and £200 million over budget), the £700m national en-route control centre (NERC) at Swanwick in Hampshire came online with the objective of reducing ATC delays and putting the UK at the forefront of European ATC providers (Majumdar and Ochieng 2004 p137). The new centre controls over 200,000sq miles of airspace over England and Wales (excluding London and the southeast below 24,500 ft and the Manchester area below 21,000ft), and handles up to 6000 flights a day. While new software replaced the antiquated programming languages and hardware47, the system’s technological complexity (two million lines of software code, 3300 functions, 23 subsystems, 200-plus workstations, and 30 miles of cabling) created its own difficulties (NATS 2005c). Despite the new technology, the number of airprox events in UK airspace in 2004 rose to its highest

47 Which had been developed in three phases by three different service providers, compounding the problems of system incompatibility (NATS 2005).
level for 12 years\textsuperscript{48} (Webster 2005a). Over half the incidents were attributed to mistakes by ATCOs, while the number of potentially catastrophic ‘Category A’ cases in the first six months of 2004 – where there is a real risk of mid-air collision – rose by a third over the same period in 2003 (ibid 2005). The UK Airprox Board (UKAB), which investigates all reported incidents, found the most frequent cause of near-misses was controllers exercising ‘poor judgement’ or getting ‘confused’, owing to irregular shift patterns and the stress of trying to maintain the functional integrity of a national system that was 35 controllers short of the full complement (ibid. 2005). Yet despite the increasing pressure, the UK maintains an enviable safety record, with less than one in every ten million flights ending in an ATC-attributable incident (Clark 2004a).

5.6 Policing the sky – new geographical understandings of Air Traffic Control

Notwithstanding the geopolitical/regulatory dimension to airspace management, the day-to-day operation of UK airspace relies on controllers interacting with a variety of technologies to ‘produce airspace’ in approved ways for aircraft. As such, contemporary ATC is a complex, spatially distributed and time-critical activity concerned with maintaining safe airborne transportation. To facilitate safe and efficient coordination, the work is heavily regulated by internationally agreed procedures, and supported by a number of technical instruments (including radar, radio and flight progress strips) that enable controllers to literally and metaphorically “see” the sky. By exploring how the technicity of these technologies mediates the production of airspace in distinct ways, creating airspace as a ‘useable’ space of mobility, the remaining sections of this chapter will show how these technologies enable controllers to order, police and maintain the sky by imposing spatial strategies that prescribe flexibility rather than absolute rigidity.

Thrift (2004b) contends that new ‘locating technologies’, including mobile telephones, satellite navigation systems and GPS, have fundamentally changed our ‘knowledges of position’, enabling individual people and objects to be identified and contacted while on the move. This, he argues, has significantly altered the character of

\textsuperscript{48} In the first six months of 2004, 109 incidents were reported compared with 83 in the same period in 2003 (Webster 2005)
space and place, ‘producing novel kinds of behaviours that would not have been possible before and new types of object[s]’ that change the way spaces are used and experienced (ibid. 2004b p583). The development and dissemination of these technologies has had huge implications for practices of mobility, creating new possibilities for real-time traffic monitoring and control (Bennett and Regen 2004), as well as facilitating the ‘trackability’ of individuals through time and space (see, for example, Green (2002) and Laurier (2004) for a discussion of the use of mobile telephones and their role in reconstituting time and space).

While much has written about the new ‘Cam Era’ (Koskela 2003) and the proliferation of remote CCTV networks, secure access entry systems, and the biometric profiling of Western society (see Fyfe and Bannister 1996; Bannister et al 1998; Koskela 2000; Lyon 2003a; Graham and Wood 2003; Graham 2005), geographers have yet to explore the implications of all the ‘new kinds of electronic...time-spaces that are making their way into the world’ as a result of the introduction of new digital technologies (Thrift 2004b p583). Zook et al (2004) note few studies (with the exception of Valentine et al 2002) actually explore the details of how different digital technologies actually ‘work’. Thrift (2004c p585) similarly expresses concern that some of the surveillance networks that structure social space do not receive adequate academic attention on account of their familiarity; ‘Like the set-up of the page, indexes, footnotes and the rest of the paraphernalia of written thinking, they have become a kind of epistemic wallpaper’ resulting in a profound state of ‘technological unconsciousness’. Hillis (1998) suggested this “invisibility” derives from the fact networked infrastructures are often concealed from public view; either buried underground or kept behind locked doors, a characteristic similarly noted by Graham and Marvin (2001). As Kaika and Swyngedouw (2000 p2) observe, many networks are ‘opaque, invisible... underground, locked into pipes, cables, conduits, tubes, passages and electronic waves’. Thus, Coutard (1999 p1) proposes their very technicity means they are frequently considered “engineer’s stuff”, ‘not worth the interest of the social sciences’. Curry (1998 p2) also speculates that the paucity of geographic research into infrastructure networks is a result of geographers subconsciously harbouring fears that ‘new technologies will lead to the death of space and place and therefore their own discipline’.

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However, not all networks have been neglected, and this academic ‘blindness’ (such as it is) is highly selective. For example, Thrift and French (2002) examined the privacy implications of the increasing ubiquity of covert or otherwise ‘invisible’ computerised data collection and surveillance. Koskela (2000) described the highly complex (often gendered) relationships between those surveyed by CCTV and those doing the surveying, while Graham S (1998a, 1998b) critically explored the interactions between new forms of information technology and the production of social space. In the context of air travel, Peters (2006) highlighted the importance of the routine but time-sensitive logistical activities performed at KLM’s operations centre in maintaining the integrity of their worldwide flight network, while Goodwin and Goodwin (1996) investigated how ‘seeing planes’ on the ramp instinctively structured the actions of ground personnel, but no equivalent research has investigated ATC as spatial practice. The aim is thus to ‘open up’ ATC to critical geographical inquiry to move beyond the largely inaccessible, technocratic, and closed professional discourses that surround it, to demonstrate that far from being “engineers stuff” a geographical analysis of how the spatial practices and technologies of ATC perpetually reconfigure time-space by changing what is seen and “known”, can both engage with, and inform, a wealth of disciplinary debates. Through an investigation of what I have termed the ‘deep actual’ and ‘deep virtual’ seeing of airspace, I demonstrate how the practices and politics of ATC vision demand new geographic conceptualisations.

To substantiate the extensive literature surveys and primary archival research that informed the opening sections of this chapter, it was necessary to conduct in-depth empirical investigations, employing both qualitative and quantitative data collection techniques, into the everyday spatial practices of ATC. The aim was to expose the existence and geographic relevance of the ‘orderings and knowledge’ (Eyles 1988 p2) of ATC to begin to understand how they systematically and routinely produce airspace. By examining the taken-for-granted ‘everyday’ dimensions of ATC in a new spatial context, the relations between people, technology, and the production of airspace can begin to be uncovered.

Original empirical material was obtained during site visits to, personal observation of, and in-depth interviews with, Air Traffic Service Managers, supervisors, Senior Air
Traffic Control Officers (SATCOs), Air Traffic Controllers (ATCOs), and ATC assistants, at Air Traffic Control Centres (ATCCs) at Nottingham East Midlands Airport, Gloucestershire Airport, Manchester Airport, and the National en-route ATC centre at Swanwick in the period November 2004 - July 2006. This produced over 20 hours of aerodrome and area control49 observation in visual control rooms (VCRs) and radar rooms50, in a variety of traffic situations (summer/winter, morning/evening, day/night), along with informal interviews with individuals occupying different positions within the professional hierarchy. I also secured access to ‘used’ Flight Progress Strips from NEMA along with other examples of procedural documentation that are not normally available for public consumption, and built up an accompanying catalogue of photographic and video evidence. However, new discourses of security and surveillance, introduced in the aftermath of the September 11th 2001 terrorist attacks, together with issues of commercial confidentiality and disclosure, fundamentally affected how the research could be conducted and the detail of the empirical material that could be disclosed. Given the safety-critical and security-conscious environment in which the research was conducted, conventional methodological techniques required refinement to ensure the presence of the researcher neither endangered flight safety by distracting ATCOs from their work51 nor compromised security. However, before these particular issues are discussed in greater depth, additional information about the research design is required.

The location of the initial empirical research was chosen both on the grounds of theoretical interest and (relative) ease of access. Given my interest in the ongoing spatial controversy surrounding the reorganisation of controlled airspace at NEMA, it was appropriate to begin my empirical research at NEMA’s ATCC. As such, I was interested both in the facility as a localized site of airspace production, and as a setting through which the broader spatial practices (and associated debates) of ATC could be examined.

49 Aerodrome control refers to aircraft that are using the airport in question, whereas area control polices aircraft that are en-route and flying at higher altitudes.
50 VCRs are located at the top of ATC towers and enable ATCOs to physically see the aircraft on the airport. Radar rooms are ground-based facilities where radar images become the ‘eyes’ of the controllers.
51 In 1933, Brittain (p38) explained that all requests to visit Croydon’s ATC tower were denied because ‘people who [are] granted permission to enter the signal-box of a railway station [may] by an animated conversation with the signalman... endanger the safety of the 10:15 down’, and thus ‘There is no time for such people in the control tower at Croydon’.
The difficulties of accessing the chosen field environment were overcome (quite fortuitously) relatively early in the research process. As part of my fieldwork into the local public response to the NEMA airspace change, I attended two community ‘roadshow’ events in southeast Leicestershire in November and December 2004. Given my desire to learn more about the types of anxieties being articulated by attendees, I adopted the position of covert researcher and did not reveal my academic interest in the debate unless specifically asked. However, I considered it prudent to be honest with airport representatives from the outset, providing them with details of my research and asking for their assistance, where appropriate. One such discussion led to an introduction to NEMA’s Air Traffic Services Manager, and invites to the ATCC quickly followed. This provided introductions to individuals at Manchester, and invites to visit the facility, which, in turn, provided contacts at Swanwick and Gloucestershire ATCCs. Once I had the approval of one ‘gatekeeper’, the network of individuals offering their assistance snowballed. Many held positions of relative power in their respective organisations, which potentially caused them to become detached from the day-to-day reality of everyday operations. As such, I sought to ensure the perspectives and experiences of both managers and ‘ordinary’ ATCOs and assistants were represented as far as possible.

As Eyles (1988) noted, field relationships can be compromised/complicated by the definitions made by ‘others’ of ‘self’. Indeed, much valuable research has been undertaken into the possible effects the physical, biological, and existential characteristics of the researcher have on the outcome of the research (ibid. 1988) and the part emotions play in the research process (Widdowfield 2000). In recognition of the influence the researcher’s positionality and behaviour can have on fieldwork, an awareness of personal reflexivity is important (see Bennett K 2002). As understood in everyday language and used in academic discourse, reflexivity describes the act of critically reflecting on your own work and experiences (Abercrombie et al 1988) and generally refers to the phenomenon of self-reference and describes the process through which researchers consider their role in shaping the research design and outcomes (Rose 1997; Ekinsmyth 2002; Valentine 2002). This involves ‘giving as full and honest an account of the research process as possible, in particular explicating the position of the researcher in relation to the research’ (Reay 1996 p443). As Schoenberger (1992 p218) explains, ‘questions of gender, class, race, nationality,
politics, history and experience shape our research and our interpretations of the world, however much we are supposed to deny it’, and so reflexivity offers a way to scrutinise the self as a researcher (England 1994).

It is inevitable that another researcher would approach the present project differently and thus draw different conclusions from those of a white, university-educated, middle-class, female researcher in her early-to-mid 20s who has a long-standing interest in commercial aviation. However, as Eyles (1988) notes, it is possible to ‘manage’ the impressions one creates within these defined parameters. During her fieldwork, Coffey (1999 p65) recounts that she attempted to ‘dress like an accountant’ in formal suits and heeled shoes to portray herself as ‘smart, self assured, confident and well managed’. So as not to appear ‘out of place’ in ATCCs, either by being over or under-dressed, I similarly gave consideration to appropriate forms of clothing. To assist my choice of attire, I inquired about acceptable dress codes before my first visit to the different field sites (which variously resulted in me wearing jeans and a casual top at one facility and a three-piece suit and heels at another). Furthermore, I was conscious of my speech and annunciation (particularly forms of address and vocabulary)\(^2\), and made a conscious effort to be an appreciative and affable guest while not loosing sight of my research objectives.

On the thorny issue of where I stood on the active participant – passive observer spectrum, I was alert to Katy Bennett’s (2002 p140) cautionary tale that ‘Too much emphasis on observation might undermine a fuller understanding of the researched, whereas staunch participation might result in “going native”, i.e. ‘overidentifying with and being an uncritical celebrant of the subculture’ (Thornton 1997 cited in ibid. 2002 p140), and I thus decided to trust my instincts and behave intuitively rather than consciously adopt an artificial mode of behaviour. This enabled me to explore the relative merits of being both an active participant and a passive observer within not only single field visits, but also within individual conversations.

\(^2\) In keeping with its technical background, the language of ATC is peppered with acronyms and abbreviations, all of which are employed to ease communication and lessen the possibility of confusion or misunderstanding between those working in the industry, but they can generate bewilderment among lay persons trying to comprehend them for the first time. As such, the use of acronyms has been limited and their full nomenclature frequently cited. Occasionally, for the sake of clarity and comprehension, some technical aspects have been simplified and occasional liberties taken with scientific accuracy.
Unlike the majority of participant observation, where the researcher inhabits an elevated and therefore ethically/morally problematic position over the researched (see Katz 1992; Mullings 1999), this thesis has more in common with McDowell’s (1998), Desmond’s (2004), and Smith’s (2006) experiences of working with ‘elites’, where the normal researcher-researched power hierarchy is reversed and the researcher placed in a position of relative powerlessness. As Herod (1999) and Sabot (1999) discovered, interviewing elites presents it own particular problems with regard to accessibility and disclosure. However, considering the security implications involved in being airside at several facilities (i.e. beyond passport/security control in ‘sterile’ areas), all ATC personnel, without exception, appeared very open and I was not aware of them hiding anything from me (c.f. Sabot 1999). This did however present certain challenges with regard to disclosure, as several of the events I witnessed are subject to ongoing CAA investigation. Consequently, though never specifically requested not to, I decided I would not feel comfortable reporting details from which individual incidents could be identified. For that reason, certain details have been omitted or anonymised.

I ensured compliance with security protocols by wearing identification badges as instructed, carrying security passes at all times, consenting to being frisked at the security checkpoints and having the contents of my bag searched, and following all instructions (including being escorted around the facility where appropriate, not entering rooms unless specifically invited to do so, and asking permission to photograph controllers and equipment). The latter was especially prudent given the increased sensitivity surrounding issues of security and prevention of terrorism. In the present security climate, photographers have been confronted by police when taking photographs of sites not previously considered sensitive, including airports, stations, bridges, and power stations (Macpherson 2004). While the Official Secrets Act of 1911 makes it an offence to photograph any “prohibited place”, including CAA property, until 9/11 this legislation was rarely enforced. However, the UK’s Prevention of Terrorism Act (2000) gives police the power to stop and interrogate any individual suspected of its contravention by, for example, photographing subjects considered potentially useful to terrorists (Macpherson 2004). However, legislative inexactitude has led to different interpretations – what is permitted at one facility may well be prohibited at another. Yet, despite prominent ‘No Photography’ posters in
passenger terminals, all the author's photographic requests were granted immediately and without question. Given this degree of access, I gained a deep insight into how ATC practice orders the sky. Selected empirical material is presented in the following subsections.

5.7 Seeing the sky – the different types (and sites) of ATC vision

It has long been appreciated that the act of looking is highly politicised – questions surrounding who does it, why, where, and how perpetually fascinate social scientists, and the revolution in surveillance techniques and the proliferation of their use means the importance of such studies is unlikely to diminish. In recognition that there are many ways of ‘seeing the sky’, a distinction is made between ‘lay’ understandings of airspace, that are available to anyone who looks skyward and sees a contrail or sees an aircraft taking off, and the professionally-informed seeing of airspace only available to trained ATCOs and support personnel. I also suggest these various ‘gazes’ can be articulated in two forms, what I have termed ‘actual’ (where the observer actually eyeballs the aircraft under scrutiny) and ‘virtual’ (whereby knowledge about aircraft is constructed through electronically-encrypted data that supplies spatial information about the use and conduct of aircraft in geographically remote sectors of airspace.)

Though appreciating such an arbitrary distinction is inherently problematic and open to question, Table 5.3 suggests how these forms might be achieved in practice.

### Table 5.3 Possible ways of conceiving airspace

<table>
<thead>
<tr>
<th>Lay understandings</th>
<th>Actual</th>
<th>Virtual</th>
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<tbody>
<tr>
<td>Families aircraft spotting</td>
<td>‘Live’ unofficial radar feeds of air traffic flows, usually accessed online or via personal radar decoders, and usually devoid of much salient information.</td>
<td></td>
</tr>
<tr>
<td>Looking out of an aircraft’s window</td>
<td>Watching a flight’s progress on the in-flight ‘air show’</td>
<td></td>
</tr>
<tr>
<td>View from the visual control room (VCR)</td>
<td>Through radar displays, computer terminals etc.</td>
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</tbody>
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The more ‘superficial’ visions of airspace, though worthy of further investigation, are not my primary concern. The following sections will, instead, explore professional
articulations of ATCO vision. Beginning with the surveillance of aircraft from the panoptic site of the visual control room (VCR), I will explore how the built form and function of ATC towers both symbolises and facilitates one dominant, globally-standardised, ocularcentric way of coding and maintaining ordered surveillance over adjacent ground and airspaces. This will be followed by an exploration of how radar enables controllers to develop ‘deep virtual’ visualisations of the traffic under their command by gazing at encoded radar displays.

5.7.1 The view from above

‘Just after 5pm, I was invited into the Visual Control Room. It was December, and it was dark. As I reached the top of spiral staircase, the airfield was suddenly unveiled before me, a sea of multicoloured lights that twinkled in the darkness; brilliant white along the runway centreline, red stop bars, flashing amber warning lamps, emerald green taxiway markings and deep indigo perimeter lights. In the distance, I could see the M1 and the continual snake-like ribbons of six lanes of traffic, and beyond that, the slightly sinister amber glow created by thousands of streetlights reflecting off the low cloud. So as not to obscure the view out over the airfield, the ambient light level was low, and the glow of the radar screens and computer monitors gently bathed us in an unearthly green light. On the apron below, powerful floodlights reflected off the puddles and the polished metal surfaces of the aircraft, while service vehicles swarmed around the jets, readying them for their next flight. From this height, the airport and its occupants resembled matchbox toys, the playthings of the men and women at the top of the tower who choreographed their movements. The new aerial perspective provided order to the nocturnal landscape; mundane, familiar spaces of roads, cities, and the airport, were transformed and given structure through different intensities, colours, and frequencies of light, all of which variously guided, regulated, and conditioned forms of airside behaviour.

The tower controller was sitting with her back to me, issuing a landing clearance to an incoming aircraft. I followed her gaze, and watched as the powerful landing lights of a DHL B757F pierced the night’s sky. With red anti-collision beacons and white navigation strobes bouncing off the damp concrete, the aircraft flew towards the runway, flaring its nose before settling its main wheels on the runway. The thick insulated glass windows reduced the sound of its reverse thrust to a murmur, as the jet slowed and then carefully exited the runway. On the taxiway, an airfield operations vehicle hurtled past on an unknown mission, its amber warning lights rotating furiously. The radio crackled, “Baby two one mike push and start please”.

I peered over the rim of the control console at the B737 fifty-or-so metres below. The juxtaposition of being up here as opposed to down there, inside rather than out, and locally grounded yet globally connected, gave
the tower a strange, dislocated, ephemeral quality, as if I could quite easily be sitting in any control tower anywhere in the world. As if reading my mind, the ground movement controller pointed at the clock and commented, "It’s bizarre isn’t it? I mean, we could be in Cairo, Bahrain or Tokyo and it would still be the same time as it is here". With that, he swung round in his chair, keyed his microphone and gave clearance for the 149-odd passengers, plus crew, to commence their journey to Belfast.'

- field diary extract (2004)

Crouch (2003) and Hayes (2006) argue air traffic control towers are the most emblematic (and visible) of airport structures. Rising above the jumble of car parks, passenger terminals, and taxiways, they project skyward, piercing the airport’s skyline, symbolising authority, order, and the rational organization of the space of terrestrial-to-aerial transition, yet (unlike the plethora of recent publications on airport terminals) geographers have yet to examine their geographical significance. Indeed, academic understandings of their form and function have arguably been conditioned by repeated exposure to media productions that portray them as inherently masculine (and therefore heroic) spaces, characterised by tension, technology, and temerity that are too specialised to warrant investigation53. Thus, while airspace is commonly understood, given meaning, and ultimately consumed in (and through) airport landscapes (of which ATC towers are a central and recurring element), no geographical research has been conducted on the view from control towers or how ‘technologies of vision’, including human eyesight and radar displays, combine to create new spatialities that structure air traffic flows.

By their very design, control towers project a particular type of regulatory power and authority over global aerial territory, and can be variously ‘read’ as symbolic monuments to capitalism, industrial regulation, and global mobility. Cultural geographers have long expressed a belief that individual landscapes are ‘authored’ and thus can be subjectively ‘read’ (and perpetually reread) as texts (see Meinig 1979; Duncan and Ley 1993). Lewis (1979 p12 in Mitchell 2000 p121) suggests human landscapes are ‘our unwitting autobiography, reflecting our tastes, our values, our aspirations, and even our fears, in tangible form’, while Duncan and Duncan (1988) suggest landscapes are ‘discursive formations’, produced through ‘the regularized,

53 Principally through airline/airport disaster novels (such as Hailey’s ‘Airport’ 1968) and movies.
organized, and routinized [sic] systems of signs that exist in any particular time or place’ (Mitchell 2000 p142). Such semiotic understandings led Fuller and Harley (2004) to suggest airport space is produced, synchronised, regulated, and monitored through specialised equipment, signage, and radio frequencies. To them, ATC represents a technical, sterile world, elevated above (and thus far removed) from the colourful bustle and multifarious attractions of the terminal (Figure 5.13).

**Figure 5.13** Big Brother’s watching (and listening). Fuller and Harley (2004) emphasised the ‘hidden’ nature of ATC transmissions (and, through their choice of photographs, the height of control towers) in their discussion of airport semiology, but in common with many other airport commentaries, failed to analyse the cultural significance of this unique form of auditory and visual surveillance.

While ATC towers can, and gradually are, being interpreted as powerfully symbolic structures that inscribe particular ideologies of national technocratic capability and international connectivity onto the landscape, the majority of work emanating from design critics and architectural commentators focus on views of the tower, not the view from it. This is not to say geographers should not examine their architectural symbolism, indeed it may prove instructive to systematically analyse ATC towers as testaments of regional or state power. Indeed, the practice of demarcating territories with watchtowers has a long geopolitical pedigree, and their presence in the landscape

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54 In their discussion of the cultural significance of ‘monuments and spectacles’, Shurmer-Smith and Hannan (1994 p199) discuss how certain buildings merge ‘propagandist authority and celebration into a singular manifestation of the state’ (see also Campi 2000).
articulates a specific vertical appropriation of space regardless of location or function, portraying the (literal) hierarchical power of the society that created them. During the Cold War, East German forces constructed watchtowers along the Berlin Wall to deter escapees, while Heathrow’s new 285ft-tall ‘eye in the sky’ was commissioned to give controllers commanding views over the airfield (de Botton 2006). See Figure 5.14.

Figure 5.14 – Demarcating territory – a redundant watchtower on the former line of the Berlin Wall near Potsdamer Platz, central Berlin, and the new Richard Rogers-designed ATC tower at Heathrow. Given that the former was designed to restrict mobility and latter facilitate it, the structures are strikingly similar in appearance.

Although recognising that ATC towers have developed into significant architectural forms in their own right, simultaneously being both ‘icons of safe flight’ and representative of the airports they serve (see Figure 5.15 overleaf), it is the view from the top, rather than the view of the top, that interests me here.

Arguably, Bentham’s assertion that power should be both visible yet unverifiable finds its ultimate expression at the airport, where the visible structure of the ATC tower provides a constant reminder of being watched while simultaneously

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55 Edinburgh’s Managing Director described the new 187ft-tall facility (Figure 5.14 above) as an “architectural statement, symbolic of where we’re coming from and where we’re going” (cited in Hales-Dutton 2006), while the Viennese airport authority sought to build ‘a unique architectural structure, and...create a new landmark for the regional surrounding the airport’ (cited in Pearman 2004 p213). At Sydney, the regeneration brief asked the architects to inject the ‘fun’ back into air travel, and Ancher/Mortlock/Woolley responded with an imaginative ‘helter-skelter’ design, illustrating that the challenge of creating a permanent image of flight safety was compatible with structural innovation and strict design parameters.
obfuscating the practices of looking. For ‘in the central tower, one sees everything without ever being seen’ (Foucault 1977 p200), and in this way, ‘[n]ot only does the panoptic machine make one visible’ but it simultaneously hides the operations of the observer (idem), creating a known, yet strangely unfamiliar, geography of ATC operations (c.f. Thrift 2004c p585). Just as McNeill (2005 p52) suggested skyscrapers pose ‘numerous questions about the nature of transnational knowledge flows, and how barely visible material transactions are housed’, the task here is to explore how the structural design of ATC towers defines, creates, and maintains global airspace by enabling controllers to see for themselves what is happening around (and under) them.

Figure 5.15 Same function, different form. The austere tower at Edinburgh (left) contrasts with the ‘fun-park’ theme at Sydney (right), yet both structures prioritise and optimise surveillance and security as well as being symbolic of the global network they serve, and (the architects hope) the local place in which they are situated.

Such architecturally imposed visibility begs an investigation of the centrality of vision in the control of airspace. As Koskela (2003 p297) appreciates, the ability to see others at all times ‘offers the basic condition for collecting knowledge’ and allows individuals to be (or at least feel) ‘in control’ of their surroundings. That said, the well-reported tendency for airports to outsize their rivals reiterates the importance of securing a privileged (elevated) site of observation from which controllers can exercise a commanding gaze. Similarly, some cultural geographers have argued such
phallic 'one-upmanship' merely serves to inscribe and reinforce a particular (male) vision onto the landscape (see Shurmer-Smith and Hamman 1994).

5.8 The politics of vision and development of radar

'Looking' has long been interpreted as connotating power over the subject of the gaze. In the aerial observatory of the VCR, controllers literally look down on airside activity below, where the diverse movements of aircraft, fuel bowser, baggage trucks, and maintenance vehicles become the aeronautical equivalent of monopoly pieces in a complicated three-dimensional board game that requires skill and flexibility to safely and efficiently choreograph their actions (see Figure 5.16).

Figure 5.16 The aerial observatory – controllers gaze down on the airfield from the VCRs at Stansted, Gloucestershire and Manchester airports (clockwise from top).

![Aerial observatory controllers](image)


In the VCR, controllers are not simply inert audiences gazing impassively at the ground below, but active constituents of the space they survey, identifying potential problems while issuing orders to continually (re)structure its form. At Heathrow, ATCOs order the routine lowering of cranes involved in the construction of Terminal
Five to prevent infringing take-off or approach areas, Donington Park Race Circuit must gain special dispensation from NEMA ATC to erect television platforms under the airport’s flightpaths\(^{56}\), and all airside vehicles have unique identification codes painted on their roof to aid aerial recognition. However, during the hours of darkness or in fog, a controller’s gaze is augmented by the provision of high-magnification binoculars, night-vision equipment and ground movement radar\(^{57}\) (Figure 5.17).

Figure 5.17 The ground movement radar at NEMA brings visual clarity to the groundspaces of the airport that are otherwise obscured by darkness.

The provision of such equipment means the phenomenon of ‘artificial vision’ is very pronounced in ATC centres (c.f. Thrift 1996). Delanda (1991) suggested that new systems of ‘panspective’ surveillance are replacing ‘panoptic’ surveillance by creating ‘extended optical intelligence’ through the acquisition of data that can’t be ‘seen’ directly (cited in Thrift 1996 p281). Indeed, while many radar rooms are situated at airports, en-route centres (like the UK’s NERC at Swanwick) are remote sites, with radar feeds from multiple radar installations being centralised at one or two key control sites. Though not explicitly writing about ATC, Crary (1990 p2) correctly anticipated that visuality will increasingly ‘be situated on…cybernetic and electromagnetic terrain where abstract visual elements…are consumed, circulated, and exchanged’ between multiple sites. Indeed, the range of modern radar means there is often considerable overlap in terms of coverage, providing controllers with a

\(^{56}\) Heathrow, NOTAM (2006) and personal communication with NEMA ATCO (2005). This also links back with the idea of how ATC discourse ‘sanitise’ the airspace around airports.

form of reciprocal vision that enables them to see what is happening in other sectors and at other airports. Work examining the rise of the ‘surveillance society’ (Lyon 1994, 2003b), thus allows an exploration of how radar electronically extends the panoptic gaze of controllers, allowing them to safely and routinely produce airspace.

From the earliest times, darkness (or the inability to see) was dangerous – armies deployed at night to surprise and overpower their enemies, while criminals and deviants were thought to inhabit dark, infested urban spaces (Mayne 1990). As such, the dominant cultural discourse of darkness perceives the absence of light as a threat, whereas visibility or bright illumination is considered a social good as it is thought to deter intruders and discourage inappropriate forms of behaviour (Schlöer 1998). For example, it has been noted the gradual electrification of urban space following the introduction of reliable arc lighting in the 1870s led to the progressive abandonment of natural daylight rhythms and that this ‘colonisation’ of the night led to the emergence of a new ‘night-time economy’ of spectacle and consumption (Schivelbusch 1988) but also produced new opportunities for surveillance (Thrift 1996). Electric lights became associated with purity as they assisted in the identification (and avoidance) of feared strangers and were praised for being good policemen by making dark areas ‘safer’ (Koskela 2000). However, they also ‘accentuated the contrast between…moral and immoral landscapes’, with the ‘bright lights’ of Soho, Pigalle and Times Square proving as attractive to the sex trade as the ‘darkest shadows’ (Dennis 2000 p225). As Thrift (1996) notes, electricity also made ‘unlit’ areas even darker, emphasising spatial inequalities in wealth and access, with affluent or otherwise favoured urban areas being connected to electricity supplies at the expense of poorer addresses (see also Nead 2000).

This ‘light politics’ extended to spaces of mobility. Electric lights were installed at major (nationally important) aerodromes in the late 1920s to enable aircraft to take-off and land after dark, enhancing the commercial viability of passenger services by extending the hours in which they could operate, epitomising all that was ‘good’ and progressive about modernity. As Brittain (1933 p38) observed, ‘Croydon aerodrome at night is a glittering paradise of high-powered lamps. Bright lights gleam from the roof of every building, and searchlights finger the sky’. However, while conventional searchlights could pierce the night’s sky in the immediate vicinity of aerodromes,
their range was very limited, and so experiments were conducted into new techniques to improve the nighttime and long-range visibility of aircraft. Hence, in anticipation of the role aircraft would play in determining the outcome of World War Two, Britain developed what was then one of the most sophisticated air-defence systems in the world (Grant 2003). At its core was a new ‘technology of vision’, which could identify enemy aircraft approaching British shores by means of radio waves. During the 1930s, a network of radar (‘radio detection and ranging’) installations was constructed along the South Coast to provide early warnings of, and a ‘first line’ of defence against, aerial attack (Wilford 2002)58. By continually transmitting high frequency radio beams into the sky and computing how long it took for any ‘echoes’ to be reflected back to the receiver59, British military tacticians were able to coordinate targeted responses to incoming air raids. A further advantage of the system was that the enemy could not tell if they had been detected, and this unverifiability was an important psychological tool as the omnipresent threat of being watched installed feelings of fear and uncertainty in the minds of enemy flightcrew (c.f. Simon 2005).

