EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ENERGY AND TRANSPORT
DIRECTORATE F - Air Transport

Assessing the Economic Costs of Night Flight Restrictions

Final Report

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February 2005

M P D Group Limited

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In Association with
Environmental Resources Management

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1 Executive Summary

1.1 Objectives of Study

The purpose of our study as defined in the specifications reproduced in Appendix A is to establish a framework for examining the economic impacts of any possible changes to an existing regime governing night flights at Community airports. The study should investigate the different economic aspects which relate to night flights and to produce a methodology as guidance to the competent authorities in Member States to assist them in preparing the analysis which is prescribed by Annex II of Directive 2002/30/EC prior to the introduction of operating restrictions.

We concentrate on the economic importance of night flights to the industry and the economic costs of further restrictions, but we do not look at the environmental consequences of such restrictions nor any economic benefits accruing to airport neighbours. Thus, we are concerned with only one side of the cost/benefit equation.

Our study is concerned with the methodology, rather than actual measurement, but necessarily involves considerably detailed review of the literature, the types of aircraft flying at night and the reasons for that. We also develop and examine the feasibility of a methodology – a "toolkit". In this Section we try to give the reader a broader overview of the subject of night flights and their importance and describe the main features of the toolkit.

1.2 Overview of Night Flights and Noise in Europe

In Section 4, we give a full review of the composition of night flights by sector of the industry, and their impact by airport. To put night flying in its context, we have examined data from different sources, including our own analysis of detailed data provided by Eurocontrol for 76 airports we included in our study, being those already covered by the Directive or likely to be so in the medium-term. A broad picture can be obtained from statistics gathered by ACI, (Airport Council International) the airport operators' professional body. Airports in their European region reporting statistics gives almost complete coverage of geographical Europe up to the Urals. The picture can be summarised by Table 1.1

A first question is the definition of "night". There is a default 8-hour definition of 2300 to 0700 in the "horizontal" Directive 2002/49/EC which applies to all modes of transport. However, this would not normally be considered a night period in air transport. The "day" period will be defined primarily by the demand for flights from short-haul passengers and will be determined in part by geographical and cultural factors. We estimate that some 8% of aircraft movements take place during the eight-hour period of which some 60% are jet transport aircraft. However, looking more closely we find that:

- Only about 2% of total movements are jet movements in the core six-hour period 2400-0600.
- Addition of the hour 2300-2359 increases this proportion to 3%; it should be noted that in the more easterly time zones, such as Helsinki and Athens, arrivals from Western Europe will tend to be very late in the evening
- Another 2% of movements are jet operations between 0600 and 0659; this is the beginning of the working day and, as will be noted below, departures at this time are essential for the operational efficiency of short-haul operators as well as for the business links of Europe's regions.

- A similar number of operations take place between 2200 and 2259, again essential for arrivals following the end of the business day and for the achievement of aircraft utilisation of short-haul operators

Table 1.1 Summary of European Airport Traffic

000 movements (take-offs and landings)	
Total Movements 24-hrs	16,486
Total movements 2200-0700	1,857
Total movements 2300-0700	1,326
As proportion of daily movements	8.0%
Jet Movements 2400-0600	324
Jet Movements 2300-0600	469
Jet Movements 2300-0700	744
Jet Movements 2200-0700	1,043
Source: Consultants' Analysis of ACI and Eurocontrol data	

The contribution of each industry sector to the default eight-hour "night" is shown in the table below.

Table 1.2 Contribution of Industry Sector to Night Flights

Night period 2300-0700 local	**Contribution to Jet Night Flights**
Scheduled Passenger - Short-haul	33.6%
Scheduled Passenger - Long-haul	13.6%
Budget Passenger	9.8%
Leisure Passenger	20.9%
Scheduled Freighters	2.1%
Charter Freighters	1.5%
Express	13.6%
Mail	2.8%
Other	2.0%
Total	**100.0%**
Source: Consultants' Analysis of Eurocontrol Data	

Each sector contributes flights to the night period, with "network" carriers' scheduled service passenger flights accounting for nearly half the total. We return to this below.

We have examined each of these industry sectors, consulted their representatives, reviewed the literature and carried out our own analysis in order to understand the reasons for the reliance of each segment on night flights, which we report in Section 3. We highlight the following points:

- Short-haul scheduled passenger services, both Low Cost and traditional, typically serve passengers who wish to start and finish their journeys in the "day"; the bulk of the fleet stays on the ground during the night. To serve the market demand, and to optimise utilisation of aircraft and crew, this implies a considerable number of arrivals in the late

evening (2200-2400) and a wave of departures at the start of the operating day (0600 to 0700). The volume will vary with the type of operation and geography.

- Long-haul passenger operations depend on flying through the night in at least one direction with landings and take-offs typically taking place during the day. The timings will be dictated by connecting traffic – typically 20%-40% of passengers on long-haul flights. So departures cannot be before mid-morning after the arrival of the first wave of feeder flights and arrivals need to be convenient for onward connections. The length of haul, time zones, curfews and commercial timings at the other end of the route produce a preponderance of morning arrivals in Europe. A large number of these need to be early in the morning – before 0700 and many before 0600.

- Leisure or passenger charter airlines achieve high rates of aircraft utilization by having one turnaround in the night. This typically takes place at the tourist destination in the Mediterranean area but there are also early morning departures from Northern European airports.

- The integrated Express carriers provide a door-to-door service to their customers, with a pick-up at the end of the working day and delivery the next day, a service which European businesses increasingly rely on for efficiency and productivity. The Express business model relies totally on being able to "hub" at an airport during the middle of the night to sort and tranship packages.

- Mail operators have the same operating pattern as Express carriers, with a sorting hub, mainly catering for domestic premium rate mail.

1.3 Restrictions on Night Flights

We present an inventory of night restrictions prevalent at the study airports in Section 4.3. We do not take account of operational restrictions (such as runway limitations) but list those which are likely to have a significant economic impact. In summary:

- 42 airports – no restrictions (23), only noise-related fees (8), or bans on noisier aircraft (11)

- 11 airports a quota system, of which 9 are "noise budget" or Quota Count systems

- 23 full or partial curfews, including the four City Airports, in some cases with exceptions and one has a curfew for take-offs.

- Where there are curfew or quotas, an eight hour period is not accepted as standard. An eight hour period (or longer) applies to the City Airports and to the noisier Chapter 3 curfews at four German airports. An eight hour period applies to five quota airports and two curfew airports. At the remaining twenty-five restricted airports, the curfews or restrictions apply for six or seven hours.

In Section 4.6 we examine the distribution of night flights by airport using the standard eight-hour definition of night. The highlights of this analysis are:

- Twelve airports, with over 50 movements per night account for about half of all night flights. They tend to be large airports, led by Paris CDG, Frankfurt, Heathrow, Madrid and Amsterdam, but also include Brussels and Cologne/Bonn (express operations) and three airports with substantial numbers of Charter operations

- Long-haul flights are concentrated at the hubs of the major network carriers, particularly Heathrow, Paris CDG, Frankfurt and Amsterdam. It appears that the QC or "noise budget" system is compatible with these operations.

- Six airports have significant numbers of night movements by Express carriers. They range from 42 movements per night at Cologne/Bonn down through Liege, Brussels, Nottingham East Midlands, Bergamo to Paris CDG with 18 movements. Of these, only Cologne/Bonn, Brussels and Paris CDG are currently subject to Directive 2002/30.

1.4 Published Methods of Assessing Economic Impacts

We have reviewed the literature and also had the benefit of discussions with stakeholders about studies carried out for them (Sections 6 below and 7). There are a wealth of studies which assess the economic impact of air transport activity. We would single out the recently published ACI EUROPE study.

The assessment procedure consists of the following steps:

- the direct impacts at the airport in terms of jobs, turnover etc
- indirect impacts – jobs created outside the airport boundary at suppliers
- induced – the jobs and income created by the spending of the direct and indirect employees, which can generally be estimated by using a multiplier
- catalytic – the wider economic effects through improving productivity, attracting investment and tourism

We have interpreted these findings and used them to estimate one simple measure of the economic impact of night flights. In doing so we have allowed for the fact that a number of day flights are dependent on "night" flights as defined – the corresponding arrival or departure and connecting flights. We have made a broad-brush allowance for this in the Table below:

Table 1.3 Broad Estimate of Employment Impact of Night Flights

Direct Employment 2001 (000)*				1400
Multipliers for indirect & induced				
Local		1.5		2100
Regional		2.1		2940
National		2.9		4060
Proportion of traffic in eight-hour "night"		8%		
With daytime flights dependent on "night" (range)	9%	to	12%	
Jobs attributable to night flights (000)**	365	to	487	

* Including estimate for off-site employment
** Excluding catalytic impacts
Source: ACI EUROPE/York Aviation; Consultants ' estimates

Thus, on this basis, about 360,000 –500,000 jobs in Europe are dependent on night flights. Other studies lead us to believe this might somewhat underestimate the impact.

Further important studies of night flights, including those at Paris CDG carried out for the DGAC and at Brussels for BIAC has built on this work to derive similar ratios for their night flights and in particular for freight and express operations. The Express industry itself has carried out several studies in different European countries. Not all of these studies look specifically at night flights, but their estimates of the overall impact of the industry together with its dependence on night operations, lead us to believe that the simple estimate of the overall impact of night flights in Table 1.3 may well be an underestimate.

We have also looked at a number of other studies dealing with night restrictions, the cost of suppressing demand and the benefits of economic liberalisation.

This body of work has enabled us to develop a methodology to assess economic impacts of night restrictions within a framework that already exists. It will always be useful to carry out analyses and surveys related to local conditions, but many of the tools are already available.

1.5 The Assessment Toolkit

The proposed toolkit will be able to use and build on the work that has already been done. In particular we propose to use the framework of direct/indirect/induced and catalytic effects that has been developed, and where benchmark values of key parameters and multipliers have been calculated.

The toolkit is designed primarily to deal, not with the economic benefits of night flights, but the economic impacts of further restrictions, and we have detailed a number of different types of restrictions which might have a direct effect on the economics of night operations.

We initially set out the procedures, types of measures, and measurement timescales which make up the toolkit in an Interim Report to the Commission.

1.6 Case Studies

Thereafter we conducted case studies at three selected airports:- Brussels Zaventem, London Heathrow and Palma de Mallorca. These are each important airports, both in terms of size (among the top 12 European airports in terms of total night movements) and in terms of the night activities they support, and are representative of the generic types of operation which we had identified. Our objective was to assess with the airport operators, airlines and other stakeholders the applicability, comprehensiveness, data availability, and general fairness of our proposals. Interviews, preceded by questionnaires, were conducted based on postulating hypothetical restrictions at each of the airports and discussing direct impacts with key stakeholders, ie how they might react to such restrictions, and whether they could provide data on employment and value added changes resulting from those reactions. We also discussed catalytic impacts with bodies representative of business and industry, and tourism, and practical, procedural and methodological approach aspects of assessments with all interviewees.

1.7 Summary of Recommended Methodology

We incorporated the views and contributions put to us in the case studies, together with the views of industry representative bodies, into our proposed methodology which is described fully in Chapter 10.

In summary, in the context of Directive 2002/30 the methodology requires competent authorities to set out clearly the proposed night restriction for which economic impact is to be measured. They must then define formal procedures for assessments, and allow a period of up to six months for affected parties to carry out such assessments of economic disbenefit. Airlines should thus be given sufficient defined time to consider problems created by new restrictions and to devise appropriate strategies to minimise losses before measuring the resulting economic effects in terms of employment – at the local, regional and national level as well as cross-border, and added value – at the country and cross-border level. Similar analyses should be carried out by the airport operator and other airport service providers, taking into account the assessments of traffic loss and flight changes reported by the airlines.

It would be the responsibility of the competent authorities (taking academic or other professional advice as required) for calculating the indirect and induced economic effects associated with the direct economic effects reported by stakeholders. At the same time - once the airport, aircraft

operator and service provider reactions are known - they should invite quantified representations (by means of public notices on an appropriate scale) from business and industrial representative organisations locally and nationally (including Chambers of Commerce), local and regional tourism bodies, as well as any specific firms or regional bodies identified by airlines as particularly impacted by revised operating plans, to assess catalytic effects.

Finally competent authorities should conduct a 'sense check' of all the data put to them, by comparing economic effects with overall regional and national economic data in Eurostat NUTS, and with 'rule of thumb' measures linking levels of air transport activity with employment and GDP.

2 Introduction

2.1 Context

This Report has been prepared for the European Commission by MPD Group Ltd in association with ERM Ltd, in order to:

- assess the economic basis for night flights in Europe;
- analyse current operating restrictions on such flights;
- develop a methodology for the assessment of the impact on the Industry of new or further operating restrictions under Article 4.2 and Annex II to Directive 2002/30/EC[1];
- test and refine that methodology through case studies at representative airports.

The Commission services have asked us to stress that the guidelines which will form a major output of the study are indeed for guidance purposes only. They are intended to assist Member States in meeting their obligations under Directive 2002/30 to assess costs and benefits when considering operating restrictions. They are not intended to be a precursor to legislation. Furthermore, it is assumed throughout that any such restrictions are considered as one element in a "Balanced Approach"[2] to dealing with noise problems at airports.

It is also important to note that the study is limited to the economic impacts of night flights and the costs to the industry, the locality, the region and the country of possible further restrictions. It specifically excludes consideration of the environmental impacts and their technical evaluation and any economic benefits to airport neighbours through increased residential values or otherwise. We must therefore re-emphasise that, as required by the Terms of Reference, this is not a cost/benefit study – it looks only at one part of the equation – the economic costs of further restrictions.

2.2 Data & Definitions

2.2.1 Base Data

We must first draw attention to some inevitable blurring of convenient labels, and to overlaps between definitions of types of flights. We return to this in Paragraph 2.2.4 below.

For our base data we are indebted to Eurocontrol, who have provided actual historic airport movement data for specimen periods of Summer (23 June – 06 July) and Winter (24 November – 07 December) 2003. Many airlines have also provided schedule information to assist in identifying flight purpose; the OAG has also been a useful published source for scheduled passenger and cargo flights.

Although scheduled passenger and cargo flight timetables are published, and indeed publicised, we have undertaken to respect commercial confidentiality regarding the timetables of non-scheduled operations, and regarding all actual historic flight data. Movements are not therefore identified by airline.

[1] Directive 2002/30/EC of the European Parliament and of the Council of 26 March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports.
[2] See ICAO Assembly Resolution A33-7, and in particular its Appendix C.

2.2.2 Night

In the interests of consistency, we have generally accepted the definition of night as the default value of 23:00 to 07:00 local time set out in Annex I to Directive 2002/49/EC[3]; and unless otherwise specified that is the period to which we are referring when using the word "night".

However, we are conscious that the definition of the length of the night period and the time at which it starts and ends are, under that Directive, subject to variation between States for measurement purposes. As long as the market is protected from distortion by the absence of discrimination, within a consistent framework account may be taken of local conditions, not only in terms of the nature of the noise problem which an airport may be seeking to alleviate, but in terms of the appropriateness of the restrictions considered.

Thus in examining night flights – and the associated aircraft movements at airports – in Europe, we have not only considered aircraft movements "at night" between 23:00 and 07:00 local time. We have also looked at the important marginal hour between 22:00 and 23:00 local time. We must re-emphasise that 23:00 to 07:00 is merely the default definition from Directive 2002/49/EC, used in this study for consistency and convenience. There is no necessary linkage between that definition for statistical, analysis or study purposes, and the period during which night operating restrictions are applied.

Our data timings are in block time – on and off stand, times equivalent to those used in timetables. Airport restrictions are not necessarily consistent, however, some are expressed in block time but some are expressed in flight (or runway) time terms – take-off to touch-down. This can be important, particularly at large and/or congested airports, when taxiing time of up to 15 minutes must be allowed for in scheduling and slot allocation.

2.2.3 Airports and Aircraft

Directive 2002/30 applies only to City airports and airports with "more than 50,000 movements of civil subsonic jet aeroplanes" of over 34 tonnes MTOW or with seats for more than 19 passengers, and refers only to the restriction of such aeroplanes' operations. In practice, this excludes almost all private, business and air taxi flights.

However, the qualification of an airport in terms of its level of activity over the three years preceding its consideration of restrictions is itself an indefinite quantity which might be achieved at any future time during the currency of the legislation. We have therefore taken care to collect data regarding not only those airports currently appearing to meet the criteria, but those around the margin and those of particular interest by virtue of their orientation toward night operations. The choice of airports is described in Section 4.2 and a complete list of the operations at the 76 airports whose night arrivals and departures have been studied is at Appendix D.

We have also gathered data on night movements by small jets and turboprops, which do contribute to the overall noise climate. These data have been filtered out from our data base and analysis, but are nevertheless discussed.

2.2.4 Flights

We have sought to categorise flights according to broad purpose, generally through identification of the main business of the operator, but also by cross-reference to aircraft type, origin/destination, membership of representative organisations, and timing (with manual checks on published and unpublished schedules and timetables). Our broad categories of operations are:

- scheduled passenger by "legacy" or "network" airlines (SP);
- low cost carriers or budget passenger (BP);

[3] Directive 2002/49/|EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise.

- leisure passenger (LP) including all operations by traditional charter airlines;
- scheduled freighter (SF);
- charter freighter (CF);
- express (E);
- mail (M);
- other and unidentified (O).

Obviously the boundaries between these categories cannot always be sharply defined. Traditional "flag carriers" operate scheduled passenger services to and from holiday resorts with competitive seat prices and blocks of seats sold to tour operators. The term "low-cost" is one widely adopted in the industry, though many airlines would count themselves now to be low-cost, and some branded as low-cost also provide some frills and business traffic is an important part of their business. We have adopted the industry nomenclature of "low-cost" but also termed them "Budget" in some of our data. Airlines that began life as "inclusive tour charter operators" selling the whole of the capacity of an aircraft wholesale to one or more tour operators have long-since sold individual seats to retail customers, sometimes directly. Now many classify their flights as "Scheduled", and appear as such in official statistics, even though perhaps a majority of passengers have bought their seats via tour operators. We see these operations, as does many in the industry as defined by the broader term "Leisure" which we adopt, but also refer to them by the more familiar term of "Charter". By the same token, "scheduled freighter" operations carry all classes of cargo ("products" distinguished by price and speed of delivery) on the same aircraft, including "express" cargo, but we have tried to identify uniquely express door-to-door/logistics operators (and their dedicated subcontractors) – although they too open some of their flights, particularly long-haul ones, to "conventional" cargo sale as scheduled freighters.

Further, some airlines best known for their passenger (or freighter or express) operations also carry mail (or other specialist contract commodities like newspapers) at night, and these flights can be impossible to identify.

It cannot therefore be overstressed that the categorisation of night flights by purpose or area of activity, while convenient and helpful as a framework for discussion of their economic impact, should not be taken as more than a general guide. Individual airports, when undertaking assessments of the economic effects of particular restrictions under consideration, will be able to identify the character of particular flights through the necessary process of consultation required by Article 10 of Directive 2002/30.

2.2.5 European Study Area and Length of Haul

After consultation with the Commission services, bearing in mind that Directive 2002/30 is over two years old and comprises "text with EEA relevance", as well as the practicalities of ready availability of consistent data and the relative distribution of currently qualifying airports, we have considered aircraft movements at airports in the 15 Member States of the Community of 2003[4] plus Iceland, Norway and Switzerland.

Since our data is based on night arrivals and departures at airports in those States, it includes domestic, intra-Community and international flights. One of our major concerns has been to correlate the type of flight with the reason for the timing of the arrival or departure, so we have had to define "short haul" and "long haul" by reference to the last/next airport served by each flight.

[4] Austria, Belgium, Germany, Denmark, Spain, Greece, France, Finland, Italy, Ireland, Luxembourg, The Netherlands, Portugal, Sweden and the United Kingdom.

Short haul comprises air transport movements at airports in our European study area originating or terminating in ECAC Member States[5] plus Belarus and States bordering the Mediterranean. Those originating or terminating elsewhere (including all of Russia) are regarded as long haul for the purposes of this study, although we look in more detail at particular origin/destination areas when necessary.

Some multi-sector long-haul flights may include an initial or terminal short-haul leg.

2.3 Conduct of the Study

2.3.1 Data Acquisition and Analysis

(a) Night Movement Data

As noted above, Eurocontrol have provided, and we have analysed, summary information on all aircraft movements at 76 airports in the study area for two specimen 14-day periods (Summer and Winter) in 2003. This includes all 54 airports currently covered by Directive 2002/30, including the four city airports, and twenty two others which we felt to be of particular interest or potential, or whose inclusion was necessary to ensure representation of each State in the study area.

This task involved:

- the multiple identification and decoding (date, time, airport of departure and arrival, operator, and aircraft type);
- identification and assignment of characteristics (flight purpose and length of haul); and
- collation and manipulation of this data;

in respect of 98,715 individual flight records by over 550 aircraft operators.

The results are used throughout this report, but the salient summaries are presented at Appendix D. Although 7% of total movements are coded "other and unidentified", this category mainly comprises small jets and turboprops not covered by the Directive. Only 1,202 (2%) of a total of 57,249 civil subsonic jet movements at study area airports at night could not be identified by operator and/or known or deduced purpose.

Even with the caveats on difficulties of identification and marginal overlaps of distinctions between carrier characteristics, stressed in paragraph 2.2.4, we believe that this is the first attempt to provide such a scale of perspective of the actual night noise climate in Europe according to flight purpose and carrier characteristics.

(b) Economic Data

In evaluating the economic benefits of night operations, and more specifically the economic disbenefits of further restrictions on night operations, we have been conscious of the need to use parameters which correspond with macroeconomic measures against which assessments of impacts on local, regional and national economies can be made.

Thus in measuring implications for airlines, airports, their customers and service partners and other dependent business beneficiaries, we will specify the provision of data which are consistent with the following parameters:-

- employment

[5] ECAC as at 21 January 2004 comprised: Albania, Armenia, Austria, Azerbaijan, Belgium, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, the FYR of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Moldova, Monaco, the Netherlands, Norway, Poland, Portugal, Romania, Serbia & Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, and UK. For the purposes of this study, Algeria, Belarus, Egypt, Israel, Lebanon, Libya, Morocco, Syria and Tunisia may be added to the ECAC list as making up **short haul** origins/destinations. All other States are **long haul**.

- value added /GDP.

The measurement of **employment** and of the implications for direct employment as a result of restrictions on night operations should be reasonably straightforward in data availability terms, for all the stakeholders involved. There is also a body of econometric research which provides us with the basis for assessment of 'multiplier' effects from direct and indirect employment by stakeholders onto induced employment. Finally, Eurostat (and National Statistics for the EEA economies) gather comprehensive and consistent data on employment at local, regional and national economies – including by industry classification, against which to measure employment impacts i.e. with consistent parameters.

The **value added** parameter allows stakeholders to bring in monetary values, requiring them to assess the effect of night restrictions on their gross revenues net of changes in bought-in goods and services. This is a measure not inconsistent with the financial data which stakeholders would have generally available, and - just as importantly - consistent with Eurostat and National Statistics at the local, regional and national level. Where there is no value added data in regional/national statistics, GDP data is available and reflects the same underlying concept.

In later sections of this report, we address the issues of:

- whether employment and value added are appropriate parameters for use in all given situations;
- how catalytic and network effects can be taken into account.

2.3.2 Literature Review

We have consulted a wide variety of sources, written, electronic, and oral (this latter covered in section 7), but we see this as an ongoing activity that by its very nature we can never describe as "completed". There is always more to learn.

Nonetheless in section 6 we shall highlight some of the salient points from a selection of these sources, to indicate how they reflect the viewpoints of interested parties and have acted as signposts in the progress of our work. We have also prepared a select bibliography that can be found at Appendix B to this report.

2.3.3 Stakeholder Consultation

As well as meeting with and ongoing dialogue with Eurocontrol, we have carried out a programme of meetings with representative bodies at the European level as follows:

- Commission Services (TREN F4): kick-off meeting, at which we were advised to assure stakeholders of the neutral non-legislative advisory nature of the study, and received guidance on the emphasis to be given to the economic costs of the restriction of flights, rather than the economic evaluation of potential environmental benefits.
- Airports Council International (ACI EUROPE): exploratory meeting with a Policy Manager leading to a more detailed discussion with the full Environmental Strategy Committee.
- Association of European Airlines (AEA): a meeting chaired by the General Manager Infrastructure and Environment which some scheduled passenger airline members also attended or sent documents, followed up by supplementary schedule and policy information.
- European Low Fares Airline Association (ELFAA): a discussion with the Secretary General, noting that this is a relatively young organisation whose membership is not comprehensive.
- European Regions Airline Association (ERA); a meeting with the Director General, ERA and his staff. The D-G also acts as the secretariat of the Committee for Environmentally Friendly Aviation, which includes most of the representative bodies we have consulted.

- International Air Carrier Association (IACA): a meeting with the Director General, representing the interests of Charter/Leisure carriers, followed up by graphic night activity information.
- European Express Association (EEA): a meeting with the Transport and Environment Committee, supplemented by a meeting with Oxford Economic Forecasting (OEF) as the author of two of the Association's studies on the industry's impact on national economies.

We have also met with the UK Department for Transport to ensure that we are fully apprised of the outcomes of their recent Night Noise Forum, and to collect Community-relevant data.

We were also in direct contact at an early stage of our work with a number of individual carriers to clear up technical questions of scheduling and to assist with identifying or checking flight purpose.

We were received with unfailing courtesy and the utmost co-operation from all of these organisations, for which we would like to express our sincere thanks.

At the later case study stage of work, we were of course in closer contact with individual stakeholder companies and organisations.

2.3.4 Development of Guidance Methodology

The work described above enabled us to prepare the first draft of a methodological toolkit as a guidance document for airports or other competent authorities to employ in assessing the economic impact of operational restrictions on night flights. We then tested that methodology in a series of case studies, described in section 9 below. This was a vital phase of our work, and significantly contributed to the redesign of elements of our initial draft assessment methodological guidance, with particular reference to the availability and suitability of quantifiable indicators at the regional level; as well as several important practical procedural aspects of assessments. Our definitive recommendations, taking the lessons of the case studies into account, are in section 10.

We take this opportunity to stress again that it is for the Member States and the airports, in considering night flight restrictions within the context of the Balanced Approach and in accordance with the implementation of Directive 2002/30, to decide upon and to value the environmental objective they want to achieve by such restrictions – that is not the purpose of our work. In such a cost/benefit or cost effectiveness analysis, our toolkit is limited to giving guidance, and that on the economic valuation of only the costs of additional restrictions. Valuation of the environmental benefits is beyond the scope of this study.

2.4 Report Structure

The next element of this Report (section 3) is a brief industry review – the basic essentials of how the businesses of the three broad classes of operators work. Those three groups are:

- passenger operations; and
- cargo (freight and mail)
- airport operators and service providers;.

Section 4 presents our quantified overview of the night noise climate in Europe, in terms of:

- where;
- when; and
- why

night movements are taking place and/or are restricted. It is supplemented by detailed data analyses in Appendix D.

In Section 5, we follow this up with an analysis for each sector of the direct impacts of night restrictions and the strategies that could be available to them to deal with such restrictions.

The two following sections (6 and 7) respectively review the literature and the stakeholder viewpoints which have informed our work and helped to shape our initial draft methodological toolkit.

In the early part of our work, we developed a draft toolkit, which we covered in our interim report. That draft toolkit is presented in section 8.

We then went on to test the methodology in a series of case studies. Those case studies, and the implications drawn from them, are described in Section 9

Finally in Section 10 we develop a recommended methodology to be adopted by Member States.

3 Industry Review

3.1 Introduction

In this section, we review the individual sectors of the air carrier industry, bringing out the key economic drivers that explain their dependence on night flights. We conclude with a short commentary on airports and other support services.

3.2 Passenger Operations

3.2.1 Scheduled Service Passenger Flights

(a) Short Haul

"Classic" or "network carrier" short haul scheduled service passenger operations in Europe can be difficult to distinguish, at the margins at any rate, from Low Cost and Charter/Leisure operations. Simplified discount fares, internet bookings, allocations of seats to tour operators, and the very wide spectrum of routes offered, show that the "traditional" scheduled service airlines (including regional carriers) have adopted some elements of the business models of other types of carriers. The main distinguishing characteristics are often their links with overseas carriers in global alliances, and their emphasis on interline and on-line (same carrier) transfer connections, feeding and being fed by long-haul flights being particularly important.

Taking connectivity together with the scarcity of slots at most hub airports, and the need to offer attractive timings to local traffic (especially high yield business passengers), it can be seen that the pressures on short haul schedulers can be severe. Flying short sectors is relatively expensive in terms of crew, ground time and costs, and aircraft utilisation. Short haul passengers do not normally want to lose sleep by flying during the night, but they normally want as full a day as possible at the start and end of their business or leisure trip.

Thus short haul scheduled passenger jet flights typically operate by day, but travel on a working day (or a holiday) can and often does start very early in the morning, and end very late in the evening. Allied to morning and evening slot congestion at busy airports, the operators' desire to maximise utilisation, and to offer fast connections from long-haul flights, the response to these demand characteristics means that many flights depart before 07:00, and many arrive after 23:00. Given an average short haul jet flight duration of the order of 2 hours or so, (and differences of up to 2 hours in local time zone within Europe), scheduling for the ideal "working day return" capability tends to push the "day" envelope at both ends.

The prima facie overwhelming contribution of short haul scheduled service passenger jets to the night noise climate as defined can thus be seen to be largely a matter of marginal intrusion on the night period in order to maximise the operating day consistent with market demand. This shows the importance of the definition of the night period in the framing of restrictions, and to recognise (as in the flexibility of definition allowed for by Directive 2002/49) that there are social and cultural differences within the Community. Thus while some airports seem to regard 06:00 local not as a time for sleep but for setting off for work, some start restrictions before 23:00.

(b) Long Haul

Almost nine out of ten (87%) of scheduled service long haul passenger jet operations at night at our study airports are arrivals, and 90% of those arrivals take place after 05:00 local. Thus although the number of night scheduled service long haul passenger jet movements identified is about the same as the number of night jet express movements, their hourly distribution is very different. They do tend to be large aircraft, which even as relatively quiet Chapter 3 certificated types inevitably tend to produce significant noise in absolute terms.

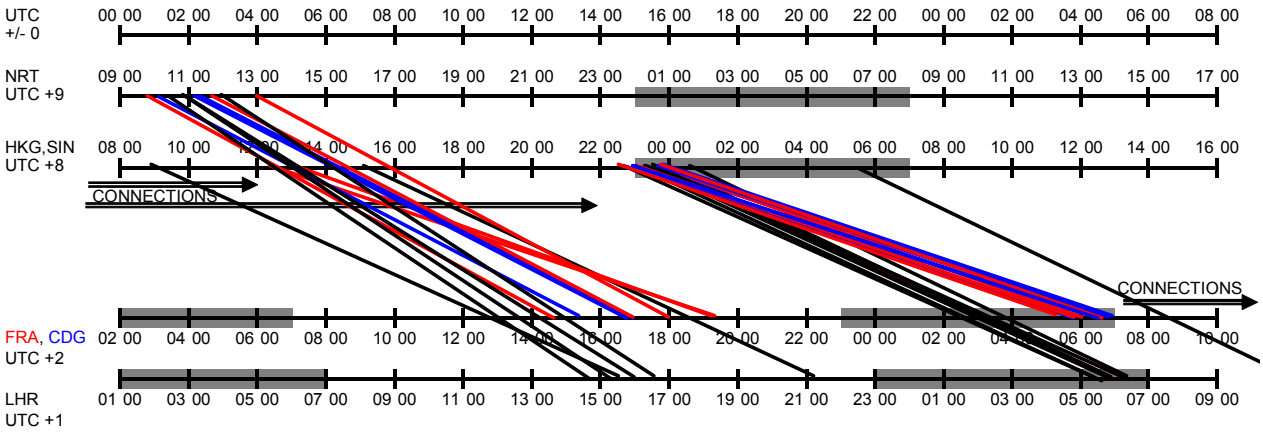
The arrivals pattern is due to a combination of factors, including:

- commercial and airport constraints upon late evening departure times (sometimes at a more distant origin for multi-sector flights);
- the interaction of local time differences around the world with the cruising speed and range of a jet (very roughly 1 hour gained/lost per 1.5 hours of flight west/east), with non-stop sectors over 9,500 km common;
- optimising crew and aircraft utilisation, taking account of duty and rest limitations;
- commercial constraints upon arrival time:
  - not too early for terminating traffic;
  - not too late for the first wave of (particularly short-haul) connections.
- this latter constraint applies to both outbound and inbound services; thus an eastbound "window" may not be available because of the arrival time of the inbound aircraft

Clearly a typical 13-hour flight to Europe leaving (say) Hong Kong (HKG) or Singapore (SIN) between about 22:00 and midnight local time is going to arrive (in Summer, with 6 or 7 hours local time gained on the way) between 05:00 and 07:00. If it leaves an hour or two earlier, it will arrive correspondingly earlier – unwelcome for terminating passengers and extending transit times for onward connecting passengers. An hour or two later departure offers a commercially unattractive post-midnight take-off, and may miss the first wave of onward connections from the European gateway.