Although the Luftwaffe’s Erprobungsgruppe eventually discovered they could avoid detection by literally flying ‘under the radar’, the system nevertheless proved a valuable tool through which ground-based operators could warn allied pilots of the location of enemy fighters, enabling them to avoid or intercept them as appropriate (Grant 2003). However, the system had its limitations. It was not simply a matter of being able to see, it was necessary to (re)arrange the material/physical world in such a way that allowed for the display, identification, classification, and isolation of individual aircraft. Unfortunately, early radar images were often cluttered and difficult to interpret, as all reflective surfaces (including storm clouds, high terrain, and moving vehicles) could produce ‘ghost’ echoes (Field 1985; Paylor 1993)60.

58 Radar worked on the principle that, once transmitted into the sky, a radio beam would travel in a straight-line unless it encountered an obstacle, in which case the beam would be reflected back, detected, and displayed as a ‘blip’ of light on a radarscope, allowing trained observers to identify the object from its size, location and speed.
59 The strength of which depends on the power of the transmitted signal, the shape and material of the reflecting object, and the size and range of the ‘target’ (Stewart 1992).
60 Indeed, personal experience of the radar room at NEMA ATCC bore this out, with ambient light levels comparable with most offices, but even now, high ground in the Peak District and high-sided vehicles on neighbouring roads still generate superfluous echoes on NEMA’s radar (source: Louise Harker, NEMA ATCO, personal communication 2005).
Furthermore, the returned images only comprised coloured ‘blips’ and no form of identification, which placed allied aircraft at risk of ‘friendly fire’. A more sophisticated ‘Identification Friend or Foe’ (IFF) system was developed during the 1940s, which married the radar signatures of individual allied aircraft with on-screen alphanumerical identification symbols (Billings 1997; Grant 2003). This enabled controllers to positively identify individual allied aircraft, producing the sky as a safer space of aeromobility.

Despite being considered ‘old’ technology by some, radar’s ability to track aircraft through time and space remains unsurpassed, and it is employed at all UK en-route and aerodrome ATCCs to monitor the progress of individual flights and represent their relative positions and trajectory to help controllers visualise traffic patterns. From the late 1950s onwards, rising volumes of commercial air traffic necessitated the introduction of new technologies that would positively identify individual aircraft in flight, and the IFF system became the basis for modern secondary surveillance radar (SSR), which combines the abstract geographical coordinates of primary surveillance radar or PSR (the original technique developed during the 1930s) with uniquely coded identification information (Field 1985).

Unlike PSR, which relies on the strength of the reflected signal, SSR relies on small radio transmitters in the flightdeck, called transponders. These automatically respond to interrogation from ground-based radar pulses and send unique coded identification ‘squawk’ signals back to the ground (see Figure 5.18 for a schematic representation of how these systems work). Since squawks are transmitted on a different frequency from the ground station pulse, SSR signals are stronger and more reliable. ‘Squawks’ consist of four-digit identification codes (such as ‘six four two five’) that are automatically produced and assigned to a particular flight before take-off and then transmitted throughout the journey. Squawks are produced in line with ICAO guidelines according to the flight’s origin, enabling trained observers to decode the flight’s origin (i.e. ex-NEMA flights typically get codes in the range 4550-4573)\(^6\). Other codes, including ‘7500’ and ‘7600’, are reserved for emergencies (and indicate

\(^6\) John Flynn and Barry McInnes, NEMA ATCOs, personal communication (2005).
Figure 5.18 Schematic representation showing how PSR and SSR returns combine to show an aircraft's position, callsign, altitude and climb information at NEMA ATC.

Aircraft

Primary radar (on site)

Secondary radar (Clee Hill)

Primary radar return encoded and sent to NEMA ATC

Secondary radar return encoded and sent via secure high-speed telephone line to NEMA ATC

Code/callsign conversion unit at NEMA ATC identifies '0250' as NEMA traffic, replacing squawk code with callsign. Non-NEMA flights are identified by their squawk code only

NEMA aircraft are positively and uniquely identified by their PSR trace and converted SSR code, giving information on their position, callsign, altitude and rate of climb

All aircraft within range are identified in this way, distinguishing NEMA traffic from overflights, and commercial services from military/private aviation. The relative positions, altitudes and trajectories of individual aircraft on the radar screen help ATCOs visualise traffic patterns and expedite safe and efficient flight.

All photographs*, digital manipulations and annotations: author
*except that in top right-hand column (Evans 1997 p105)
radio failure and hijacking respectively)\textsuperscript{62} or use by the military (Underdown and Palmer 1997). In the UK, ‘7000’ denotes the “conspicuity code”, a squawk that is used by all transponder-equipped light aircraft flying in Class D airspace (ibid. 1997). Generally, PSR is used to ensure separation and control, but SSR alone may be used in case of emergency or when the PSR system fails (ibid. 1997). However, SSR only works with transponder-equipped aircraft and others show up as primary radar echoes. Ground-based ATC computers then translate the transponder signature back into flight data, providing controllers with information about the operator, altitude, callsign, origin/destination, aircraft type, air and ground speed, and vertical speed (if it exceeds 500 feet per minute), and display this alongside the relevant PSR ‘blip’ that shows the aircraft’s physical position in space (Figure 5.19).

Figure 5.19 Section of a radar display at Manchester ATC. The converted SSR squawk and PSR ‘blip’ provide spatial and identification information about a recently-departed flight, data which is overlaid on a static grid demarcating airspace boundaries.

The resulting two-dimensional images of aircraft flying through three-dimensional space are layered on top of a grid of lines and symbols demarcating different airspace sectors, the position of airports, navigation beacons and waypoints, replacing a

\textsuperscript{62} Any SOS signals are dealt with by the distress and diversion unit at London ATCC who establish the nature of the emergency (if any). Very often, SOS alerts are triggered in error by private pilots dialling the wrong code into their transponders (Source: Louise Harker, NEMA ATCC, personal communication).
familiar terrestrial geography with the characteristics of an aerial network. Thus, the physical shape of the airspace is revealed both by lines on the display screen and the densities and trajectories of traffic flows. Radar is thus a selective abstraction of the situation at one point in time that is processed and communicated through a specific graphic form, with all the associated problems of such representation (see Owen 2005). While the PSR image and SSR returns interact with one other and the flight database, the hybrid image can never communicate the whole picture, as only pieces of information the software programmer deemed relevant to the safe handling of a flight are displayed. The resulting display comprises an interesting fusion of static and dynamic data, for while the position, speed, and altitude of aircraft is constantly changing, the flight identifier remains constant. As a flight leaves the sector of airspace within the radar’s range, both the image and information about the flight is discarded, yet knowledge gained during the flight’s passage (such as the pilot radioing the controller about the location of turbulence) helps structure how that airspace is used after that aircraft has passed into the jurisdiction of another controller.

At airports, radar helps controllers safely marshal lines of inbound and departing aircraft in accordance with both local and national airspace protocols, but this creates an astonishingly complex assemblage of different objects flying through multiply-encoded spaces (see Figures 5.20 and 5.21). The responsibility for rendering complicated 2D images into three dimensions rests with individual controllers, and many revealed they develop detailed mental visualisations of the airspace they are working. At NEMA, one controller commented that “aircraft bounce off flightlevels in my head” while a colleague remarked that the construction of mental images “is not something we do consciously, it just happens – I look at a radar display and instinctively see it in 3D”. In an effort to ‘see like a controller’, Stapelberg and Fritz (2001) attempted to visualise 2D radar data from Frankfurt/Lagen ATCC in three dimensions, while Director Mike Nevell (1999) tried to help his audience ‘see’ into the mind of a controller by visualising the radar screen as a rotating virtual three-dimensional ‘game’ in which individual aircraft were emphasised and illuminated (Figure 5.22).

63 Thus, the only way controllers can quickly gain additional information about a flight (such as determining how many people are aboard in case of emergency) is through radio communication with the flightdeck.

64 Source: personal communication, NEMA ATCOs (2005).
Figure 5.20 Partially decoded radar display, NEMA ATCC, 20th June 2005, combining live PSR feeds from the airport’s on-site radar installation with SSR images from the NATS/CAA SSR station at Clee Hill, Shropshire.

Note the two broad swaths of high-altitude aeromobility (marked with yellow dotted lines and arrows) layered on top of the NEMA traffic and how, given the higher altitudes, no ground speeds are displayed (c.f. Figure 5.22).

Light aircraft outside NEMA’s PSR range (i.e. over 40-50 miles away) squawking 7000 - note how they only appear as SSR crosses rather than coloured PSR blips.

NEMA - note the white ‘ghost’ echoes to the north of the field, a result of high-sided lorries on the M1 and A50.

Location of SAPCO waypoint.

Ryanair flight FR1924 (NEMA to Murcia) at 11,900ft climbing at over 500ft per minute.

Photograph and annotations: author
Two inbound aircraft leaving the ROSUN stack, XLA2217 (a B757) at an altitude of 5,100ft and groundspeed of 209 knots and JDA43W (a Piper Seneca) at 4,000ft at a groundspeed of 138knts. Seconds after this photograph was taken, the Excel crew received a TCAS resolution advisory (see Chapter Four), ordering them to abandon their descent and climb, even though there was no risk of collision.

Outlines of Mersey estuary

Liverpool airport with extended runway centrelines running east-west

BRT842 inbound to Manchester from the DAYNE stack at an altitude of 6,700ft and ground speed of 247 knots

Protected ILS zone, inbound aircraft can be dropped to 1,600ft once inside this piece of airspace

Extended centreline of runway 24R (ILS beam)

Manchester Airport

BRT842 inbound to Manchester from the DAYNE stack at an altitude of 6,700ft and ground speed of 247 knots

Photograph and annotations: author
Figure 5.22 Different ways of representing ATCO vision - stills from ‘Pushing Tin’ (1999). Here, unlike the mental models ATCOs claim to develop, only selected information about flight number, altitude and trajectory is displayed.

The results, while arguably more approachable for the layperson, are unlikely to be employed in ATC facilities. Personal experience of talking to ATCOs confirms Mackay’s (1999) findings that controllers are dismissive of the potential of 3D radar displays because they force everyone to “see the sky in the same way” thus removing subjectivity. While increasingly sophisticated Short-Term Conflict Alert Systems automatically monitor separation distances and alert controllers if they are breached (Hales-Dutton 2001), radar cannot (as yet) control aircraft; it can only display what is happening ‘out there’ and assist controller judgement. Thus, in conjunction with the experience and discretion of human agents, radar becomes not so much a machine of vision as a machine that facilitates the ordering and sorting of aircraft according to their origin/destination, routing, flight profiles, and the characteristics of the terrestrial geography below. For while the approximate outlines of major settlements appear as blue lines on NEMA’s radar displays, it is up to controllers to expedite their avoidance by low-flying aircraft. There are no ‘keep out’ notices in the sky, no fences to block unauthorised movement, so the lines that show the location of urban areas and the grids that mark the boundaries of control zones play an important role in the demarcation of aerial territory and help controllers identify when aircraft ‘trespass’ into restricted areas or transgress from their flightplans (see Smith 1990).

Radar consequently has an important ‘sanitising’ effect; ensuring airspace is only used in a ‘proper’ manner by approved practitioners by excluding unauthorised ‘others’. As Hubbard (2000 p248) observes with regards to on-street prostitution, a similar ‘exclusionary urge’ manifests itself ‘in the way that city space, often regarded as

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65 Personal communication, NEMA ATCOs (2004, 2005).
democratic and open, has become increasingly regulated. As a result, groups and individuals whose lifestyles are viewed as incompatible with so-called ‘normal’ ways of behaving increasingly have their access limited’. In the context of aviation, anything other than (commercially valuable) passenger or cargo-carrying flights or (geopolitically sensitive) military and VIP traffic is increasingly marginalised with radar the tool through which such exclusion is effected. As a member of the British Gliding Association’s Airspace Committee, who regularly negotiated with NATS, the RAF, USAF, CAA, and individual airports to try and secure maximum access for gliders explained, his work “mainly consisted…of fighting a rear-guard action to try to slow the steady erosion of our freedom of the skies” to challenge the “the casual way that access to airspace can be arbitrarily denied to gliders and light aircraft”.

Until 1999, private pilots could use most areas of airspace, without radios, under VMC, or Visual Meteorological Conditions (i.e. in good weather), without ATC clearance.

“Up to 1975, this even included the whole of the LTMA [London Terminal Maneuvering Area] and the Birmingham and Manchester TMA's [Terminal Maneuvering Areas] as well. We were allowed to cross Airways in VMC "Expeditiously". What is now the Daventry CTA [Control Area] was then Airway Amber One and about a quarter of its current width [and] we crossed the lower levels in VMC regularly.

Over the years, NATS has adopted the view that allowing VFR traffic to fly in controlled airspace with IFR traffic is generally not acceptable if the VFR traffic is non-radio (the argument for this is not substantiated by statistics, there has, as far as I know, only ever been one collision between a glider and an airliner ever, anywhere in the World - the airliner landed safely). [Now] ATC units generally don't allow gliders in if they can avoid it, claiming that the 'workload is too high'. Too high for safety, or too high for those who would rather not have to work too hard?"

Former member of the BGAs airspace committee (personal communication, 2006)

The widespread use of radar surveillance means there is no need for controllers to keep a physical watch on remote glider sites, as any unauthorized activity can be seen on their radar screens. Though writing in a different context, this concurs with Foucault’s (1980 p155) assertion that ‘There is no need for arms, physical violence or material constraints’ as a gaze is as effective in disciplining would-be transgressors. Accordingly, were it not for comprehensive radar coverage, private pilots could infringe controlled or otherwise restricted areas of airspace without reproach.
Although radar surveillance is unverifiable, the high likelihood of being spotted acts as a disciplining force structuring forms of pilot behaviour by imposing a constant state of self-vigilance. The mutual respect between pilots and controllers was evident both in the empirical observations of ATC and pilot practice (see Chapter Six for details). Yet, while several flightcrew joked about “big brother” breathing down their necks, one senior pilot remarked that while he appreciates some of his younger, less experienced, colleagues may not always fly the “neatest” descent profiles, “as long as they get the thing down in one piece, I’m happy, and prepared to defend them if ATC get stroppy [sic] with us” 66.

However, whenever practicable, pilots, in common with other individuals ‘internalize the rules, regulate their own behaviour...and, thus, exercise power over themselves’ to act in appropriate or ‘normal’ ways (Koskela 2003 p299) by behaving in accordance with engrained protocols of flight that are practised on a regular basis (c.f. Foucault 1977). However, the potential for an inexperienced pilot to ‘slip through the net’ and breach the normal rules of spatial engagement remains. In March 2006, a Ryanair flight landed at Ballykelly airbase five miles away from its intended destination at City of Derry airport after the Captain mistook the former for his destination (Jones 2006); in June, a cargo aircraft missed the runway at NEMA, shearing off its right main landing gear, after the pilots misjudged their approach (Owen 2006); and in October, a light aircraft collided with an apartment block in Manhattan (Bine and Philp 2006). Controllers must therefore remain alert to any eventuality, using radar to identify transgressors, and radio to resolve potential conflicts (see Exchange 5.3 overleaf).

66 Anonymised field diary extract, 2005.
Exchange 5.3 Radar - the disciplining eye. This exchange occurred on the NEMA tower frequency (124.0 MHz) during my field observation. Bmibaby flight 5328 from Malaga (callsign Baby 51M) is making an approach to runway 09, but a light aircraft infringes NEMA’s controlled airspace near to the jet, requiring the B737 to take avoiding action.

**Aircraft** – “East Midlands good afternoon. Baby five one mike with you inbound runway zero nine. We are presently at five thousand feet, heading two nine five and we have November”

**ATCO** – “Baby five one mike, hello, you are number one. QNH one zero one five, November is current”

*Silence – Baby 51M continues approach*

**ATCO** - <audibly annoyed> “Will the light aircraft eight miles southeast of East Midlands squawking seven thousand identify yourself? You have infringed controlled airspace.”

*Silence*

**ATCO** <urgently> “Baby five one mike avoiding action, left turn immediately onto two two zero degrees, hold at four thousand feet.”

**Aircraft** - <immediately> “Baby five one mike, roger, left turn immediately onto two two zero degrees, not below four thousand feet. <Audibly relieved> It’s OK, we’ve got him on TCAS”

**ATCO** – “Baby five one mike, roger, thanks. I say again, will the light aircraft who’s infringed my airspace please identify yourself. I’ve got you on radar.”

Field diary extract (2006)

Here, the pronominal choice used by the ATCO in the final part of the exchange is significant; “my airspace” implies a degree of ownership or control normally only articulated on a national or international level (see section 5.1). Furthermore, his decision to say “I’ve got you on radar” emphasises the importance of the ‘electronic gaze’ in policing the sky and capturing pilot error.

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67 ‘November’ refers to the version of the weather report the pilots are using. Weather observations are taken every 30 minutes at 20 minutes past, and 10 minutes to, the hour, and are given a letter of the alphabet to ensure all operators are working to the latest edition. Here ‘N’ (‘November’ when spoken phonetically) is current.

68 TCAS (or ‘Traffic Alert and Collision Avoidance System’) uses SSR returns to evaluate the mid-air collision risk posed by other aircraft during a flight and, as such, acts as another ‘eye’ on the flightdeck (see Chapter Six for a detailed explanation).
5.9 “TopJet six eight zero turn left heading zero nine five” - introducing controller talk

In addition to the radio signals that are used to construct radar images, radio is also used as a medium of spoken communication between aircraft and controllers through which instructions, requests, and observations, are passed and acknowledged. The introduction of two-way radios marked an important phase in the development of aviation as they enabled pilots to ‘remain in contact with the land even when distance, darkness or the weather have hidden both dangers and landmarks from his sight’ (George 1949 p125) and radio remains a key technology through which control over airspace is articulated.

In common with other aspects of the industry, radiotelephony procedures have been standardised to ensure global comprehension and compliance. Although French had been the lingua franca of flight since the first manned balloon ascent in 1783, English was adopted as the universal language of aviation after World War Two to lessen the dangers of in comprehension and misunderstanding between growing numbers of ATCOs and pilots, especially among those who spoke English as a second language (see Voigt 1996)\(^69\). The UK’s CAA (1999) recognise clear and unambiguous communication between ATC and aircraft is crucial and, to facilitate this, the English language is standardised, with the alphabet represented and spoken phonetically to ensure phrases, words and numerals are clearly understood\(^70\) (Charlwood 1967; Duke 2001a; Tajima 2004).

Numbers involving altitude, cloud height, visibility, or runway visual range, which contain whole hundreds and whole thousands, are spoken separately (i.e. “two thousand five hundred feet”), whereas numbers in callsigns, altimeter settings, flight levels (except FL100), headings, windspeeds, squawk codes and radio frequencies are all spoken separately (Duke 2001b), i.e. “Shamrock two zero six, contact London on one two seven decimal four”. Furthermore, strict protocols determine what words can

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\(^69\) In 2005, it was reported that ATCOs at Heathrow missed two mayday calls from a landing Alitalia Airbus because they didn’t understand the Italian pilot’s heavy-accented English (Clark 2006b).

\(^70\) Yet, within individual countries, pilots and ATCOs can speak their native language, with considerable safety implications (see BEA 2000, a report of a fatal crash at Paris CDG in which the use of French by French controllers and flightcrew was deemed to have contributed to a collision between a British and a French-registered aircraft).
be used when, and the order in which they must be spoken, and pilots and controllers are trained to deliver concise, clear, but above all, accurate information (CAA 1999).

The messages themselves are transmitted on dedicated ‘airband’ frequencies, which are typically in the range 110-140MHz to avoid interference from public radio stations, although interference from pirate channels is not unknown (see Smith 2005). Each sector of airspace is thus administered through different frequencies and, at major airports, different frequencies are used for arriving, departing and taxiing flights. Pilots are able to hear all the transmissions between the ground controller and other aircraft operating on that frequency, so pilots can determine the relative spatial position of other aircraft via the information they receive in their headsets, allowing them to develop situated mental understandings of the relative position and operating characteristics of the aircraft around them.

To ensure ATCOs address the correct pilots, all commercial flights are allocated a callsign and a flight number. Usually, the callsign relates to the company’s name, such as easyJet’s ‘easy’ and bmibaby’s ‘baby’ (though notable exceptions include ‘Speedbird’ which identifies international British Airways flights, and Aer Lingus’s ‘Shamrock’ callsign). This corporate identifier is followed by a three or four character combination of numbers and letters. For example, a controller at NEMA addressing the 7am easyJet flight to Rome Ciampino (flight number EZY6577) will address “easy six five seven seven”. After establishing the identity of the flight being addressed, the controller then articulates his/her commands, including altitude and heading changes, speed restrictions, route clearances, taxiing/stand information, take-off or landing clearances, and other information salient to the safe conduct of that flight. Ideally, ATCOs limit the number of instructions in any transmission to three, which pilots then read back to ensure the message has been received and understood correctly. Radio is thus used to authorise clearances, decline requests and discipline pilots, while flightcrew use it to communicate both with controllers to request new headings and/or altitudes and to (re)confirm instructions, and to pilots of other aircraft in the vicinity. Verbatim transcripts of ATC transmissions, including vignettes involving departing flights, en-route traffic, inbound aircraft, and non-routine communications, appear in Appendix 3.
Given the rise in flights, the vagaries of the British weather and other emerging contingencies, radio communication is a vital aspect of efficient ATC, but radio space is becoming an increasingly precious commodity. During a 50-minute flight from Heathrow to Manchester, Hales-Dutton (2004) estimated the non-flying pilot (i.e. the one handling radio communication) makes around 130 transmissions with 12 different ATCOs at three control centres involving ten frequency changes. Personal observation in Manchester ATCC revealed controllers deal with a ceaseless barrage of communication requiring a variety of responses. The risk of misunderstanding is compounded when several flights are assigned similar flight numbers. Recalling the hazards associated with her previous posting at Liverpool, a controller at NEMA recounted the “stupidity” of giving near-identical flight numbers to a succession of easyJet flights which departed the airport within a few minutes of each other (i.e. 4566, 4655, 4665 or equivalent). In the period 2004-2005, NATS recorded 538 communication ‘incidents’ in UK airspace involving pilots mishearing or misunderstanding controller instructions, or pilots erroneously responding to an instruction that had been issued to another aircraft (Jones P 2005).

5.10 ‘Authoring the sky’: using flight progress strips

A further solution to the problem of choreographing aircraft movements through airspace is provided by paper Flight Progress Strips (FPS). Unlike radar images, which only provide controllers with two-dimensional representations of the relative positions of the ‘here and now’ of aircraft in flight to help them visualise traffic flows, FPS tell controllers ‘at a glance’ the intentions and operating characteristics of all aircraft that are in, or just about to enter, their sector of airspace. Individual strips comprise 20 x 2½cm lengths of card onto which salient information about individual flights (including the flight number, airline, type of aircraft, intended routing, requested altitude, anticipated airspeed, scheduled time of arrival or departure, and details of any slot restrictions) is automatically encoded and printed (see Figure 5.23). For clarity and consistency, national regulations stipulate the precise layout or

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71 As a result of this rising radio ‘chatter’, many older pilots and controllers suffer from tinnitus and premature hearing loss. Source: FO Lisa Wood, personal communication (2005).

72 Significantly, despite experiments aimed at introducing electronic or ‘virtual’ strips, controllers continually expressed a preference for conventional paper strips, arguing they enhance flight safety by being independence from (and therefore not reliant) on the continuity of power supplies or the functioning of computer programmes (Mackay 1999).
‘information architecture’ of strips and dictate which codes and abbreviations can be used.

Figure 5.23 Coding the sky. Blank flight progress strips from NEMA ATC showing the layout of information for a bmibaby flight to Toulouse and an easyJet flight from Gatwick.

Such standardised codes and abbreviations create a body of shared knowledge from which individual controllers can construct a dialogue about the progress of flights in their airspace. Foucault (1972, 1980) proposed that such practices of coding reveal an important link between the production of knowledge and power. As Shurmer-Smith (2002 p128) notes, such practices ‘can be highly exclusionary when only ‘insiders’ know the special meanings of words, quotations and even shared jokes’. As one controller remarked when I commented on the seemingly-bewildering array of symbols and codes used, “Don’t worry, it’s not that complicated really, we just like to give the impression of impenetrability so people think our job is harder than it actually is”73. Flight progress strips can thus be conceived of as a practice, that delineates the boundaries between industry professionals and untrained ‘others’ who do not understand the codes and thus cannot participate in the (re)production of airspace and the ‘controller talk’ that facilitates it. In order to highlight how the representation and recording of individual flights on FPS influences the way airspace is used, the following sections explain how airspace information is (de)coded on flight strips, that creates a global system of shared communication that, theoretically, enables ATCOs to direct planes anywhere in the world.

73 Anonymised field diary extract (2004).
Before take-off, flight data is extrapolated from the flightplans of individual services (see Chapter Six). Flow management computers at Eurocontrol in Brussels then analyse the spatio-temporal profiles of all the services that intend to use European airspace for all or part of their journey, imposing slot restrictions when and where necessary to facilitate flow. Once processed and approved, coded electronic flight data is sent to all the relevant ATCCs where the strips are printed out before a flight takes off or arrives in a particular sector of airspace. Air traffic control assistants then check the slips and place them into coloured holders to differentiate between different types of services. At NEMA, in common with the rest of the UK, flight strips detailing arriving aircraft are placed in buff-coloured holders while blue holders contain strips of departing flights. Individual strips are then placed in chronological order on stripracks to sequence the flow of aircraft though the sky (see Figure 5.24).

Figure 5.24 A striprack in the radar room at NEMA. The printout automatically arrives from the computer (left), the ATC assistant then checks and places it in a coloured holder and places it in the correct sequence in the striprack. The radar controller (right) then moves it to their workstation when the strip becomes active.

New strips are inserted at the top of the rack furthest from the controller, providing a "model" of air traffic, for as controllers relinquish control of one flight and pass the

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74 For example, on June 20th 2005, northbound departures from NEMA picked up a restriction at the Trent VOR beacon, which delayed them by an average of 20mins (field diary, NEMA ATC 2005).
trip to a colleague, the remaining strips move down to take their place, bringing aircraft closer to the controller in both time and space (with the relative ‘height’ of individual strips on the rack standing proxy for the altitude of arriving aircraft as they gradually descend towards the controller). In addition to sequencing traffic flows and creating ‘order’ in the sky through chronological sequencing, controllers also regularly offset particular strips to the left or right or hold them in their hands to alert them to potential conflicts or remind them of non-routine situations. As such, the stripack enables controllers to periodically reorder the strips (and thus the flow of aircraft through the sky) as traffic/meteorological conditions dictate (Harper and Hughes 1993).

Consequently, FPS not only organise airspace, they simultaneously function within it. By constantly switching their gaze between the stripack and the radar screen, controllers build up spatial awareness of the ‘place’ of individual aircraft within wider traffic flows. The stripacks are located in front of the radar display to enable controllers to annotate the strips with reference to the radar images they see and the radio transmissions they are involved in (see Figure 5.25).

Figure 5.25 ATC technologies at NEMA (left) and Manchester ATCCs (right). These workstations ensure controllers are supplied with spatial information about the position of aircraft in their sector of airspace. Note the controller on the right actively creating space for an aircraft by annotating the strips and the range of equipment that provides information on traffic flows, local and universal time, non-standard procedures, and weather conditions at both control centres.

Once a strip becomes ‘live’ and its aircraft under active control, every salient detail about the flight, including heading changes, altitude clearances, speed restrictions, or

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special instructions, are added to update the basic printed information. As these changes are dependent on contingencies (including the volume of air traffic and weather conditions surrounding the airport), no two strips are ever the same and individual controllers literally ‘author’ the sky to reflect their personal view of the airspace under their command. In this way, the practice of using FPS continually (re)produces dynamic airspaces in a standard format and, as such, can be described as a form of ‘productive power’ as the rationalisation of space and time functions to create airspace and render it ‘knowable’ to pilots and controllers (c.f. Pickles 2004). The act of inscribing fresh information also ensures other controllers could immediately assume responsibility for a sector in case of sudden illness, something particularly important in the Visual Control Room (VCR) where the risk of collision is higher. The tower controller thus continually makes and remakes a ‘runway’ on their striprack, sandwiching the active strip detailing the departing or arriving aircraft between two plastic buffers. This visually reinforces the occupation of the runway, confirming the ‘right’ of one aircraft to be there, lessening the risk of incursion while facilitating the smooth transfer of control between ATCOs. This reinforces the notion that controllers divide their airspace into ‘pockets’ of space and time that they then allocate to different aircraft.

At Manchester, which handles both aerodrome traffic and overflights, flight strips are physically handed ‘down the line’ between sectors as the flight progresses. In the VCR, a wooden chute is used to post strips from the ground movement controller (sitting on the upper level who is responsible for authorising push-backs and monitoring taxiing aircraft) to the controller in charge of departures (on the lower level) who, in turn passes it to departure control after take-off. When a flight leaves the airport’s airspace, the used strip is collected and stored for a minimum of six months75 (CAA 2005b). Meanwhile, a duplicate strip is printed in the next ATCC to track the flight’s progress, a process that continues until the aircraft lands.

To expedite the identification of authorisation, individual controllers use different coloured pens and learn to recognise one another’s writing. As one controller

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75 As such, strip archives provide a valuable repository of information that can be consulted in case of accident or incident.
explained, this is significant as, despite the degree to which their work is prescribed by (inter)national protocols, individual controllers are still able to execute some individual discretion, with no two controllers creating the sky in the same way. Thus, an ability to recognise a colleague’s writing helps controllers understand who authorised what manoeuvre and why. Of course, this also means that in case of incident, the controller in charge can be identified and questioned, raising interesting issues surrounding the extent to which controllers regulate and discipline their own activities while at work.

Depending on traffic volumes and weather conditions, individual strips can get covered in annotations, showing how the process of active control ‘creates’ airspace in flexible ways. This act of inscribing unique information in a predetermined style and format defines the airspace in the controller’s own terms, reflecting their singular vision of the traffic in their sector at that particular point in time. Thus, while every controller ‘writes the sky’ in different ways according to different traffic and weather conditions, the way that individuality is ‘seen’ and expressed is standardised, with controllers continually reorganising dynamic traffic information and presenting it in a universally structured manner. This act of inscribing multiple layers of information onto the strips means they can be understood as a palimpsest, as airspace is continually written and re-written (Figure 5.26).

Figure 5.26 Annotated strips at Gloucestershire airport
Figure 5.27 Annotated flight progress strips showing the standard layout of coded flight information for aircraft departing from, and arriving at, Nottingham East Midlands airport

**Departing flight**

- **Stand number** (Five Lima)
- **Aircraft type** (B732 = Boeing 737-200)
- **Weight category of aircraft** (M = medium)
- **Requested flightlevel** (180 = 18,000ft)
- **4-letter ICAO designation of destination airport** (EIDW = Dublin)
- **Reporting point** (WALIN)
- **Edition of Automatic Terminal Information Service (if known)**

<table>
<thead>
<tr>
<th>Flight Number</th>
<th>Aircraft Type</th>
<th>Time ETD passed to Manchester ATCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>RYR539</td>
<td>B732</td>
<td>0543'01</td>
</tr>
</tbody>
</table>

**Arriving flight**

- **Flightplan number**
- **Aerodrome of departure** (LKPR = Prague)
- **Aircraft type** (B733 = B737-)
- **Aircraft weight category**
- **Scheduled time of arrival**
- **Squawk ident number**
- **Runway in use** (27)

<table>
<thead>
<tr>
<th>Flight Number</th>
<th>Aircraft Type</th>
<th>True airspeed</th>
<th>Release point</th>
<th>Edition of ATIS the aircraft is using</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZY6504</td>
<td>B733</td>
<td>430 knots</td>
<td>(13,000ft)</td>
<td></td>
</tr>
</tbody>
</table>

Source: NEMA ATC (2005)
Yet, for all their apparent flexibility, controllers are trained to annotate strips in accordance with a strict international system that aims to minimise misunderstandings by stipulating what, where, when, and how, they can be annotated (see Figure 5.27). While the inscriptions are unique, each 'variable' has a limited number of possible values, although the combination in which they can appear is virtually infinite (Figure 5.28).