Table 3.1 and Figure 3.1 analyse Summer 2003 non-stop flights between sample points of HKG and SIN in Asia, FRA and CDG in Continental Europe, and LHR.. Neither HKG nor SIN have night curfews, so the departure times (and European arrivals) appear to be primarily commercially driven. Most flights from SIN (and some other Asian points) are *en route* from more distant but also unrestricted origins such as Jakarta (CGK), Melbourne (MEL) or Perth (PER); while one is scheduled to continue Transatlantic from Europe. Some start in Sydney (SYD, UTC +10), which has a curfew from 2245 local – mid-afternoon departures transit SIN late evening. One that leaves just before the SYD curfew goes through SIN in the night and reaches Europe at mid-day; this presumably depends upon Australia-Europe traffic without picking up significant traffic in SIN. All the single-sector services are timed to make connections at both ends, with the exception of two arrivals from SIN (one at FRA and one at LHR), and one at LHR from HKG, which are too late for most onward connections and thus must rely upon the dense terminating traffic to these destinations.

Figure 3-1 Sept 2003 Non-Stop Westbound Passenger Services from Asia to Europe



Source : Consultants' analysis of September 2003 published timetables.

Broadly one would expect westbound arrivals in Paris to be later than arrivals in Frankfurt for example, and those in London to be later again (offset by the extra hour of local time gained), but

that is not always the case. This is partly due to departure times, but there can be differences of up to 7% in scheduled block times which may be for technical or artificial reasons, such as differences in aircraft capability, cruise technique, expected arrival delays, or perhaps due to flying at sub-optimal speeds in order not to arrive in Europe too early, which we have been told can occur.

This suggestion seems to imply that if they arrived too early they would be in conflict with operating restrictions. Leaving later might overcome that problem, but that could be commercially undesirable in many cases (perhaps impossible due to curfews elsewhere). By the same token, however, we understand that arriving earlier could also be commercially undesirable. That aside, consideration of any relaxation of current restrictions is beyond our remit. However, should an airline's considered least-cost response to any proposed new restrictions be to fly at sub-optimal speeds (rather than reschedule or cancel flights for instance), any additional net costs including fuel and crew would certainly have to be taken into account (as reduced value added) in precisely the sort of assessment required by Directive 2002/30/EC.

Table 3.1 Non-Stop Westbound Services from Asia to Europe, September 2003

Origin	From (UTC)	To (UTC)	Operator & Aircraft	Depart (Local)	Arrive (Local)	Elapsed	On to
SYD -	SIN (+8)	FRA (+2)	QF 744	2250	0530	12:40	
CGK -	SIN (+8)	FRA (+2)	LH 744	2305	0535	12:30	
	SIN (+8)	FRA (+2)	SQ 744	2350	0630	12:40	- JFK
	SIN (+8)	FRA (+2)	SQ 777	1230	1910	12:40	
	SIN (+8)	CDG (+2)	SQ 334	2250	0555	13:05	
PER -	SIN (+8)	CDG (+2)	QF 744	2300	0610	13:10	
CGK -	SIN (+8)	CDG (+2)	AF 777	2300	0615	13:15	
	SIN (+8)	CDG (+2)	SQ 744	2335	0640	13:05	
MEL -	SIN (+8)	LHR (+1)	QF 744	2245	0520	13:35	
	SIN (+8)	LHR (+1)	SQ 744	2320	0550	13:30	
SYD -	SIN (+8)	LHR (+1)	BA 744	2315	0555	13:40	
MEL -	SIN (+8)	LHR (+1)	BA 744	2335	0620	13:45	
SYD -	SIN (+8)	LHR (+1)	QF 744	0540	1215	13:35	
	SIN (+8)	LHR (+1)	SQ 744	0900	1530	13:30	
	SIN (+8)	LHR (+1)	SQ 744	1240	1910	13:30	

From (UTC +/-)	To (UTC +/-)	Operator & Aircraft	Depart (Local)	Arrive (Local)	Elapsed
HKG (+8)	FRA (+2)	CX 744	2345	0600	12:15
HKG (+8)	FRA (+2)	LH 747	1315	1915	12:00
HKG (+8)	CDG (+2)	AF 777	2335	0630	12:55
HKG (+8)	CDG (+2)	CX 744	2355	0645	12:50
HKG (+8)	LHR (+1)	BA 744	2305	0515	13:10
HKG (+8)	LHR (+1)	VS 346	2325	0555	13:30
HKG (+8)	LHR (+1)	BA 744	2345	0545	13:00
HKG (+8)	LHR (+1)	CX 744	2355	0545	12:50
HKG (+8)	LHR (+1)	CX 744	0045	0620	12:35
HKG (+8)	LHR (+1)	CX 343	1505	2105	13:00

From (UTC +/-)	To (UTC +/-)	Operator & Aircraft	Depart (Local)	Arrive (Local)	Elapsed
NRT (+9)	FRA (+2)	LH 744	0950	1435	11:45
NRT (+9)	FRA (+2)	NH 744	1135	1635	12:00
NRT (+9)	FRA (+2)	JL 744	1300	1800	12:00
NRT (+9)	CDG (+2)	JL 744	1015	1540	12:25
NRT (+9)	CDG (+2)	JL 744	1110	1635	12:25
NRT (+9)	CDG (+2)	NH 744	1125	1640	12:15
NRT (+9)	LHR (+1)	JL 777	1020	1445	12:25
NRT (+9)	LHR (+1)	BA 744	1055	1515	12:20
NRT (+9)	LHR (+1)	NH 744	1140	1555	12:15
NRT (+9)	LHR (+1)	VS 346	1100	1600	13:00
NRT (+9)	LHR (+1)	BA 744	1200	1625	12:25

Source : Consultants' analysis of published timetables

At both SIN and HKG, there are a few flights (generally operated by based airlines, which perhaps put more emphasis on their own Asian inbound connections) leaving Asia in daytime, reaching Europe in the afternoon or evening. By contrast, Table 3.1 and Figure 3.1 also show that all non-stop flights (of similar duration) to the same European destinations from Tokyo

Narita (NRT, UTC +9) leave between 0950 and 1300 local; thus arriving in Europe in the afternoon. In this market, timings are not influenced by aircraft transiting NRT. NRT has a 2300-0600 curfew, so the latest evening departures (2200 to 2230) would arrive in Europe between 0300 and 0400.

Table 3.2 and Figure 3.2 look at the same phenomena in eastbound terms – flights from North America to the same sample European hubs, with Boston (BOS, UTC –4) and San Francisco (SFO, UTC –7) our overseas examples. No curfews affect the schedules.

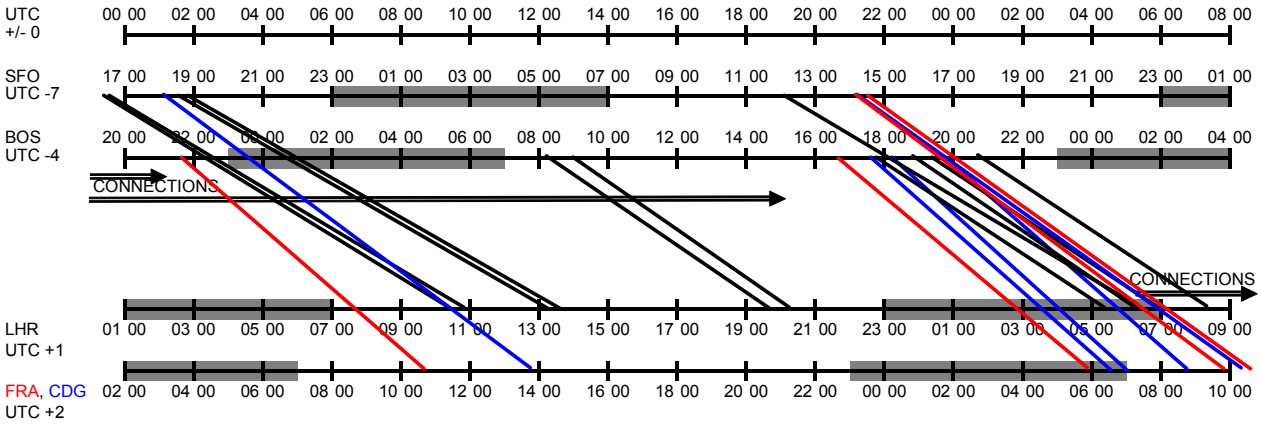
Table 3.2 Sept 2003 Non-Stop Eastbound Transatlantic Scheduled Passenger Services

From (UTC)	To (UTC)	Operator & Aircraft	Depart (Local)	Arrive (Local)	Elapsed
SFO (-7)	LHR (+1)	UA 777	1205	0625	10:20
SFO (-7)	LHR (+1)	VS 744	1630	1030	10:00
SFO (-7)	LHR (+1)	BA 744	1635	1050	10:15
SFO (-7)	LHR (+1)	BA 744	1850	1305	10:15
SFO (-7)	LHR (+1)	UA 777	1855	1315	10:20
SFO (-7)	CDG (+2)	UA 763	1420	1020	11:00
SFO (-7)	CDG (+2)	AF 777	1815	1355	10:40
SFO (-7)	FRA (+2)	LH 744	1420	0950	10:30
SFO (-7)	FRA (+2)	UA 777	1430	1030	11:00

From (UTC)	To (UTC)	Operator & Aircraft	Depart (Local)	Arrive (Local)	Elapsed
BOS (-4)	LHR (+1)	BA 777	0810	1945	6:35
BOS (-4)	LHR (+1)	AA 777	0900	2020	6:20
BOS (-4)	LHR (+1)	BA 744	1750	0515	6:25
BOS (-4)	LHR (+1)	AA 777	1850	0620	6:30
BOS (-4)	LHR (+1)	VS 744	1925	0655	6:30
BOS (-4)	LHR (+1)	BA 744	2045	0820	6:35
BOS (-4)	CDG (+2)	AF 777	1740	0630	6:50
BOS (-4)	CDG (+2)	AA 763	1810	0655	6:45
BOS (-4)	CDG (+2)	AF 343	1955	0845	6:55
BOS (-4)	FRA (+2)	LH 332	1645	0550	7:05
BOS (-4)	FRA (+2)	LH 343	2140	1045	7:05

Source : Consultants' analysis of published timetables

Figure 3-2 Sept 2003 Non-Stop Scheduled Eastbound Transatlantic Passenger Services



Source : Consultants' analysis of published timetables

Afternoon or evening departures of overnight flights are the rule, although there are some morning departures of daytime flights from Boston (and New York, Washington and Toronto). At SFO, where the block time is 10 or 11 hours, morning departures would (appear to) unattractively offer all day and all night on board for an arrival before 0700. In addition, even for a US airline, efficient aircraft utilisation is only achieved if the aircraft schedule is pivoted on the European point. As mid-morning departures from Europe are required, the inbound aircraft will arrive around noon or early afternoon on the West Coast. Thus despite the desirability of achieving onward connections in Europe in the early morning, SFO departures are mostly scheduled between 1400 and 1900 local, arriving in Europe after 1000.

From BOS it is only a six or seven hour flight to Europe, so most overnight eastbound schedules would have to leave after 1800 (1900 for Europe's western seaboard) to arrive after 0700. That looks quite an attractive compromise between the declared wish to leave at the end of a working day and arrive to start of the next.. However, while the spread of timings is less concentrated than at Asian airports, at least half the services studied arrive before 0700, and thus catch the first wave of onward connections.

Within the constraints of the relationships between time zones and the speed of aircraft, there is some flexibility according to the commercially competitiveness of timings and the degree of availability of slots. There is perhaps a further competitive constraint related to the layout and operation of the airport served; expressed in its published "minimum connecting times" (MCT). For a long haul arrival connecting at our Figure 3.1 sample airports to another international flight, these minima vary from a flat 45 minutes at FRA, through 45 to 60 minutes at CDG (depending on terminal), to between 45 minutes and 90 minutes (depending on terminal and destination) at LHR. Thus to offer a full range of onward connections to flights departing about 08:00, a long haul flight would have to be scheduled to arrive:

- at FRA, by 07:15;
- at CDG, by 07:00;
- at LHR, by 06:30.

In practice a spread of arrivals/departures has to be catered for, and hubbing airlines are doubtless selective in scheduling to make on-line rather than interline connections.

The broad conclusions we would draw are that (given the availability of slots):

- as long as they are untrammelled by curfews, the easiest and most commercially attractive scheduling windows for long haul departures to Europe imply night flights with arrivals between 0500 and 0700;

- there is some flexibility in scheduling to meet these commercial goals, although competition seems to lead to almost everyone offering more or less the same timings;
- where imperative curfews or geography require, airlines do manage to adapt their schedules to day flights with daytime arrivals in Europe, and offer a wider choice of timings.

3.2.2 Low Cost or Budget Passenger Operations

"Budget" or "Low Cost" have become an extremely important sector of the industry. Costs are minimised by short turnrounds leading to high utilisation of aircraft and crew, direct commission-less one-way sales, no frills service, no compensation for no-shows, use of cheaper airports, and no provision for connecting traffic. Revenue is maximised by high load factors and sale of ancillaries such as meals on board, insurance, car rental, and hotel bookings – as well as simplified fares and a sophisticated yield management to keep revenues up.

Some of these elements of the low-cost business model are practised in whole or part not only by Charter carriers but also by scheduled service airlines which are progressively adopting low-cost practices. Some have adopted the name of low-cost carriers even though they have maintained many of the services offered by traditional scheduled carriers.

A further characteristic of some but not all of these carriers is that they will use secondary or tertiary base or destination airports where initially at least they may be the sole or major operator. Few such airports fall within Directive 2002/30 (although we have deliberately ensured the inclusion of two, Frankfurt-Hahn and Liverpool, in our coverage) but half a dozen of the airports qualifying on size or other grounds are also characterised by substantial Low Cost traffic, not necessarily at night, however. Nevertheless, because we have not sought data about such specialist airports as Charleroi, Lübeck, and Skavsta, our identification of Low Cost night jet movements as accounting for just over 11% of the total in our study area may be understated.

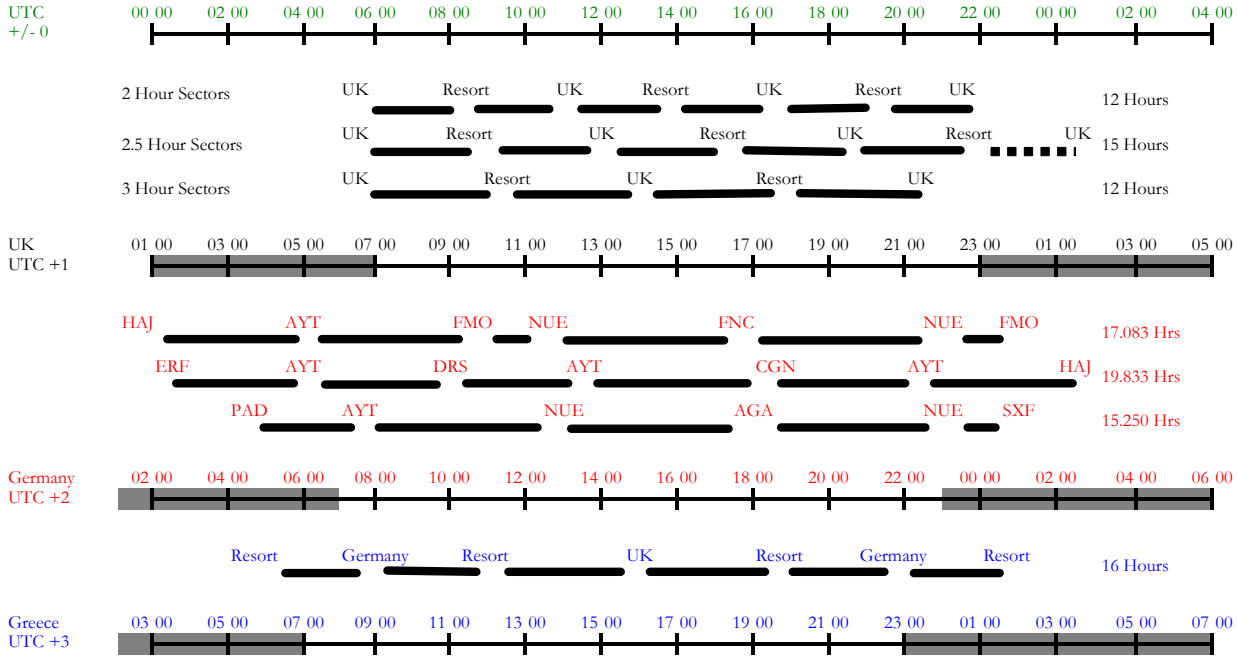
Despite the importance of utilisation in minimising fixed aircraft ownership costs per flying hour, Low Cost carriers tend not to fly in the middle of the night – unless serving holiday resorts where such scheduling is acceptable in the marketplace. We may say that the Low Cost carriers tend to have longer operating days than many classic network carriers, rather than being night operators. In addition, they try to minimise crew stopover costs, so they will tend to have a wave arrivals at their home bases in the late evening.

3.2.3 Charter or Leisure Carriers

Charter carrier's capacity used only to be sold wholesale to tour operators who bundled aircraft seats together with hotel beds and surface transfers to retail package holidays. This still happens, but these holiday flights are also characterised by individual seat sales. The industry shows examples of both vertical and horizontal integration, as in the TUI Group, with surface facilities (including cruise ships), several airlines, and retail travel agencies. Although the mass European market still remains largely centred on Mediterranean resorts served by flights from cooler northern climes, long haul holidays are an integral part of the operations of many Charter/Leisure airlines.

From the airline viewpoint, the crucial factor is the seat price, calculated on a load factor much higher than can be realistically targeted by a scheduled service operator generally aiming to maximise yield by prioritising business travellers. High aircraft and crew utilisation are thus essential to the Charter/Leisure carrier, and the most commonly quoted objective of a northern-based operator is the need for three rotations (return flights between markets and resorts) per 24-hour day, in order to achieve aircraft utilisation of 12 hours per day or more, on predominantly short to medium haul operations.

Figure 3-3 Typical Summer Charter/Leisure Schedules



Source : Consultants' estimates and analysis of current published timetables.

This can be difficult to achieve when airports serving conurbations in their market areas have curfews or quota-related restrictions. Figure 3-3 illustrates this for a UK-based airline. Over 2-hour or 3-hour sectors, with 45-minute turnrounds throughout the day and virtually no margin for delays, a 12-hour aircraft day can – theoretically - be squeezed into the 07:00 to 23:00 (local time) period, always provided that the airline can get exactly the airport and *en route* slots it requires. Even in such ideal conditions, at a 2.5 hour average sector length – fairly typical for Spain and Italy from the southern half of the UK or northern France – the last sector can not be completed before "night". In practice, in 2002 British charter carrier Air 2000 was able to report 12 hour daily utilisation in a fleet of 6 Airbus 320, while each of Britannia's 19-strong 737-800 fleet recorded 10 hours per day[6].

By flying at night, at least in Summer, two or even three quite long range rotations are currently scheduled by (for example) Air Berlin in Germany. The second part of Figure 3.3 shows specimen aircraft integrations serving Antalya (AYT), Funchal (FNC), and Agadir (AGA), from Hanover (HAJ), Münster-Osnabrück (FMO), Nürnberg (NUE), Erfurt (ERF), Dresden (DRS), Cologne-Bonn (CGN), Paderborn-Lippstadt (PAD) and Berlin-Schönefeld (SXF) – not all in both directions on the three cycles shown. While there are shorter aircraft days, these three aircraft cycles (not necessarily the same aeroplanes throughout the day or each day) produce between 15 and 20 hours each.

These cycles also illustrate a feature of the German industry, Charter/Leisure flight hubbing (e.g. FMO-NUE-FNC-NUE-FMO). The FMO-NUE and *vice versa* sectors will also offer connections to/from other resorts. The NUE hub was even more marked in the Winter schedules (of 2001/02 for instance), enabling holidays in Agadir to be offered with local flights on Tuesdays from and returning to no fewer than 14 German airports, connecting with one round trip[7] from NUE to AGA and back. All the local departures took off between 06:10 and 06:55, while the NUE 8-hour return trip to AGA left at 09:00 and returned after a one hour turnround at 18:05.

[6] For short haul scheduled service passenger operations, 7 or 8 hours per day is more usual.

[7] Three departures were provided for each Tuesday, but only one return flight number was used; plus one direct round trip from FMO with a Berlin-Tegel (TXL) connection.

The return connections all arrived at local points between 2110 and 2140. Each of those connecting aircraft would have continued to one of at least 14 resort destinations.

Air Berlin is not the only carrier practising hubbing at a southern German gateway, Condor (now branded as "Thomas Cook powered by Condor") does the same through Munich for instance. Again the intense hub activity tends to be morning and evening, technically "night" (early morning and perhaps late evening) departures and arrivals being at the spokes.

Finally Figure 3.3 shows the ability of "resort-based" Charter/Leisure carriers to schedule three rotations per day more easily that their northern competitors – provided that the resort airports have no night restrictions. Sample round trips using legs of 2.5 or 3 hours are shown, in this example using a resort destination in Greece and markets in Germany and the UK. Although Greece is a further one hour ahead, the principle of "night" first departures and last arrivals at the resort permitting "day" turnrounds in northern Europe can also hold for Italy, Spain and other southern bases with careful scheduling. The marketing disadvantage in the simple round trip rotation case is that the holidaymaking family "loses" at least half a day of their time at resort.

All in all Charter/Leisure carrier flights account for just under one in five of all night jet movements at our study airports. There is, as might be expected, a marked seasonality in these movements, 75% of them taking place in the summer sample period against 25% in winter.

3.3 Freight and Mail

3.3.1 Scheduled Freighters

While many of the world's "traditional" scheduled passenger airlines retain freighter aircraft and operate them to published schedules, less than half the world's "conventional" airfreight is carried on freighter aircraft. Most freight travels in the belly holds of passenger aircraft, in passenger/cargo combi aircraft, and on trucks.

It is important to bear in mind that "scheduled freight" is by no means a homogeneous product. A typical scheduled freighter operation will carry various kinds of cargo, including mail and express, as well as consignments characterised by – and charged at – different levels of urgency and delivery guarantee time.

We have identified an average of only about 23 short haul scheduled jet freighter movements per night at our study airports during the four sample weeks, including short-haul legs of multi-sector long haul flights. The great majority of. intra-European scheduled freighter timetables specify the "aircraft type" as road feeder service trucks (RFS).

The even lower number of long haul scheduled freighter flights at our study airports are often operated on behalf of major European and US carriers by specialist cargo airlines under wet lease or aircraft/crew/maintenance/insurance (ACMI) contracts, typically flying MD11F and Boeing 747-400F aircraft. There are some all-cargo carriers operating scheduled flights in their own right, such as Cargolux in the Community. Asian companies seem more likely to be operating their own long-haul freighters.

Broadly speaking, the flow of world trade and thus of long-haul flown cargo, tends to be westbound around the world. There are also north/south (and *vice versa*) freighter services of course, notably between Africa and Europe.

Some long haul flights operated by or identifiably on behalf of Express operators are also offered for sale as scheduled (implicitly "conventional") freighters, but we have treated these flights as Express since that is their main function. This re-emphasises the difficulty in categorising airline operations today.

3.3.2 Charter Freighters

There are still some "tramping" operations, but airlines describing themselves as charter freight operators may well be operating regularly on given routes, sometimes with specific contract cargoes such as newspapers or perishables. They may in some cases be operating on behalf of scheduled freighter operators; on the other hand scheduled service carriers are generally happy to fly whole aircraft charters for customers on demand, if they have spare capacity.

It is in the nature of the activity of such carriers that we cannot be precise as to the function of many charter freighter flights. The essence of charter operations of all kinds is, however, that they fly a service tailored "à la carte" to their customers' requirements, rather than offering a "table d'hôte" pre-scheduled service, albeit one designed to appeal to the marketplace.

Once having identified operations on behalf of express carriers among the activities of charter cargo operators, we have found very few jet charter freighter movements in the study area – about a dozen per night, on average.

3.3.3 Express

Express companies are not just airlines. The essence of their very competitive business is the totally integrated intermodal transportation of consignments door to door to guaranteed time limits, for which the European standard is "overnight", and Intercontinental up to 48 hours, although (cheaper) deferred services are also available.

Typical consignments over distances above 400km therefore follow some or all of the steps in the following sequence, core steps being emboldened:

- **pickup** at end of local working day, and road transport to local depot
- **road transport** to regional gateway airport for unitisation[8]
- feeder air transport to secondary-hub or sub-hub airport for consolidation
- **air transport** to international hub
- unload, **sort**, load
- **air transport** to secondary-hub or sub-hub airport
- feeder air transport to regional gateway airport for break-bulk
- **road transport** to local depot
- **delivery** at start of local working day.

Under 400 km, road transport is generally used throughout. Trains are also used, extensively in the United States but relatively rarely in Europe.

The timing of the critical path is constrained by:

- the competitive importance of the latest (end of business day) pickup;
- the crucial core sort time, between the last aircraft arrival at the hub and the first aircraft departure from the hub;
- the competitive importance of the earliest (start of business day) delivery.

Thus by definition it appears inevitable that the core sort time should fall "in the middle of the night" (with associated air transport movements at the hub, as well as later/earlier ones at the ends of the spokes), given the geographical size of Europe, and while the overnight pickup/delivery facility remains a market imperative.

[8] To standard ULD (unit load devices: pallets, containers).

The picture is somewhat simplified in the summary above. There are also long-haul connections to be considered, for instance. It should also be noted that, particularly at the ends of the spokes to/from the hubs, not all the air transport movements take place during the (default) night hours.

Although our approach is necessarily neutral, and we are concerned neither to defend nor to condemn particular actors on the night flight scene, in seeking to understand and devise means of evaluating their impact on Europe's economic life we must draw attention to the way in which the availability of overnight transportation of documents and goods has become an integral part of the way in which Europe works. For example:

- customers have adapted to the availability of express, developing the "just in time" logistics philosophy through the use of the express industry's effective provision of an "in flight" components and distribution warehouse facility for manufacturers as diverse as motor vehicles, textiles, chemicals, telecommunications equipment and retailing, both in intra-European and international trade;
- interaction has developed between customers and the express operators, so that (for example) specialist laboratory pathological testing has become an express-reliant overnight activity, and an important aspect of the express business;
- the express industry has diversified (or rather mutated) to take on aspects of the manufacturing role, (for instance) not only collecting defective personal computers for repair, and delivering the repaired items, but carrying out the repairs on behalf of the manufacturer.

There is increasing reliance upon overnight/24 hour transportation of documents, receipt of components, and despatch of products in competitive European and world markets. Paradoxically, however, it is that definition of the express product which imposes the need for night flights. It is not inconceivable that the express industry could exist as a 48-hour business using road and perhaps rail if there were no night flights at all in Europe – although the nature of European economic life would be very different, and its international competitiveness would be affected if "overnight" were still available overseas.

3.3.4 Mail

Mail has similarities to express in that it is a fast document and package transmission service, virtually door-to-door. These affinities are brought into focus by the acquisition of DHL by privatised Deutsche Post AG as its Express and Logistics Division, from which it earns as much revenue as from mail.

Despite increasing liberalisation of postal services (in the Netherlands and the UK for instance), domestic mail nevertheless works in a generally non-competitive context in that when a letter is posted it is consigned without choice to the care of a State owned and/or operated and/or regulated service provider – even Deutsche Post AG has an exclusivity licence until 2007 for mail. If express carriers and couriers compete for this business they do so before the choice of service is made by the sender, a single national postal service is the norm. We have found no provision for domestic "air mail" – guaranteeing that a domestic letter will be carried by air for a premium price – in Europe. Product pricing relates to delivery time targets and guarantees without reference to mode of transport.

International mail does not generally offer such tight time delivery guarantees, even at premium rates, perhaps because the business is not internationally integrated in the same way as the express industry. While normally travelling specifically as "air mail" short haul and long haul international mail appears to have more in common with conventional cargo than with express cargo, and often flies in the belly holds of passenger aircraft.

The dedicated night mail flights we have identified are thus typically domestic, using one or two regional sorting hubs with spokes radiating to local sorting centres, carrying premium rate letter

post. The airline operators carrying the mail are under contract to the postal authorities, and fly under their own names. They include large scheduled passenger and cargo airlines, regional passenger operators, charter freight and express airlines, as well as air taxi operators and other small firms. Thus we can not be as confident as we would like that we have correctly identified all the dedicated mail flights operating in our study area at night. Our overall impression is that the use of this type of operation is declining, as postal service providers under financial pressure to act commercially can not charge more for a domestic letter because it is carried by air. It is still important in relatively remote, peripheral and/or thinly populated areas like islands or the Arctic.

3.4 Airports and Other Service Providers

The airports and other service providers essentially serve the carriers. Thus their need for night operations reflects the demands of their airline customers. A few other comments are relevant.

Airports are unusual in that they have wider responsibilities, exercising a public service function, whether publicly-owned or not. Thus:

- Airports are conscious of the interests of the communities they serve. Thus, they will be aware of the wider economic benefits of night flights.
- They have long-lived assets and have to take a longer-term and more strategic view of investments than many of their customers. As such, they are conscious of the potential damage caused by aircraft noise to the political context in which they operate, and thereby to their freedom to operate. This has led to the concept of the "environmental capacity" of an airport.
- This explains the position of airports as intermediaries between airlines and the public. It is airport representatives who are often at the forefront of measures to curb aircraft noise at source, and to curb land uses to reduce exposure to noise. This will colour airports' attitudes no night flight restrictions.
- Some airports are part of a system. Thus airport operators may be readier than airlines to accept restrictions at one airport, if the ultimate customer, passenger or freight shipper, can be served at another airport.
- Others find themselves in a competitive position with other airports in the region. If further restrictions are imposed at one airport, the competing airport(s) could attract business away from it.
- Other sectors use airports at night. Apart from operators of non-jet aircraft, there are air taxi, military, ambulance other emergency demands. An airport may also want to cater for delayed flights. As a result, airports may well stay open at night even if they are shut to mainstream jet transport aircraft. This will have to be taken into account in the economic evaluation.

Other service providers to be taken into consideration are:

- Air navigation service providers; again they need to have a minimum presence at night, irrespective of the volume of aircraft operations
- Control authorities including Immigration, Customs, Port Health, security and police.
- Ground handlers including aircraft caterers etc
- Other commercial operators of car parks, catering facilities, shops etc
- Freight forwarders

3.5 Other Aircraft Operations

Directive 2002/30 applies to airports with more than 50,000 annual movements by jet aircraft with at least 19 seats or weighing more than 34 tonnes, and to restrictions affecting such aircraft.

We also note that under Directive 1992/14, jet aircraft below these minima are not subject to the phase-out of Chapter 2 aircraft. As regards the smaller jets and all non-jets our understanding of Directive 2002/30 is that:

- If a Member State is contemplating restrictions at airports with fewer than 50,000 qualifying movements, then it is not obliged to carry out an environmental and economic assessment
- If the restrictions contemplated apply solely to non-qualifying aircraft, then again there is no obligation to carry out an assessment.
- In other cases an assessment has to be carried out, and that assessment has to encompass all interested parties. This would include operators of non-qualifying aircraft, whether or not such aircraft were included in the proposed restrictions.

Thus, we propose that the assessments described in this report should apply to all aircraft operators. For convenience, we refer to these "non-qualifying" aircraft as "smaller aircraft".