Figure 5.28 ‘Used’ flight progress strips from the radar room at NEMA, 2nd October 2004 - showing the unique spatio-temporal ‘biography’ of a bmibaby flight from Faro (top) and a Britannia Airways flight to Alicante (bottom).

In addition to commercial services, general aviation flights that are using the airport’s controlled airspace require FPS. In most cases, such flights have not filed computerised flightplans, so ATCO’s must liaise by radio with their pilots and hand-write the strips. Given the reduced operational performance of these aircraft relative to commercial jets and the need to ensure adequate separation between them, general aviation flights are recorded on either pink or buff strips depending on whether the aircraft is using the airport (Figure 5.29) or merely transiting through its controlled airspace (Figure 5.30)

Figure 5.29 Pink FPS for G-BGGP, 2nd October 2004. Note the use of different codes and symbology for VFR (visual flight rules) traffic.

Source: NEMA ATC (2005)

76 The ability to hand-write strips also ensures that the service can continue to function even with inoperative computers/printers.
Furthermore, the sky is ‘written’ in different ways according to whether the strip is being used in the visual control room or the radar room. Whereas radar controllers need to record heading and altitude changes of incoming flights, tower controllers merely accept them on final approach and record the time of arrival and the stand to which they were allocated (Figure 5.31). For outbound aircraft, the reverse is true, with the tower controller making the majority of annotations concerning stand number, initial routing, and time of departure (Figure 5.32). Thus the physical site of control within individual ATCCs affects how airspace is produced.

Figure 5.31 One flight, two strips, two controllers, two sets of information. The strip from the radar room (top) is annotated with heading changes and altitude clearances, while the strip from the VCR only records time of arrival and stand allocation.

Figure 5.32 Comparison between the annotations on a departure strip used in the radar room (top) and VCR (bottom). Note that the lower strip has more annotations as a function of it being used to taxi the aircraft to the runway from its stand.
5.11 Controlling the sky above NEMA

This chapter has discussed the geopolitical regulation and structure of UK airspace, together with the people and technologies that produce it. It has shown how airspace production is both dependent on, and occurs at, both the macro (i.e. international protocols dictate how it is used and controlled and by whom) and micro scales (congestion in one local sector of airspace creates a knock-on effect equivalent to an aerial traffic jam that can take many hours to clear and impact on people and places many miles away from the original incident). By way of a summary, Figure 5.33 illustrates how the sequential organisation of activities at one site, NEMA ATCC, combines to produce controlled airspace above the airport. In so doing, it demonstrates how individual actions only become appropriate (or even possible) when the activity preceding it has been satisfactorily completed (c.f. Nevile 2005).

Dodge and Kitchin (2004b) have argued that as people negotiate space, they beckon particular forms of space into being, and that space is hence a ‘practice, a doing, an event, a becoming – a material and social reality forever (re)created in the moment’ (Dodge and Kitchin 2005 p172). In the control tower at NEMA, controllers simultaneously bring time and space into being, producing manageable ‘pockets’ of airspace to be occupied and utilised by aircraft. By interacting with, the ‘information landscapes’ of radar available to them (c.f. Davis 2001), which encode and (re)present flight information in a virtual form, radar controllers at NEMA continually bring physically distant airspace(s) into being. The ‘practised eye’ of the controller is crucial here, for although radar surveys the sky, the returned images are worthless unless a trained agent is looking and responding to the patterns they produce (c.f. Koskela 2000). For Foucault, ‘the supervisor is not simply an authority responsible for maintaining the system of control so much as...a skilled administrator...charged with marking the connection between the individualised behaviour of the [aircraft] and the knowledge of the general social body...not just anyone will do. The capacities and competencies of the supervisor...form an integral part of the panoptic structure’ (cited in Simon 2005 pp12-13). Given the responsibility involved, only highly trained individuals, who have demonstrated their competence, can do the looking.77

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77 Controllers who are eligible to work in the visual control room (where the speed of traffic is slower, there is less risk of collision and they are only working in two dimensions) are not licensed for radar
Figure 5.33 How it works: fusing geography and technology in the Air Traffic Control centre to produce airspace above NEMA - A simplified guide to the process.

1. Coded flightplan received by NEMA ATCC

2. Flight Data Computer automatically prints out blank flight progress strips (FPS)

3. Blank FPS are placed on the striprack beneath the radar display

4. Using radar and radio, and taking into account local weather and traffic conditions, ATCOs annotate and update blank FPS with information on headings, altitudes, Routings, and timings of individual services.

5. Annotated FPS effectively ‘produce’ airspace above NEMA, allowing ATCOs in the tower or radar room to monitor the status and position of individual aircraft to expedite the safe and efficient flow of air traffic above the Airport. Used FPS thus provide a rich source of spatio-temporal data that requires further geographical research.
raises several interesting questions. Compared with conventional face-to-face social interactions, control by radar is faceless – controllers and pilots rarely meet one another, and both parties are kept isolated from ‘normal’ society during the course of their shift. In the electropanoptic power-space of the radar room, control relies on ATCOs correctly interpreting millions of bits of data.

The importance of the ATCO gaze to flight safety should thus not be underestimated. Two senior controllers at NEMA spoke of developing a ‘sixth sense’ from the radar screen to the point where they knew when an aircraft was in trouble even before the flightcrew declared an emergency. Though unable to articulate how they acquired this ability to detect problems, they suggested that, over time, experienced controllers develop an intimate understanding of the equipment they use – appreciating the particular foibles of individual displays and compensating for their known deficiencies while memorising the information architecture of the airspace they control, permitting the rapid identification of ‘out of place’ or ‘out of sync’ aircraft. Yet, for all the geographical literature on hybridity, talk of human-radar hybrids would perhaps be overstated. Modern radar systems do allow controllers to reconfigure their displays according to personal preference or changing traffic situations, and the ability to zoom in on the image enables ATCOs to go ‘deeper’ into the system, but the relationship is one sided – the two do not become one. This capacity to instantaneously switch between panorama and detail aids decision-making and reaffirms a controller’s possession and authority over the sector of airspace. However, the empirical fieldwork revealed that many controllers see radar as a useful aide memoir rather than the be-all and end-all.

The official practices of producing and controlling airspace above NEMA arguably reflect Lefebvre’s (1991) second understanding of space, being the conceived (air)space of pilots, ATCOs and CAA/NATS administrators. Notwithstanding Massey’s (1994) persuasive argument that space is actually the product of complex interacting practices of production, consumption and power, it is still useful to consider airspace (particularly controlled airspace) as a series of discrete time-spaces positions until they have passed the requisite examinations and undergone a period of supervised familiarisation.

in which aircraft fly. Indeed, it is easy to underestimate the importance of the physical properties of airspace and lose sight of the fact they (in conjunction with ‘artificial’ geopolitical boundaries) promote (or prevent) certain spaces of aerial movement\(^79\). In Koskela’s words (2000 p248) it ‘matters what kind of physical…frames space offers for social interaction, where objects in space lie (both vertically and horizontally), and how things are located in relation to each other’.

5.12 Summary – ATC as spatial practice

This chapter has explored the multiple interlocking dimensions of airspace production, charting the development of international legislation governing its use, through the contemporary structure of UK airspace, to the spatial regimes of Air Traffic Control at individual sites. While the spatial practices involved in airspace production appear very prescribed, with controllers’ tasks mediated by international regulations, formal operating manuals, procedural checklists, and technology, realising air traffic control practice in real time, with actual aircraft, is also shaped by personal discretion, that is, individual controllers can override normal procedures in an emergency. Here, priorities shift from facilitating flow to preventing accidents, and normal rules of spatial engagement are suspended. This is not to undermine the importance of scripted operating procedures, indeed anything more than an occasional disregard for them would quickly result in chaos, and any disruptions to normal flow patterns, no matter how seemingly slight, have significant knock-on impacts for the whole network. For example, during a field visit to Manchester ATCC, the European-wide Tactical Flow Management Software reported staffing problems at Stansted were having an impact on traffic inbound to Berlin, while fog at Amsterdam was necessitating the rerouting of departures from Frankfurt\(^80\).

While much useful work undoubtedly remains to be done on ‘who represents which places in which ways’ (Shurmer-Smith 2002 p130), this chapter has shown how an increasingly aeromobile society demanded new forms of aerial regulation and surveillance. Empirical observations of ATC practice revealed controllers utilise a

\(^{79}\) Here, I’m referring to certain atmospheric phenomena including hurricanes and thunderstorms, as well as topographic features that induce particular meteorological conditions (such as high ground creating violently oscillating mountain waves) that preclude certain forms of flight.

\(^{80}\) I’d like to thank Graeme Ford, ATC supervisor at Manchester Airport for demonstrating this system and helping me decode the information it displayed.
variety of resources to make timely decisions to produce, understand, manage, and perform airspace at a variety of scales. Moreover, the professional practice of Air Traffic Control is enacted through personal discretion, whereby individual controllers have the flexibility to choreograph the production of airspace in their sector within the confines of internationally agreed protocols and continually changing contingencies. As one controller joked, “Controlling 'planes is easy - pilots generally do what they’re told. It’s making space in the sky for them that’s difficult”\(^81\).

\(^81\) Source: anonymous field diary extract (2005).
On January 8th 1989, BD092, a British Midland B737-400 en-route from London to Belfast, crashed into the embankment of the M1 motorway while attempting an emergency landing at East Midlands Airport. Post-accident analysis revealed that while the twinjet’s left engine (#1) had suffered foreign object damage, confusion on the flightdeck led to the healthy right-hand (#2) engine being shut down (AAIB 1990). Tragically, this coincided with #1 engine ceasing to vibrate, leading both pilots to erroneously believe they had the situation under control. The damaged engine continued to function until power adjustments were made during the final approach, when the additional fuel flow caused it to catch fire and irreversibly lose its ability to produce thrust. Upon realising their mistake, desperate attempts were made to relight engine #2, but there was insufficient time to restart it and the aircraft hit the ground 200 yards short of the runway, killing 47 of the 126 people on board (Smith 1992; Besnard et al 2004). The UK Air Accident Investigations Branch concluded the disaster was caused by a complex interaction of human and system failure, whereby the pilots were disorientated and overloaded with conflicting information, with catastrophic consequences (AAIB 1990; Besnard et al 2004). Subsequent investigations revealed many pilots found the digital engine displays difficult to read, and British Airways demanded analogue equivalents be installed in their B737-400 fleet (Shaw 1999a).

The significance of the Kegworth tragedy to the social history of NEMA was introduced in Chapter Three. I have begun this chapter with this vignette to introduce the theme of how explicit knowledge about airspce is codified and visualised on the flightdeck of commercial airliners. Through an investigation into the complex relationship that exists between pilots and technology in the networked space of an aircraft, the concept of the ‘pilot’s gaze’ is invoked as a means of comprehending how multiple representations of airspce on the flightdeck work, how they code that space,
and how they inform pilots’ understandings of their location. In so doing, the visual regime of the flightdeck is considered as a socio-technical workspace that informs professional understandings of airspace in tangible and scripted, yet flexible, ways.

While geographers have shown considerable interest in investigating the complex relationship between the introduction of new forms of technology and the production of social space (see Graham and Marvin 2001 and Thrift and French 2002), they have not conducted research on how commercial airline pilots develop and communicate situated understandings of airspace through the interpretation of flightdeck displays and the routine sequential practice of completing flight-phase related activities. This academic lacuna is due, in part, to strict security protocols that render the acquisition of the necessary permission to conduct such research problematic, and also because aviation’s technical language and unique operating procedures render it an intimidating prospect for study. Whilst understandable, this omission is serious, as many tragic accidents involving commercial aircraft have been attributed to pilots exhibiting poor spatial awareness or misinterpreting or unquestioningly trusting malfunctioning flightdeck instruments (Norris 1981; Prince 1990; Beaty 1991; Cushing 1994; Faith 1996, 1998; Strauch 2002). Indeed, rarely is the accurate production and unambiguous interpretation of space, as mediated through increasingly sophisticated electronic avionics software, more critical than on the flightdeck of a commercial airliner.

The importance of the distinctive scopic regimes of air traffic control (ATC) was discussed in the previous chapter, yet this chapter will show how this institutionalised practice of ‘seeing space’ cannot work effectively without complementary avionic systems on the flightdeck that inform pilots of their spatial position relative to terrestrial navigation beacons and other air traffic. As such, air traffic controllers and pilots continually constitute and coordinate airspace through the systematic mutual elaboration and organisation of control and surveillance activities between and among multiple sites. Building on the previous chapter on the multiple geographies of ATC, this chapter accordingly explores how the emerging digitality and utilisation of representational technologies on the flightdeck (including digital electronic displays, paper navigation charts, and other forms of procedural documentation) transform the way airspace is organised, managed, and understood.
In so doing, this chapter builds on a range of sociological research into the mundane and practical elements of work, social interaction, and technology in complex organisational environments (see Heath et al 1999). In the context of aviation, extant studies into the work of airline employees have typically focused on interactions between frontline staff and customers, examining the demanding performative routines enacted by flight attendants and check-in staff (see Hochschild 1983; Mills 1998; Tyler and Taylor 1998; Taylor and Tyler 2000; Höpfl 2002; Bolton and Boyd 2003; Nicholls 2005; and Whitelegg 2005). Interesting and valuable though these literatures are, this chapter contributes to a more limited number of studies (see though Nevile 2004a) that examine the specialised work of flightcrew, who continuously interact with highly complex technology to guide their aircraft through the sky in accordance with a strictly regulated ATC system. Original fieldwork material, gathered during empirical personal observation of commercial pilot training sessions in full-motion aircraft simulators, is used to consider how the spatial practices of flying airliners produce airspace. Later in the chapter, the exacting use of specific technical artefacts and procedural activities that enable pilots to safely *aviate* (fly their aircraft) and *navigate* (direct it from a to b), will be examined, in recognition that the ways in which these objects (re)produce and order airspace have been neglected by geographers.

6.1 ‘Flying through code/space’: introducing flightdeck geographies

‘We were two hours into the session when the Training Captain suddenly cut all electronic power to the flightdeck instruments to simulate a catastrophic in-flight generator failure. We were immediately plunged into darkness, with only the faint glow of the computer-generated skyscape outside the windows lighting up the interior of the simulator. The electronic cooling fans failed too, and it became eerily quiet. We were alone, hurtling through a virtual troposphere at close to the speed of sound with only a bank of blank computer screens for company. The First Officer swore quietly under his breath, but it was the Training Captain who spoke first. “Well, you can see what a bloody mess we’ve got, only those stupid standby instruments left” he remarked with typical understatement.’

- anonymised field diary extract, 2005

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1 Dodge and Kitchin (2004a)
This vignette illustrates the importance of pilots developing and repeatedly updating complex understandings of their aircraft’s performance, progress and situation relative to both navigation beacons and other air traffic. In a split second, the Training Captain transformed the exercise from a routine flight into a potentially serious situation that relied on the ability of the flightcrew to switch from acting as systems overseers and computer programmers to immediately and accurately compensating for the spatio-temporal information void left by the failed systems. Gone were the multi-purpose Primary Flight Displays (PFDs) that present information on attitude, speed, and altitude; gone too were the colourful Navigation Displays (NDs) showing waypoints and areas of intense precipitation. The electronically-powered Flight Management Computers (FMCs) were redundant too, and the only sources of information on the central control panel were the remaining mechanical instruments, comprising a standby compass, altimeter, radio direction finder and attitude direction indicator (ADI), more commonly known as an ‘artificial horizon’.

Instinctively, the First Officer reached for the ‘Quick Reference Handbook’ (QRH), a weighty Company publication containing information about the appropriate response to different abnormal situations, and simultaneously keyed his microphone, calmly issuing a “mayday” distress call to air traffic control. Following the completion of, and compliance with, the QRH’s recommendations, the Captain abandoned all thoughts of proceeding to our intended destination and began searching through a folder of navigation charts for suitable alternative landing sites, expressing his desire to “get this thing down as soon as we can” in case the electrical fault was symptomatic of a bigger, as yet undiagnosed, problem. In the words of Dodge and Kitchin (2004a), the ‘code/space’ of the flightdeck had failed, and the resulting crisis was an unnerving experience.

Previous chapters have begun to highlight the growing interest geographers have shown in the notion that computer software (code) is deeply embedded within the infrastructure of contemporary capitalist societies and is thus central to the spatial formation of everyday life (Dodge and Kitchin 2005; Graham 2005). In the context of commercial aviation, the sheer number of computer components installed in modern aircraft reveals the extent to which code mediates the production of airspace (Figure 6.1). Of the 2.6 million lines of software code in a Boeing 777, 600,000 are dedicated
to the ‘Aircraft Information Management System’ (AIMS) - the aircraft’s electronic ‘brain’, which processes and displays information on communications, flight management, engine operating data and maintenance logs, and links hydraulic actuators in the aircraft’s fuselage to the primary flight controls via ‘databases’, bidirectional information highways that ship two million bits of information per second around the aircraft (Norris and Wagner 1996; Birtles 1998).

**Figure 6.1 Hidden infrastructures of flight.** Normally hidden bundles of wires and circuit breakers provide an indication of the electronic complexity of modern aircraft.

![Image of hidden infrastructures of flight](source: www.b737.org.uk)

As Chapter Two outlined, the sophistication of these various electronic systems means pilots increasingly fly through ‘real space’ virtually (Dodge and Kitchin 2004a p201), using a plethora of digital instruments and sensors that collectively ensure pilots not only fly through different types of airspace safely, but can negotiate their aircraft around, under, over, and between different sectors. Furthermore, aircraft are equipped with integrated internal pneumatic, hydraulic, fuel, and waste systems (Figure 6.2 and 6.3), as well as being intimately connected to external networks of global positioning satellites, ATC centres, ground-based navigation beacons, continuous radio weather broadcasts, and other aircraft, rendering them complex ‘networks within networks’ (Figure 6.4).

Taking inspiration from the seminal work of Manuel Castells (1996), Dodge and Kitchin explore how the production of specialist computer software, ‘code’, mediates
Figures 6.2 (top) and 6.3 (bottom). Schematic representations of the hydraulic and pneumatic systems of a B737-300, highlighting the ‘hidden’ networked geographies of aircraft systems.

Image sources: www.b737.org.uk
Figure 6.4 Diagram showing interconnectivity between selected “external” air traffic management networks at a variety of scales and altitudes (N.B. for clarity, airline company datalink and radio communications are omitted).
the production of different ‘code/spaces’ of aviation, from check-in counters, security checkpoints, departure lounges and aircraft cabins, to baggage reclaim and retail areas. Through the presentation of selected case studies, they argue these various ‘code/spaces’ collectively create a totalising aviation environment that has similar form and function regardless of physical location (see Lloyd 2003; Wood 2003; Fuller and Harley 2004; Gordon 2004; Pearman 2004 for further discussions surrounding the alleged placeless environment of airport terminals). Furthermore, they provocatively suggest the pervasive use of automated security and surveillance systems at every stage of every flight means the practice of travelling by air has become virtualised to the extent that corporeal aeromobilities are totally reliant on the safe, efficient, and routine functioning of a multitude of different virtual networked computer systems, from reservation databases to flight planning software and passenger manifests. For the most part, these systems are taken for granted and dependence on them only exposed when a computer breakdown at air traffic control grounds flights or a malfunctioning baggage system misroutes luggage (see Clark 2004b and Clement 2004a, 2004b, 2005b; and Rudebeck 2004 and Taylor 2005 respectively).

The central tenet of the ‘code/space’ thesis suggests such spaces are qualitatively different from the more familiar ‘coded spaces’ of the built environment, a subtle yet significant terminological distinction. In the latter, the functioning of code is not a prerequisite to the continued operation of that space. Here, ‘code matters to the production and functioning of a space, but if the code fails the space continues to function as intended, but not necessarily as efficiently, safely, or with as little cost’ (Dodge and Kitchin 2004a p198). For example, if a CCTV system monitoring a street fails, the street will continue to function as a pedestrian and vehicular thoroughfare, although activities within it will not be recorded. Thus, in a ‘coded space’, the role of software is ‘one of augmentation, facilitation [and] monitoring...rather than control and regulation’ (idem). Conversely, in a ‘code/space’, the relationship between code and space is dyadic, i.e. mutually constituted and reinforced. ‘In a code/space, the domination of code is so pervasive that if one half of the dyad is put out of action then the entire code/space fails’ (idem), thus security alerts close terminals, computer errors delay check-in, and technical system failures ground aircraft. Unlike a ‘coded space’, when the technology producing a ‘code/space’ fails, there are no alternatives,
as manual techniques cannot perform the role of the failed systems as efficiently or safely. In this situation, a software malfunction leads to a complete breakdown of the space, as it cannot function as intended. Naturally, the consequences of such failures range from mild inconvenience to total catastrophe.

Thrift and French (2002) similarly articulate the importance of recognising how computer software (code) automatically ‘produces space’, and how the writing, production and consumption of software exhibits highly uneven geographies in terms of access, use, and impact, that reflect social and political power inequalities. In so doing, they demonstrate everyday lives are shaped by interactions with a myriad of different software codes, encompassing everything from apparently innocuous alarm clocks and digital watches, to ubiquitous mobile telephones and credit cards (see also Dodge and Kitchin 2004c). Going further, Ueno and Kawotoko (2003 p1529) suggest that space is not given, but is actively produced through the use and application of technologies that literally ‘make space visible’. This activity of ‘producing space’ is often accomplished through a heterogeneous collection of situated and coordinated actions involving a variety of different technologies and human actors. In the context of the present Chapter, this suggestion that space is actively produced and visualised when required is significant, with modern commercial aircraft understood as contemporary ‘code/spaces’ par excellence on account of the number of, and near total reliance on, sophisticated electronic avionics and life-support systems.

6.2 ‘Authorised personnel only’ - The challenges of researching flightdeck geographies

Given the nature of the chosen fieldwork and the security implications involved, obtaining the necessary authorisation and access to conduct the research was problematic. In light of strict security directives instigated in the aftermath of the September 11th terrorist attacks, it has become very difficult for non-airline personnel to observe and describe the spatial practices and routines of commercial airline pilots, as carriers have been instructed to rigorously enforce a ‘locked door’ policy, which prohibits passengers from ever visiting the flightdeck. Indeed, such is the concern

2 While I appreciate that the global airline industry has produced highly uneven geographies of mobility/immobility on account of its commercial operating imperatives, this is not my primary concern.
over illegal access, flightdeck doors have been reinforced with bullet-proof material, deadlocks, and secure closed-circuit entry systems ‘to improve intrusion resistance to the flightcrew compartment’ (Fair 2001 p70), and armed ‘sky-marshals’ are carried on selected flights (Calder 2003b, 2005c). Consequently, the closest passengers can legimitately get to the flightdeck is by sneaking a glance through an open door when boarding, or by listening to announcements about weather, routing and flight times. Passengers are forced to entrust their continued existence to two ‘faceless’ individuals who are instructed not to leave the protected space of the flightdeck. More than ever, flightdecks are constructed as places where ‘they’ [pilots] work and ‘we’ [passengers] cannot go. For this reason, flightdecks have assumed an aura of mystery, with much of what goes on in them only coming into the public arena after a major incident, thanks to media fascination with the information contained in the Flight Data and Cockpit Voice Recorders, collectively known as the ‘black boxes’ (Faith 1996).

To compound these difficulties, passengers are prohibited from entering restricted areas at airports by armed guards, secure access entry systems, and stringent legislation. They are frisked, questioned, and biometrically scanned; their baggage is x-rayed, searched, and smelt by sniffer dogs, while their every move is monitored by CCTV systems, one-way glass, and undercover police officers (Taylor R 2004; Woolf 2004; Fuller 2005). In order to reach the security search area, passengers are directed through a maze of walkways, which have less to do with queue control, and more to do with ensuring that all angles of their bodies are captured on camera. Resistance to this pervasive surveillance, or transgression from the approved role of docile passenger (for example by queue-jumping, running, or ducking under the barriers) attracts instant police attention, as such behaviour is deemed suspicious and indicative of guilt, as one is not meant to hurry through security. Furthermore, passengers are prohibited from using cameras or mobile telephones in ‘sensitive’ areas, including immigration halls and x-ray areas (in case such devices are camera-enabled or have been manipulated to detonate explosives), and have even been asked not to congregate in galley areas or form queues for the lavatories once on board the aircraft (Borger et al 2004).

The increasing criminalisation of individuals with a genuine interest in aviation adds to a general feeling of anxiety. In the context of the ongoing international controversy
surrounding the ‘extraordinary rendition’ of terrorist suspects by the US, the CIA has attempted to frame planespotters as national security threats (Seean and Tremlett 2005). It is an offence to listen in to air-to-ground radio transmissions in many countries, and the Greek authorities arrested and charged a party of British aircraft enthusiasts for ‘spying’ on a Greek airbase (Anast 2001). As Balmer (2004) has noted, military secrecy has its own geography, controlling where people can go and what they can do, and the same is true for air travel. As MacDonald (2006 p67) also remarks, ‘one of the supreme contradictions of secrecy...is that the ‘enemy’ is assumed to be one of the privileged bearers of visual intelligence: it is the state’s own citizens who must be kept in the dark.’ Indeed, the bureaucratic paper-trail involved in obtaining the requisite permission to observe the flight simulators had, as one Training Captain admitted, less to do with concern about my potentially leaking secret information about pilot training or airline operations than anxiety that the reputation of airline security in the UK would be seen to be compromised by a research student (c.f. MacDonald 2006).

Given the security climate in which the research was conducted, the conventional method of simply asking cabin crew for permission to visit the flightdeck during a revenue service was no longer an option as, post-9/11, airlines have been instructed to refuse all such requests on security grounds, and past personal experience of this tactic has revealed an unwillingness on behalf of the (predominately female) cabin crew to allow a female passenger to speak with the (usually male) pilots. Furthermore, even if such permission could be granted, this would only enable me to see operations during the cruise, not different flight phases, and financial constraints dictated this method was not feasible. I therefore approached the Flight Operations Departments of six airlines that regularly fly out of NEMA, in the hope a specific request supported by an academic agenda would elicit a positive response. In March 2005, letters were dispatched to the Flight Operations Director and/or the Chief Pilots of six UK airlines; bmibaby, bmi regional, Britannia, easyJet, First Choice and Thomas Cook, in the hope they would be in a position to accede to my request.

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3 Individuals were identified through company websites and Endres’ (2005) Guide to UK airlines. The six airlines represent a range of service styles (charter, low-cost and full-service scheduled) and operate a variety of aircraft types to a range of destinations from NEMA.
Before approaching them, I spent time developing specialist knowledge of the structure, language and operating practices of UK airlines, including aspects of crew training, standard operating procedures, radiotelephony protocols and the technical performance of different aircraft and avionics systems, to develop, as Sharrock and Anderson (1986 p96 cited in Neville 2004a p22) put it, a level of ‘disciplinary competence’. In order to be proficient in the language of commercial aviation, I assimilated information from a variety of sources, including enthusiasts’ texts on commercial aviation and air traffic control procedures, as well as relevant academic, professional, and industry reports on specific aircraft types, accident reports and flightdeck operations manuals. I also watched relevant television documentaries and commercially available DVDs, to learn the correct terminology and phraseology of everyday airline operations.

The initial correspondence conveyed details of my research (with supporting academic references from my Supervisor, Head of Department, and Director of Research) and inquired about the possibility of being a flightdeck observer on a revenue service from NEMA to enable me to witness the flightdeck environment at first hand. Replies were received from all carriers except easyJet, who also failed to respond to subsequent requests for assistance. Of the airlines that did reply, First Choice and Thomas Cook felt unable to help owing to security concerns, but bmi (together with subsidiaries bmi regional and bmibaby) and Britannia Airways (now ThomsonFly) were more helpful.

Although, as I suspected, it was not possible for the airlines to grant admission to the flightdeck, they offered, as a ‘next best’ alternative, access to recurrent pilot training programmes on full-motion flight simulators so I could ‘see’ a flightdeck without breaching security protocols. In addition to sanctioning the rare crossing of the closely-guarded boundary between the (public) passenger cabin and the (private) space of the flightdeck by an external party, bmi regional invited me into the crew room at NEMA to observe pre-flight preparations for scheduled services to Brussels and Paris Charles de Gaulle, staff in the Navigation Services, Flightcrew Training, and Lisa Wood, British Airways, personal communication, 2006).

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and Technical Departments at bmi provided other flight-phase related documents including weather forecasts, loadsheets, flight progress logs and navigation charts (see later this chapter)\(^6\).

The simulator sessions I was invited to observe constituted bi-annual ‘Operator’s Proficiency Checks’ (OPC), two-day recurrent training courses during which flightcrew have to demonstrate their professional competence to a Company Training Captain, working in the capacity of a Civil Aviation Authority (CAA) examiner. The first day is dedicated to revalidation tests where the examiner scrutinizes pilots’ performances during normal and ‘routine’ emergency situations, while the second is reserved for ‘Line Oriented Flight Training’ (LOFT). This involves flying a simulated service from a to b, while the Training Captain exposes the pilots to problems en route that the crew have to work together to (re)solve. In the unlikely event of inadequate performance, licences will not be revalidated without further training and assessment. As Nevile (2004a pp21-22) notes, the opportunity to collect this type of empirical material was both fascinating and rare, as for ‘legal, safety and security, and business and professional reasons, airlines are usually extremely wary about allowing people to observe...their pilots’.

The empirical material presented in this chapter was hence obtained during six simulated flights in the autumn of 2005: two in a Boeing 737-300 ‘Classic’ aircraft simulator with bmibaby crew; two in an Airbus A320 simulator with bmi pilots (all of which were undertaken at bmi’s training centre in West Drayton, Middlesex), one LOFT session\(^7\) in the dual Boeing 757/767 simulator with Britannia flightcrew, and one flight in the A320 simulator at GECAT’s training facility in Crawley, West Sussex\(^8\). (A technical compendium detailing the operating performance and characteristics of these different aircraft appears in Appendix 4).

Flight simulators are ‘complex, ground-based devices that attempt to create a synthetic but realistic flight environment for pilots for the purposes of training and

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\(^6\) Furthermore, individual pilots working for British Airways and easyJet also supplied useful information.

\(^7\) While bmi and bmibaby were happy to allow me to watch both days of the training syllabus, Britannia suggested it was inappropriate for me to observe the first day of their session.

\(^8\) The simulator provider, GECAT (General Electric Commercial Aviation Training), was initially reluctant to grant me access and I had to consent to having my name checked against several global databases of terrorist suspects before security clearance was obtained.
assessments (Lee 2005 p60). The origins of flight simulation date back nearly 80 years, when Edwin Link’s cockpit training aid was developed to facilitate pilot familiarisation and qualification (Gunston 1990), and their modern high-fidelity full-motion descendants are now the preferred method for training and examining commercial flightcrew as they enable instructors to introduce pilots to situations that would be too hazardous or expensive to replicate on real aircraft (Evans 1997).