4 Analysis of Night Flights in Europe

4.1 Overview

4.1.1 Introduction

Every 15 seconds (on average), between 23:00 and 07:00 local time (the default "night" period), a commercial jet aircraft takes off or lands in one of our Study Airports. We have identified over 57,000 such night jet movements at some 70 airports over 28 days in 2003 – two periods of 14 days to ensure seasonal representation (23 June – 06 July inclusive, and 24 November – 07 December inclusive)[9]. That implies an annual total of night jet movements of the order of three quarters of a million at those airports. Of these, about four-fifths were by jet aircraft.

To give a general picture, we have grossed up our study results, using returns made to ACI by almost every significant airport in geographical Europe. This indicated that our study airports account for some 65 per cent of all the movements. We then refined this estimate by eliminating a number of airports that cater mainly for private or club aircraft. As a further step, we eliminated those smaller airports that we believe from our general knowledge of the industry not to have significant numbers of jet operations. This showed that our airports account for some 77 per cent of jet operations. We also found that our study airports also account for 77 per cent of passengers. Applying these latter proportions, we estimate that jet movements in the eight-hour "night" period account for just under 6 per cent of all aircraft movements in Europe. Our analysis is shown in the following table:

Table 4.1 Overall Numbers of Movements

	All Europe	**Study Airports**		**Estimate for all Europe**
	(000)	**Annual** (000)	*Multiplier derived/*	
		From ACI data		
Total Movements	16,486	10,463	*1.58*	
excluding airports with insignificant air transport	15,140	10,463	*1.45*	
excluding airports with insignificant night jets	13,562	10,463	*1.30*	
Passengers (millions)	1,061	815	*1.30*	
		From Study Data		
		Four sample weeks	x 13 annual (000)	Multiplier applied	annual (000)
Total movements 2200-0700		98,715	1,283	1.45	1,857
Total movements 2300-0700		70,470	916	1.45	1,326
Jet Movements 2300-0700		57,249	744	1.30	965
Jet Movements 2200-2300		22,946	298	1.30	387
Movements 8 hours/24 hours			8.8%		8.0%
Jet movements 8 hours/total 24 hours			7.1%		5.9%

Source: Consultants' analysis of Eurocontrol & ACI data.

[9] That excludes nearly 23,000 additional jet movements in the 22:00 – 23:00 hour, included in night restrictions by some airports. It also excludes over 18,000 further movements between 22:00 and 07:00 by small jets (below 34 t MTOW and 19 passenger seats) and turboprops.

To re-cap, our database relates to those airports covered now or potentially by Directive 2002/30 in the Community of 15 Member States in 2003 plus the EEA States of Iceland, Norway, and Switzerland. From ACI statistics which give total aircraft movements for our study airports, we can establish that approximately 9% of all movements take place at "night" according to the standard definition of the extended eight-hour period.

Our database excludes:

- Smaller airports in the 18 study countries. These will tend to have fewer "night" movements because they will have a higher proportion of their movements accounted for by aero clubs and other general aviation categories. Of their air transport activity, the smaller airports will also tend not to have based airlines, which are likely to generate early morning departures and late evening arrivals. Furthermore, they tend to support service only by smaller aircraft which will disproportionately be operated by non-jet aircraft.
- Airports in the rest of Europe, including the ten new members of the EU. We do not know of any reasons why the pattern of operations at those airports should differ greatly from their counterparts in the study countries, except that there are fewer large hubs with significant intercontinental traffic.

We have examined in detail the traffic statistics prepared by ACI to estimate the impact of the factors mentioned in the first bullet point above, using indicators such as traffic levels, passenger numbers and average passengers per aircraft. Our estimates indicate that for Europe as a whole, some 8% of movements are in the eight-hour "night" period and that some 6% of all movements are "night" jet movements.

Fully detailed statistics relating to our study airports are presented at Appendix D. This section of the Report provides an overview, with salient extracts from and analysis of that data in succeeding sections.

4.1.2 Night Movements by Airport

As may be seen in Figure 4-1 and Table 4.2, the busiest 14 airports at night account for just over 50% of the total night jet movements identified in the study area. A further 17 airports bring the cumulative total to 75%, while none of the remaining 45 airports studied contribute more than 1% each.

Altogether we have covered 50 core airports plus a further 26.

Of our 26 additional airports:

- five[10] were included due to the extension of our study area to include the EEA countries of Iceland, Norway and Switzerland, but contributed only 3.4% to total night jet movements, Zurich ranking 29th;
- seven[11] completed airport systems, and accounted for a further 3.5 %, Bergamo ranking 27th;
- the remaining fourteen[12] had potential, or other special reasons for inclusion, and took 8.4% of total night jet movements; only Liège, ranking 13th overall, being in the top 31 which handle 75% of the total (and indeed bringing the cumulative total of the first 13 to 49.5%).

[10] Zurich (ZRH), Oslo-Gardermoen (OSL), Geneva (GVA), Keflavik (KFL) and Trondheim (TRD).

[11] Milan-Bergamo (BGY), Milan-Linate (LIN), Belfast International (BFS), Berlin-Schönefeld (SXF), Venice-Treviso (TSF), Tenerife-Norte (TFN) and Rome-Ciampino (CIA).

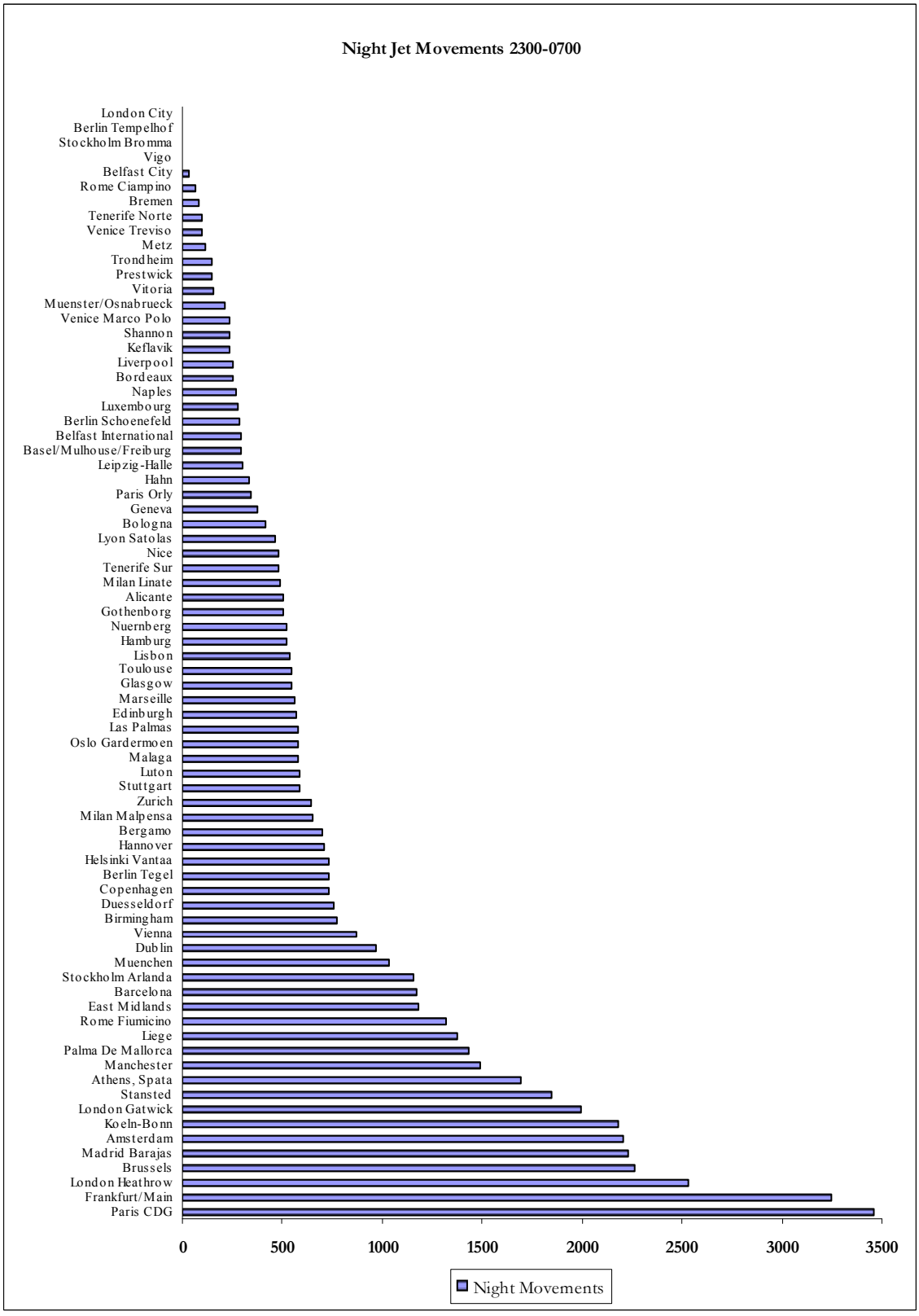
[12] Liège (LGG), Nürnberg (NUE), Bologna (BLQ), Frankfurt-Hahn (HHN), Leipzig/Halle (LEJ), Bordeaux (BOD), Liverpool (LPL), Shannon (SNN), Münster-Osnabrück (FMO), Vitoria (VIT), Prestwick (PIK), Metz (ETZ), Bremen (BRE) and Vigo (VGO).

Table 4.2 Night Jet Movements at European Airports (four sample weeks)

Airports	Thousands of Movements	Percentage of Total
CDG, FRA, LHR, BRU, MAD, AMS, CGN, LGW, STN, ATH, MAN, PMI, LGG, FCO	29	51%
EMA, BCN, ARN, MUC, DUB, VIE, BHX, DUS, CPH, TXL, HEL, HAJ, BGY, MXP, ZRH, STR, LTN	14	24%
AGP, OSL, LPA, EDI, MRS, GLA, TLS, LIS, HAM, NUE, GOT, ALC, LIN, TFS, NCE, LYS, BLQ, GVA, ORY, HHN, LEJ, BSL/MLH, BFS, SXF, LUX, NAP, BOD, LPL, SNN, KEF, VCE, FMO, VIT, PIK, TRD, ETZ, TSF, TFN, BRE, CIA, BHD, VGO, BMA.	14	25 %
THF, LCY	0	0%
Total	57	100%

Source: Consultants' analysis of Eurocontrol data

Figure 4-1 Night Jet Movements at European Airports



Source: Consultants' analysis of Eurocontrol data

4.1.3 Hourly Analysis

Different types of operation have different scheduling constraints (sometimes overlaid or complicated by airport operating restrictions at the European airports served or elsewhere), and thus different time signatures. The overview quantified in Table 4.3 and illustrated in Figure 4-2 gives the overall picture of night jet movements at our study airports. It should be remembered that short haul departures from one airport are likely to become short haul arrivals at their destination two or three hours later – a further reason why we generally refer to movements, rather than "flights".

It is notable that the over half of movements are in the first and last hours of the default night definition. These hours are frequently excluded from night restrictions as we show later in Section 4.5. Only 22% are in the core four-hour period in the middle of the night.

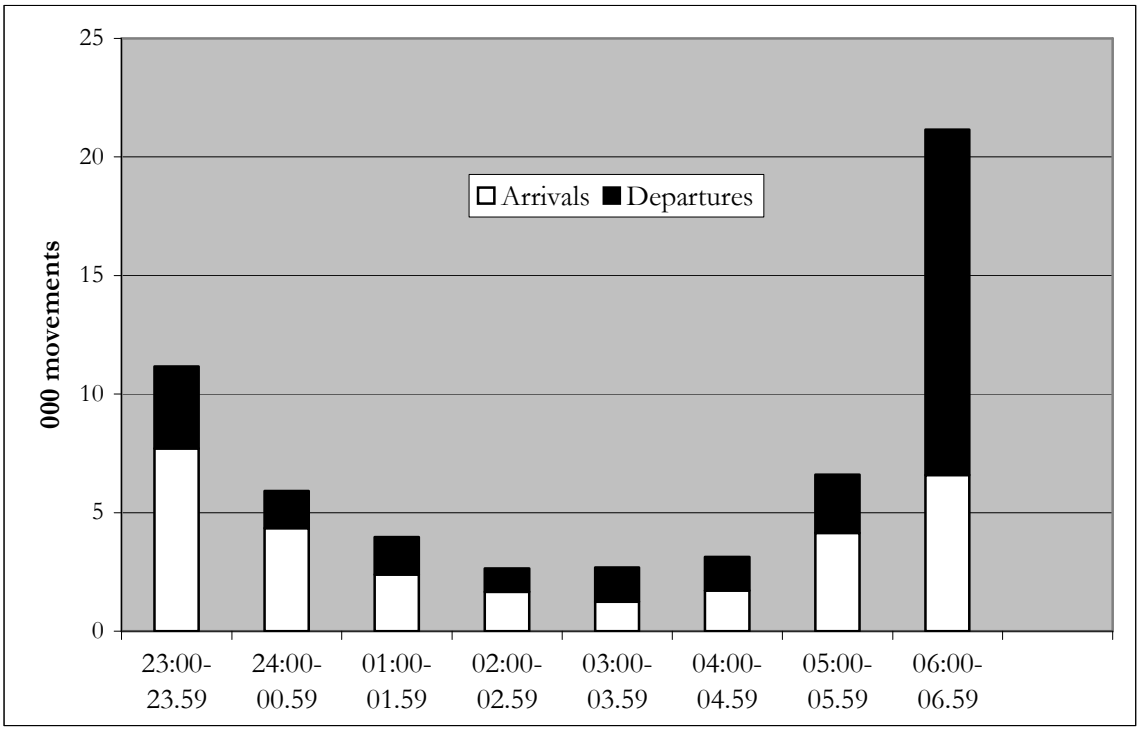
It should also be borne in mind that the 22:00 – 22:59 hour is busier overall (with nearly 23,000 jet movements, almost 70% of which are arrivals) than any single "night" hour, perhaps as operations are scheduled to avoid "night" restrictions.

Table 4.3 Hourly Distribution of Jet Night Movements (4 Sample Weeks)

Hour	Thousands of Movements			% of Total		
	Arr	Dep	Total	Arr	Dep	Total
23:00 – 23.59	7.7	3.4	11.1	26%	12%	19%
24:00 – 00.59	4.3	1.6	5.9	14%	6%	10%
01:00 – 01.59	2.4	1.6	4.0	8%	6%	7%
02:00 – 02.59	1.7	1.0	2.7	6%	4%	5%
03:00 – 03.59	1.2	1.4	2.6	4%	5%	5%
04:00 – 04.59	1.7	1.4	3.1	6%	5%	5%
05:00 – 05.59	4.2	2.4	6.6	14%	9%	12%
06:00 – 06.59	6.6	14.6	21.2	22%	53%	37%
Total	29.8	27.4	57.2	100%	100%	100%

Source: Consultants' analysis of Eurocontrol data.

Figure 4-2 Hourly Distribution of Night Jet Movements



4.1.4 Operational Analysis

We shall look in more detail in Section 4.4 at the characteristics of the different types of night jet operations, following through the outline descriptions in Sections 3.2 and 3.3 of the way such operations work in Europe, and why they fly at night. Here we give an overall view of the relative importance of each industry sector.

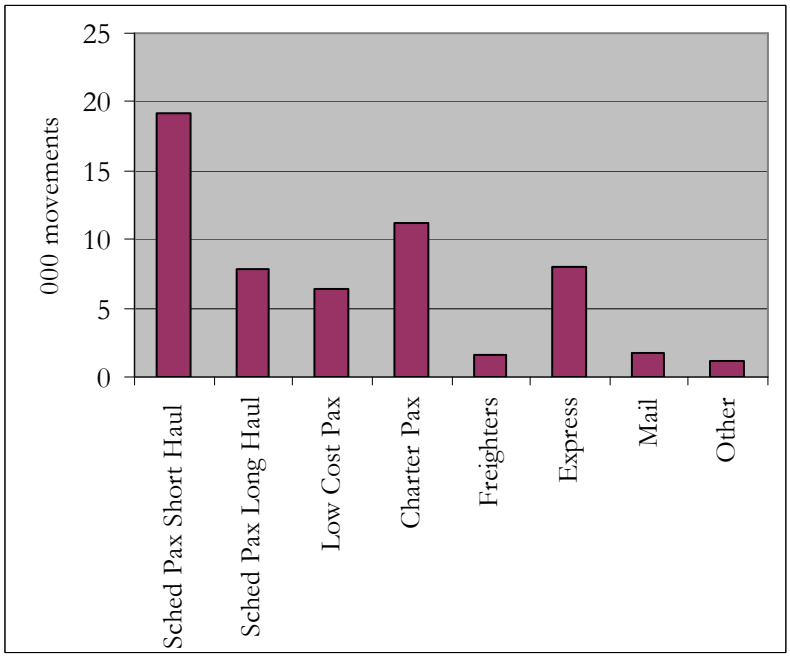
Table 4.4 Night Jet Movements by Industry Sector (4 sample weeks)

	Summer		Winter		Total	
Type of Operation	Movements	% of	Movements	% of	Movements	% of
Scheduled Passenger	14.2	43%	12.8	52%	27.0	47%
Low Cost Passenger	3.8	12%	2.7	11 %	6.5	11 %
Charter Passenger	8.4	26%	2.8	11 %	11.2	20 %
Freighters	0.8	2 %	0.8	3 %	1.6	3 %
Express	4.0	12%	4.0	17 %	8.0	14%
Mail	0.9	3 %	0.9	4 %	1.8	3 %
Other[13]	0.7	2%	0.4	2%	1.1	2%
Total	32.8	100%	24.4	100%	57.2	100%

Source: Consultants' analysis of Eurocontrol data.

[13] Includes unidentified movements.

Figure 4-3 Night Jet Movements by Industry Sector (4 sample weeks)



Source: Consultants' analysis of Eurocontrol data.

Perhaps surprisingly, most night jet movements are by short haul scheduled passenger flights – but almost half of those are in the 06:00 to 07:00 hour, scarcely perceived as "night" by day return passengers, or even by the working population in many European countries. That Charter flights account for the next largest number of flights is as to be expected (despite seasonality). Long haul passenger aircraft movements (mostly early morning landings, with large aircraft) outnumber Express operations (with arrivals and departures concentrated on hubs in the "middle of the night" and "spoke" movements in the shoulder hours). Low Cost passenger flights are next, with freighters and jet mail operations appearing to make a relatively minor contribution to the European scale of night operations, although they have significant impacts at particular airports.

Each category will however be subjected to detailed analyses in the remainder of this Section, the choice of airports for study being looked at first (Section 4.2), then current restrictions (Section 4.3), before the night movement characteristics of the different types of flight purpose or activity are examined, so that the interaction of activity and restrictions can be analysed (Section 4.5) and classified (Section 4.6).

4.2 Choice of Airports for Study

As agreed with the European Commission DG TREN/F3, the scope of this study includes airports in the 15 states of the EU as constituted on 01 January 2004[14], and also airports in the 3 EEA states[15], but excludes all airports in the ten new Member States.

[14] Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Sweden, United Kingdom

[15] Iceland, Norway, Switzerland

Directive 2002/30/EC provides criteria for specifying those airports where relevant authorities are obligated to apply the rules of the 'balanced approach' in dealing with further night noise limitations:-

> *Airports averaging > 50,000 annual civil jet movements by aircraft over 19 seats (or over 34 tonne MTOW) over three calendar years*
>
> *All City airports*

Although these criteria have guided us in the choice of airports for study of the economic impacts of night flights, we have taken into account other issues as well

- from a methodological aspect, there is no single database across European airports which records civil jet movements net of small jets – this data would only be available to the individual airport authorities
- because of external events since 2001 (09/11, SARS, Iraq War) affecting world travel markets, civil aviation activity in Europe has been quite volatile, with quite large swings in airport movements, and hence averages over the last three years may – at the margin – exclude airports which would normally be subject to the legislation
- during the currency of the legislation a number of smaller airports may well achieve the movements criterion
- stakeholders have indicated that there are a number of smaller airports whose activities are particularly skewed toward night activity and hence may provide useful evidence of the economic impact of such activity.

We have had access to total airport movement data at European airports through ACI and to commercial movements in 2002/3 at European airports via Sofreavia / BIPE[16], and further traffic statistics from a variety of sources. In all cases the data has been treated with some caution, since there are obvious problems of definition and consistency. In particular the published data can include small jet operations, as well as air taxi movements, and may also include aero club and private aviation, positioning flights, air tests or training flights.

The final list of airports has therefore been designed to provide an overview of night noise in Europe rather than a comprehensive inventory, and consistent with - though more comprehensive than - airports strictly defined by the Directive's criteria.

The first group of 54 airports tabulated below are defined as 'core',

- more than 35,000 annual jet movements and thus meeting or likely to meet Directive criteria within the foreseeable future, or, with more than 100,000 air transport movements in 2000/1 and/or 2002/3, or
- City airports under Directive, or
- only or representative airport of an EU (of 15 members) or EEA state

[16] Interim Report to EC DG TREN-F3 'Study on the different aspects of Noise Limits at Airports

Country	Airport name	IATA code		
Austria	Vienna	VIE	Core	>35k Jet
Belgium	Brussels	BRU	Core	>35k Jet
Denmark	Copenhagen	CPH	Core	>35k Jet
Finland	Helsinki	HEL	Core	>35k Jet
France	Bordeaux	BOD	Core	>35k Jet
France	Lyon Satolas	LYS	Core	>35k Jet
France	Marseille	MRS	Core	>35k Jet
France	Nice	NCE	Core	>35k Jet
France	Paris Charles de Gaulle	CDG	Core	>35k Jet
France	Paris Orly	ORY	Core	>35k Jet
France	Toulouse	TLS	Core	>35k Jet
Germany	Berlin Tegel	TXL	Core	>35k Jet
Germany	Berlin Tempelhof	THF	Core	City Airport under Directive
Germany	Cologne-Bonn	CGN	Core	>35k Jet
Germany	Duesseldorf	DUS	Core	>35k Jet
Germany	Frankfurt/Main	FRA	Core	>35k Jet
Germany	Hamburg	HAM	Core	>35k Jet
Germany	Hannover	HAJ	Core	>35k Jet
Germany	Munich	MUC	Core	>35k Jet
Germany	Stuttgart	STR	Core	>35k Jet
Greece	Athens Eleftherios Venizelos	ATH	Core	>35k Jet
Iceland	Reykjavik Keflavik	KFL	Core	Representative airport of MS
Ireland	Dublin	DUB	Core	>35k Jet
Italy	Bologna	BLQ	Core	>35k Jet
Italy	Milan Linate	LIN	Core	>35k Jet
Italy	Milan Malpensa	MXP	Core	>35k Jet
Italy	Naples	NAP	Core	>35k Jet
Italy	Rome Fiumicino	FCO	Core	>35k Jet
Italy	Venice Marco Polo	VCE	Core	>35k Jet
Luxembourg	Luxembourg	LUX	Core	Only airport of MS
Netherlands	Amsterdam	AMS	Core	>35k Jet
Norway	Oslo Gardermoen	OSL	Core	>100k ATM
Portugal	Lisbon	LIS	Core	>35k Jet
Spain	Alicante	ALC	Core	>35k Jet
Spain	Barcelona	BCN	Core	>35k Jet
Spain	Madrid Barajas	MAD	Core	>35k Jet
Spain	Malaga	AGP	Core	>35k Jet
Spain	Palma de Mallorca	PMI	Core	>35k Jet
Sweden	Gothenburg	GOT	Core	>35k Jet
Sweden	Stockholm Arlanda	ARN	Core	>35k Jet
Sweden	Stockholm Bromma	BMA	Core	City Airport under Directive
Switzerland	Basel/Mulhouse Euroairport	BSL	Core	>100k ATM
Switzerland	Geneva	GVA	Core	>100k ATM
Switzerland	Zurich	ZRH	Core	>100k ATM
UK	Belfast City	BHD	Core	City Airport under Directive
UK	Birmingham International	BHX	Core	>35k Jet
UK	Edinburgh	EDI	Core	>35k Jet
UK	Glasgow Abbotsinch	GLA	Core	>35k Jet
UK	London City	LCY	Core	City Airport under Directive
UK	London Gatwick	LGW	Core	>35k Jet
UK	London Heathrow	LHR	Core	>35k Jet
UK	London Stansted	STN	Core	>35k Jet
UK	Luton	LTN	Core	>35k Jet
UK	Manchester	MAN	Core	>35k Jet

The second group of 22 airports are defined as non-core and have been included for one or more of:-

- completes an airport system including the related core airport(s)
- typical Charter/Leisure operations
- typical freight/express/mail operations
- typical 'Low Cost airline' operations
- recent rapid growth, or potential for exceptional growth

Belgium	Liege	LGG	typical freight/express/mail
France	Metz	ETZ	typical freight/express/mail
Germany	Berlin Schoenefeld	SXF	completes airport system
Germany	Bremen	BRE	recent or potential growth
Germany	Frankfurt Hahn	HHN	typical 'budget'
Germany	Leipzig-Halle	LEJ	recent or potential growth
Germany	Munster-Osnabruck	FMO	recent or potential growth
Germany	Nuremberg	NUE	recent or potential growth
Ireland	Shannon	SNN	typical freight/express/mail
Italy	Milan Orio al Serio (Bergamo)	BGY	completes airport system
Italy	Rome Ciampino	CIA	completes airport system
Italy	Venice Treviso	TSF	completes airport system
Norway	Trondheim	TRD	recent or potential growth
Spain	Las Palmas	LPA	typical leisure
Spain	Tenerife Norte	TFN	typical leisure
Spain	Tenerife Sur	TFS	typical leisure
Spain	Vigo	VGO	typical freight/express/mail
Spain	Vitoria	VIT	typical freight/express/mail
UK	Belfast International	BFS	completes airport system
UK	East Midlands	EMA	typical freight/express/mail
UK	Liverpool	LPL	typical freight/express/mail
UK	Prestwick	PIK	typical freight/express/mail

4.3 Inventory of Night Movement Restrictions at Study Airports.

For the purposes of this study, we have only analysed those night restrictions at the study airports that act as an economic constraint on operators.

Many airports seek to limit noise exposure at night to surrounding populations by imposing operational constraints, e.g.

- limiting runway preference for take-off and/or landing,
- imposing more rigorous noise-abatement flight procedures
- limiting taxi power settings, or running of auxiliary power units (which provide power to the aircraft on the ground), or engine test runs.

Such constraints will not normally affect the underlying ability of carriers to operate at night as they see fit, and have a negligible impact on the potential economic benefits of night flights, unless they restrict payload in certain conditions.

Restrictions which may have a direct effect on the economics of night operations include the following

- limitation on operation by the noisiest aircraft
- quotas (sometimes noise-weighted) in terms of activity
- night noise surcharges
- curfews

Our analysis of relevant night restrictions at study airports has been based almost entirely on the Boeing website database[17] supplemented by further information from the Sofreavia / BIPE report (op. cit), and by information provided by individual airport companies. Information on the Boeing website was updated in April 2004, and reflects data supplied by airport authorities as at Autumn 2003.

Directive 92/14/EEC as amended, phasing out Chapter 2 operations, has been implemented throughout Europe, leading to a total ban on all Chapter 2 aircraft at night since April 2002.

The following 23 airports impose **no night restrictions** at all on Chapter 3 jet aircraft.

Austria	Vienna	VIE	Core
France	Metz/Nancy	ETZ	
Germany	Hannover	HAJ	Core
Germany	Leipzig-Halle	LEJ	
Greece	Athens Eleftherios Venizelos	ATH	Core
Iceland	Reykjavik Keflavik	KFL	Core
Ireland	Dublin	DUB	Core
Ireland	Shannon	SNN	
Italy	Bergamo	BGY	
Italy	Bologna	BLQ	Core
Italy	Milan Linate	LIN	Core
Italy	Milan Malpensa	MXP	Core
Italy	Rome Fiumicino	FCO	Core
Italy	Treviso	TSF	
Italy	Venice Marco Polo	VCE	Core
Norway	Trondheim	TRD	
Spain	Alicante	ALC	Core
Spain	Barcelona	BCN	Core
Spain	Malaga	AGP	Core
Spain	Palma de Mallorca	PMI	Core
Spain	Tenerife Sur	TFS	
Sweden	Stockholm Arlanda	ARN	Core
UK	Belfast International	BFS	
UK	Prestwick	PIK	

The following airports, while imposing no physical constraints on night flights, do make **surcharges** on landing fees for night flights, thus creating some economic disincentive for night flights.

[17] Airport Noise Regulation Information Web Site - www.boeing.com/commercial/noise

Belgium	Liege	LGG	
Finland	Helsinki	HEL	Core
France	Bordeaux	BOD	Core
France	Marseille	MRS	Core
France	Nice	NCE	Core
Germany	Berlin Schoenefeld	SXF	
Germany	Frankfurt Hahn	HHN	
UK	Nottingham East Midlands	EMA	

All four of the **City airports** impose an **absolute curfew** on jet operations at night. However, the timing and duration of the curfews does vary:

				Night Jet Curfew Hours	
				From	**To**
Germany	Berlin Tempelhof	THF	Core	21:00	05:00
Sweden	Stockholm Bromma	BMA	Core	21:00	06:00
UK	Belfast City	BHD	Core	21:30	06:30
UK	London City	LCY	Core	22:00	06:30

Two of the airports commence the curfew as early as 2100, while all relax the curfew before 0700.

A number of **non City airports** also impose **absolute curfew**s, but again with timing and duration varying.

				Night Jet Curfew Hours	
				From	**To**
France	Paris Orly	ORY	Core	23:30	06:00
France	Toulouse	TLS	Core	22:00	06:00
Germany	Duesseldorf	DUS	Core	22:00	05:00
Germany	Hamburg	HAM	Core	22:00	05:00
Italy	Naples	NAP	Core	23:00	06:00
Italy	Rome Ciampino	CIA		24:00	06:00
Luxembourg	Luxembourg	LUX	Core	23:00	06:00
Spain	Las Palmas	LPA		22:30	09:00
Spain	Tenerife Norte	TFN		23:00	08:15
Spain	Vigo	VGO		23:00	07:00
Spain	Vitoria	VIT		00:00	06:45
Sweden	Gothenburg	GOT	Core	21:00	06:00

In the case of Orly, there are in addition quotas on the number of flights from 2200 - 2330 and from 0600 – 0700 with noise surcharges, while at Dusseldorf all take-offs are banned from 2100. The four Spanish airports are closed to all traffic during the hours indicated.

Three German airports impose a **night jet curfew** but with the exception of night mail flights.

				Night Jet Curfew Hours	
				From	**To**
Germany	Stuttgart	STR	Core	23:00	06:00
Germany	Berlin Tegel	TXL	Core	22:00	05:00
Germany	Bremen	BRE		22:30	06:00

(Stuttgart also allows landings up to 2330).

The three Swiss airports have **variable curfew hours**, depending on the type of operation involved.

				Night Hours	
				From	To
Switzerland	Geneva	GVA	Core	22:00	06:00
Switzerland	Basel/Mulhouse Euroairport	BSL	Core	23:00	06:00
Switzerland	Zurich	ZRH	Core	22:00	06:00

Geneva and Basle allow scheduled operations up to 2400 and from 0500. The Zurich airport restrictions are relaxed on scheduled operations up to 2400, with a further limitation to 2300 where the approach is over Germany – a matter that has been subject to dispute with the German authorities.

A significant number of airports effectively impose **curfews on the noisier Chapter 3 aircraft** during specified hours, while permitting unlimited operations by quieter aircraft.

				Night Jet Curfew Hours	
				From	To
Denmark	Copenhagen	CPH	Core	23:00	06:00
France	Lyon Satolas	LYS	Core	23:30	06:15
France	Paris Charles de Gaulle	CDG	Core	23:30	06:00
Germany	Munich	MUC	Core	21:00	05:00
Germany	Munster-Osnabruck	FMO		21:00	05:00
Germany	Nuremberg	NUE		21:00	05:00
Germany	Cologne-Bonn	CGN	Core	21:00	05:00
Netherlands	Amsterdam	AMS	Core	23:00	06:00
Norway	Oslo Gardermoen	OSL	Core	23:00	05:00
UK	Edinburgh	EDI	Core	23:00	06:00

At Munich airport even the quieter Chapter 3 aircraft are banned between 2300 and 0400. However, at Amsterdam Schiphol all Chapter 3 aircraft may land throughout the night. Nearly all these airports also impose a night noise surcharge.

One airport in the UK- Luton - imposes **a curfew on take-offs only**, with no restriction on landings except for noise surcharges.

				Night Jet Curfew Hours	
				From	To
UK	Luton	LTN	Core	23:00	06:00

Two airports impose **simple quotas**, severely limiting the number of movements allowed during the night period.