Simulators synthesise the surroundings, sound effects, sights and acceleration forces of a real aircraft while remaining on terra firma, and their physical fidelity means pilots can qualify to fly different aircraft without ever handling a real one. However, while simulators look, feel, and even smell like real aircraft, they are essentially very expensive virtual-reality ‘games’ that can be paused and reprogrammed but suffer the foibles of any computer, namely software glitches and unexpected malfunctions. This problem is compounded by the difficulties of synchronising so many different, largely incompatible, computer systems. As one Training Captain explained after a particularly nausea-inducing fault that rendered the visual and motion cues out of synchronicity, “we’ve got normal computer systems trying to communicate with aircraft systems and motion actuators... hundreds of processors... it’s no wonder it sometimes goes wrong”. Another spoke incredulously of the fact that “these [simulator] systems are thousands of times more expensive than your average laptop [computer], yet only have one-hundredth of the computing power”.

Simulators impart various acceleration, deceleration and rotational forces on their occupants to accurately replicate the sensations of flight. By exerting two different forms of motion, translational and rotational, in the vertical, longitudinal and lateral planes, sensations associated with pitch (up and down), roll (tipping from side to side) and yaw (skidding from side to side) can be faithfully replicated (Lee 2005). However, from a training perspective, the most important motion cues are obtained visually, and visual models must be perfectly synchronised with the motion simulation, as nausea and spatial disorientation can quickly result.

All objects in simulated visual scenes are displayed on a two-dimensional screen and lack the normal binocular distance cues of three-dimensional reality. The limitations of the visual models are also compounded by the small extent of the area onto which the computer-generated images (CGI) are projected. Indeed, flightdeck surrounds
restrict the field-of-vision, and pilots can’t look ‘up’, ‘down’ or ‘behind’ the simulator as they can in a real aircraft. However, within these limitations, CGIs provide seamless visual coverage across the simulated terrain or airspace. While several crews reminisced about the ‘cartoonish’ appearance of early visual models, the A320 simulator boasted near photo-realistic quality displays, something I came to appreciate when I was invited to assume the role of First Officer for a flight out of Geneva. However, given the majority of training I observed involved low visibility procedures, we spent most of our time in ‘cloud’, staring at a blank grey screen, the only splashes of colour appearing on the runways and aircraft that populated the groundspaces of the virtual airports we visited.

As Lee (2005 p27) appreciates, ‘[s]ound plays a complex and varied role in the cockpit environment’ as it provides pilots with feedback on the operating status and performance of engines (through pitch, tone and vibration), indicates when undercarriage is raised, lowered and locked, or when flaps and slats are moving. These hydraulic sounds continually compete with the noise of powerful cooling fans, while chimes, claxons, alarms, rattles, and beeps, signify different flight stages or emergencies, producing a distinctive aural geography of the flightdeck.

All the ‘flights’ lasted for four hours and were preceded by a 90-minute pre-flight brief and a 60-minute post-flight debrief. This resulted in 20 hours of observation in the simulators, seven and a half hours of pre-flight discussion, and five hours of debriefing. On all the simulators, I sat in the observer/training seat, which is located about four feet behind the First Officer’s position, to the right of, and slightly behind, the Training Captain who was seated at the ‘Instructors Operating Station’ (IOS) (a wall of touch-screen computer displays that control the simulator) behind the Captain. From here, I had a good view of all three pilots, flightdeck instrumentation, and the IOS screens where the Training Captain programmed system malfunctions and monitored the pilot’s performance (Figure 6.5).
Before commencing my fieldwork, I gave a short presentation detailing my academic background, research aims, reasons for wanting to collect the data, the methodological techniques I would employ, how I would present and use the empirical material, and what I hoped to achieve by doing so. I stressed that all my fieldnotes would be anonymised so no individual could be identified from them, and emphasised my gratitude to them for allowing me to observe their work. I continually reiterated that I was not interested in their performance *per se*, but how spatial information is presented on the flightdeck through the various instruments and codified through checklists and standard operating procedures, and how pilots respond to that information. I also emphasised I would be willing to stop my observations or leave the session at any time if they felt my presence was disruptive or inappropriate, although in the event, all professed to be so busy that they forgot I was sitting behind them⁹.

Here, it is salient to draw on MacDonald’s (2006 p56) experiences of ‘observant practice’ to highlight both how the spectacle of the flight simulator embodied

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⁹ This resulted in one amusing situation when a First Officer reached behind his seat to pick up a manual in the bag at my feet but grabbed my left leg by mistake, resulting in laughter and an embarrassed apology, “I’m so sorry, but I’m not used to there being a leg there!”
different articulations of power and how my presence inevitably altered the hierarchical command relationship between Training Captain, Captain, and First Officer. Interestingly, while I was subordinate to them (I was their guest and only knew a limited amount about, and had only a limited say over, the procedures I observed), they similarly knew relatively little about my research, academia in general, or how I would present my observations, putting them in a unaccustomed position of relative powerlessness in their own workplace. A couple of crew expressed surprise at my research interest and joked I was either a spy from the CAA or a journalist from the Daily Mail\textsuperscript{10}. One Training Captain did ask to see copies of my fieldnotes after the session to see “what on earth you were writing”, while two other pilots asked for copies of the relevant chapter(s) of my thesis prior to submission, although they assured me this was to satisfy their personal curiosity rather than a desire to check-up on the accuracy of my observations. Significantly, several pilots remarked that the presence of a female researcher in the overwhelmingly masculine environment of the flightdeck changed their behaviour; several gave advanced apology for any expletives, obscenities, or sexual innuendoes I might hear while joking they would do their best to curb the excesses of their lewd behaviour, while one Training Captain said he did not want to go down in my fieldnotes as a “bastard” and promised he would not “play the role of ‘bad cop’”. The opportunity to be involved in all aspects of the training sessions was very interesting, although the post-flight debriefs were occasionally rather uncomfortable when the session had not gone well and individual pilots were being criticised. As one Training Captain remarked to his examinee, “You’re a great cockpit manager, just a shame you fucked up the flying”.

The majority of the flightdeck procedures I observed were all pre-prescribed, that is they would have occurred whether I had been present or not as the Training Captains had a list of tasks to examine. However, once these official tasks had been satisfactorily completed, several Training Captains encouraged my active involvement in the evolving scenarios, asking which situations it would be most useful for me to observe and programming the simulator accordingly, much to the amusement and

\textsuperscript{10} The former concern was quickly dismissed on grounds that they employ few women, and the latter because I was deemed too articulate and well-informed.
occasional consternation of the pilots involved. Thus, the act of observing continually alternated between passive detachment and active engagement.

Field observation began as soon as I had the consent of all the pilots involved and had answered their questions about the purpose and scope of my research. The first 90 minutes of the session were spent in a classroom with the Training Captain discussing how the session will run and what he expects to see in terms of crew cooperation and flight management. The pilots are given some advanced warning about the generic scenarios they will face and have the opportunity to ask questions about the structure of their assessment. Given the official nature of this briefing, several Training Captains apologised they did not have time to fully explain all the acronyms and procedures. Fortunately, however, I understood the majority of what was said (bar several incredibly detailed technical discussions).

Following the conclusion of the pre-flight brief I was led down to the simulator. The device itself was on standby, its six hydraulic legs fully retracted. The surroundings were very clinical. The windowless room was harshly lit by fluorescent tubes, the light from which bounced off the brilliant white walls adorned with warning notices and evacuation procedures. A retractable metal drawbridge connected the simulator to the stairway, providing access from our aerial walkway. The machine comprised a large white box with a band of black panels around the front where the visual models are projected (Figure 6.6). A bundle of thick grey cables snaked out of its underside like gigantic umbilical cords, connecting it to banks of computer processors and hydraulic actuators, which were all simmering and humming with intent, reiterating that electricity and computer code are the lifeblood of modern commercial aviation, and that it will not function without a constant supply of both.
Following a health and safety briefing, I was invited into the virtual world of the simulator. Despite the importance of the flightdeck to the operation of an airliner, there is surprisingly little room for manoeuvre, and the first few minutes were spent accommodating three pilots, one research student, and six large bags of operations manuals in a dark confined space littered with obstacles including seats, parts of the aircraft, and assorted paperwork. However, once safely ensconced in the simulator, I was able to record key incidents and examples of flightcrew practice, from pilot conversations, to radio transmissions, passenger calls, cabin crew emergency ‘NITS’ briefings\textsuperscript{11}, cockpit alerts and warnings (both aural and visual), as well as external noises (including that from the engines, flaps, and landing gear), motion sensations, and other sources of visual and kinesthetic information. On all the flights, I was provided with a headset so I could hear what the pilots were saying (as the noise of the electronic cooling fans and simulated aircraft noise [principally airflow and engine noise] meant the simulator environment was very noisy and normal speech difficult to distinguish without electronic amplification). The first few minutes were spent getting acclimatised to the simulator and familiarising myself with the layout of the flightdeck instruments. Unfortunately, the field environment was not conducive to note taking. The low luminance of the visual models and flight displays meant I was

\textsuperscript{11} ‘NITS’ is the acronym used by bmi to structure the form of emergency briefings that are given to cabin crew, and stands for ‘Nature, Intentions, Time Available, Special Instructions’ (i.e. nature of the emergency [fire, hydraulic failure], what the flightcrew are going to do [carry on to destination or divert], how long before the aircraft lands [to give them time to do the emergency drills] and, finally, if there are any special instructions concerning the landing i.e. if there is a hazard on one side of the aircraft that renders evacuation slides inoperative).
often writing in the dark, to the point where I couldn’t see the words on the page (for security reasons and so as not to disturb their training, I was not able to use any form of digital recording equipment, including a camera, in the simulator)\textsuperscript{12}. Verbatim fieldnote extracts appear in Appendix 5.

Over time, I began to learn where and when to look at different flight instruments, and began to pre-empt the pilot’s (re)actions at different stages of the flight. The privileged position afforded to me as a non-specialist but informed observer enabled me to watch the Training Captain programme various scenarios into the IOS so I knew what was coming before the pilots did. This was particularly useful before they practised certain emergency situations such as wind shear and emergency descents from altitude, as it enabled me to prepare myself for the sudden sound of claxons and violent movements. Some of the scenarios required the pilots to fly holding patterns above the airport while they dealt with specific problems and, during this time of relative inactivity, the Training Captains leant over and explained the details of the scenarios they had set, what might cause them, what the pilots were doing at that precise moment, and what they needed to do in the near future.

On one approach, the Training Captain leant over and told me all about the importance of QNH (a reading of local barometric pressure that indicates the aircraft’s altitude above sea level), to which I nodded and asked whether QFE measurements (a related reading of local barometric pressure that indicates the aircraft’s height above the airfield) are ever used. He looked rather surprised and said, “You know what QFE is? Sorry, you must think I’m so patronising”. On other occasions, I felt it necessary to confirm that I did indeed know what they were talking about by citing an acronym’s full nomenclature. This had the dual purpose of confirming my correct use of the terms while demonstrating my (albeit limited) knowledge of ‘pilot talk’ and aircraft systems.

The artificially rendered and computer mediated environment of the flight simulator produced some odd effects of spatial and temporal dislocation. With the door shut and

\textsuperscript{12} Indeed, the B737 wasn’t fitted with any form of background lighting so I was writing totally blind, using my left hand to regulate the progress of my pen down the page to ensure that I neither wrote on my clothes, nor wrote over text I had just written. The Training Captain was very apologetic but admired my ability to write in the dark.
the motion enabled, the occupants are totally isolated from reality. At simulated altitude, you are convincingly tricked into believing you really are flying (given the low luminescence of the visual models) through perpetual twilight. Indeed, on more than one occasion, I had difficulty convincing myself that I was not sitting in a real aircraft. This disorientation was compounded by temporal disjunction from actual local time. For reasons of scheduling and coordination, the aviation industry operates on UTC (see Chapter One), a universal standard time equivalent to Greenwich Mean Time. Consequently, all the clocks in the simulators and in the training centre were set to UTC, which indicated an hour earlier than local (British Summer) time. This caused confusion for both crews and author alike, when it was not made clear whether we were operating (and therefore meeting each other) on local or UTC time.

6.3 The visual geographies of the flightdeck

In recent years, it has been suggested that geographers have increasingly engaged with the ‘visual’ component of their discipline (Nash 1996; Rose 2003; Ryan 2003). Though using varied visual images, including the maps, slides, photographs, and diagrams, that produce and disseminate geographic knowledge, Rose (2003 p212) notes that geography ‘continues to rely on certain kinds of visualities and visual images to construct its knowledges’, expressing concern that ‘the ways in which particular visualities structure certain kinds of geographical knowledges’ have been ignored (ibid. 2003 p213). More pertinently, she argues all forms of visualisation ‘have their foci, their zooms, their highlights, their blinkers and their blindness’, which create distinctive power-laden geographies of what can, and cannot, be seen and known. Inspired by Pickles’ (2004) work on the material technologies that enhance vision, and Rose’s (2003) challenge to identify geographical ‘blindness’, the following discussion investigates how flightdeck technologies produce geographical knowledge by enabling pilots to ‘see’ and interpret airspace.

Given the inherent complexity of aircraft systems, and the need to monitor their performance, modern flightdecks feature a bewildering array of buttons, dials, levers, lights and electronic displays, which convey information about different aspects of the aircraft’s operation and performance. To bring order to this complexity, there are five distinct information regions on the flightdeck: the main instrument panel, the glareshield, the control column, the central pedestal, and the overhead electrical panel.
(Figure 6.7). While the precise layout of flightdeck instruments differs between aircraft types and manufacturers the generic arrangement is similar and, as such, can be understood to privilege one particular way of seeing airspace, as pilots are trained to sequentially consider the flight as a series of flows (Figure 6.8).

**Figure 6.7 Basic flightdeck layout of a modern twin-engined Airbus airliner**

![Flightdeck Layout](source: www.airbus.com/gallery with author’s annotations)

**Figure 6.8 A scripted pre-flight visual flow check.**

![Flow Check Diagram](source: Brown and Holt 2001 p153)
My empirical observations revealed that, in routine situations, pilots spend a lot of time simply sitting in companionable silence watching the readouts from flightdeck instruments, and while the need to point at particular instruments or listen to air traffic control transmissions may occasionally punctuate their gaze, the majority of information is acquired visually, and the information architecture of the flightdeck is thus determined by ease of visual surveillance. As Degani and Wiener (1990 p49) note, 'the instruments, units, and system panels are arranged in certain “geographical” locations according to frequency-of-use [and] criticality', creating certain conventions of ‘reading’ instruments. Indeed, in order to facilitate efficient visual scans, the original layout of the four principal flight instruments has been preserved on modern aircraft (Theurissen and Etherington 2002).

Looking forward, the Captain occupies the left-hand seat, the First Officer the right. The main instrument panel, which contains the Primary Flight Displays (PFDs), Navigation Displays (NDs), landing gear lever and engine performance indicators, is immediately in front of them. This also contains separate analogue instruments (including a secondary altimeter, vertical speed indicator and radio direction finder) that operate independently of the main systems. With the exception of the landing gear controls, the main displays are duplicated, with each pilot’s display powered by separate onboard computers for added safety. This central group of primary instruments is regularly scanned, and the flow of visual data translated into spatial information that enables pilots to identify malfunctions and, if necessary, make corrective movements to thrust levers and the control column (Forman 1990).

The central control column (or side-stick on some Airbus models) is the equivalent of a steering wheel on a car that controls the moving surfaces on wings and tail enabling the aircraft to pitch, roll and yaw. The autopilot controls and display selectors are housed in the glareshield immediately above the main instrument panel. The overhead electrical panel, set into the roof of the flightdeck, contains lights, switches and circuit breakers that control various aircraft systems including fuel flow, pressurisation, anti-icing systems, external lights, and emergency warnings. The central pedestal contains the alphanumeric keyboards and displays for the two flight management computers.

However, unlike a steering wheel, when the control column is centred, the aircraft will hold the new bank attitude until a corrective input is made to roll the wings level.
(FMCs), thrust levers, flap selectors, speedbrake controls, radio communications panel, and transponder, while the rudder pedals and brakes are located at the pilots’ feet (see Figure 6.9).

Interestingly, Gillian Rose’s description of 35mm slides can easily be applied to flightdeck displays, which also ‘have a luminosity of colour which is... striking, glowing in the darkened room like jewels of disciplinary data, gorgeous and compelling...and worthy of geographic examination’ (ibid. 2003 p215). However, the apparent veracity of flightdeck displays makes it easy to forget they are spatial abstractions, negating any meaningful discussion of their truth status or accuracy. There is a danger that pilots become seduced by their instruments, failing to question their accuracy or what they don’t show. As one experienced pilot noted, flightdeck displays ‘make for an impressive array, but it’s hell on a dark night if the lights go out’ (Beere 1992 p31).

However, as Dodge and Kitchin (2004a) recognise, there is a danger that discussions about the production of ‘code/space’ are dismissed for being technologically deterministic. While computer code does routinely produce airspace in predetermined ways on the flightdeck of commercial aircraft, the code/space of the flightdeck becomes effective through the practice of individual pilots, who experience the space in markedly different ways. As such, the code/space of the flightdeck ‘is constantly in a state of becoming, produced through individual performance and social interactions that are mediated, consciously or unconsciously, in relation to the mutual constitution of code/space’ (ibid. 2004a p204). Even in the totalising aviation environment of the flightdeck, where survival is dependent on life-support systems run by computer code, code/space is still negotiated and interpreted by human agents, and pilots have the power to disregard or override automated systems if the situation demands it, for computerised systems can only operate in accordance with programmed design parameters which may be incompatible with safe flight in certain circumstances.

14 See also recent critiques of Augé’s (1995) ‘non-place’ hypothesis which argues different people experience the same space in a multitude of ways according to individual circumstance.
Figure 6.9 The flightdeck of the bmi Airbus A320 simulator with important flight control components highlighted and described

- Flightdeck windows - visual models are displayed on a ‘surround vision’ screen behind the glass, giving an illusion of distance and three-dimensions
- Triple-channel autopilot control mode control panel
- Electronic flight instrumentation system control panel. ND screen controls (‘ROSE’, ‘ARC’ or ‘PLAN’ mode are selected from here)
- Standby radio magnetic indication finder
- FMC display screen and keyboard (identical to FO’s side)
- Captain’s seat
- Radio control panel (identical to FO’s panel)
- Transponder control panel
- Thrust levers and master engine controls
- Engine and APU fire controls
- Aircraft lighting controls
- Upper ECAM screen - displays engine parameters, the operational status of flaps and slats as well as warning pilots of faults and emergencies
- Landing gear indicators (three green lights indicate nose, left and right gear is down and locked)
- Landing gear lever
- Lower ECAM screen - provides flight-phase related information such as electric and hydraulic systems information as well as providing diagrammatic representations of system malfunctions. Pilots can select the data that is displayed by using the FMC keyboard
- Rudder pedals
- First Officer’s seat

Photo: author
As part of their work routine of flying an aircraft, individual pilots must work together as a team to successfully perform the required flight-related activities and develop shared understandings about the aircraft's performance and flight progress. As such, pilots 'occupy and act according to a limited range of recognised professional identities' which are aligned to certain flightdeck duties and responsibilities (Nevile 2004a p33). On any flight, a pilot is assigned two formal identities. The first comprises an official rank, or status, as either Captain or First Officer (FO)\textsuperscript{15}, which is usually commensurate with levels of training, experience and qualification. The second identity is either that of 'Pilot Flying' (PF) or 'Pilot-Non-Flying' (PNF) (also occasionally termed 'Handling' and 'Non-Handling Pilot'). The PF is in control of the aircraft, that is, they alone makes inputs to control the aircraft's performance at all stages of the flight from take-off to landing. They are also responsible for decisions such as when to engage or disengage the autopilot, as well as conducting some elements of pre-flight planning. Throughout a flight, the PNF acts as the PF's professional assistant, handing all 'housekeeping' activities including reading and performing checklist items, operating the radios, dealing with system abnormalities, obtaining and processing meteorological information, crosschecking and calling out critical flight information (such as altitudes and speeds), and ensuring the PF acts in accordance with standard Company operating procedures\textsuperscript{16}.

Unlike the official rank of Captain or FO, the identities of PF or PNF are only held for the duration of a flight, and both flightcrew are equally qualified and capable of performing both roles. Consequently, the Captain or the FO could be the PF or PNF, although company policy and common courtesy ensures the two roles are equally shared. As the senior ranking pilot, the Captain is always in command of the flight, regardless of which pilot is acting as the PF, and has sole responsibility for the conduct and safety of the flight and its occupants. Until the introduction of Crew Resource Management (CRM) training, which places an emphasis on team work, it was reported that many senior (male) pilots exhibited what Faith (1998 p179) termed

\textsuperscript{15} A third category, Senior First Officer (SFO), denotes a pilot who has considerable experience as an FO, but does not have the requisite qualifications required to be a Captain.
\textsuperscript{16} Captain Dave Robertson, bmi, personal communication (2005)
the 'Captain God Complex', whereby FOs and cabin crew felt unable to challenge his decisions, with occasionally fatal consequences\(^{17}\).

To coordinate flightdeck activities, each pilot must be familiar with the duties and responsibilities associated with each role. This allows both crew to understand what is going on and what each pilot is doing at any given time. The various duties of the PF and PNF are explicitly spelled out in training and manuals, which specify what actions should be performed and when they must be executed, while defining the terminology that should be used in given circumstances. These procedures vary slightly from airline to airline, with the following empirical details being derived from bmi and Britannia flightcrew protocols.

6.4 ‘Fly by sight’ - The practice of flying by seeing

Observation of flightcrews in the simulators revealed that the perceptual demands placed on pilots are considerable, as they must continually synthesise accurate spatial awareness from a considerable amount of coded raw data. Piloting is thus a complex and cognitively-demanding activity, requiring specialised skills, discipline, and judgement, in an uncertain and changing environment, and quick, prudent decision-making based on knowledge of the aircraft, environment, team and personal capabilities and limitations (Billings 1997; Endsley \textit{et al} 1998). Pilots must constantly input and evaluate a myriad of diverse and dynamically coded data in order to remain “ahead of the ‘plane” in time and space to anticipate what they are likely to encounter in the short-term and take actions to avoid potential problems. For example, a pilot ‘must not only comprehend that a weather cell – given its position, movement and intensity – is likely to create a hazardous situation within a certain period of time, but s/he must also determine what airspace will be available for route diversions, and ascertain where other potential conflicts may develop’ (Endsley \textit{et al} 1998 p2). The maintenance of this spatial awareness necessitates monitoring the status, attributes and dynamics of the flight, including airspeeds, position, altitude, heading, ATC clearances, Traffic Alert and Collision Avoidance System (TCAS) information, and

\(^{17}\) In addition to male ego, cultural differences have been found to contribute to accidents. South Korea’s patriarchal and hierarchical society has contributed to the national carrier, Korean Air, having one of the highest accident rates of any major international airline, as junior flightcrew feel unable to question or challenge authority (Strauch 2002).
weather returns, comprehending their meaning and significance and projecting their status in the near future.

There is a broad consensus in the aviation community that increasing automation has changed the tasks associated with flying commercial aircraft (Dekker and Hollnagel 1999). While Elmer Sperry demonstrated the first autopilot in 1912, the first powered flight control systems did not appear until the early 1950s, when the miniaturisation of computer components (following the invention of the transistor in 1947) enabled the widespread application of digital technology to flight (Gunston 1990). Horizontal situation indicators (HSI) and vertical situation indicators (VSI) superseded compasses and primitive artificial horizons as the primary instruments of spatial awareness during the 1960s\textsuperscript{18}, while the advent of microprocessors and printed circuits during the 1970s allowed communication, navigation and other flight management functions to become increasingly automated. This, in turn, heralded a significant change in flightdeck layouts in the early 1980s, as banks of electromechanical or analogue flight instruments were replaced by multicoloured Cathode Ray Tube (CRT) screens that could display, on demand, information on navigation, aircraft performance, weather and system malfunctions. The latest generation of modern flight control computers are capable of undertaking numerous interrelated tasks concerned with thrust, trajectory, vertical (V-NAV), and lateral (L-NAV) navigation (Gilchrist 1998), but while much of the practice of flying is becoming increasingly automated (Billings 1997; Rignér and Dekker 1999), the role of the human pilot in monitoring and programming the code/space of the flightdeck remains vitally important (65-80\% of all aircraft accidents are still attributed to pilot error (Billings 1997))\textsuperscript{19}.

As Billings (1997 p65) notes, AFS have had 'profound effects on the ways aircraft are flown, on the ways the aviation system is managed, and on the human pilots and air traffic controllers who operate the system', but psychologists have expressed concern that far from making flight safer, higher levels of automation are actually contributing

\textsuperscript{18} Precise navigation aids in the form of VOR, DME, and ILS radio beacons capable of determining both distance and azimuth enabled a British Trident to make the first 'blind' completely automated Category III landing at Heathrow airport in 1965 (Billings 1997).

\textsuperscript{19} Automation has been identified as a contributory factor in major accidents at Bangalore (1990), Strasbourg (1992), Nagoya (1994) and Cali (1995) (Vakil and Hansman 2002).
to accidents, as they detach pilots from the ‘feel’ of their aircraft (Vakil and Hansman 2002). As one pilot noted, ‘In these advanced aircraft you have to pick up everything optically. You can’t hear anything, you can’t smell anything, you can’t feel anything... Man is a 50,000-year old piece of software, not designed to move in the fourth dimension, and [modern aircraft] are depriving him of a very essential redundant sensory channel: the tactile one’ (cited in Faith 1996 p86). Thus, industry-funded researchers assert that ‘[n]o single feature has mitigated flightcrew cognitive workload as much as these new displays...and no technological advance has done as much to make the modern airplane more error-resistant than its predecessors’ (Billings 1997 p92). However, many pilots resent the progressive encroachment of automation arguing that as computers can only function in accordance with their design parameters, certain aspects of flying become more complicated (and in certain cases, more dangerous) than they need to be as software displaces (some) human skills.

Some senior pilots have expressed concern that flightcrew could become over reliant on these automated systems which could lead to complacency and disaster (Stix 1991, Singh et al 1997). As Hourizi and Johnson (2003 p860) note, ‘[t]he acquisition, maintenance and repair of awareness [on the flightdeck] is... particularly difficult to achieve and can be devastating when lost’. Indeed, many perfectly airworthy aircraft have crashed into high ground or run out of fuel owing to crew confusion or pilot error (Nevile 2004b). In light of these dangers, pilots are trained to take a very active role in an automated flightdeck to maintain situational awareness to ensure they develop ‘appropriate individual and shared understandings of what the technology is doing, what it knows, what is motivating it to act in certain ways...at certain times’ (Nevile 2004a p207).

Most spatial information is obtained from the primary flight displays (PFDs) and aircraft system indicators (although paper documents, aural checklists and past professional experience all combine to provide real-time information about the status of a flight.) Primary Flight Displays (PFDs) convey all the ‘basic’ information about the spatial situation of the flight, including attitude, airspeed, altitude, vertical speed.

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20 SFO Adrian Plant, bmi Heathrow, personal communication (2005).
and heading. Given the significant differences between the information architecture of electromechanical and electronic displays, this discussion will focus on the representational practices of electronic PFDs, as these were installed in all of the aircraft I observed. Modern PFDs comprise an ‘Electronic Attitude Direction Indicator’ (EADI) that depicts the position of the aircraft relative to the horizon (Figure 6.10).

Figure 6.10 Annotated ‘in service’ photograph of a Captain’s EADI on a B737-700 showing how the information situates the aircraft in (air)space

Image source: www.b737.org.uk/flightinsts.htm with author’s annotations

This display informs situational awareness by telling pilots at a glance whether their aircraft is climbing, descending, or banking (their ‘attitude’). This information is automatically calculated and continually relayed from the aircraft’s Internal Reference System (IRS), a series of continually spinning gyroscopes that accurately determine the aircraft’s movement in three dimensions. The EADI also alerts pilots if the aircraft is approaching its aerodynamic stalling speed or encountering windshear. Collectively, the EADI displays over 20 pieces of spatial information about the
vertical and lateral profile of the flight and the aircraft’s velocity. Attitude information is also duplicated on standby artificial horizons on the main instrument panel, ensuring the aircraft could be flown safely even after a major electronic systems failure (see Figure 6.11).

In addition to acquiring primary flight information from the EADI, information about aircraft performance is acquired from system displays that continually inform pilots of the operational status of the aircraft, and to allow them to identify malfunctions. On the A320, ECAM (Electronic Centralised Aircraft Monitor) alert messages have a very clear and logical order of priority. Warnings (in red) always appear at the top of the screen, while cautions (in amber) appear below. Warning messages relate to any condition that threatens the integrity of the aircraft or the safety of its occupants (including cabin depressurisation, engine fire, or overspeed). The detection of any such alert automatically triggers the illumination of the master warning/caution light on the glareshield and an alarm. Pressing the relevant button rearms the system, but messages on the ECAM display don’t disappear until the problem has been satisfactorily resolved. Some warning, caution and advisory messages are inhibited during take-off and landing to avoid distracting the pilots and only illuminate when the aircraft reaches a certain speed on the runway and remain so until a set altitude, or time after departure.21

The information architecture of all the screens is colour-coded to prioritise particular data and ease its interpretation. Green indicates serviceability; white, the information structure on engine dials, PFDs and Navigation Displays (NDs); amber, faults or potential problems, while red is used to indicate serious immediate danger such as engine fire or depressurisation. Blue denotes measurement (such as temperatures, weights, pressures, percentages) and ‘sky’ on EADI; terrain is represented in brown, while green, yellow and red are used to indicate terrain and weather on the navigation displays. Thus, in addition to a pilot’s gaze being scripted by visual flow patterns, it is also informed by colour, as the eye is naturally drawn to red and amber, indicating danger or faults.

21 When the system is engaged, a magenta message ‘TO Inhibit’ (take off inhibit) appears on the screen.

Figure 6.11 Annotated ‘in-service’ photograph of a B737-300 Captain’s primary and standby flight instruments

Airspeed indicator and mach meter indicating 239 knots (nautical miles per hour) or mach 0.74 (identical to electronic readout on EHSI). The red and white striped ‘barbers pole’ indicates the maximum speed at which the aircraft can fly at that height, without exceeding its airspeed envelope. Conversely, the orange ‘bug’ indicates the lowest safe speed. As height increases, and the air thins, these two speeds converge.

Primary electronic horizontal situation indicator (EHSI) showing attitude, air and ground speed, mach number, and which aspects of the autopilot are engaged.

Radio magnetic indicator showing the aircraft’s heading (duplicating that on the electronic navigation display), and distance to, and direction of, the next radio beacon.

Electronic navigation display showing in ‘Arc’ mode with the compass arc (top, in white), track (magenta), heading, wind speed and direction, planned route (magenta) and navigation beacons and airports (blue). Note the TCAS return, in the bottom middle of the screen (in white text), indicating the presence of an aircraft 2000ft below.

Turn and slip indicator, showing balanced flight.

Analogue altimeter showing the aircraft is at 36,980ft on the universal standard pressure setting of 1013mb (equivalent to 2991 inches of mercury).

Vertical speed indicator (in 1000 feet per minute increments).

Source: www.b737.org/pftinsts with author’s annotations.
In addition to PFDs 'making space visible', the TCAS (Traffic Control and Collision Avoidance System) display enables pilots to 'see' the position of other air traffic in the vicinity and situate themselves in airspace by providing abstract two-dimensional representations of the position and trajectory of all aircraft in the surrounding airspace. Introduced into commercial service at the beginning of the 1990s, TCAS' conflict detection and resolution capabilities have made its installation mandatory on all commercial aircraft carrying over 20 passengers (or with a maximum take-off weight exceeding 15,000kg) within European airspace (Duke 2001b).

The system itself comprises integrated hardware and software components that automatically scan, once per second, a minimum of 15 nautical miles ahead, and 7.5 nautical miles behind, the aircraft. Working on the same principle as secondary surveillance radar (SSR), TCAS identifies any aircraft in the vicinity and interrogates their transponders to evaluate whether their proximity (in terms of track, altitude, vertical speed, or heading), poses a collision risk. The use of TCAS thus invokes particular notions of control over aerial territory and time, by alerting pilots to collision hazards with sufficient warning to enable them to take avoiding action. Moreover, it represents another example of the development and use of a technology that safely divides airspace into useable 'pockets' of space and time. However, as MacDonald (2006 p57) notes, 'vision...is not just about passive 'seeing', but about active 'looking', and requires knowledge and experience to formulate a relationship between the identified objects and self.

Although modern TCAS software always functions in the same way, the display outputs vary considerably, and the following description is based on my observation in the A320 simulators, where TCAS returns are overlaid on the navigation display. The scanning aircraft appears at the bottom, with all other aircraft being depicted by a variety of colour-coded symbols depending on their proximity. Numbers indicate the operator and callsign of other flights and show their altitude relative to the scanning aircraft (e.g. +11 equates to 1100 feet above; -03, 300 feet below). The addition of an arrow, pointing either up or down, indicates whether the vertical speed of the target aircraft exceeds 500 feet per minute (e.g. +20 indicates traffic 2000 feet above descending at greater than 500 feet per minute). Traffic further than five nautical miles away is considered a 'surveillance target' and represented by a hollow white

diamond. If it encroaches closer than five nautical miles, the diamond becomes solid and the aircraft becomes a 'proximity target'. If the distance between the two aircraft continues to decrease, the symbol changes to a solid yellow circle, and then, with collision imminent, the intruding aircraft is represented by a red square (Brown and Holt 2001). A typical TCAS display appears as Figure 6.12.

Figure 6.12 A TCAS display on a B737NG, locating, identifying and evaluating the threat posed by an intruding aircraft - note the white surveillance target in the 11 o'clock position, close to the scanning aircraft.

Data relating to (clockwise from top) ground speed (GS), True Airspeed (TAS), wind speed (all knots), and wind direction (degrees)

Programmed track

Data relating to weather radar

Data relating to automatic direction finder (ADF)

Aircraft’s magnetic heading

Details of, and distance to, next navigation beacon

Location of next navigation beacon

TCAS return Aircraft 1900ft below the scanning aircraft climbing faster than 500ft per minute. No risk of collision

Aircraft’s position

Location and identification of major airports (EGCC = Manchester)

Source: www.b737.org.uk/navigation.htm with author’s annotations

More sophisticated ‘TCAS 2’ software augments these visual traffic warnings by providing ‘Traffic Advisories’ and ‘Resolution Advisories’ when required. Traffic advisories are given 40 seconds before impact and comprise an automated spoken warning "Traffic Traffic". If avoiding action is not taken, the pilot receives a spoken resolution advisory 20-30 seconds before impact ordering an evasive manoeuvre such
as “climb” or “descend”\textsuperscript{22} to avoid collision (in such circumstances pilots simply follow these commands and do not require ATC clearance). If both aircraft are equipped with TCAS 2 software, the two systems automatically determine and offer deconflicting resolution advisories to their respective flightcrew (i.e. one instructs the pilot to climb, the other descend)\textsuperscript{23}.

Empirical observation of different flightcrews’ responses to TCAS alerts demonstrated that the act of looking for/at other aircraft becomes performative. As soon as a target appeared on the screen, the non-flying pilot would routinely try and establish visual contact by peering out of the flightdeck windows. As MacDonald suggests (2006 p57), ‘to have a target in sight is to have already changed the relation between subject and object’. Thus there are important points to be made here about practices of looking and the control of (air)space. As Paul Virilio (1998 p24) remarked, to control territory one must ‘possess the best means to scan it in order to protect and defend it’. The use of the word ‘target’ to describe other aircraft indicates the pervasiveness of a military discourse structured by aerial dog-fights and the need to guard Self against Others. As one pilot joked, after five collision targets lit up his TCAS screen and required him to perform a series of violent evasive manoeuvres more akin to flying a fighter jet than an airliner, “God, it’s like Star Wars out there”\textsuperscript{24}. Thus TCAS, a specialised form of airborne radar, helps flightcrew protect ‘their’ airspace by identifying (and avoiding) dangerous ‘others’, for notwithstanding any ATC clearance, it remains a flightcrew’s responsibility to prevent mid-air collision (CAA 2002).

By enabling pilots to ‘see’ the traffic situation in the vicinity of their aircraft, TCAS’s ‘electronic eyes’ provide a prime example of how technology is implicated in the production of airspace (see Thrift and French 2002 and Dodge and Kitchin 2004a, 2005 for more). TCAS thus simultaneously organizes the sky, giving pilots the spatial

\textsuperscript{22}N.B. at present, the system is only capable of giving vertical conflict resolutions, although it is hoped future systems will be able to offer lateral resolutions too.

\textsuperscript{23}Tragically, the decision by a Russian pilot to follow ATC advice rather than his TCAS resulted in the mid-air collision between a passenger TU-154 and DHL B757F over Uberlingen, Germany in 2000 (see BFU 2004; Bennett 2004).

\textsuperscript{24}This scenario was kindly programmed by the Training Captain so I could see how multiple airborne targets were visualised and prioritised and how pilots would respond to them. Fortunately, this situation is never likely to occur in everyday airline operations.
information they need to construct three and four-dimensional understandings of the speed, trajectory and relative altitudes of all aircraft operating in their immediate vicinity. In this way, pilots report that these graphic depictions of airspace are worth "more than a thousand words".

However, while TCAS’s ability to make airspace visible to pilots in space and time through colour-coded two-dimensional displays illustrates how technology mediates the production of space, their very abstraction means certain dimensions of airspace are ignored. As with so many systems, TCAS is not infallible; it is merely a tool fostering spatial awareness of certain objects within its detection capabilities. At present, it can only identify transponder-equipped aircraft and offer resolution advisories in the vertical (not lateral) plane. It does not override pilot discretion, merely advises possible causes of action. Yet, despite its limitations, pilots agree that TCAS, when used in conjunction with radio communication and on-board weather radar, is one of the most valuable perceptual tools they use. By helping pilots negotiate the safest route, TCAS represents not only an advanced form of electro-optical vision, but situates the embodied eyes of the flightcrew (and thus the aircraft they command) within dynamic airspace.

6.5 Wayfinding in the sky – the geographies of aerial navigation

‘Navigation’ declared Myerscough (1941 p3), ‘is the science by which a craft is enabled to fly from one point to another, in the minimum amount of time, or across the shortest distance’. Given the hostile external environment in which commercial aircraft fly, it is imperative pilots know their spatial position at all times as the consequences of ‘getting lost’ can be catastrophic. On September 1st 1983, a Korean Air B747 en-route from Seoul to Anchorage, Alaska, was shot down by the USSR air force after it strayed into sovereign Soviet airspace as a consequence of the aircraft’s internal navigation system being incorrectly configured before take-off (see Taylor 1997) and, ever fearful that electromagnetic radiation could corrupt autopilot commands and send aircraft off course, passengers are prohibited from using certain pieces of electronic equipment in-flight (Leppard and Harlow 1995). Thus, discourses of navigation have structured the development of aviation since its origins.

In the early days of passenger aviation, pilots navigated by major landmarks including roads, towns, and railway lines (Walters 1979). As the network of passenger services grew throughout the early 1920s, identification codes were painted on barns and on top of airfield hangars so pilots could determine their location from the air. As all navigation was done visually with reference to the ground, aircraft had to fly beneath the cloud base, often resulting in a turbulent ride and increased risk of collision. The deaths of seven people in a mid-air crash 60 miles north of Paris in 1922 highlighted the dangers of unregulated airspace and resulted in the formation of specific air routes across the Channel. As a pre-cursor of the modern airway system, pilots flying between London and Paris were instructed to remain east of Ecouen, Abbeville, Etaples and Ashford when flying towards Paris, and west of them on their return, and radiotelephony stations were constructed at Croydon and Lympne in Kent in 1920 to enable ground controllers to communicate with pilots over the Channel (NATS 2005a). By the end of that decade, rising numbers of aircraft flying into major British airports necessitated the creation of specific arrival and departure routes which ensured adequate separation between inbound and departing aircraft and managed the acoustic climate around airports (ibid. 2005).

As aircraft began flying progressively further, faster, longer, and higher, pilots began encountering an unfamiliar and unordered aerial space and, in an effort to introduce structure and reference points to this featureless ocean of the air, aeronautical charts began to map intangible/invisible waypoints, the location of which were defined by latitude, longitude, and a five-letter identifier (see Chapter Five). Significantly, by mapping structures that were not there, aviators were able to develop logical relationships and aerial links between distant airports, creating an understanding of the dimension and properties of the airspace between them while allowing patterns of aerial flow and mobility to be (re)produced. Today, the sky is criss-crossed by numerous flightpaths, control zones and airways, all of which are represented by a distinctive style of cartography that codes the sky in ways that have yet to be systematically explored, resulting in charts that are quite unlike conventional forms of terrestrial or ground-surface maps.

As Ueno and Kawotoko (2003) note in relation to automobility, it is impossible to disentangle that space of mobility from the objects, signs and maps that formulate the
road as a distinct space, and I argue the same is true for airspace. As Dodge and Kitchin (2004b p159) recognise, ‘[m]aps and visualisations have long been used as a way of making the world more comprehensible’ through the classification, representation and communication of complex sets of topographical or relational data and ‘have always been of theoretical and practical importance to geographers’ (Pickles 2004 p27). As Harvey (2001 p111) notes, ‘mapping’ space is a ‘fundamental prerequisite to the structuring of any kind of knowledge’.

As a consequence of their multifarious uses and applications, maps ‘constitute concentrated databases of information about the location, shape, and size of key features of a landscape and the connections between them’ (Dodge and Kitchin 2004b p159).

Although computer systems guide aircraft between airports, pilots frequently refer to paper charts to familiarise themselves with departure or arrival procedures, look up gate locations, or acquaint themselves with the layout of taxiways and high-speed runway exits at their destination. They will also consult them in an emergency to evaluate alternative landing sites. Indeed, for all the sophisticated electronic navigation software installed on the flightdeck, it remains a precondition of an airline’s Aircraft Operator’s Certificate (AOC) that a comprehensive library of paper navigation charts is carried in the flightdeck of all aircraft26.

At a technical level, airspaces are relatively easy to map - the physical architecture and topology of the network can be superimposed over terrestrial geographic space and/or the traffic flowing through it represented using an appropriate form of graphic visualisation. However, airspaces are highly transient landscapes, and their spatial configuration (like groundscape) is constantly changing. As Flach and Rasmussen (2000) note, there are multiple possible paths through the sky that will satisfy both operational and commercial purposes. Indeed, every flight uses airspace in a slightly different way even if nominally following the same track. In this respect, airspace exhibits similarities with Internet traffic, where fixed ground-based infrastructures (servers, routers, and cables) become the equivalent of airports, ATC and airways to distribute information in flexible ways through time and space. However, unlike railways and roads, where the physical space of flows is demarcated even when no vehicles are passing, the structure of airspace reverts to a void, only brought into

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26 Captain Keith Jones, bmi Heathrow, personal communication (2005).
being when aircraft fly through it (i.e. it is constantly (re)created through a process of *ontogenesis*) (c.f. Dodge and Kitchin 2005). As such, it can be understood as a form of what Dodge and Kitchin (2005 p173) termed ‘background coded space’, whereby the provision of specialist code can mediate the production of space if deliberately activated. Thus, in just the same way as code controlling signals, ticketing, lighting, and escalators (re)produce the London Underground for three million passengers a day, radar, ATC, avionics software, and coded navigation waypoints points, similarly (re)configure airspace to facilitate aeromobility. Likewise, just as they contend that spatial ontogenesis can occur across multiple timespaces, rendering concepts of ‘local’ and ‘global’ scales redundant, the reiterative production of airspace similarly results in ‘multiple, simultaneous, but partial, spatial-time configurations that are at once ‘local’ and ‘beyond’ (ibid. 2005 p174). However, unlike tangible changes to ground-based transport and communication infrastructures, airspace changes are intangible until external parties experience their effects, such as in the ongoing controversy surrounding the airspace reorganisation at NEMA (see Chapter Four).

Owen (2005 p16) remarked that ‘two-dimensional aviation charts...represent a bewilderingly complex three-dimensional land, sea and airspace’, where linear thematic layers are stratified on top of one another and decoded by professional users who are conversant with the specialised language, symbology, and protocols of airspace exclusion zones, upper and lower air routes, radio navigation beacons, and areas of high ground. In his opinion, aviation charts represent:

> ‘an extreme example of the tortuous transformation from three dimensions to two because, in addition to the ground features that provide relational information, there are many different kinds of volumes of airspace to be negotiated, each with their own permissions, rules and other characteristics. The pilot flies through these or around them: not just over them, but also above, under and between them. In a busy and feature-laden airspace like that around southern England, the problem of spatial orientation and interpretation is acute; and highly refined sign-reading is critical to survival or the retention of one’s flying licence’

Owen (2005 p16)

Yet despite the inherently ‘geographical’ nature of his comments, Owen was writing as a graphic designer (albeit one interested in navigation and signage systems), and though he is right to argue that many of the features of aeronautical charts have no
physical reality and the delimitation of different sectors of airspace, through specialised icons, symbols, lines, hatching and colour, is an abstraction designed to control aeromobility in the absence of any ‘natural’ physical points of orientation, he falls short of discussing the implications of such abstraction in creating a ‘mile-high’ aerial geography of perpetual movement frozen in time/space. Nigel Gates, writing in the *Geographical Magazine* in February 1989, reproduced an AERAD en-route navigation chart to illustrate his article on airspace congestion and the complexity of air traffic flows above London but, curiously, he neither referred to, nor provided an explanation of the chart in his text, thus implying that his audience would either naturally comprehend the map (simply by virtue of being geographers) or would be bewildered (effectively illustrating his point).

Geographers have long been interested in ‘locating, identifying and bounding phenomena and thereby situating events, processes and things within a coherent spatial frame’ (Harvey 2001 p220), and the importance of cartography as a way of systematically ‘ordering knowledge’ was recognised as long ago as the 15th century, when the drive for overseas exploration, expansion, and trade accelerated the development of cartographic practice (Harley 1988, Turnbull 1989). As a result of the complex territorial reappropriation of foreign lands during the period of European expansion, imperial powers became involved in, and committed to, the development of national mapping programmes to consolidate the power of the central state against subversive regional and local interests (see Pickles 2004). For example, in Britain, the Hydrographic Office of the Admiralty initiated a national maritime mapping programme in 1795, which, by codifying safety-critical nautical knowledge about harbour depths and the strength of tides and currents, facilitated the safe oceanic transportation of goods around the world while simultaneously asserting territorial control over Britain’s coastline and sovereign waters (Delano-Smith and Kain 1999). Through this and similar cartographic regimes, the world’s seas were progressively categorised as either sovereign or international waters, and varying rules and regulations governing access to, and use of, each were devised (see Chapter Five).

However, while national appropriation and geopolitical control of the seas has a long history, it is only within the last one hundred years with the invention of heavier-than-air powered flight that it became necessary to map airspace. Wilford (2002) provides
a fascinating account of how the development of aircraft both demanded and precipitated new forms of cartographic practice, as pilots both needed (and could now create) accurate navigation charts. Yet while aerial photography from hot-air balloons had revolutionised cartographic practice during the 19th century by revolutionising the ‘view from the air’ (see Vidler 2000 and Chapter Two), it was not until the aerial bombing and reconnaissance flights of the Second World War, and the subsequent introduction of regular passengers services, that accurate ‘maps of the air’ were required (Wilford 2002).

Following the end of World War Two, small-scale aeronautical charts were produced to facilitate the development of regularised international passenger aviation and a global classification system was devised. Thus, in this respect, aircraft ‘internationalised cartography in very important and positive ways’ (Thrower 1999 p171) by creating a ‘graphic symbol of centralized political authority’ that introduced a new concept of spatiality (Harley 1988 p384). Pickles (2004 p62), however, suggests such universal geo-coding of space progressively eliminated the bodyspaces and groundspaces of human activity as ‘alternative mapping opportunities were eradicated or sublimated under the universal logic of law, administration and measurement’. Indeed, the geopolitical role of maps as tools of statecraft and oppression have been well documented, and there is an extensive literature on the limitations of cartographic practice and multifarious (ab)uses of maps from imperial propaganda and the ‘rational’ organisation of space, to domestic social domination and control (see Black 1997, Harley 1996, Harvey 2001). Deconstructionists first began identifying cartographic inconsistencies in the late 1980s and, borrowing from the work of some postmodern theorists, demonstrated how maps are as important reflections of cultural power and claims to territory as they are records of topographical accuracy (Wood 1994). In light of this, Pickles (2004 p62) wrote of the need for geographers to be alert to the institutions that create and disseminate cartographic knowledge in recognition of the fact that all maps are products of particular representative practices that inevitably reflect the ‘interested selectivity of the state’ and, equally importantly, the information societies ‘value’ (c.f. Wood 1994).

Consequently, much of the history of European and British cartography ‘centres on its military rationale and application, [as it]…was prepared under military aegis, or for
military purposes" (Black 1997 p147). In the context of World War Two, geographical knowledges were produced in secret for military use, and access to them restricted in order to protect national security and maintain strategic superiority over the enemy. The role of aircraft in warfare meant that geopolitical power ‘went vertical’ and the realisation of aerial vulnerability ‘led to a new sense of space’ among the allied nations, stimulating the production of accurate maps from which to plan aerial bombing raids (ibid. 1997 p155). A new international air map of the world, the ‘World Aeronautical Chart’ (scale 1:1,000,000), was compiled to satisfy the needs of military aviators during World War Two. The chart, with its Lambert conic conformal projection, saw much use by pilots during the conflict, but the shaded relief and clearer symbology of the ‘International Operational Navigation Chart’ (ONC) soon replaced it (Thrower 1999). The ONC, in turn, was superseded by smaller scale aeronautical charts, including the 1:5,000,000 Global Navigation and Planning Chart and the 1:2,000,000 Jet Navigation Chart, as well as the 1:500,000 ‘Tactical Pilotage Chart’ and the 1:250,000 ‘Joint Operational Graphic’ (ibid. 1999).

Indeed, the Mercator projection used in many military charts is unsuitable for commercial flight; ‘great circle routes and distances were poorly presented [and] distances in northern and southern latitudes were exaggerated’ (Black 1997 p156). As passenger services continued to develop after the war, new en-route, approach and procedural charts, covering specific regions and airports with detailed topographical and other safety-critical information, began to appear. However, owing to the huge technical challenge of rendering a complex three-dimensional surface with constant positive curvature onto a two-dimensional piece of paper, these publications (like all maps) were a compromise between shape, area, and azimuth (see Pickles 2004) and developed high levels of abstraction, being very selective in what they portray. Furthermore, the challenges of (re)mapping a world in which global and national time/space co-exist required a radical new approach that allowed topographical and topological representations to coexist. Today, the networked economy of global airspace occupies a unique spatiality, being partly deterritorialised but linking a variety of points on the globe by cutting across national borders while simultaneously being connected (albeit sometimes tenuously) to the ‘local’ ground below.

27 Even the famous projection developed by the Flemish cartographer Gerhard Mercator in 1569 was achieved at the expense of distortion at the poles (Pickles 2004).
Just as terrestrial maps employ different formats for different purposes, different cartographic practices have been developed for aeronautical navigation. These range from small-scale high and low altitude en-route charts, to regional airspace information supplements, radar vectoring charts, and individual aerodrome booklets. Given such complexity of airspace architecture, careful mapping is required to facilitate the comprehension of, navigation within, and safe use of, different manifestations of airspace, and different publications enable pilots to visualise spatial relations in a complex but largely intangible aerial environment. Here, the important distinction between different practices of flying must be emphasised. Private pilots, holding only the most basic of aeronautical proficiency qualifications are only allowed to fly under VFR (Visual Flight Rules) conditions, meaning they can only fly during daylight hours when the visibility is sufficiently good enough to enable them to maintain clear visual contact with the ground. To operate at higher altitudes, at night, or in cloud, pilots must hold an ‘Instrument Rating’, which allows them to operate under Instrument Flight Rules (IFR) conditions.

Pilots flying under VFR conditions navigate with reference to ground-based features and so all VFR charts contain a base layer of detailed topographical, hydrographical, and cultural information (including cities, towns, roads and railways28) over which aeronautical information is superimposed (Thom 1987). While the representation of cultural or topographic information follows a familiar format the addition of low-altitude information, including airspace boundaries and the location of restricted, military, or dangerous areas of sky (such as those containing tall transmitters, skyscrapers, gas venting stations, or free-fall parachuting sites), adds a third dimension to the chart (see Figure 6.13).

IFR charts differ significantly from their VFR counterparts. On IFR charts, terrain features are less important, though for reference and orientation coastlines are always shown. These charts depict the location (latitude and longitude) of radio beacons and waypoints, and show the trajectory of individual airplanes and the flight levels at which they operate, as well as other information salient to the safety of aircraft (such as minimum safe altitudes and danger areas). In total, three different types of IFR charts

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28 Significantly, distinctive land use patterns, just as disused railways, which may not be so relevant for ground-based navigation, are highly visible from the air, and are therefore emphasised.
Figure 6.13 Annotated extract of a VFR chart showing the relationship between the airspace above part of the East Midlands and the ground below.
exist - High altitude, Low altitude, and combined High/Low altitude – and while three different agencies (the European Aeronautical Group/AERAD, Jeppesen, and the CAA) publish them, all adopt standard ICAO symbology.

For example, AERAD's en-route High Altitude charts are drawn using Lambert's Conformal projection at a scale of 1:2,000,000, whereas Low altitude charts are drawn using the Oblique Mercator Projection at a scale of 1:500,000 (AERAD 2004). The use of different projections and scales is significant. As Owen (2005) notes, projection 'gives a point of view' whereas scale, 'an understanding of time and horizon'. Flying at speeds approaching Mach 0.80 (80% the speed of sound) requires new representations of airspace - distance now not only exhibits physical characteristics it has a temporal dimension as well. Thus, on one concertinaed page, charts display the maximum distance a flight can travel in both space and time (see Figure 6.14). Thus place is turned into passage and airspace striated into controlled flows that take a known time to traverse.

As Figure 6.15 shows, larger scale High Altitude charts use a limited colour palette: blue depicts coastlines and identifies airports, green indicates minimum safe altitudes and delimits the boundaries of different airspace sectors, brown identifies danger areas such as gas venting stations, areas of high electromagnetic radiation, and bird sanctuaries, while black portrays and describes the trajectory and altitudes of airways and the location and frequency (where relevant) of navigation beacons and waypoints. Low altitude charts also contain information about landing aids and holding areas at major airports, information that is irrelevant to pilots flying at higher altitudes (see Figure 6.16). Combined High/Low area charts exhibit different features again to ease the transition between upper and lower airspace, and the Lambert Conformal conic at a scale of 1:800,000 is commonly used. Here, blue and black ink is used to differentiate high from low altitude airways. Minimum safe altitudes, distances between navigation beacons/waypoints, and danger areas appear in pink, while the name, location, and frequencies of individual VOR beacons appears in green. Grey is used to mark the boundaries of terminal manoeuvring areas and airport control zones (Figure 6.17).
Figure 6.14 Annotating the chart. Here, the First Officer of a transatlantic service from Heathrow to Dallas has drawn the flight plan onto a North Atlantic Flight Progress Chart. Note how the critical mid-point over the Atlantic ocean has been marked, key waypoints identified, and diversion airports clearly circled. Also of interest is the scale bar at the bottom which gives distance in terms of nautical miles and the time (in minutes) taken to fly it. (Source: Lisa Wood, British Airways)
Figures 6.15 and 6.16 Annotated comparison between a High and Low Altitude UK IFR navigation chart

Chart sources (l-r): En route High altitude Atlantic Transition, UK(H)6 (effective 23/12/2004) and en route Low Altitude British Isles chart, UK(L)2 (effective 23/12/2004) (European Aeronautical Group)

Figure 6.15 High-Altitude chart (1:2,000,000)

Boundary of London/Scottish FIRs  Maximum elevation ('000s and '00s of feet)

Airway centreline

NEMA

Coastline  Daventry VOR beacon

Figure 6.16 Low-Altitude chart (1:1,000,000)

Pole Hill VOR

NEMA

NEMA west beacon

Uncontrolled airspace

Military air traffic zones

Controlled airspace
Figure 6.17 Extract of a combined High/Low altitude area navigation chart, London, 2004
(Source: European Aeronautical Group En-route London area navigation chart (Europe High/Low) INS 2, 5, 8, 29/11/2004)
As such, the vertical hierarchy of IFR charts provide progressive levels of geographical abstraction, as the relevance of the ground below diminishes in importance as altitude increases to the point where it merely becomes a backdrop for a complex aerial network that is laid over and above traditional geographic space. At altitude, complex airspaces are transformed into rationalised, globalised, visible entities through the medium of the navigation chart, but the notion of an idealised universal airspace of unfettered aeromobility demands critique; for while lines depicting the trajectory of airlines spatialise the sky through which aircraft fly and structure understandings of airspace, significant gaps can be identified in the layers. Pickles (2004) explored how the transmutation of lines and the drawing of boundaries translates into lived reality, and while airspace charts show the configuration of airlines and the location of airports, they do not map the reality of aircraft noise air routes inflict on communities below. As Owen (2005 p17) notes in relation to maps of seaside towns that show the local beach but omit the sewage outfall, such narratives provide neither a ‘duty of care’ nor acknowledge ‘unpleasant reality’. Paraphrasing Harley’s (1996) arguments about the representation of the US in road atlases, airspace charts could similarly be described as examples ‘of gross simplicity’ – there is nothing in the sky other than airways and no legitimate way of ‘getting at’ the blank airspaces between the strictly defined aerial corridors that operate up to 24,500ft (see Chapter Five). As such, once embedded in the published chart, the lines defining airways ‘acquire an authority that may be hard to dislodge’ (ibid. 1996 p441). Like a road atlas, airspace charts delimit the boundaries of secure knowledge; flights are assumed to be safe so long as they stick to the prescribed routes. Furthermore, national borders appear to lose their significance in a transnational world of aeromobility where sovereign territorial control is deemed of less importance than access to air services.

In addition to low and high altitude charts, commercial pilots also require cartographic representations of the approach and departure routes at different airports. Self-contained ‘Aerodrome Booklets’ thus present detailed information on airport facilities and operating minima, and provide graphic depictions of permissible standard instrument departure (SID) tracks and standard terminal arrival routes (STARs). Unlike VFR and IFR charts, these graphic abstractions have no basis in ‘real world’ geography and are devoid of any scale. Consequently, pilots must visualise the bearings and distances between reporting beacons and manoeuvre their aircraft
accordingly. As Figures 6.18 and 6.19 demonstrate, these charts contain complex coded diagrammatic and alphanumeric information about where and how pilots should fly, giving information on expected climb rates, required altitudes and information on speed restrictions to expedite descent planning, as well as data on the location of waypoints and navigation beacons. Before beginning their descent, flightcrew also review a series of charts depicting the approach procedures that will establish aircraft on the automatic Instrument Landing System (ILS). Given the lower altitudes, these charts contain information on the location and extent of high ground, as well as providing a vertical diagram of the correct descent profile that must be flown (Figure 6.20). At larger airports, where traffic flows are heavier and flightpaths more numerous, these charts appear even more bewildering to the uninitiated (Figure 6.21). Thus, the charts combine good graphic design – communicating detailed information about airspace procedures – with the aesthetic conventions of clear style.

In addition to using conventional paper charts, pilots constantly refer to abstract representations of airspace that are depicted on digital navigation displays. Unlike early aviators, who could only access a limited range of navigation information, the quantity of data available to modern flightcrew is phenomenal; for example, the basic navigation package installed in the Flight Management Computer of an MD-11 (a long-range tri-jet that has found widespread use with passenger and cargo operators) comes with 32,500 navigation waypoints and airway route structures pre-programmed into it (Billings 1997). While such systems reduce crew workload and improve navigation accuracy, some pilots expressed reservations about the systems suggesting they could compromise flight safety by introducing complacency and reducing professional discretion. For example, my field observations revealed that the majority of in-flight navigation is done solely by reference to these digital flightdeck displays, with paper charts only reviewed before take off and landing or in the event of an emergency diversion.

Each pilot has his/her own navigation display, which is located near the PFDs. They present information on the flight’s progress by identifying the distance and time to the next programmed waypoint or VOR beacon. Essentially, these displays function as moving electronic aeronautical charts that are orientated ‘heads up’, meaning the aircraft is always ‘going up’ regardless of the actual heading being flown. For any
Figures 6.18 and 6.19 Abstract representations of NEMA’s airspace - Trent and Wallasey SID (left) and ROKUP STAR (right)

Source: NEMA Aerodrome Booklet (EGNX_51AJ) Effective 12/05/2005 (European Aeronautical Group p16 and p21)
Figure 6.20 An ILS approach chart for runway 27 at NEMA

Source: NEMA Aerodrome Booklet (EGNX_51A)
(Effective 12/05/2005) European Aeronautical Group
Figure 6.21 The ‘artistic’ geographical complexity of airspace around Paris Charles de Gaulle airport, as mediated through a departure (left) and an arrival chart (right).

Source: AERAD LFPG Aerodrome charts kindly supplied by John Welsh, bmi Navigation Services Department, 2005.
given flight, pilots either select a pre-programmed route or enter a set of coordinates (latitude, longitude and altitude) into the autopilot via the alphanumeric keyboards mounted at knee-level on the central pedestal to augment information stored in the navigation database. Once entered and verified, the aircraft automatically follows this programmed route using the vertical (V-NAV) and lateral (L-NAV) autopilot modes until it receives other instructions. The navigation display thus integrates a variety of spatial data to give a clear and precise representation of the aircraft’s position with reference to its pre-planned course. NDs thus provide another way through which pilots can ‘see’ airspace, but the information they contain is highly abstracted. As one retired pilot noted, passengers should never ask “What’s down there?” because ‘flying solely by reference to radio aids or internal navigation the pilots don’t have a clue if it is Birmingham or Bombay. By the time the map has been unpacked and they have worked it out it will be fifty miles behind’ (Beere 1992 p61). Indeed, even the ‘airshows’ available to passengers during some short-haul flights (that typically show the aircraft’s progress and information on airspeed and distance to destination) are linked to the aircraft’s navigation system and so measure progress with reference to obscure-sounding radio beacons rather than major cities (Hawkins 1994).

Given the different ages and sophistication of the avionics equipment, the format of the NDs were different in each aircraft I observed. The A320 allows pilots to select one of three basic modes (‘PLAN’, ‘ARC’ and ‘ROSE’). ‘PLAN’ comprises a static, true-north up depiction of the entire departure-to-touchdown route as programmed into the FMC during pre-flight preparations. This provides electronic confirmation of the flightplan and allows pilots to see at a glance it has been correctly entered, or recalled from, the FMC. It is only ever consulted before take-off, whereas during flight, ‘ARC’ or ‘ROSE’ modes are selected. The former comprises a 90-degree expanded compass arc showing the aircraft’s planned track and heading against a background of fixed flight-plan waypoints and relevant navigational aids whereas ‘ROSE’ features a 360-degree compass circle, showing navigation features of airspace behind the aircraft. Like the ‘ARC’ display, this is orientated in line with the aircraft’s heading, but ‘ROSE’ places the aircraft in the centre of the display, providing 360-degree information on the location of alternative airfields (information that is especially useful in emergencies when pilots have to land their aircraft as quickly as possible). These different modes can be independently selected by the two pilots
according to the spatial information they require at any one time, although the flightcrew I observed predominately used ‘ARC’ mode (see Figure 6.22).