				Night Hours	
				From	To
UK	Glasgow Abbotsinch	GLA	Core	23:30	06:00
Portugal	Lisbon	LIS	Core	00:00	06:00

The Glasgow quota applies only during the summer months, though with night noise surcharges throughout the year.

Other airports impose **Quota Count (QC)** systems to limit noise at night – mostly in the UK. QC systems are based on a count of aircraft movements against a noise quota according to aircraft noise classifications, distinguishing between arrivals and departures. Their effect is to discourage the operation of noisier aircraft at these airports, especially for departures, but allowing flexibility in the mix of aircraft. In some cases such as London and Brussels, there may be

supplementary bans on specific aircraft types e.g. at Heathrow during the full night period, even though the QC system only operates from 23:30 to 06:00.

				Night Hours	
				From	**To**
Belgium	Brussels	BRU	Core	23:00	06:00
Germany	Frankfurt/Main	FRA	Core	23:00	05:00
Spain	Madrid Barajas	MAD	Core	00:00	06:00
UK	Birmingham International	BHX	Core	23:00	06:00
UK	Liverpool	LPL		23:00	07:00
UK	London Gatwick	LGW	Core	23:00	07:00
UK	London Heathrow	LHR	Core	23:00	07:00
UK	London Stansted	STN	Core	23:00	07:00
UK	Manchester	MAN	Core	23:00	07:00

All these airports, except for Madrid and Liverpool, also impose **night noise surcharges**. It is of interest to note that most of the UK airports define night as between 23:00 and 07:00, in line with the default definition within the Directive. No other airports within the study define night in this exact way, and no airport other than these UK airports end the night period as late as 0700. The information on QC-type restrictions at Frankfurt is based on the Fraport website, which seemingly has superseded the information displayed on the Boeing website.

4.4 Analysis of Night Activity

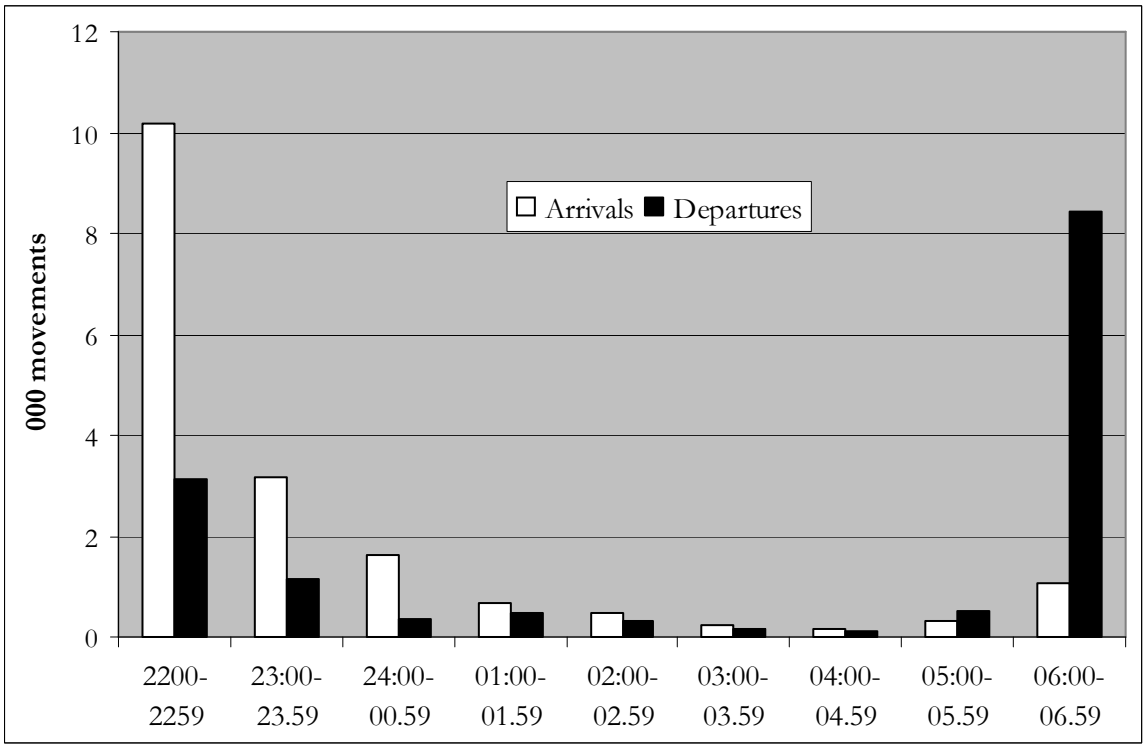
4.4.1 Scheduled Passenger Operations - Short Haul.

As discussed in Section 3.2, the short haul scheduled passenger business is primarily focussed on daytime operation. Yet the 19,200 such night jet movements identified in our sample 28-night period account for a larger proportion (34%) of night movements at our study airports than any other category of operations – more than all cargo flights together. The key to this is the directional distribution of the movements in our study area through the (default) night hours (23:00 – 07:00 local):

- 73% of short haul scheduled jet night departures take off between 06:00 and 07:00;
- 41% of their arrivals land between 23:00 and midnight.

The late evening landings will result from departures at the end of the business day, particularly those involving the crossing of time zones such as from Dublin or Lisbon to Helsinki or Athens. If we look outside the default night period, we find 36% more short haul scheduled passenger jet movements (with arrivals outnumbering departures by 3 to 1) at our study airports in the single 22:00 to 23:00 hour, than occur during the whole 23:00 to 06:00 period. Nonetheless, there remain nearly as many short haul scheduled service passenger jet movements during those seven "core" hours than there are all types of cargo jet movements.

Figure 4-4 Short Haul Scheduled Passenger Jet Movements (4 Sample weeks)



Source: Consultants' analysis of Eurocontrol data.

This traffic is somewhat seasonal, the summer/winter relationship of movements being 55/45, with middle-of-the-night movements being rather more thinly spread in Winter, as there tend to be lower frequencies to holiday resorts, for which the market seems readier to accept night flights.

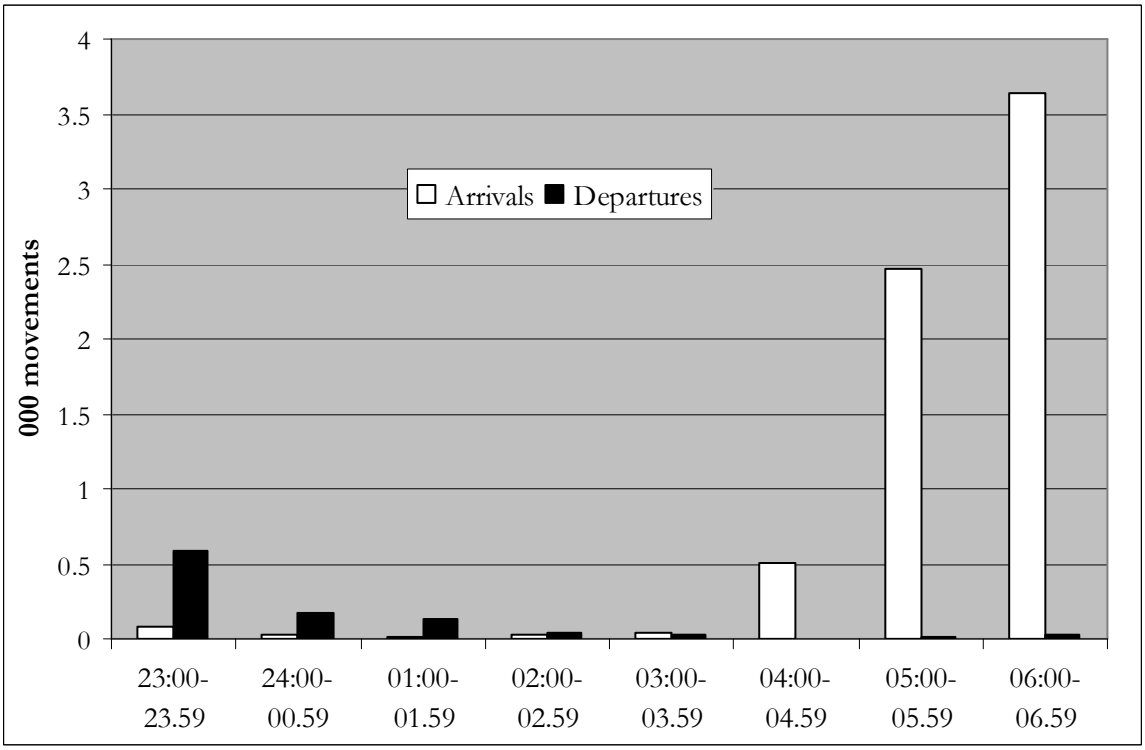
The busiest airports in terms of short haul scheduled passenger night jet operations are Athens Spata (7% of the total), Rome Fiumicino (6%), and Madrid (5%). They are followed by Amsterdam, Heathrow, Frankfurt/Main, Barcelona, Stockhom Arlanda and Helsinki (each with 3% or 4%). Those top nine airports account for some 40% of the total of such night activity.

The salient point with regard to short haul scheduled passenger flights is, however, that at the European level their major impact is on the first and last hours of the (default) night period.

4.4.2 Scheduled Passenger Operations - Long Haul.

We identified 7,800 long haul scheduled passenger night jet movements at our study airports over 28 nights – 14% of the total. As exemplified in Section 3.2, long haul passenger jet operations from some parts of the world – notably Asia and the North American eastern seaboard – tend to arrive in the very early morning. This is due to a combination of global time differences, optimum competitive connectivity, and maximum utilisation of resources.

Figure 4-5 Long Haul Scheduled Passenger Jet Movements (28 Night Sample)



Source: Consultants' analysis of Eurocontrol data.

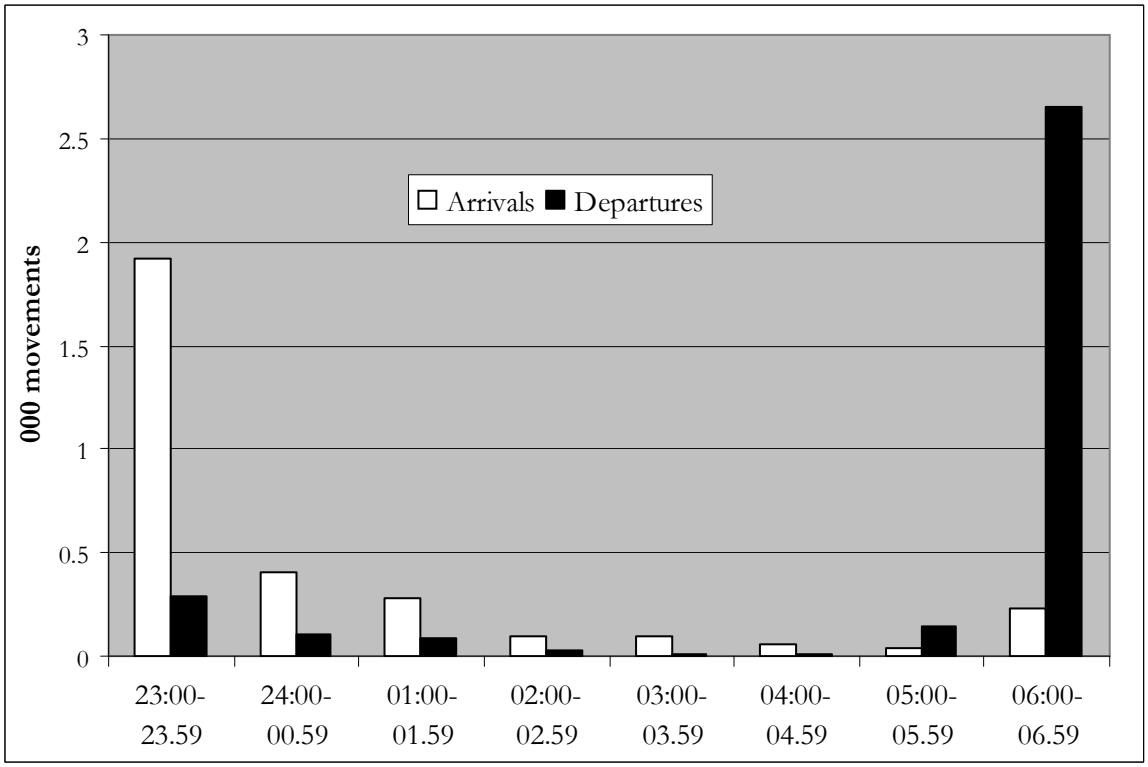
These flights are concentrated at a relatively small number of airports. Heathrow has 22% of total long haul scheduled service passenger jet movements at night (at certain times of year being claimed to face a local time disadvantage *vis-à-vis* most of continental Europe). Paris CDG, Frankfurt/Main and Amsterdam have 18%, 15% and 10% respectively. Madrid (6%), Gatwick (5%) and Zurich (4%) complete the concentration of some 80% of such movements on just 7 airports.

That the overwhelming night impact of these flights is of early morning arrivals is graphically clear from Figure 4-5. It should be remembered that these flights tend to be operated by large wide-bodied jets, albeit well within Chapter 3 certification limits, with each movement inevitably producing a noise event of greater intensity (sound pressure level) over a larger noise footprint, than a smaller Chapter 3 aircraft.

4.4.3 Low Cost Passenger Operations

One in nine of night jet movements are Low Cost passenger operations. But some 80% of the 3,300 Low Cost departures we found in the 23:00 to 07:00 period occurred between 06:00 and 07:00; and 61% of the 3,100 arrivals occurred between 23:00 and midnight.

Figure 4-6 Budget Passenger Jet Movements in Europe (4 sample weeks)



Source: Consultants' analysis of Eurocontrol data.

As Figure 4-6 confirms, despite serving Mediterranean resort destinations (particularly in Summer) as well as cities, Low Cost carriers fly rather long days than nights. The busiest airports for this type of traffic at night were Stansted (with 22% of the identified total), followed by Amsterdam, Luton, Gatwick, Hahn, Brussels, Dublin, Köln/Bonn, Bergamo and Liverpool (each with 3%, 4% or 5% of the total) – however, several airports specialising in this sort of traffic, like Charleroi and Skavsta, were not in our sample.

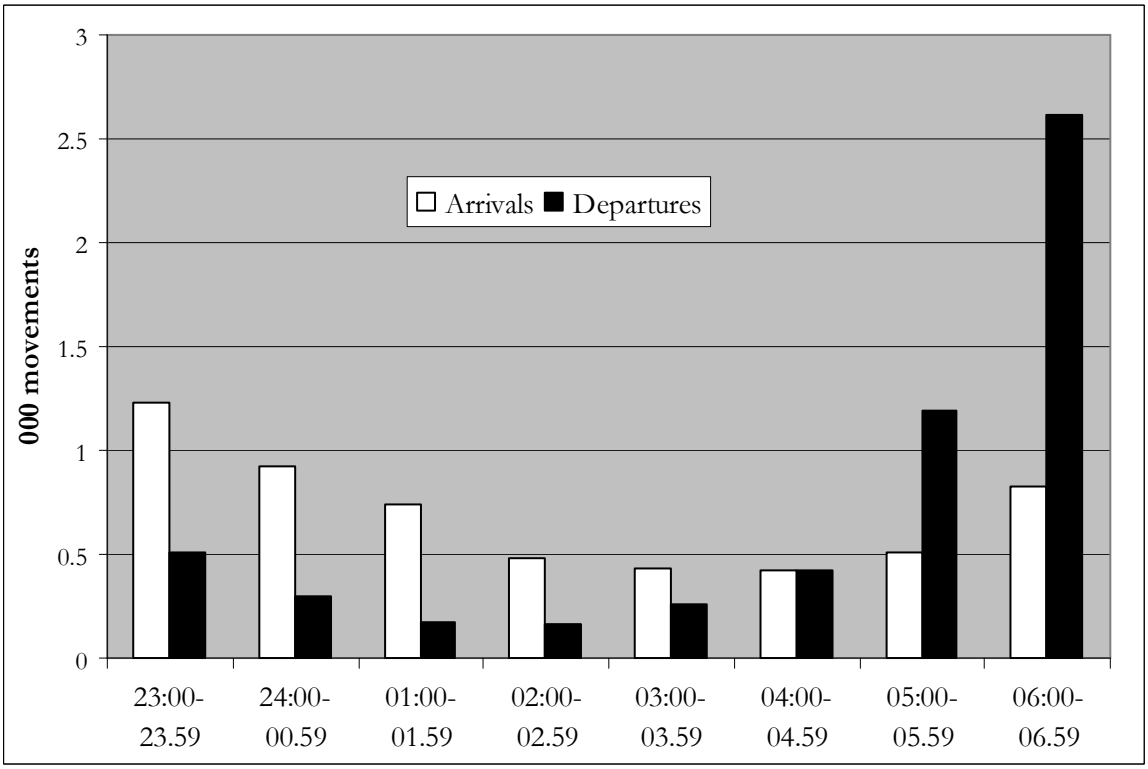
4.4.4 Charter/Leisure Passenger Operations

Charter passenger operations are seasonal, and this is reflected in their night jet movements. Of the total 11,200 Charter jet movements we identified during the default night period, 75% were in the Summer and 25% in Winter.