Figure 6.22 Annotated in-service photograph of a navigation display on a B737-300 in ‘ARC’ mode

In addition to displaying navigation data and TCAS returns, modern NDs can also overlay weather information, derived from the primary radar dish situated in the radome (or nose) of the aircraft. In clear air, radar echoes are not returned, but when they encounter water vapour (whether in the form of clouds, rain, or ice) they are reflected back into the dish and, depending on the frequency and intensity of these returns, computer processors build up an image of the location, extent and intensity of cloud formation and precipitation. This information is overlaid on the NDs, and colour-coded according to the intensity of precipitation, from blank areas (indicating no rain) through a spectrum of greens, yellows, oranges and reds to magenta (indicating light rain through to severe thunderstorm activity). Pilots always try to
avoi d fl y ing throu g h red and magenta- co lo ur ed areas, as these indicate the presence of well-formed cumulonimbus clouds with their associated strong updrafts, turbulence, heavy rain and/or hail and lightning that can unnerve passengers and damage the airframe. However, radar can only indicate the location and possible severity of turbulence - the responsibility for avoiding these areas rests with the pilots who have to interpret the displays in light of their experience and present traffic conditions to decide whether to initiate a call to ATC to request alternative flightlevels or headings. Occasionally, volumes of traffic in the surrounding airspace or the extent and location of storms mean they are impossible to avoid, but by “keeping ahead of the plane”, pilots can anticipate a deteriorating ride and warn their passengers accordingly:

"Can we turn left onto two-two-zero degrees and descend flightlevel eight-zero please? We're trying to avoid the weather"

- call to approach control from a bmibaby pilot inbound to NEMA, February 2006

However, even with sophisticated flight control and management systems, adverse weather conditions still disrupt normal practices of air traffic control. The above transmission was received as a cold front was moving across the East Midlands, bringing squally showers, hail, and turbulence, and the radio frequencies were jammed with pilots requesting alternative flightlevels and headings to avoid numerous thunderstorms and heavy turbulence. However, in crowded airspace, there is little room for manoeuvre as allowing one aircraft to deviate from its flightplan can impact on all other traffic in that sector. On 28th April 1998, severe thunderstorms over Southeast England meant aircraft approaching Heathrow could not land, and the Clacton sector was quickly overwhelmed. The weather was so severe that aircraft were forced to hold for up to 30 minutes and, at the height of the storm, over 50 aircraft were circling above the Essex coast (Hulse 1998). Although such disruption is rare, incidents like this highlight the vulnerability of the air transport network to adverse meteorological conditions.

Accurate up-to-date weather forecasts are therefore vital to commercial aviation (Quantick 2001). An international system of definitions and codes has been developed

to facilitate the worldwide distribution of weather data, both before and during flight. During pre-flight planning, pilots study a range of coded meteorological information relevant to their intended route. This includes forecasts and actual surface conditions at their origin and destination airports, as well as en-route predictions and the situation at alternative landing sites. During flight, weather radar is continually displayed on the navigation display and pilots can listen in to ‘VOLMET’ radio broadcasts detailing weather conditions in their sector. As they approach their destination, pilots tune into ‘ATIS’ (‘Automatic Terminal Information Service’), which continually broadcasts information about actual surface conditions on the active runway (AERAD 2005).

METARs are routine coded weather observations that are updated every half hour at 20 minutes and 50 minutes past the hour31. These are complemented by aerodrome forecasts (TAFs) that are updated every six hours and describe the prevailing conditions at an aerodrome over a set period. Unlike METARs, TAFs contain information about the probability and likely timing of significant weather events (see Box overleaf). Although the content of these messages is dependent on atmospheric conditions, METARs always follow the same format and, as such, their production and distribution internationalises global weather forecasting in very significant ways (see Appendix 6). On 26th September 200532, NEMA’s METAR read:

**METAR EGNX 261220Z 3S014KT 2800 DZ OVC012 12/11 Q0991 NOSIG=**

Decoded, this reveals the conditions at NEMA (identified by its international code EGNX) at 12:20 UTC on the 26th of the month were a surface wind of 14 knots from a bearing of 350 degrees, horizontal visibility of 2.8km, and moderate drizzle. The sky was overcast at 1200ft, the temperature +12°C, and the dew point +11°C. The Aerodrome QNH (local atmospheric pressure) was 991mb, and no significant change was forecast for the next two hours.

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31 Louise Harker, ATCO, NEMA, personal communication (2005).
32 The date I was invited to the bmi regional crew room at NEMA.
Example of a TAF

FCUK31
EGLL 310624 13010KT 9000 BKN010 BECMG 0600 SCT015 BKN020 PROB30 TEMPO 025G40KT 4000 TSRA SCT010 BKN015CB BECMG 3000 BR SKC=

Decoded, this forecast UK bulletin 31 for Heathrow airport on 31st of the month, valid from 06:00-24:00hrs, reads: Wind 10kts from 130 degrees, visibility 9km, broken cloud at 1000ft, visibility becoming 6km with scattered cloud at 1500ft, broken cloud at 2000ft with 30% probability of temporary 40kt gusting wind from 025 degrees and 4km visibility with moderate thunderstorms and rain, scattered cloud at 1000ft, broken cumulo-nimbus cloud at 1500ft; visibility becoming 3km with moderate mist and clear skies

Source: Captain Keith Jones, bmi Heathrow (2005)

The development of satellite communications networks and the growing sophistication of meteorological modelling have also improved the speed and accuracy of aeronautical weather forecasts (Quantick 2001). During pre-flight planning, bmi regional pilots log into ‘Pilot Brief International’ (an online meteorological service for airline crew) to print off weather charts for their route. One pilot was heard to ask of his colleague, “Have you got the weather yet?” revealing the act of obtaining a weather forecast is a symbolic moment in the progress of any pre-flight brief. Without it, pilots cannot confirm the flight planning computers have correctly anticipated the effect of weather conditions on the flight and have recommended sufficient fuel is uplifted. This online information comes in the form of synoptic area forecasts and spot wind charts (see Figure 6.23). For longer flights, smaller scale charts are required. Called ‘sigmets’ (standing for significant meteorology activity), these charts typically show the location of areas of severe turbulence or other atmospheric conditions (such as volcanic activity) that may compromise flight safety (Figure 6.24). Sigmets are often overlaid on graphic depictions of the route an aircraft will fly, enabling crew to anticipate turbulence, uplift additional fuel (if required) and warn passengers and cabin crew of forthcoming turbulence (Figure 6.25).

Yet, for all the navigation charts and weather forecasts, one of the most important documents relating to navigation is the flightplan, which details the routing individual aircraft will follow. Flightplans are produced several hours before take-off and are automatically sent to all ATCCs along the route, enabling flow management
Figure 6.23 UK low level forecast (left) and spot wind chart (right) for 26th September 2005. Note how (unlike conventional weather forecasts that only detail surface conditions) these charts provide a forecast at different altitudes creating a ‘3D’ depiction of the weather.

Source: Courtesy of Captain Steve Carver, bmi regional, NEMA (2005)
Figure 6.24 Sigmet charts for Europe (top) and Europe, Middle East and Asia (bottom), 19th March 2006. While sharing similarities with conventional meteorological charts, signets contain additional information on areas likely to experience clear air turbulence (CAT), the altitude of the base of the troposphere, and the location, altitude, and strength of the jet stream.

Source: FO Lisa Wood, British Airways (reduced scale)
Figure 6.25 Sigmet showing the route of a flight from Heathrow to the Kuwait in relation to significant meteorological conditions observed/forecast between 10,000ft and 63,000ft.

Source: FO Lisa Wood, British Airways
computers to analyse traffic patterns and issue ‘slots’ to prevent or ease bottlenecks. Many scheduled services use recurrent flightplans and individual flightcrew rarely do any planning. As one British Airways pilot noted “We just fly where we are told to go”\(^3\). Flightplans are vitally important for scheduling (the maintenance of the aerial network) and navigation (the production of airspace) and, like virtually all other aspects of the industry, are coded according to international conventions (see Figure 6.26). This enables details of the route to be mapped (Figure 6.27).

Figure 6.26 Code mediating the production of airspace: flightplan for BMA237, NEMA (EGNX) to Brussels (EBBR), 20\(^{th}\) June 2005

<table>
<thead>
<tr>
<th>ZCZC YMA3S3 201235</th>
</tr>
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<tbody>
<tr>
<td>FF EGNXPZX EGNXZTZX</td>
</tr>
<tr>
<td>201235 EBBDMFP</td>
</tr>
<tr>
<td>(FPL-BMA237-IS</td>
</tr>
<tr>
<td>-E145/M-SRWY/C</td>
</tr>
<tr>
<td>-EGNX1635</td>
</tr>
<tr>
<td>-N0430F230 DTY A47 BENSU W70 VABIK UW70 KOK</td>
</tr>
<tr>
<td>-EBBR0052</td>
</tr>
<tr>
<td>-DOF/050620 RVR/300 ORGN/RPL</td>
</tr>
</tbody>
</table>

Source: NEMA ATC (2005)

The codes at the top detail the type of flightplan, when it was issued, the places in which it is effective, the aircraft type (an Embraer 145), and weight category (used for flight planning and radar sequencing). The flight is scheduled to depart NEMA at 16:35 and has requested an initial flightlevel of 23,000ft routing via DAV, BENSU, VABIK, and KOK into Belgian airspace. The flight is estimated to take 52 minutes. The information at the bottom details the type of equipment installed in the aircraft and the minimum visibility in which it can land (in this case the RVR (runway visual range) must be greater than 300m).

While it is recognised that train drivers develop detailed cognitive maps about the location of signals, emergency reversing points, unguarded level crossings, and known suicide spots (see Heath et al 1999); and taxi drivers (Skok 2000), motorists (Brown and Laurier 2005), and hikers (Sheffer 2004) develop tacit knowledge about

\(^{33}\) BA First Officer Lisa Wood, British Airways, personal communication (2006)
Figure 6.27 A flightplan (top) and a cartographic representation of the encoded route (bottom) illustrate the different ways in which airspace can be (re)presents. Note how the division of the sky into different sectors and zones of control cuts across national borders, creating a pattern of aerial jurisdiction that is suspended above, and bears only passing relationship to, the territorial claims of nation states below.

Source: FO Lisa Wood, British Airways
local street layouts and environment, no work has been conducted into whether airline pilots also develop such understandings about the routes they fly, though interviews with bmibaby, bmi regional and British Airways pilots indicate this could be a productive area of inquiry. Indeed, as NEMA’s bmi regional pilots always fly near-identical services, they have acquired specialised knowledge about the routes, atmospheric conditions they are likely to encounter, and the layout of airports at either end. As Holt Thomas (1920 p29) remarked:

‘aviators who fly regularly on a given route will begin to know their landing-grounds and guiding signs just as an engine-driver gets to know the “run of the road” when he is taking a train daily over the same given section. This familiarity...is very useful to the aviator, and a great assistance to him when weather conditions are bad.’

Indeed, even in an era of satellite navigation and automatic pilots, the view from the window remains important: one pilot commented “I know, for example, if we pass Milton Keynes on our right, we are going in the right direction”. Once airborne, pilots complete a number of ‘housekeeping’ tasks associated with navigation, comparing their predicted and actual arrival times at various waypoints and keeping track of fuel burn, information which is entered onto navigation logs as the flight progresses (Figure 6.28). This information is then collated at the end of the flight and analysed at company headquarters with the aim of improving efficiency and monitoring pilot practice.

6.6 Summary

This chapter has considered the routine practices of flying aircraft via the coding, visualisation, and interpretation of airspace. Based on empirical observation of recurrent pilot training sessions in full-motion simulators and analysis of genuine flight-phase related documentation, the geographical dimensions of primary flight displays and practices of navigation have been discussed. In so doing, the chapter has documented how flying a commercial aircraft is an inherently geographical act, where the interdependence and interaction between multiple encoded infrastructures, technologies, and practitioners are integral to the production of airspace.

34 Captains Steve Carver and John Evans, bmi regional NEMA, personal communication (2005).
35 First Officer Nick Dunn, bmi regional, personal communication (2005).
36 Captain Steve Carver, bmi regional NEMA, personal communication (2005).
Figure 6.28 Extract of an annotated flight navigation log showing waypoints, altitudes, distances, elapsed time, fuel burn, and weather information. Interestingly, one senior Captain revealed that he can mentally reconstruct a flight's progress and conduct from the codes and annotations on the navigation log even if he was not present on the flight-deck. Such ability derives, in part, from his experience of flying the route, but also from the use of universal codes that scripted and recorded the journey.

![Navigation Log Image]

Source: Courtesy of Captain Steve Carver, bmi regional, NEMA (2005)
systems whose complexity and power are much greater than the sum of their parts' (Dodge and Kitchin 2005 p 164).

Furthermore, it has demonstrated that, despite strict regulations governing how and where individual aircraft can fly, flightcrew maintain a significant level of discretion that enables them to bring airspace into being in different ways according to changing contingencies. Thus, no aircraft uses the sky in exactly the same way – every manoeuvre is performed slightly differently from that of a colleague even though safety regulations dictate that they all fall within the limitations of standard operating procedures. Far too often, however, human geography has been indifferent to the ways in which people use technology to produce space (see Hillis 1998). By and large, geographers have treated aircraft as objects to be observed, their routes plotted, their service frequencies analysed, and, in so doing, have disassociated route networks from the everyday practices of piloting and navigation that produce them.

While some may argue that the introduction of new flightdeck technologies means airspace is mediated less and less by human discretion, this chapter has shown how airspace is continually brought into being and actively negotiated in new ways through the combined agency of technology and pilot practice. As one pilot remarked, "technology is great, when it works...when it doesn't, I like to know that I can compensate for any system failure by bypassing these supposedly 'infallible' electronic gubbins [sic] to get my aircraft down in one piece". Other pilots also alluded to how their increasingly computerised workplace environment has, conversely, increased individual discretion and responsibility, "sure, the computer can do it better than me, but now I have a choice whether to be lazy or do it myself." Very often, such choices are informed, in part, by the near parental interest pilots take in their aircraft. One commented, "It sounds crazy, but pilots do develop a relationship, a mutual understanding if you like, with the airframes they fly". As if in conformation, several flightcrew were heard to ask if the flight management computer on "alpha fox" was still "misbehaving" or whether engineers had fixed the intermittent fault with "zulu india's" weather radar, while others discussed the relative

37 Source: anonymised field diary (2005).
38 Source: anonymised field diary (2005).
39 Source: anonymised field diary (2005).
advantages of Rolls Royce vis-à-vis General Electric powerplants, noting that while the former takes "ages to spool up" they nevertheless reward you "with a real kick in the back" if managed effectively\textsuperscript{40}.

Such conversations, though seemingly banal, go a long way towards showing that the formation of code/space on the flightdeck is not universal or technologically determined (see Dodge and Kitchin 2004a). Instead, it is contingent upon the embodied performances and practices of individual pilots, who use their discretion and experience to interact with nominally identical, yet subtly different, systems and equipment.

\textsuperscript{40} Source: anonymised field diary (2006).
Chapter Seven

Discussion and conclusion

'Secondary airports and airfields have rarely been the subject of intensive study. Many of them...play an important role in air transport...Our preoccupation with the major sites should not blind us to the part played by the smaller airports and airfields. They will provide an absorbing subject to anyone with the inclination to study them.'

Sealy (1957 p195)

7.1 The production of UK airspace

Following the first scheduled passenger flight between England and France in August 1919, the production and control of global airspace became a matter of intense political concern. Following the ratification of many of the proposals debated in Chicago in 1944 and the commencement of regular international air services after the Second World War, access to (and control over) airspace became a key geopolitical issue and individual nation states sought to seize control of as much airspace as possible (see Chapter Five). During the twentieth century, the sky was progressively cleaved into areas of sovereign control, and further subdivided into discrete 'blocks' airspace that were subject to different rules and regulations. Under the auspices of national defence and air safety, the UK, in common with many of its European neighbours, created separate areas for military and civilian air traffic, a decision that requires commercial flights to circumnavigate large areas of restricted airspace and negotiate complex approach and departure routes.

While this structure proved adequate for volumes of air traffic in the twentieth century, the present airspace structure now arguably promotes the very type of unwanted aerial encounter it was designed to prevent, with many questioning the spatial logic of requiring aircraft to converge at a few navigation beacons and forcing them along strictly defined airways (Ogilvy 1989). While the EU's 'Flexible Use of Airspace' programme aims to abolish distinct areas of military and commercial airspace in upper airspace, and improve airspace efficiency by enabling aircraft to fly the shortest straight-line route from A to B, technological and geopolitical obstacles
currently prevent its adoption at lower altitudes. Annexing areas of Class G airspace and ‘bolting them on’ to existing sectors of controlled airspace thus remains one of the easiest ways of accommodating increased traffic flows. Yet, while this procedure makes economic sense and undoubtedly offers attractive short-term solutions to air traffic congestion, the policy is increasingly being challenged both ‘in the air’ by different airspace users and on the ground by communities who oppose such changes.

This research has demonstrated that commercial aviation is a vast consumer of (air)space, and has suggested that airspace production is an inherently geographical and spatial act. However, in a similar vein to Zook et al (2004 p158) who suggest the relative ‘invisibility’ of Internet infrastructures has negated any discussion of the network’s materialities or spatialities, the lack of geographic studies of airspace production could lead to the erroneous assumption that airspace is somehow aspatial or non-geographic. Empirically, the research has shown that it is misleading to talk of airspace being divorced from terrestrial geography, as pilots and controllers continually consider the topographical and cultural characteristics of the ground they are overflying, even if the majority of passengers are oblivious to the practicalities of where and how they fly. Such notions surrounding the physical ‘embeddedness’ of airspace are important not only because of their highly uneven geographical distribution and resulting socio-cultural implications in terms of (in)equality, air pollution, and deteriorating acoustic climate, but also because of increasing concern about the network’s vulnerability to terrorist attack, with damage or threats to grounded nodal points (airports) and/or the network’s mobile components (aircraft) causing major disruption (Leppard et al 2006; Webster et al 2006). Batty’s (1993 pp615-616) discussion of cyberspace as a ‘new kind of space, invisible to our direct senses, a space which becomes more important than physical space itself [and which is] layered on top of, within and between the fabric of traditional geographic space’ is, therefore, also an appropriate descriptor of airspace.

The implicit positioning of airspace, and the air routes within it, in extant literatures as ‘conduits’ or ‘spaces of flows’ in which aircraft fly thus negates serious considerations of the everyday socio-spatial practices that work to (re)produce them. As Hillis (1998) remarked with reference to telecommunication networks, human geographers typically focus on the fixed infrastructure or the distributive functions of
a network and rarely look 'behind the scenes' to understand how such systems work. Similarly, the literature review identified certain lacunae that, given present political and environmental controversies surrounding aviation growth, demand considered empirical and theoretical investigation. Of particular significance is the paucity of geographic research into the everyday, yet largely 'hidden', spatial practices of Air Traffic Control and piloting and how they, often in within a framework of local community opposition, collectively reproduce airspace.

Using innovative data sources, this thesis demonstrates the importance of developing dual understandings of airspace – both from the perspective of professional practitioners and people on the ground who unwillingly ‘consume’ the airspace they create. By detailing how the development and widespread utilisation of new aeronautical technologies has resulted in an increasingly ‘aeromobile’ world in which air transport has become a familiar mode of travel for many, and by exploring the changing ways geographers have approached the study of aviation, the literature review revealed that while much has been written about evolving airline networks, airport hubs, and aviation’s capacity to ‘shrink’ global space-time, airspace remains an under-researched and under-theorised site of human activity. Where it has been considered, it has often been included within studies of anti-airport expansion protest and concerns about aircraft noise, negating any detailed investigation into how airspace is socially produced, contested, and maintained through ongoing practices of opposition, negotiation, and management. Indeed, current debates surrounding aviation growth have focused primarily on the politics of airport expansion while questions of future airspace provision have been largely overlooked.

7.2 Understanding NEMA's airspace

Using the controversy surrounding the reorganisation of NEMA’s controlled airspace, this thesis suggests that a more holistic understanding of airspace production requires a knowledge both of (inter)national aeronautical law and a willingness to engage with all stakeholders involved in, or affected by, the production of different airspaces (including local community groups, air traffic controllers, commercial airline pilots, airport authorities, regulatory bodies, and local Councils). There are important reasons for focusing on what, at first, appears to be a very local issue, as the political, economic, environmental, and social ramifications of NEMA’s airspace expansion
reverberated well beyond the immediate vicinity of the airport. The airspace change affected not only how commercial aircraft use the skies around NEMA now and in the future, but also how the airspace around Birmingham, Coventry, Doncaster-Sheffield, and Manchester airports is used. NEMA’s enlarged airspace also impacted on General Aviation users, as it forced them to fly elsewhere by restricting the number of light aircraft movements permitted and severely curtailing the number of training flights accepted. The drawing of new boundaries around NEMA’s controlled airspace could thus be understood as an act of protection (for the airport and aircraft using it) by the exclusion of unwanted (i.e. less lucrative or potentially dangerous) aeromobile others.

The airspace change also changed national air traffic control procedures, as it enabled outbound aircraft to liaise directly with London Control upon departure to expedite their journey (as opposed to the old regime under which aircraft were handed to Manchester ATCC first). This had the knock-on effect of enabling Manchester controllers to concentrate on their own traffic and helped London ATCC slot NEMA traffic into the en-route airways more easily\(^1\), but meant controllers at NEMA had to learn to ‘see’ the sky around the airport and control the aircraft within it differently. NEMA’s airspace reorganisation also affected pilot practice, with commercial flightcrew having to learn new departure routes and arrival procedures (particularly in respect of continuous descent approaches) to ensure they remained ‘on track’ and did not incur fines for excessive noise or route deviation. The research also highlighted the critical importance of engaging local communities with airspace change proposals from the outset, thereby facilitating productive dialogue between the airspace change sponsor and local communities. Hopefully such policies would help avoid some of the acrimonious exchanges that occurred between ELVAA supporters and NEMA.

### 7.3 Expanding NEMA’s airspace

By determining the old configuration of controlled airspace at NEMA from airport archives, aeronautical publications, and interviews with current airport personnel, and comparing them to the new airspace regime, it was possible to map the routes and, in light of personal knowledge of the social geography and physical topography of Leicestershire, describe the characteristics of the ground below the old and new

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\(^1\) Graeme Ford, Manchester ATCC, personal communication (2005).
flightpaths. However, Chapter Three was not simply an exercise in locational analysis, as NEMA’s motivation for requesting the airspace reorganisation was bound up in complex economic and political restructuring that went far beyond the confines of the airport. Here, wider issues of privatisation, deregulation, and liberalisation are implicated, as these facilitated the sale of the airport, first to National Express in 1994 and then to the Manchester Airport Group (MAG) in 2001. The new owners quickly realised that they could not consolidate the airport’s position or (more significantly) deliver future growth within the limitations of the existing airspace structure. The commercial ambitions of MAG meant they sought to extend the range and frequency of services from NEMA. Part of this programme required physical extensions to the passenger terminal and airside infrastructure (through the provision of larger cargo sheds, resurfaced taxiways, and better airfield lighting), but the airport did not control enough aerial space to accommodate all the flights it hoped to attract.

Since the airport opened as a commercial facility in 1965, expansion rhetoric has always been couched in terms of the significant economic benefits the region would enjoy as a result of a larger airport (through improved employment opportunities and the prospect of inward investment that a high profile airport facility might bestow). However, by the turn of the Millennium, increased competition from neighbouring airports at Birmingham, Coventry, and Doncaster-Sheffield (the latter two of which only began commercial operations a few years ago), meant NEMA had to work harder to win and retain airline and passenger custom. Under increased pressure to develop a pleasant experience for passengers and an efficient service for airlines and have the aerial infrastructure in place to facilitate expansion, NEMA conducted an ‘air grab’ on the previously uncontrolled Class G airspace to the east of Leicester and over southern Derbyshire and southwest Nottinghamshire. By claiming ‘ownership’ of and exclusive control over this additional airspace, NEMA ensured that not only could the airport accommodate future growth but, as significantly perhaps, prevent competitors from using this space to grow at NEMA’s expense. However, while the plans for the airspace reorganisation conformed to central Government policy regarding routing flightpaths away from densely populated urban areas (see DfT 2003a), the local debate centred on where the new boundaries were drawn. As Pickles (2004) has noted, the drawing of a line or a boundary is an inherently geographical and spatial act, and differing interpretations surrounding the placing of these invisible ‘lines in
the sky' above NEMA raise interesting questions surrounding the representation of space and the 'right' of different groups to claim ownership over it and exclude others from using it.

In accordance with CAA regulations, NEMA undertook a lengthy period of public consultation with affected parties, including airlines, unitary authorities, local Parish Councils, and residents about the planned changes. However, in a genuine oversight, the airport overlooked Oadby and Wigston Borough Council (in Leicestershire), and neither informed them of the plans or give them a opportunity to oppose them, even though the new airspace incorporated areas above the borough. This handed a legitimate grievance to a group of articulate, relatively wealthy, politically aware, professional individuals in rural east Leicestershire, who accused NEMA of devious or underhanded planning tactics. Undoubtedly, one factor that helped sustain the ELVAA/DEMAND protest was the presence of members with legal, political, and aviation expertise who were able to provide detailed insights into the proposals and decode the language of official documents. The chairman, Steve Charlish, holds a commercial pilot's licence, while other members of the committee included a practicing solicitor, an academic, and a property developer, all of whom had personal interests in preserving the environment of rural Leicestershire.

Under their leadership, local opposition was generated and coordinated under the banner of 'ELVAA' (East Leicestershire Villages Against Airspace). Though membership of, and support for, the group fluctuated over time, supporters comprised both life-long county residents and a new generation of 'countrified commuters' who had bought into the area because of its 'unspoilt countryside' and 'peace and quiet'. Ideas of rurality and rural living were thus strong motivating forces as protesters strove to protect their homes (and by, implication, their livelihoods, families and investments) from the acoustic and visual incursion of unwanted and highly aeromobile 'Others'.

Personal attendance at public meetings and an examination of local newspaper articles revealed the issue of tranquillity (or perceived noise intrusion) was an especially sensitive topic because of the diurnal, or temporal, dimensions of air traffic using the new flightpaths. While the airport sought to increase all aspects of its operation, night
flying was discovered to be particularly contentious. NEMA's lack of designation (or any other nationally-audited operating limitations), unrestricted 24-hour operation, and central UK location, made it an attractive prospect for freight companies. The logistics company DHL even moved a substantial part of their northern European operation from Brussels to NEMA to avoid the financial penalties they faced for breaching Belgian noise restrictions. Consequently, for the first time, residents of east Leicestershire claimed to be disturbed by low altitude freight flights using skies above them all through the night. Freight flights were perceived to be particularly intrusive because, not only are freight aircraft typically older and noisier than their passenger counterparts, but the lower levels of ambient noise in the countryside at night allegedly make noise peaks more disruptive. Moreover, by the time the aircraft pass over east Leicestershire, they are flying under 10,000ft, and legally have to be illuminated by flashing anti-collision strobes, green and red navigation lights, and, when on final approach, bright white landing lights, making them not only audible, but highly visible against the night sky. The extent of night flying at NEMA was confirmed through personal analysis of Air Traffic Service records which showed that in any 24-hour period, up to 65 aircraft could be operating at night (i.e. between 23:00-07:00 local time). This freight traffic was predicated on NEMA not being designated, a fact ELVAA supporters claimed was scandalous. The volume of night flights and dissatisfaction with NEMA's complaints procedure ultimately led to 'ELVAA' changing its name and emphasis to 'DEMAND' (Demand East Midlands Airport is Now Designated). In so doing, the group sought to be more geographically inclusive (embracing all protesters who were affected by the new flightpaths) and simultaneously raised its political profile, rallying local MPs and Councillors, from all political parties, to their cause. However, night flying represented but one issue. Drawing on the powerful rhetoric of climate change and environmental desecration, supporters articulated their displeasure at the urban population of the East Midlands jetting off on holiday to the Mediterranean for a weekend break, decreasing their quality of life and disturbing the global climate as they did so. This resentment of the aeromobile 'other', though mainly implicit, arguably had a class dimension, which led the airport's supporters to claim that the NIMBY attitudes of a minority of residents were selfish and outdated. Nevertheless, despite increasingly acrimonious exchanges on the letters pages of local
newspapers and the DEMAND website, the rhetoric emanating from DEMAND steadfastly remained “why should ‘they’ be able to disturb ‘our’ tranquility and quality of life?”

This debate also raised the vexed question of objective versus subjective measurements of noise. While NEMA monitors aircraft noise and fines offenders who exceed stipulated limits, protesters maintain that the thresholds are not low enough. The empirical research in Chapter Four discovered that the airport receives multiple complaints from a few highly sensitised and motivated individuals, yet there is no accurate way of determining whether a lack of formal complaints from other people indicates a lack of real personal grievance or noise disturbance. More work is clearly needed to discover whether the ‘silent majority’ of east Leicestershire (and other areas affected by aircraft noise) perceive aircraft noise as a disturbance and, if so, determine the reasons why they choose not to complain.

The case study of NEMA’s changing airspace, and DEMAND’s response to it, shows how airspace is actively contested and negotiated both ‘on the ground’ by groups who oppose its use and ‘in the air’ on a day-to-day basis by controllers and pilots. Though usually peripheral to the (re)production of airspace, in this example, DEMAND protesters were a vital component of the narrative because they, through determined action, forced a second period of consultation and revisions to the original plans. Consequently, communities on the ground are an important (and often overlooked) component of airspace production.

7.4 Key theoretical advances
This thesis has investigated the political and technical practices that resulted in the transformation of airspace above NEMA. In so doing, it has identified a new way of ‘doing’ geographical research on airspace and has highlighted some important theoretical issues:

As Chapter Two detailed, air travel has metaphorically shrunk the globe for millions of passengers every year and has had pervasive effects on societies and economies, changing patterns of international mobility and human migration, creating new trading blocks and political allegiances, promoting face-to-face cultural interaction, and
fundamentally changing the nature of space and place. However, the rising demand for air travel means airspace now involves a complex range of organisational, social, economic, cultural, and environmental issues. As Ogilvy remarked nearly twenty years ago, the rising demand for aeromobility has resulted in ‘crowded skies, hijacking, [the] saturation of holiday resorts, air and noise pollution, [more] land needed for airports, litigation...and cultural imperialism’ (Ogilvy 1989 p285).

By reviewing the chronological development of geographic research on commercial aviation, this thesis has shown how the development of commercial passenger flight in the 20th century demanded the extension of traditional Cartesian understandings of territory to embrace the third (aerial) dimension, and how this, in turn, necessitated the formation of new transnational forms of regulation and governance. During the twentieth century, the sky became a three-dimensional space layered with strategic military, commercial, and political strata. New legislation was developed, and invisible boundaries inscribed upon the sky for reasons of national defence and economic protection. Over time, a plethora of bi-lateral and multi-lateral international agreements were signed, which stipulated which airlines could fly, where they could land, and how often the services could operate. This new discourse of ‘aeropolitics’ was a source of much political contestation, as individual nations sought to cede as little and gain as much control over airspace as possible, limiting access to certain areas and preventing certain types of aerial movement. The conquest of the skies added a third dimension to human experiences of time, place, and space, rendering extant geographical accounts, that describe how people move about on the earth’s surface (or, at most, only a few storeys above it), inadequate. It also required the introduction of a new vocabulary of aeronautical terms, including ‘flightpath’, ‘airway’, ‘control zone’, and ‘flightlevel’, to describe both complex airspace structures, and their use by aircraft. For the first time, aviation forced an awareness of the ‘depth’ or ‘height’ of the sky and the altitudes, trajectories, and operational restrictions of the airlanes within it and, as a result, airspace was increasingly quantified, delimited, and controlled.

The research has also described how and why, in an effort to monitor the sky for signs of aerial invasion, radar was developed as a new tool of electromagnetic surveillance. This equipment was subsequently adapted for use by commercial aviation to regulate
access to airspace and, in conjunction with radio transmissions, control of increasing numbers of aircraft to ensure the integrity and safety of the system. In paradigmatic terms, this marked a shift from an implicitly structuralist approach to the study of airspace (in which the administrative and organisational dimensions of airspace management within a highly regulated capitalist system are examined) to a more post-structuralist stance based on ideas of surveillance and control. This theme was developed in Chapter Five to posit that ATC could be understood as an expression of centralised panoptic state control that developed from a natural social desire to extend and control territory. The fact that airspace is subject to such intense control and standardisation can be understood as an attempt to minimise the inherent risks associated with air travel. The NEMA case study illustrated the importance of looking at the local manifestations of global governance. Indeed, Tomlinson (1999) argues that processes of globalisation often find their most important expressions in the transformation of localities, something Sealy (1957) similarly alludes to in the quotation that opened this chapter. The ‘global’ nature of airspace (re)production has thus been shown to have very ‘local’ effects, which are often contested and challenged by those on the ground who refuse to allow themselves to become subordinated to a global airspace logic without a fight. Through airspace, organisations and institutions can extend their influence in time and space beyond their immediate environs, but, it is important not to assign simple causal or deterministic relationships to airspace (re)production. Instead, human geographers must recognise that airspace, though a product of the same professional practises, does not have a universal impact, and that the unique social, political, and cultural characteristics of individual neighbourhoods will result in airspace being experienced in different ways by different people in different places at different times.

While complex interactions between technology, society, space, and global/local scales are not a new phenomenon, and are by no means unique to air travel, this thesis has identified a set of practices which are particular to the (re)production of airspace and differ from processes that facilitate terrestrial transport networks or telecommunication systems. As Graham and Marvin (2001) have noted, western society has become so accustomed to using spaces of mobility that the practices that work to produce them (and their social relevance) are often overlooked. Some have suggested their apparent banality renders them ‘invisible’ to academic scrutiny. As
Brown and Laurier (2003) note, while the rhetoric of a ‘space of flows’ has great impact and drama, it fails to explain how those flows are initiated and sustained. Similarly, the author discovered that there is also the potential to become so involved in the practices and protocols of ATC or the techniques and technologies of piloting, that one loses sight of the different ways airspace is produced and experienced in different locales. Arguably, the details of what happens in local places as a result of the (re)production of airspace above them is as important as understanding how airspace is ‘made to work’ in the first place. For example, it has shown that airspace not only induces new forms of corporeal mobility but also stimulates new expressions of social activity, both on the ground and in the air. For Brown and Laurier (2003 p4 original emphasis), the relative position of a person or a place vis-à-vis the network is important, for the latter ‘comes to be more important than the individual place – space dominates over place’.

In summary, airspace can usefully be understood as a product of numerous interlocking practices that operate at a variety of spatial scales and manifest themselves in different ways in different places thought time, encompassing everything from anti-airport expansion protests to the ‘hidden’ geographies of ATC centres and aircraft flightdecks. The (re)production of airspace should not, therefore, be understood as the product of some hierarchical ‘top-down’ relationship, but the product of a space that is constantly challenged and negotiated by ‘local’ people on the ground who are disturbed by the use of the sky above their homes and communities by commercial flights. As Kelly (1999 p396) pertinently asks ‘what is a global influence that isn’t in some way ‘localized’. And how many ‘local influences’ are really bounded in such a neat way?’ NEMA’s airspace must thus be theorised not as one social space but many, constantly negotiated and brought into being by the different commercial imperatives, operational strategies, and local loyalties of a multitude of users and agents. Arguably, until all these diverse views are taken into consideration, geographers will be unable to fully answer that most crucial of issues of why airspace production is often controversial. It is a question that, with more work, I believe geographers will be well placed to answer.
7.5 Empirical contribution to existing research

This thesis proposed a new geographical research agenda for studies of airspace. In so doing, it introduced several data sources that are ‘new’ to English-speaking human geography. These include Flight Progress Strips, aeronautical charts and related navigation publications, and personal observation of both controllers at NEMA and other sites and pilots undergoing recurrent flight training in aircraft simulators.

The empirical findings from Chapters Five and Six showed the importance of incorporating ideas of contingency into geographical understandings of airspace (re)production. In particular, the need for controller and pilot discretion within set procedures and routes was emphasised. As the observation work revealed, the sky is not an inert medium, and changing atmospheric conditions mean no two flights using NEMA’s airspace are ever the same. Consequently, the maintenance of a safe aerial network requires both pilots and controllers to continually monitor the sky and make decisions about traffic flows, turbulence, visibility, and flight profiles. Furthermore, this work highlighted the continued importance of the human actor in a system that is increasingly mediated by technology. During a simulated incident that had the potential to degenerate into an emergency in a matter of seconds, I was reminded of the importance of pilot and controller discretion in maintaining the safety of UK skies. The practices of ATC and piloting are thus of equal importance in the (re)production of NEMA’s airspace; neither should be studied in isolation, and the complementary nature of these practices must not be overlooked.

7.6 Future research directions

This thesis has provided an initial analysis of the geographies of UK airspace (re)production, however many potentially worthwhile lines of inquiry remain. The theoretical background and empirical techniques used in this research could be employed in other airspace disputes, whether in a local, national, or international context, to see what lessons can be learned from the NEMA controversy in planning future amendments to controlled airspace. In particular, it is suggested airports (or the CAA in the case of higher-altitude en-route airspace reorganisation) must investigate the socio-economic characteristics of the areas likely to be affected by airspace changes before preparing detailed plans. In this area alone, geographers have much to contribute.
Within a UK or European context, it may be necessary to examine the rise in business aviation and the unique demands these services will undoubtedly place on the provision of airspace, as businesspeople seek to avoid the airspace and airport delays associated with commercial passenger flight by chartering or owning their own executive aircraft and flying it between smaller, less congested, airports which are nevertheless near major cities and airports (for example, it would be beneficial to explore the difficulties associated with integrating large passenger aircraft using Heathrow with smaller, lighter airframes using neighbouring Northolt aerodrome into the airspace above west London\(^2\)).

On a European scale, it would be interesting to look at the implications of the fragmentation of European airspace administration that is being effected by certain European Governments through the partial or total privatisation of their Air Traffic Service providers (such has been effected in the UK with NATS and with Switzerland’s ‘Sky Gate’) at a time when Eurocontrol is pursuing the European-wide Single European Skies (SES) initiative with the aim of improving airspace efficiency and coordination by ‘freeing’ European skies from national regulatory constraint. Such work would undoubtedly complement Stephen Graham’s work (2001a, 2001b) on the ‘splintering’ or commercialisation of urban utility services, transportation networks, and communication systems. Allied to this, it may prove worthwhile to explore both the political economy of airspace charging, exploring who administers and regulates it, where the money is invested, and whether individual countries and airlines (and, by association, passengers) are getting ‘value for money’, together with the environmental implications of the current airspace structure. The Virgin Atlantic chairman Sir Richard Branson argued the “mess” of European airspace is “punishing the environment” and suggested that revolutionising the existing airspace structure would ‘save’ 150m tonnes of carbon every year (cited in Wills and Nicholls 2007 p31). Clearly, optimising ATC routings would reduce track mileages and lower the quantity of pollution emitted per flight, and economic geographers could, no doubt, quantify such changes in terms of the time/cost savings associated with reducing delays and speeding-up flight times.

\(^2\) Source: Colin Andrew, NATS, personal communication (2006).
Political geographers could also make valuable contributions to studies of airspace geopolitics, both in a commercial and a military context. Political fragmentation has long been identified as a barrier to free flight, and while certain countries enjoy reciprocal flying rights, access to airspace is still used as a political negotiating tool. In October 2006, Russian officials delayed the inaugural flight of a new service between London and Hong Kong by refusing to honour the overflying rights Oasis Hong Kong airlines had purchased (Fresco 2006), while military restrictions around oil installations in the Middle East mean commercial aircraft have to fly costly circuitous routes to avoid them. The severe penalties for ignoring these restrictions are emphasised in the NOTAMs (Notices to Airmen) pilots receive before a flight. In Kuwaiti airspace, for example, flightcrews are reminded that:

‘Acft [sic] shall not fly lower than 6000ft within 1.2nm of the oil terminals without prior approval. Coalition Forces on and around the oil terminals are prepared to take defensive measures incl [sic] the use of deadly force against any acft [sic] whose identity or intentions are unknown and which pose a threat to coalition maritime security forces/legitimate shipping present and the oil terminals’

NOTAM (2005), source anonymised.

Similarly, when entering Uzbekistani airspace, pilots ‘must establish contact with Tashkent control at least 10mins prior to crossing the Uzbekistan state boundary both eastbound and westbound’. Failure to comply ‘may result with acft [sic] being refused entry’ (NOTAM 2005). Diplomatic relations also determine the suitability of emergency landing grounds. For example, UK pilots, flying UK-registered aircraft, are instructed never, even in a dire emergency where hull-loss is imminent, to divert to Iran or other ‘unfriendly’ countries in the Middle East where the UK Government considers the aircraft and its occupants would be at considerable risk of harm. Given increased concern about aviation security and international terrorism, there is also a need to examine new practices of racial profiling and social sorting as airports seek to differentiate those who can enjoy unfettered access to airspace and those whose opportunities to travel by air are more restricted. As the novelist David Lodge (1996 p2) remarked, the airport ‘is about movement; but it is also about separation, categorisation, segregation. It is almost obsessively concerned with dividing people into classes and groups and making sure they don’t come into contact or get mixed up with each other’. Clearly, there is much that needs to be said about the agents that

3 Source: anonymised field diary (2006).
assess the threat individual passengers pose, the biometric techniques that are used to identify them, and the political agendas that shape them. There is also a need for considered debate about the use of armed ‘skymarshals’ on some services. Although this thesis has focused principally on the day-to-day (re)production of airspace, there is clearly a need research the ‘deep’ institutional practices that formulate aeronautical law and the geopolitical imperatives that underpin the implementation of new security directives.

From a cultural or social geographical perspective, it could be argued that the standardisation of ATC and pilot practice has effectively silenced any discussions of gendered difference – airspace was historically encoded and produced by men, for men. This voyeuristic, authoritative, even overpowering gaze, projected male fantasies onto the female form, with aircraft traditionally given female names and treated as disobedient flighty forms that had to be wrestled into submission (c.f. Hailey 1968). Yet despite being the sole preserve of men for many years, increasing numbers of women have found employment as controllers and pilots, and further investigations could usefully explore whether male and female practitioners ‘see’ the sky differently. The value of such work became evident during a conversation with a female ATCO at NEMA who revealed that while her male colleagues expressed excitement about the arrival of unusual aircraft types and found excuses to drive out on the apron to see them, female controllers were less interested in the spectacle of elderly Lithuanian-registered Antonovs and were more concerned with the practical considerations of handling what were often much slower and less agile airframes piloted by crews with a limited command of English. Indeed, she implied there was still an element of childish ‘boys and their toys’ about ATC, which female controllers found vaguely amusing and were (generally) happy to indulge by staying at their posts while their male colleagues piled into cars and drove onto the airfield. Similarly, a Training Captain commented on how male and female recruits, undergoing their initial flight training, approach new tasks in noticeably different ways and experience difficulty with different components of the course.

Finally, there is evidently scope for more work on how new technologies (such as ground-controlled unmanned aerial vehicles, new satellite positioning systems, communication technologies, and autopilots) will change the ways in which airspace
is (re)produced. In this regard, Dodge and Kitchin’s work (2004a, 2004b, 2005) on the formation of different code/spaces and the pervasiveness of computer technologies in everyday life will prove invaluable to human geographers working in this field. In light of this assertion, and to stimulate further dialogue about human discretion on the flightdeck, human geographers must continue to investigate how aircraft technology helps pilots realise their intentions in time and space and how, by doing so, they continually bring airspace into being. Additional research could also examine the geographies of flightcrew communication (how and when pilots talk, and to whom) and flightdeck organisation (how they manage the various automated systems and how they interact with these technologies), as this may reveal much about the processes that mediate the production and control of airspace.

In all cases, there is clearly significant potential for geographers to liaise closely with colleagues in industry and Government and help inform debates about air travel and airspace policy. If the interest in, and willingness to help, shown by numerous individuals in airlines, airports, and ATCCs towards my research is anything to go by, the future for collaboration between academic researchers and industry professionals is bright.

7.7 Thesis summary
Just as it has always been acceptable for physical geographers to include a study of rock formations and the historical/geological processes that have created the patterns they find under the earth’s surface, the development of commercial aviation (a comparatively recent phenomenon) has enabled a similar extension upwards (see Chapter One). As a result, it is now accepted that the traditional focus of geography – writing about the earth and everything on it – has legitimately been expanded upwards to include the sky above. However, as flying is such a recent development, significant gaps remain in the knowledge base, especially with respect to understanding the processes that create the patterns of airlanes and flightpaths above the UK. Chapter Two thus demonstrates not only what geographers have managed to achieve in a short time frame, but, more importantly in the context of this thesis, what they have not yet done in terms of analysing the ways in which airspace is administered by international protocols and produced by air traffic controllers and airline pilots. This historical context furthermore reveals that when surveillance was the prerogative of people in
power (as with Imperial Airways in the 1920s and 1930s), there was little contest over the use of airspace, either on the ground or in the air.

Chapter Three performs several important functions; it provides the setting for the present study, which attempts to fill some of the gaps identified in the extant geographical literature on air travel, and details what happened ‘on the ground’ when an attempt was made to ease the congestion in the aerial space above and around NEMA. Chapter Three also raises important philosophical challenges about the nature of space and place and the suitability of using scalar terms such as ‘global’, ‘regional’, and ‘local’ in an era of mass international aeromobility, and shows how the spaces of an airport are simultaneously ‘grounded’ (both literally and metaphorically) and ‘airborne’. NEMA’s airspace change proposal, while developed ‘on the ground’ by planners and air traffic controllers, had significant implications for both the airport itself (in terms of additional passengers and flights), and the aerial space above it. Chapter Four, which details the local community response to the airspace change follows, and marks a significant move into studies of ‘extra-geographical’, i.e. aerial, territory.

The reasons why the airspace above NEMA was so congested and therefore contested depended, to a large extent, on how it was ‘produced’ and ordered by practices of air traffic control. It was imperative to explore how the spatial regimes of ATC ‘worked’ to produce particular airspace configurations above and around the airport. This necessitated detailed archival and observational fieldwork in different ATCCs to understand not only how ATC at NEMA worked, but how it was intimately tied into the national airspace network, and the similarities and differences in airspace production at one site.

This investigation led to a descriptive chapter on flightdeck geographies, in recognition that the airspace ATCOs produce is then used and made real by pilots. This is the equivalent of what used to be termed the pilots ‘Behavioural Environment, or the space in which and through which they fly, although the vocabulary is now all about ‘code/spaces’ and ‘virtual’ reality. As Chapter Six demonstrates, airspace is mediated on the flightdeck by a small number of highly trained actors whose work has received surprisingly little attention from academic geographers. Not only do airline
pilots make airspace real, they make the spatial experience of flight real for millions of travellers every year. Thus, just as Chapter Two suggested, airlines seek to make flying fun, exciting, relaxing, or carefree through the use of in-flight magazines, corporate insignia, in-flight service, and the attractiveness of their cabin crew, Chapter Six argues that one of the most significant ways airlines' 'produce airspace', thanks to pilots on the flightdeck who physically transport passengers though the sky, has been overlooked for too long. Chapters Five and Six also show how airspace is contested 'in the air' (requiring short-term collision avoidance systems and TCAS equipment, and designated military air traffic zones).

7.8 Final thoughts
By charting the complex and changing interlocking political, institutional, economic, social, and environmental frameworks of NEMA's airspace, this research challenges the notion that airspace is a 'tunnel' of mobility in the sky, and demonstrates instead that it is a product of numerous (often contested) practices that operate at a variety of spatial scales and manifest themselves in different ways at different points through time. Moreover, the thesis explored how the social practices of protest, air traffic control, and piloting, (re)produce airspace in distinct ways and, by implication, may introduce unforeseen changes in the way airspace is used and experienced.

This research also indicated that the whole development of commercial aviation could become circular. The current emphasis on security and surveillance and the exclusion of unwanted 'Others', however defined, is arguably returning air travel to the hierarchical class and power relations that existed in the 1920s and 1930s in which certain types of passenger were excluded. To a certain extent, this is already true (or has always remained true) of war-zones. In Iraq, middle-eastern 'warlords' are still taking 'pot-shots' at aircraft (c.f. Chapter Two), only now their targets are helicopter gunships rather than canvas biplanes. A return to the 'Golden Age' of flying of the late 1920s and 1930s, while advocated by some airlines as a welcome return to in-flight opulence, would clearly come at the expense of numerous features previously enjoyed in peacetime (including many beyond the range of this thesis such as human rights and international migration). It may also alter the geopolitical world balance and inevitably result in very different corporeal experiences of travel. Furthermore, the ability to reconcile aviation growth with commitments to reduce environmental...
pollution present an important geographical conundrum, for if air traffic growth is restricted by punitive taxation or other cost mechanisms, the demise of international passenger shipping (apart from luxury cruising for the very rich), means the range of choices open to the international traveller would be severely curtailed with all the ramifications for the global(ised) economy that this would surely entail.

Geographers must therefore draw attention to these pressing issues. By so doing, they would begin to fill in some of blank pages at the back of the Air Force Officers' atlas and begin to calm the nerves of the terrified Army officer who was petrified at the thought of flying off the last page. By developing new avenues of geographical research into commercial air travel, geographers will have the most detailed understanding of all the issues required to help them advise policy makers and politicians around the world for the benefit of both humanity and the environment. They must not let the opportunity slip by unnoticed, or shirk the enormous responsibility incumbent upon them.

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4 Indeed, in the current geopolitical climate, the very fact they were military officers could be significant.
Appendix 1

Key aspects of NEMA’s Airspace Change Proposal

Under the proposals, NEMA wanted to extend the existing area of controlled (Class D) airspace around the airport to increase capacity and lessen the environmental and acoustic impact of their operations on Charnwood and South Derbyshire. The proposals involved increasing the area of controlled airspace both north and west of the airport, which would enable aircraft to overfly Nottingham (between 2500-10,500 ft), towns and villages in north Nottinghamshire (including Belper, Heanor and Hucknall) between 4000-10,500 ft, as well as villages in Derbyshire (including Matlock and Alfreton as far north as Chesterfield) between 7500-10,500 ft. In addition, further extensions to the south and east of the airport were proposed, taking in Leicester city itself (between 4000-10,500 ft), villages to the south and east of Leicester (between 5500-10,500 ft), and the area between Market Harborough and Corby (at 7500-10,500 ft) (NEMA 2004a p5).

The proposals advocated the creation of three new SIDs, ‘DAVENTRY 2’, ‘TRENT 2’ and ‘POLE’, two new STARs, and the relocation of the two holding areas to near Hucknall and Market Harborough. However, the new flightpaths meant aircraft will operate over areas of rural East Leicestershire, which had never been previously overflown by low-flying commercial aircraft.

Departures

Owing to the prevailing wind, 70% of flights at NEMA take off into the wind (i.e. in a westerly direction). These routes are unaffected by the proposals, and it is only the remaining 30% of easterly departures that are altered. Of those, 65% head south for mainland Europe, reflecting the popularity of flights to the Mediterranean.
Easterly departures - southbound

The old easterly 'Daventry 1' SID route took aircraft directly overhead large settlements in north and west Leicestershire. Under the plans, this has been retained, but joined by a new route, 'Daventry 2', which sends aircraft over rural east Leicestershire. Given operational constraints, 'Daventry 2' would only be used by a small proportion of traffic (approximately five aircraft per night when in use), but while it reduces the number of people overflown between 3000-5000ft by 76%, aircraft flying under 3000ft would affect 31% more people (Table A). However, when Daventry 2 is in use, no aircraft will fly over Charnwood in northwest Leicestershire.

Table A Population affected by noise from 'Daventry 1' and 'Daventry 2' SIDs

<table>
<thead>
<tr>
<th>SID</th>
<th>Population affected to 3000ft</th>
<th>Population affected to 5000ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daventry 1 (old)</td>
<td>1,460</td>
<td>11,732</td>
</tr>
<tr>
<td>Daventry 2 (new)</td>
<td>1,907</td>
<td>2,829</td>
</tr>
</tbody>
</table>

Source: EMA (2003 p11)

Easterly departures - northbound

Aircraft departing towards the east, but heading north, would follow either the amended 'Trent 1' track ('Trent 2') or the new SID route, 'Pole'. As a result of 'Trent 2' being moved further east, aircraft no longer overfly Long Eaton or the eastern fringes of Derby, dramatically reducing the number of people overflown by aircraft under 5000ft (Table B). Approximately half of all easterly departures will fly the 'Trent 2' track, while the other half will fly a new route, 'Pole'. It is anticipated that 18 aircraft a day will use 'Pole', but the trajectory of the route, over the western suburbs of Nottingham, will subject more people to noise (Table B). For this reason, 'Pole' is only available for use during the day.

Table B The effect of replacing 'Trent 1' with 'Trent 2' and 'Pole'

<table>
<thead>
<tr>
<th>SID</th>
<th>Population affected to 3000ft</th>
<th>Population affected to 5000ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trent 1</td>
<td>3,162</td>
<td>47,401</td>
</tr>
<tr>
<td>Trent 2</td>
<td>3,162</td>
<td>37,482</td>
</tr>
<tr>
<td>Pole</td>
<td>2/546</td>
<td>47,748</td>
</tr>
</tbody>
</table>

Source: Adapted from NEMA (2003 p12/p13)

The anticipated change in population overflown by departing aircraft using the old (O) and proposed (P) departure routes is shown in Table C.
Table C Change in population affected by existing and proposed departure routes

<table>
<thead>
<tr>
<th>Departure Route Change</th>
<th>&lt; 3000ft</th>
<th>3000-5000ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>'Trent 1' (O) to 'Pole' (P)</td>
<td>-19%</td>
<td>0.70%</td>
</tr>
<tr>
<td>'Daventry 1' (O) to 'Daventry 2' (P)</td>
<td>31%</td>
<td>-76%</td>
</tr>
<tr>
<td>'Trent 1' (O) to 'Trent 2' (P)</td>
<td>No Change</td>
<td>-21%</td>
</tr>
</tbody>
</table>

Source: NEMA (2004a p7)

Arrivals

Unlike departures, both easterly and westerly arrival paths have been altered. The greatest change to the tracks flown by arriving aircraft is to those flights that arrive from the south. Under the plans, these aircraft will fly over less populated areas of eastern Leicestershire, rather than flying west of the city as they had done previously, before turning east to make their approach.

Westerly arrivals - from the south

Under the plans, aircraft arriving from the south will now fly east of Leicester before turning to the east to line up with the runway.

Westerly arrivals - from the north

Under the old regime, aircraft flew over Derby in an easterly direction until they were clear of Nottingham, before making their final approach. Under the proposals, these aircraft will fly to the west of Derby city centre and then over the southern fringes of Nottingham.

Easterly arrivals - from the south

Previously, aircraft flew west of Leicester and over Measham and Ashby-de-la-Zouch, before turning onto their final approach path over Burton-on-Trent. Now, aircraft fly east of Leicester, negotiate a 'dog-leg' Loughborough and then line up to land.

Easterly arrivals - from the north

Under the old system, aircraft flew over Derby before lining up on their final approach over the village of Melbourne. Now, aircraft stay north of Derby for longer, flying further east then they used to, before turning west over Derby and lining up to land. By altering both the westerly and easterly arrival routes in this way, the airport
estimates that aircraft under 3000ft will overfly 92% and 85% fewer people respectively (Table D6).

Table D Population affected by changing easterly and westerly arrivals

<table>
<thead>
<tr>
<th>Direction</th>
<th>&lt;3000ft</th>
<th>&lt;5000ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westerly arrivals</td>
<td>-92%</td>
<td>-77%</td>
</tr>
<tr>
<td>Easterly arrivals</td>
<td>-85%</td>
<td>+13%</td>
</tr>
</tbody>
</table>

Source: NEMA (2004a p9)

The new routes and extended CAS facilitate the use of continuous descent approaches (CDAs), a procedure identified as ‘best practice’ by the CAA on account of it reducing aircraft noise by up to 5dB(A) (NEMA 2004). During a CDA, aircraft adopt a continuous 3-degree descent gradient, eliminating the need to ‘step down’ through intermediate flight levels, reducing the need to alter engine power settings and wing flap configuration (NEMA 2004).

Under the old regime, airspace congestion had meant that arriving aircraft were often instructed to descend to artificially low altitudes while still some distance from the airport to ensure adequate separation from outbound flights. The airspace change ensures safe lateral separation between inbound and outbound aircraft and facilitates the use of continuous descent approaches (CDA). NEMA (2004) estimates the ability to support CDAs will reduce the number of people affected by low-flying aircraft (i.e. those under 3000ft) by 90%. Of those that remain affected, aircraft will be operating at higher altitudes, although that is no comfort to those communities who have never been previously overflown.

**Holding areas**

Occasionally, aircraft are required to ‘hold’ before they are able to land, owing to adverse weather conditions or runway congestion. At NEMA aircraft were for a total of 17 hours in 2003, a figure that is predicted to increase without the airspace change. Under the old regime, aircraft approaching NEMA from the west were held over the village of East Leake, while flights arriving from the east were stacked over Melbourne. Under the new regime, these stacks have been relocated above Market Harborough in southern Leicestershire, and Hucknall in Nottinghamshire, and called ‘Pigot’ and ‘Rokup’ respectively. Aircraft that are required to hold, do so at a
minimum altitude of 8000ft, compared with 4000ft in the old stacks, reducing both their aesthetic and acoustic impact.

**Predicting future growth**

In 2003, an average of 77 commercial aircraft arrived at NEMA every day (Table E). However, ‘in the next few years’ the airport hopes traffic levels will grow by 50% producing an extra 39 arrivals a day (Table 1.7).

Table E Average number of arrivals per day by route 2003 and (in brackets) assuming future 50% growth

<table>
<thead>
<tr>
<th>Route</th>
<th>Average number of daily aircraft movements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westerly (from south)</td>
<td>35 (53)</td>
</tr>
<tr>
<td>Westerly (from north)</td>
<td>19 (28)</td>
</tr>
<tr>
<td>Easterly (from south)</td>
<td>15 (23)</td>
</tr>
<tr>
<td>Easterly (from north)</td>
<td>8 (12)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>77 (116)</strong></td>
</tr>
</tbody>
</table>

Source: NEMA (2004a p10)

Assuming 50% growth, the 116 departures daily would route as follows (Table F).

Table F Breakdown of the routes flown by outbound aircraft, assuming 50% growth

<table>
<thead>
<tr>
<th>Route</th>
<th>Assuming 50% traffic increase – proposed routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westerly departures - southbound</td>
<td>52</td>
</tr>
<tr>
<td>Westerly departures - northbound</td>
<td>29</td>
</tr>
<tr>
<td>Trent 2</td>
<td>4</td>
</tr>
<tr>
<td>Pole</td>
<td>7</td>
</tr>
<tr>
<td>Daventry 1</td>
<td>22</td>
</tr>
<tr>
<td>Daventry 2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>116</strong></td>
</tr>
</tbody>
</table>

Source: NEMA (2004a p10)
Appendix 2

Timeline of key events and selected meetings

November 2003 – NEMA submit ACP to CAA for approval

13th January 2004 – First public meeting at Billesdon Coplow, east Leicestershire attracts c500 residents after extensive leafleting campaign in local villages. ELVAA forms, Steve Charlish assumes chairmanship of group.

19th January 2004 – First ELVAA newsletter launched – website (www.elvaa.org) becomes a key campaign tool

23rd January 2004 – 1st ELVAA committee meeting held. Aims defined as i) make people aware of new flight paths, ii) oppose their introduction and iii) act as a focal point for residents who are against the proposal.

February 2004 – Edward Garnier MP publicly declares support for ELVAA

27th May 2004 – 2nd ELVAA public meeting at Billesdon Coplow, east Leicestershire

1st June 2004 – Leicestershire County Council discuss controls on night flying

8th June 2004 – 1st ELVAA demonstration on College Green, Westminster, results in extensive media coverage of the campaign

21st June 2004 – First period of consultation on the airspace change proposal ends


11th August 2004 – NEMA halts implementation of the airspace change and launches a second phase of consultation.


17th November 2004 – Airspace roadmap at Great Glen Village Hall, southeast Leicestershire. Author in attendance

2nd December 2004 - Further public roadshow event at Judgemeadow Community College, Leicester. Author in attendance

3rd December 2004 – ELVAA public meeting held at Kibworth Community Centre, southeast Leicestershire in conjunction with the Kibworth Harcourt Conservation Society. Author in attendance.
13th December 2004 – Second staged protest on College Green, Westminster. DEMAND launched. Author in attendance.

16th December 2004 - Final roadshow event at Spondon Village Hall, Derby.

22nd December 2004 – Author granted first airside tour of ATC facilities at NEMA.

1st January 2005 - DEMAND launch online petition.


3rd February 2005 – DEMAND produce 40,000 postcards for residents to send to Tony Blair MP.

28th February 2005 – CAA approve airspace change for the second time.

6th April 2005 – DEMAND present a petition at 10 Downing Street calling for designation that contains over 1000 signatures.

5th May 2005 – Steve Charlish announces he is standing as an independent candidate at the Bruntingthorpe Division CC election with mandate to fight for night controls at the airport (he is unsuccessful).

12th May 2005 – New airspace procedures become operational.

20th June 2005 – Second visit to NEMA ATCC.

14th July 2005 – Airside tour of ATC facilities at Manchester Airport (including visits to VCR and radar rooms), observation, and discussions with ATCOs.

26th July 2005 – Observe Operator’s Proficiency Check (OPCs) in ThomsonFly B757/767 aircraft simulator, GECAT Facility, Crawley


4th-5th October 2005 – Observe OPCs in bmi B737 Classic aircraft simulator, West Drayton, with NEMA bmibaby crew.


14th March 2006 – Meeting with Jenny Saville and Neil Robinson, Environment and Safeguarding Department, NEMA.

17th March 2006 – 7.30pm DEMAND public meeting, Illston-on-the-Hill, east Leicestershire, with guest speaker Edward Garnier MP. Author in attendance.

19th May 2006 – Airside tour of ATC facilities at Gloucestershire Airport courtesy of ASTAC.
Appendix 3

ATC transmissions

Example A - a departing flight
Aircraft - “Manchester, good evening. This is bmibaby five one Charlie climbing flightlevel sixty on the ASNIP departure.”
ATCO - “Roger, climb flightlevel one nine zero, baby five one Charlie.”
Aircraft - “Climbing flightlevel one nine zero, baby five one Charlie thanks”

- field diary extract, 2004

In this exchange, bmibaby flight 51C (flight number WW5103) has departed from NEMA en-route to Cork, and is climbing to 6000ft on the ASNIP SID, which routes aircraft northwest from NEMA towards Liverpool and the coast. The pilot first addresses the ground station, ‘Manchester’, to check he is operating on the correct frequency, and then identifies his flight by its callsign and relays his altitude and trajectory. The ATCO acknowledges this information (“Roger”), and clears him to climb to FL190 (equivalent to 19,000ft). The pilot then reads back the clearance to and initiates the climb. This system of repeating safety-critical information ensures that the messages have been received by the correct aircraft and understood.

Examples B and C - overflying aircraft reporting their geographical position
Aircraft - “Manchester, good evening. Jersey seven eight eight with you inbound Pole Hill.”
ATCO - “Roger Jersey seven eight eight. Descend flightlevel two five zero, expect further descent in twelve miles owing to traffic.”

- field diary extract, 2005

In this transmission, FlyBE BE788 calls Manchester to report they are crossing Manchester’s airspace and are on a heading to intercept the VOR beacon at Pole Hill, and will thus soon leave Manchester’s controlled airspace. The controller determines from the accompanying flight progress strip that the aircraft is inbound to Edinburgh.
from Southampton, and he begins its descent earlier than normal owing to conflicting traffic. In this way, the controller looks forward in time and space to resolve a potential conflict by slotting the flight into a space in the surrounding traffic flow.

Aircraft – “Ten miles before Honiley, Speedbird one nine two.”

ATCO – “Speedbird one nine two, good evening. Continue that level but be advised you have traffic one thousand feet below you at your ten o’clock position, range five miles”

Aircraft – “Roger Manchester, thanks for that. We have him on TCAS”

- field diary extract, 2005

Here, BA192 informs Manchester ATC that they are 10 miles away from the Honiley beacon in Warwickshire, confirming to the ATCO the presence of the flight in their airspace. The controller responds by clearing them to continue flying at their present level, but warns them of the position and range of nearby traffic, the presence of which the pilots have already detected via TCAS (see Chapter Six).

Example D – ATCO initiated descent

ATCO – “Turn left heading one four five degrees baby two four victor. Descend flightlevel two four, speed not greater than decimal eight one until advised.”

Aircraft – “Descend flightlevel two four, speed not greater than decimal eight one, baby two four victor.”

- field diary extract, 2005

Here, bmibaby 24V is instructed to immediately commence a left turn onto a heading of 145 degrees and simultaneously begin a descent to FL24 (2400ft) while ensuring their indicated airspeed does not exceed Mach 0.81. As ever, the pilot reads back the information and confirms his callsign.

Example E – a non-routine transmission

Aircraft – “East Midlands, this is baby three eight echo, we have weather straight ahead. Can we change heading to three four zero degrees please? We’ve just seen a big flash of lightening out to our left hand side.”

- field diary extract, 2006
A technical compendium detailing the performance of the different airframes observed in the flight simulators

The Boeing 737

The twin-engined Boeing 737 (Figure i) is the most popular commercial aircraft ever built. At any one time, there are estimated to be 1250 B737s airborne around the world, and one takes off or lands every five seconds (www.b737.org.uk 2005). The model appears in nine versions; the oldest, the -100 and -200 series, the ‘Classic’ -300 to -500 airframes, and the newer ‘New Generation’, or ‘NG’, -600 to -900 models, which typically seat between 130 and 190 passengers (Shaw 1999a). Given their range, capacity and performance, B737s are very familiar short-haul models and are currently in service with a number of UK airlines including bmibaby and British Airways.

Figure i A bmibaby B737-300 series

The main differences between the three categories of airframe are the age of the design and hence the sophistication of the avionic systems and flight controls. The ‘Classic’ 300 model (the type observed in the simulator) represents the first attempt by a major aircraft manufacturer to install Electronic Flight Information Screens
(EFIS) on the flightdeck and it was interesting to compare the emerging digitality of the airspace information on this airframe with the more sophisticated ‘glass’ flightdeck of the A320 (Figure ii).

Figure ii Comparison between a B737-300 ‘Classic’ flightdeck (left) and a B737-700 ‘NG’ model (right). Note the replacement of the old electromechanical instruments fitted in the –300, with the six flat CRT screens in the –700 series.

The Airbus A320

Airbus’s A320 (Figure iii) is a short-to-medium range narrow-bodied airliner that first flew in 1987. It typically seats up to 180 passengers in a single-class layout and was launched as a direct competitor to Boeing’s 737 (Laming 2000). Given the aircraft’s seating capacity, economic operating characteristics and range (up to 3000 miles), the A320 is very popular with European airlines and consequently is a frequent visitor to NEMA. The A320 is the base model for a family of airliners including the smaller A318 and A319, and the larger A321. The flightdeck of the A320 represents one of the first generation of ‘glass’ flightdecks where traditional ‘clockwork’ electromechanical instruments have been superseded by six electronic CRT (cathode ray tube) displays. Other major differences include the replacement of the conventional central control column with a hand-held sidestick controller (which resembles a computer gaming joystick), and the extent of automation. The A320 was one of the first aircraft to make use of sophisticated electronic fly-by-wire (FBW) technology.
Unlike older aircraft, there is no physical connection between the flightdeck and the aircraft's control surfaces. In FBW systems, control inputs are electronically conveyed to various components and then hydraulically actuated.

**Figure iii An A320 operated by Thomas Cook**

![An A320 operated by Thomas Cook](image)

**Boeing's 'twins' – the 757 and 767**

The Boeing 757 and 767 airframes (Figure iv) entered service in the early 1980s. Unlike other Boeing models, they were designed with a common flightdeck so that pilots could enjoy dual qualification, reducing training costs and easing scheduling.

**Figure iv Comparison between a B757 (left) and a B767 (right)**

![Comparison between a B757 (left) and a B767 (right)](image)

The smaller narrow-bodied 757 can typically seat up to 230 passengers in a single class layout and has a range up to 7000km depending on configuration, while the wide-bodied 767 can seat up to 300 passengers and has a maximum range of 11,230km (Birtles 1999, 2000). ThomsonFly operates both types from NEMA.
From take-off to touchdown: the practices of piloting – selected field notes

The following vignettes are verbatim transcripts of selected flight scenarios I observed during the empirical fieldwork for this research in the autumn of 2005. They remain ‘as written up’ and have not been ‘sanitised’ or clarified. All scenarios have been anonymised “to protect the innocent” as requested. Pilots are referred to by their professional identities (FO and TC standing for First Officer and Training Captain respectively); all callsigns have been replaced with ‘XXX123’; and features that uniquely identify one particular aircraft have been omitted. The scenarios were chosen from a database of over twenty to illustrate different aspects of flight operations and the importance of computer displays and paper documentation to the safe (re)production of airspace.

**Flight scenario 1 – multiple hydraulic failure**

*Context*

Flight ‘XXX123’ had just landed at Manchester from Orlando, Florida, and had offloaded some passengers and cargo. My Captain and FO were the new crew who were scheduled to fly it on the final leg of its journey from Manchester to Gatwick where the remaining passengers were scheduled to depart. However, the TC had programmed the simulator so that the left main landing gear tyre would shred on take off and, once airborne, the left and central hydraulic systems would fail in quick succession. This would disable the autopilots meaning the crew would have to fly the aircraft manually. The timing of the failures would ensure that the flaps and ailerons had not had time to retract properly making the aircraft difficult to control. In addition, the TC had only loaded five tonnes of fuel, which meant they would quickly find themselves in a critical fuel situation if they flew a holding pattern for too long while deciding on the best course of action.

*Simulation*

The Captain and the FO were already in the simulator when I arrived, programming the Flight Management Computer and running through pre-flight checklists readying the ‘aircraft’ for its ‘flight’. Thanks to the timely appearance of some headphones, I could hear the conversations between the Captain, the FO and the TC, and also transmissions between the FO (the designated ‘Pilot Non-Flying’ for this sector) and ATC (one of many ‘exterior’ roles played by the TC). As this exercise was simulating a revenue flight, the pilots had to behave as if they had a cabin full of passengers.
behind them. Following a short brief between the crew, the TC engaged his programme and switched on the motion actuators, which raised the simulator up on its hydraulic jacks by approximately 5 feet to allow for a full range of movement and the visual display flickered into life, replicating the view of stand 27 at Manchester Airport from the flightdeck.

The pilots reviewed their flightplan. The aircraft was due to depart runway 06L at Manchester, before turning south towards Birmingham and climbing to an initial altitude of 12,000ft. The transition altitude for the flight was 5000ft and they were expecting a Wallasey SID. They had already checked the ATIS and the weather was a chilly +2 degrees Celsius, with a slight crosswind and the sky was overcast at 1000ft. The QNH was 1010. The FO ran through the pre-push back checklist, reviewing items including cabin pressurisation, oxygen systems, pneumatics, hydraulics and anti-icing systems; pressing switches and moving levers where necessary. The Cabin Manager then confirmed the passengers were all present and the cabin was secure and ready for take-off. The FO then called Ground Movement Control, requesting push back clearance. The flight was instructed to squawk 2247, which the FO dialled into the transponder. A short delay to the pushback was experienced while other aircraft manoeuvred behind us. The FO then made a cabin services announcement, telling the ‘passengers’ about the route, the weather and the estimated time of arrival in Gatwick. In the meantime, the Captain, as ‘Pilot Flying’ was in spoken communication with the driver of the tug (the TC again).

On receiving ATC clearance, the aircraft was pushed away from the stand and the simulator replicated the sensation of bumping over uneven concrete. The visual display meanwhile depicted us gently backing away from the terminal and turning to face to the right. I’ve no idea how it tricked us, but it really felt that we were moving backwards. The Captain then called for right (# 2) engine start. The FO ran through the pre-engine start checklist and crosschecked the Captain’s actions, observing him opening the relevant fuel pumps. Both pilots watched the EICAS screen intently for details of the start-up, observing the steady rise in turbine and compressor rotation speeds and firing the ignition switch when appropriate. The rise in exhaust gas temperatures confirmed that the engine was running. The Captain then received hand off from the tug driver, who disconnected the tow-bar from the nose gear. The Captain then asked him to confirm that all exterior access panels were closed and that the nosewheel locking pins had been removed. On receiving an affirmative reply, the Captain started the left (#1) engine.

When both engines were running and stable, the FO ran through the pre-taxi checklist and requested taxi clearance from ATC. Upon its receipt, the Captain steered the aircraft using the nose-wheel tiller around the maze of taxiways on a route as specified by ATC, before making a final right turn towards the threshold of runway 06L where he was ordered to contact the tower on “119.4”. Throughout the taxi, the Captain was checking the serviceability of the rudder, spoilers and elevators by pressing on the rudder pedals to deflect the rudder right and left, raising the spoilers and turning the control column to the left and right, all the while monitoring the digital displays to ascertain whether the aircraft was responding as it should. He asked the FO to set the flaps to five degrees and watched him execute his instruction. He then explained what he would do in the event of a rejected take off (i.e. aborting the take off roll before V1) and what the FO’s duties would be in that eventuality.
Satisfied, the Captain manoeuvred the aircraft to the holding position and waited for take-off clearance. The tower radioed the flight and asked them when they would be ready for take-off – the FO replied they were “good to go” as soon as they reached the threshold. Manchester tower then cleared the flight to take off immediately from runway 06L, adding that the wind was 040 degrees at 15knots and the QNH was 1010. The FO acknowledged the call and repeated, “cleared to take off on zero six left, XXX123”.

The Captain manoeuvred the aircraft onto the runway and opened up the throttles. The aircraft accelerated quickly, the simulator making authentic noises of the engines spooling up and replicating the sensation of acceleration forces by tipping the simulator backwards so that we were all forced into our seat. The Captain was concentrating on watching the engine readouts and keeping the aircraft near the centreline of the runway using rudder inputs. The FO meanwhile was watching the speed increase, calling out “80” and then “100 knots”. When it reached 120 knots, the FO called out “vee one, rotate”. The Captain pulled back firmly but smoothly on the control column, pitching the aircraft up to 15 degrees above the horizon. The simulator faithfully replicated this motion, by tipping us up further, pinning us into our seats. As the aircraft rotated, there was a small bang and a slight but perceptible vibration from behind. This was the tyre burst that the TC had programmed, but neither the Captain nor the FO knew this. After scanning their instruments for any problem and confirming that the aircraft was indeed climbing, the Captain called, “Positive rate of climb, gear up”. The FO then moved the landing gear lever to the “up” position and waited until the undercarriage had retracted with a whirr and a bump and the lights on the flightdeck changed from green to red and then extinguished, indicating all three sets were up and locked. As the aircraft accelerated into the climb, the tower called to tell them to change frequency to 134.42MHz, which the FO dialled into the communications panel on the central pedestal. When the aircraft was passing through 3000ft, the upper EICAS display indicated that the left hydraulic system had failed with an amber alert message. This did not cause too much concern, as the two remaining hydraulic systems could easily cope with the added load. The Captain elected to continue with the climb and instructed the FO to progressively retract the flaps to ‘clean up’ the aircraft to increase its aerodynamic efficiency. However, during the retraction sequence, the central hydraulic system also failed, leaving the flaps still partially extended.

In the space of a couple of seconds, the situation had deteriorated from routine, to mildly inconvenient, to potentially catastrophic, as the pilots had no idea what had caused the double failure and thus couldn’t ascertain whether or not it was likely to affect the remaining system which would render the aircraft uncontrollable. The Captain had to concentrate on flying the aircraft, as the ‘floating’ flaps were disturbing the airflow, making the aircraft difficult to control. Meanwhile, the FO consulted the QRH (Quick Reference Handbook) for the relevant checklists. As the system failures had rendered the autopilot inoperative, they disengaged it and elected to fly the aircraft manually. They discovered, to their concern, that the central system also powers braking and nose wheel steering, compounding the dangers of an emergency landing. They quickly decided the safest option was to return to Manchester. This didn’t present too much of a problem, as the aircraft only had a light fuel load and so did not need to jettison fuel before landing. As the aircraft was passing through 4200ft, The Captain issued a “Pan Pan” emergency call to
Manchester control, advising them of their hydraulic problems and requesting a holding pattern they could fly while they try to sort out the problem, before stating that they were anticipating making an emergency landing back at the airport “within 15 minutes”. Manchester control acknowledged their distress call and instructed them to turn onto a heading of 190 degrees and maintain their present altitude.

At this point, the cabin crew manager entered the flightdeck to inform the pilots that during the take off roll, passengers at the rear of the cabin had heard a loud bang preceded by several seconds of severe vibration (the physical manifestation of the tyre burst). The Captain thanked him for the information but briefed him on the altogether more serious hydraulic problem, stating that they were going to return to Manchester within the next 15 minutes and asked him to prepare the cabin and the passengers for an emergency landing. The FO then addressed the passengers saying “Ladies and Gentlemen, this is your First Officer speaking. After departure, we experienced a small problem with the hydraulic systems on the aircraft, and, as a precaution, we are going to return to Manchester to enable our engineers to take a look at the aircraft before we resume our journey to Gatwick. I’d like to apologise for the disruption to your schedules and I’ll talk to you again after we land. Your full attention to the cabin crew’s instructions is appreciated.” As he was doing this, Manchester ATC authorised a right turn onto a heading of 280 degrees on the same level and advised them to contact Manchester Director on 119.5MHz.

Further consultation with the QRH and messages on the upper EICAS screen confirmed that, for an unknown reason, all hydraulic pressure had been lost in the left and central hydraulic systems and warning messages were displayed in amber left of the engine readouts on the upper EICAS screen. The screen read:

```
L Hyd System Press
TE Flaps Disagree
C Hyd System Press
Stab Trim
R Yaw Dampers
L Yaw Dampers
Rudder Ratio
L Hyd System Qty
R Hyd System Qty
```

This told them that there was a problem with the quantity of fluid in both the centre and left hydraulic systems and that they were not pressurised. This had resulted in the trailing edge flaps disagreeing, had led to a problem with the trim stabiliser, meant the rudder ratio was incorrect, and resulted in the left and right yaw dampers being inoperative. Before the faults had arisen, this portion of the EICAS screen was blank. The checklists had warned them that the autopilots wouldn’t work and that the airspeed brake would not deploy after landing. However, the main autobrakes should work. After a couple more changes of heading, the Captain indicated that the fuel was starting to run low (they had started out with 5 tonnes and were down to 3.5 by this stage) and that they had to make an approach to the airport. The Captain began to slow the aircraft and called on the FO to deploy flaps to 20 degrees to provide additional lift (at this stage they were relying on the one remaining right hydraulic system for power). The QRH told them that the maximum crosswind they could land
the crippled aircraft in was 20knots (only 5 faster than the wind speed they took off in). While all this was going on, the Captain was fighting to hold the aircraft level and the altitude began to creep up. However he soon noticed and corrected it while the FO ran through the diversion checklist. All the while, we were above cloud and could not see any ground-based visual references as to our position. The FO called Manchester Flight Director to ask for very specific meteorological data and information about the runway in use. ATC replied that the wind was 360 degrees at 15knots, the visibility good at 10km although the sky was overcast at 1000ft. The ground temperature was plus 2 degrees Celsius and the QNH 1010. The runway in use was 06L, although they advised that 06R was also available if desired. After consultation with the Captain, he requested an approach to 06R, as they did not know how effective their braking would be, and as 06R is longer than 06L, would give them more space to play with. Also the Captain noted “it’s the one we usually use” indicating familiarity with the approach procedures and the runway itself was important. The FO made a call to ATC to that effect, and ATC informed them that the emergency services were standing by.

The Captain talks to the FO about the procedures for executing a ‘go around’ procedure. The landing gear extends and locks and the FO calls ATC to acknowledge the interception of the localiser beam to runway 06R. At 3500ft, they establish the aircraft on the ILS. ATC respond, telling them the wind is coming from the north at 15knots. At 2500 feet, an automated American-accented male voice calls out “twenty-five hundred” and then “one thousand” at 1000ft above the runway. The floating ailerons and flaps are creating considerable drag and the Captain is fighting the tendency for the aircraft to pull to the left. At 900ft, the aircraft breaks through the cloud and the runway is in sight for the first time. The FO calls out “500 feet” and “100 feet” as the Captain flies the aircraft toward the runway. As the main wheels touch the ground, the burst tyre collapses and the aircraft lurches violently to the left. The Captain throws in a massive rudder input to regain control and brakes hard to slow the aircraft, using both reverse thrust and autobrakes to bleed off speed. The result is dramatic deceleration, which the simulator replicates by tipping us forward. My bag and jacket slither across the floor, as does everything else that is not tethered. The TC braces himself by putting is feet against the back of the Captain’s seat, while I desperately dig my feet into the floor and cling onto the arm rest of my seat. After a few seconds, the speed decreases and the simulator returns to its upright position. The aircraft has come to a stop about three-quarters of the way down the runway, facing the grass. The TC then announces that the scenario is finished, grins, and asks the pilots if they enjoyed it. Neither reply.

**Flight scenario 2 – FMC [flight management computer] failure and explosive depressurisation**

Our aircraft departed from runway 33 at Birmingham, and started to climb to FL150 direct to Pole Hill VOR beacon. Almost immediately after passing 15,000ft, the pilots encountered an FMC failure and had to navigate with reference to the RMI and VOR instruments. They receive ATC clearance, and climb to 35,000ft. Shortly after establishing their aircraft in the cruise, the pressurisation system fails. There is a explosive bang, and a loud scream of escaping air. The FO immediately reaches for his oxygen mask as the cabin high altitude warning claxon sounds and master caution lights illuminate. He scans his instruments for signs of any other problem and checks that the passenger’s oxygen masks have automatically deployed. The then looks over to the Captain, who has failed to get his mask on as promptly and is slumped in his
seat, totally incapacitated and therefore unable to play any further part in the exercise (the TC had told the Captain before the session started to pretend to collapse to check the FO's proficiency at handling the situation). With his Captain unconscious, the FO immediately assumed control of the aircraft, issuing a “mayday” distress call on both the frequency he is operating on and the emergency all-station distress frequency, saying “Mayday XXX123”, emergency descent, leaving flightlevel three five zero for one hundred” (10,000ft). As he does so, he throttles back the engines to reduce the structural load on the airframe (as he doesn't know what caused the depressurisation), and pushes the nose forward. The airspeed builds quickly as the aircraft plummets through the flightlevels (the electronic needle on the standby altimeter is whizzing round anticlockwise, indicating a rate of descent in excess of 6000ft a minute). It is all very bumpy and quite frightening. Once the aircraft is established in the emergency descent, the FO leans over and shakes the Captain's shoulder in an attempt to raise him, but to no avail. At 10,000ft, the FO levels off the descent and removes his oxygen mask (as too much oxygen can be as dangerous as hypoxia). At this point, the Captain regains consciousness and moves his hands towards the throttles. The FO immediately pushes him away and refuses to relinquish control, saying “sit back and relax mate”, before telling him what had happened and what he was doing to bring the Captain back into the loop. The FO then flew a manual approach to Edinburgh airport, safely landing the aircraft. The whole emergency took about two minutes, demonstrating just how quickly things can go wrong.

Flight scenario 3 - Multiple TCAS targets
Flight XXX123 is inbound to EGCC (Manchester). The TC stops the exercise and offers to programme a number of TCAS 'scenarios' for me to see. These consist of a ‘normal’ traffic advisory, where the intruding aircraft poses no collision threat, a ‘straightforward’ resolution advisory, where an automatic female voice instructs the pilots to “Climb Climb”, and a multiple TCAS alert with two aircraft threatening our flight. The first RA sounds and the pilot performs a steep climb, but as soon as we are clear of that conflict, a second RA instructs our aircraft to dive. We see the second aircraft shoot over our head on the visual models. I'm later informed our combined closing speed was over 1100mph.

The introduction of RVSM in European airspace has meant TCAS has increased in importance because as the aircraft are closer together, there is less time to react. CAA rules stipulate that pilots have to respond to TCAS resolution advisories within eight seconds otherwise they lose the right to fly – this only leaves 12 seconds to point of collision, by which time, the aircraft may only be 200ft away. In reality, the reaction was instantaneous. The FO said he was flying into San Francisco the previous month when his flight was vectored into a potential collision with another aircraft. His TCAS told him to climb, which he did, but the pilot of the other aircraft, in addition to putting his machine into a dive, also banked sharply. The TC remarked that this was a dangerous overreaction, as the TCAS commands had ensured that they would not crash, and TCAS can only give vertical solutions to relational problems – it cannot instruct movements in the lateral dimension. The pilot of the other aircraft was putting his flight in increased danger by altering both his vertical and lateral position and owing to the accuracy of automated GPS navigation, aircraft literally fly one of top of the other and there is very little lateral separation along airways.
Flight scenario 4 - major fuel leak and low visibility procedures at Malaga

We begin at the second leg of a charter from East Midlands to Malaga. At Malaga, the weather is bad. The runway is flooded and low visibility operating (LVO) procedures are in force. Captain briefs his FO, warning about high ground to the west and northeast of the airport, and identifies alternative landing sites at Almeria, Jerez and Seville should the visibility drop beneath prescribed operating minima. The TC loads 9.93 tonnes of fuel giving us a gross weight of 68.33 tonnes. With the squawk iden transmitting, and pushback clearance given, the Captain orders right engine (#2) start. When stable, the same procedure lights the left hand (#1) engine. During taxi, the Captain checks the rudder deflection and sets the flaps and slats for take-off.

Ten minutes into the cruise, amber warning messages appear on the electronic flight information screens indicating a clog in the fuel feed filter to engine one, so the pilots run through the scripted QRH procedures to switch this pump off and transfer its load to another. The FO presses reaches up to overhead panel and presses button marked ‘ENG 1 LTK PUMP’ “Fault” to the “Oft” position. However, almost immediately, a warning on the EFIS screen states there is a 700kg fuel imbalance between the two engines. This is obviously of concern and the pilots begin discussing the possibility of a major fuel leak (N.B. aviation fuel measured in weight not volume as it expands and contracts according to temperature).

The Captain summons the Senior Cabin Attendant (SCA) to the flightdeck and asks him to go back into the cabin and discreetly check the wings for anything unusual, such as debris or an obvious a fuel leak. The Captain then radios ATC and asks to be put into a hold around the ‘BELIN’ waypoint to avoid flying through the cumulonimbus clouds. The TC whispers an aside to me, “you don’t want to meet lightening if you have a major fuel leak”. As he is saying this ‘FUEL’ begins flashing on lower flight information screen in amber. The SCA returns to report there is fluid streaming out of the left hand wing roughly in line with the engine pylon. The pilots consult the QRH again and decide to switch off both centre tank fuel pumps along with engine #1 in case the fuel is leaking out from a faulty engine seal. XXX123 issues a “pan pan” distress call and a red “Land ASAP” message appears on the upper electronic screen. The FO upgrades the distress call to a “mayday”, and studies the fuel pages on the FMC to see how much fuel they have left in each of the tanks.

While the FO is occupied pumping the remaining fuel between the tanks to retain trim and balance, the Captain begins looking for alternative landing sites on the navigation display and starts checking the coded weather forecasts for each. The FO meanwhile informs the passengers that “owing to a slight technical problem, we will unfortunately have to divert to another airfield”. Descending through 20,000ft, the pilots decide to start the APU [the auxiliary power unit] to supply the electrical power that would ordinarily be supplied by the left engine, as additional power is needed for the anti-icing systems on the wings as they are flying through cloud. The weather reports show that Malaga is out due to deteriorating weather, and the only option is to land at Seville as we do not have enough fuel left to make any of the other alternatives. Fortunately, the leak has stabilised as no more fuel has been lost. The FO then consults the landing charts for Seville and completes the paperwork while the Captain flies the aircraft and liaises with ATC. The Captain then summons the SCA back to the flightdeck and gives him a ‘NITS’ briefing. Meanwhile, Seville ATC clears us to descend to 5000ft on a QNH of 1026.
Given the high terrain around the airport, as the aircraft descends through 5000ft, the FO switches on the terrain radar, overlaying an image of the topography of the ground below onto his navigation display. Significantly, the Captain’s navigation display is still overlaying weather returns, enabling him to avoid the worst of the rain and turbulence. The weather deteriorates on our approach to below permitted visibility minimums and the Captain has to perform a go-around and the aircraft climbs powerfully back into the sky even though only operating on one engine. New heading and altitude changes are received and followed in quick succession before the pilot lowers the landing gear, breaks through the cloud, and safely lands his crippled aircraft.
Appendix 6

METARS - (de)coding the weather

The following METAR shows how weather information is coded and decoded.

METAR for Nottingham East Midlands Airport, 12:20UTC on 30th October 2005.

A - This section describes the type of weather report, either;
   a) A 'METAR' (a routine weather report), or
   b) A 'SPECI' (a special weather report published if significant changes are forecast)

B - Location (ICAO four-letter airport code).
   EGNX=Nottingham East Midlands

C - Time - This indicates the day of the month and time of the observation in hours and minutes UTC, followed by the letter 'Z' ('zulu') denoting 'time'.
   301020Z=30th of the month at 10:20

D - Details of wind speed and direction - Wind direction is given in true degrees (three digits) rounded to the nearest 10 degrees, followed by the mean wind speed (two digits) over the ten-minute period immediately preceding the observation. These figures are followed by the abbreviation KT (knots) to indicate wind speed.
   34013KT=wind 340 degrees at 13 knots

E - Horizontal visibility in meters (if lower than 10km)
   1500SW5000N=1.5km to the southwest and 5km to the north

F - RVR (Runway Visual Range) - This includes the prefix 'R' followed by the runway designator, a diagonal line and then the runway visual range at the touch-down zone (in metres).
   R27/P1500=visibility at the touchdown zone of runway 27 is 1500m

G - Weather This group may consist of intensity indicators and letter abbreviations combined in groups of two to nine characters drawn from the table below:
### Qualifier Weather Phenomena Table

<table>
<thead>
<tr>
<th>Qualifier</th>
<th>Weather Phenomena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity or proximity</td>
<td>Descriptor</td>
</tr>
<tr>
<td>1 (-) Light</td>
<td>MI</td>
</tr>
<tr>
<td>(No qualifier) Moderate</td>
<td>BC</td>
</tr>
<tr>
<td>1 (+) Heavy or 'well developed'</td>
<td>BL</td>
</tr>
<tr>
<td>VC In the vicinity (within 8kms but not at aerodrome)</td>
<td>SH</td>
</tr>
<tr>
<td></td>
<td>TS</td>
</tr>
<tr>
<td></td>
<td>FZ</td>
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<tr>
<td></td>
<td>PR</td>
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</tbody>
</table>
| Mixtures of precipitation types are reported as one group, but up to three separate groups may be inserted to indicate the presence of more than one independent weather type e.g. MIFG, VCBLSN, +SHRA, RASN or -DZHZ when decoded mean shallow fog, blowing snow in the vicinity of the aerodrome, heavy rain showers, rain and snow, and light drizzle and haze respectively (AERAD 2005 MET36).

**H – Cloud** - used to indicate extent and type of formation

a) FEW = 1-2 oktas, SCT (scattered) = 3-4 oktas, BKN (broken) = 5-7 oktas, OVC (overcast) = 8 oktas

The last three figures indicate the height of the base of the cloud layer in hundreds of feet above the aerodrome

e.g. SCT020 = scattered clouds at 2000 feet above the aerodrome

Types of cloud other than significant convective clouds are not identified. Significant clouds are: CB Cumulo-nimbus and TCU Towering Cumulus

Reporting layers or masses of cloud are reported as follows:

a) First Group - Lowest individual layer of any amount

b) Second Group - Next individual layer of more than two oktas

c) Third Group - Next highest layer of more than 4 oktas

d) Additional Group - Significant convective cloud if not already reported
The cloud groups are given in order of ascending height.
e.g. FEW005 SCT010 SCT018CB BKN025 reports a few clouds at 500ft,
scattered cloud at 1000ft, scattered cumulo-nimbus at 1800ft and broken
cloud at 2500ft.

When there is no cloud to report, the cloud group is replaced by SKC (sky
clear). Obscured sky is coded VV followed by the vertical visibility in
hundreds of feet. When vertical visibility cannot be assessed, the group will
read VV///. In fine weather (i.e. visibility over 10km, no cloud below 5000ft,
no CB and no significant weather phenomena in the vicinity of the
aerodrome), the horizontal visibility, RVR and cloud groups are replaced by
the code ‘CAVOK’ (‘cloud and visibility ok’).

BKN005 OVC020 = broken clouds at 500ft and overcast at 2000ft

I – Temperature and Dewpoint (in Degrees Celsius separated by a diagonal line)
13/10 = temperature of 13 Degrees Celsius and a dewpoint of 10 Degrees

J – QNH (aerodrome atmospheric pressure) Values are rounded down to the nearest
whole figure and are reported as a four-digit group preceded by the letter Q.
Q0994 = 0994 millibars

K – Supplementary information - including recent significant weather phenomena
such as thunderstorms or wind shear. Recent weather refers to operationally
significant weather observed in the period since the last observation, but not
present now. The appropriate weather code will be inserted, preceded by the
letters RE. Windshear (WS) is also recorded for safety reasons.

RETS = warns of recent thunderstorms

L – Trend - forecasts any significant changes in conditions during the next two hours.
a) NOSIG = No significant change forecast
b) BECMG = Becoming
c) TEMPO = Temporary
BECMG and TEMPO may be followed by a time group (hours and minutes
UTC) preceded by one of the letter indicators FM(from), TL(until) or AT (at).

M – Runway state - This eight-figure runway state group may be added to the end of
the METAR (or SPECI) when there is lying precipitation or other runway
contamination. It is composed of the runway designator (first two digits), the
type of runway deposits (3rd digit), the extent of the contamination in percent
(4th digit), the depth of the deposit in mm/cm (5th and 6th digits), and finally,
the reported effect these deposits have had on aircraft braking action. Braking
action

27290993 = Runway 27 is wet or has water patches 9mm deep on less
than 10% of its surface. Braking action is reported to be medium to
good
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Postscript

Since this thesis was completed, Nottingham East Midlands Airport has again been renamed. On December 8\textsuperscript{th} 2006, it became 'East Midlands Airport -- Nottingham, Leicester, Derby' (Kasak and Peplow 2006).

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