As may be seen from Figure 4-7, some 23% of the total movements were departures after 06:00, while 19% were arrivals in the two hours before 01:00. There is little activity in the middle of the night, but there is some, particularly at the resort airports.

The busiest airports for this category of night traffic (23:00 to 07:00 overall) were Gatwick (9% of the total), Manchester (8%), and Palma de Mallorca (6%).

Figure 4-7 Charter/Leisure Passenger Jet Movements (4 sample weeks)



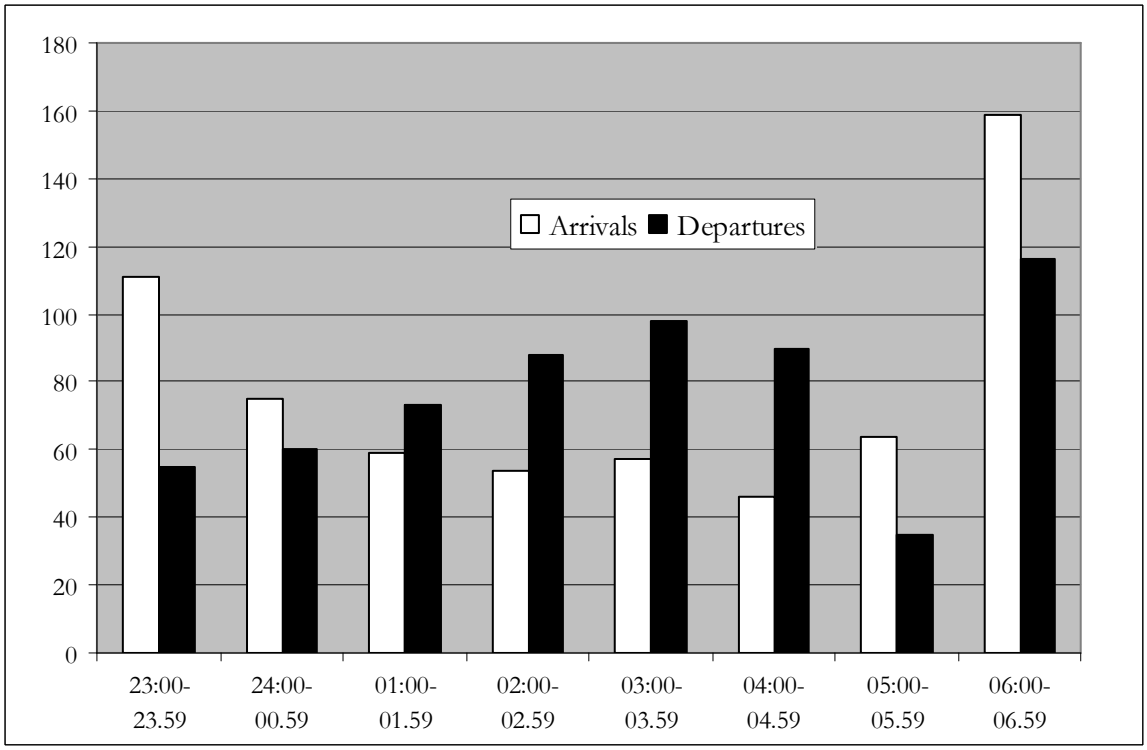
Source: Consultants' analysis of Eurocontrol data.

4.4.5 Scheduled Freighters

We have identified, on average, some 44 scheduled jet freighter movements per night (a total of over 1200) across our study airports. These flights accounted for about 10% of all jet cargo night movements at our study airports, but only 2% of all jet night movements. However, nearly half (47%) were direct long-haul flights, and these tend to be relatively large noisy aircraft. Further, some long haul origin/destination services make a short haul stop *en route* to serve more than one European hub.

The busiest short haul scheduled jet freighter airport in our study area at night was Köln/Bonn (also the busiest overall, with a 17% share), and the busiest for long-haul was Frankfurt/Main (second overall at 16%), which has Europe's largest cargo throughput overall. In that latter claim it is rivalled by London-Heathrow, where we found only the occasional scheduled jet freighter at night. Liège was third busiest overall at night, with 11% of the total.

Figure 4-8 Scheduled Freighter Jet Movements in Europe (4 Sample weeks)

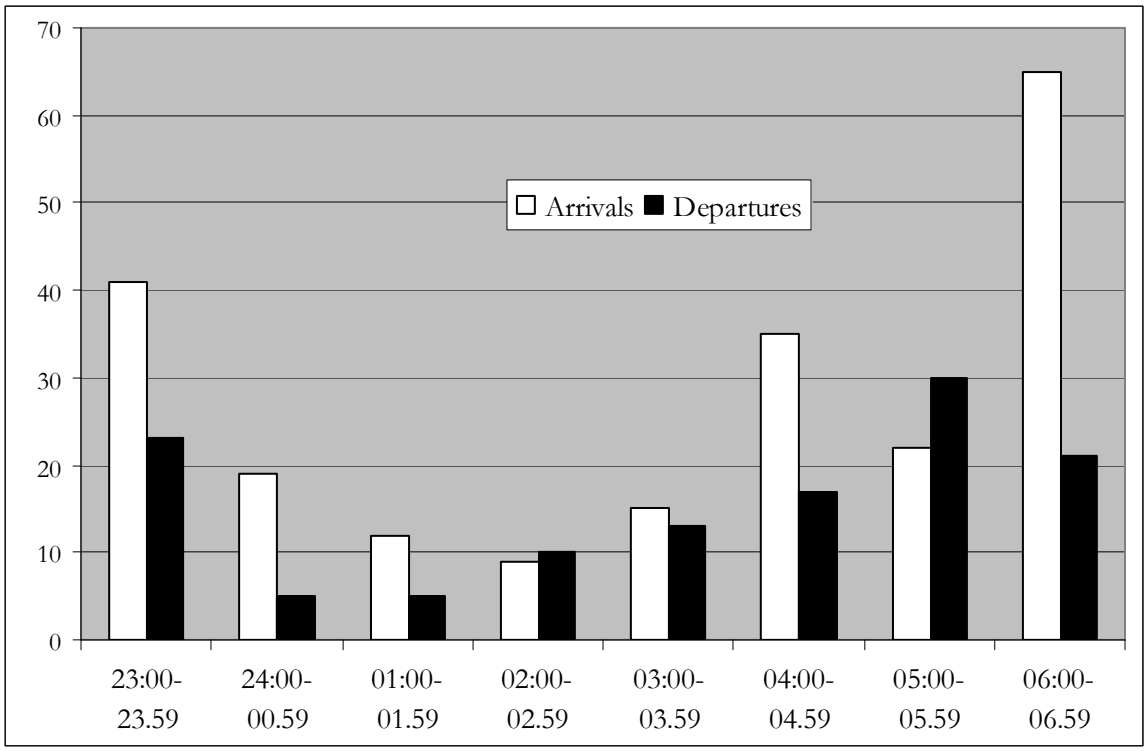


Source: Consultants' analysis of Eurocontrol data.

4.4.6 Charter Freighters

At less than 350 night jet charter freighter movements identified, this is our smallest category for analysis, with less than 1% of total night activity. Indeed even this may be something of an over-statement. We believe we have been able to correctly identify most scheduled freighter and express operations regularly flown on behalf of the nominal operator by charter companies, as well as to distinguish between passenger and freight operations in terms of charters generally. However, when dealing with the small numbers remaining in the sample under this category at particular airports, some anomalies may remain.

Figure 4-9 Charter Freighter Jet Movements in Europe (4 Sample weeks)



Source: Consultants' analysis of Eurocontrol data.

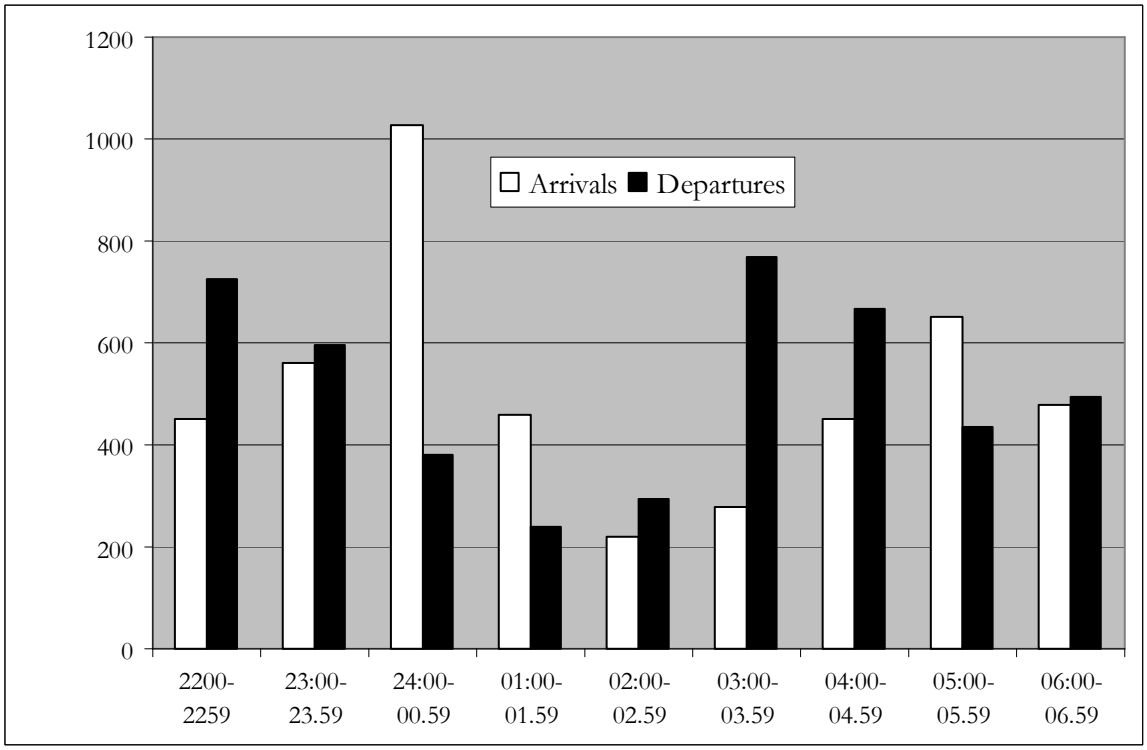
We have no reason to suspect that broad pattern of the time distribution shown in Figure 4-9 is unrepresentative, however. The important thing about this business in this context is its very unpredictability, in that charter airlines fly where and when their charterers demand, so far as airport restrictions permit.

4.4.7 Express

We have identified, on average, some 286 jet express movements per night across our study airports, a total of 8,000 over the four sample weeks. That might increase to 300 or more per night if all regional gateways were studied, and would certainly do so if movements in the 22:00 to 23:00 hour were included –it is departures outside the default "night" period which become night arrivals at other airports, particularly at spokes.

Express flights accounted for 60% of all jet cargo night (23:00 – 07:00) movements at our study airports, and 14% all jet night movements. The busiest airports in our study area in terms of night express flights were Köln-Bonn, Liège, Brussels, East Midlands, Paris CDG and Bergamo – all hubs or major sub-hubs on a European scale.

Figure 4-10 Express Jet Movements (28 Night Sample)



Source: Consultants' analysis of Eurocontrol data.

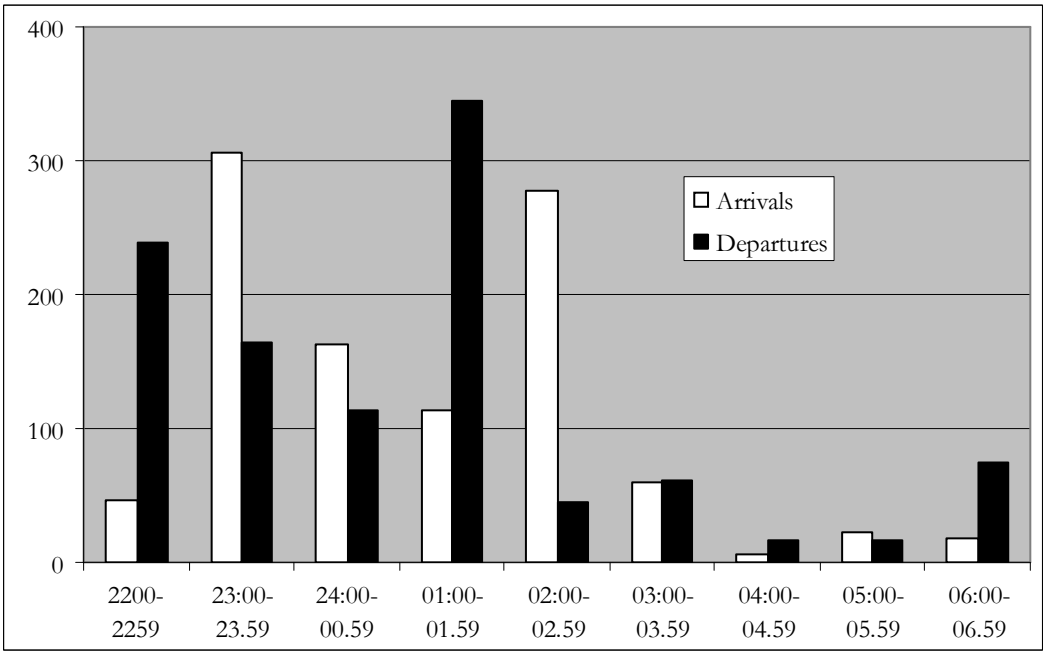
From, Figure 4-10 which we have extended to 22:00 for illustrative purposes (although there are also express movements before that and after 07:00 in the morning), the predominant directional "waves" of the pattern of operations described in Section 3.3.3 can be seen:

- departures (from spoke airports);
- arrivals (at the hubs);
- departures (from the hubs);
- arrivals (at the spokes).

4.4.8 Mail

We have found almost a thousand night mail movements per week in the study area – but over half of them are turboprops (or small jets). The total number of identified jet mail flights was 1,800, only 3% of total night jet activity. Paris CDG is the busiest night mail airport, mostly with jets. Its closest rival in total in total night mail movements is Liverpool, which has no mail jets, being wholly served by turboprops (and perhaps some small jets). Restriction to jets (in line with Directive 2002/30) may therefore give a somewhat unrepresentative picture.

Figure 4-11 Mail Jet Movements (4 Sample weeks)



Source: Consultants' analysis of Eurocontrol data.

Virtually all dedicated jet mail flights are domestic, certainly they are all short haul (as they are operated on contract to national postal authorities). Thus while a spoke-to-hub-to-spoke pattern can be discerned in the chart above, it is compressed, with overlaps, due to the particularly short haul general nature of such operations.

Paris CDG, Frankfurt/Main, Marseille, Stansted and Stockholm-Arlanda, with associated sub-hubs/spokes, account for most dedicated jet mail movements.

4.5 Activity/Restrictions Analysis

We have found little evidence that different types of night time jet restrictions at European airports, other than curfews, have had much influence on the overall level of night jet activity (though they may well have reduced the amount of noise nuisance e.g. where airlines have re-equipped with quieter aircraft). The broadest comparison shows the average number of night jet movements per night over the four fortnightly periods at each airport, together with the type of restriction (if any) currently imposed at the airport. The types of restriction are as detailed previously (Section 4.2, with the most stringent restriction being a total curfew, followed by quotas and partial curfews, then by restrictions on noisier aircraft, then by noise Quota Count restrictions, then by surcharges and finally no restriction at all.

Figure 4-12

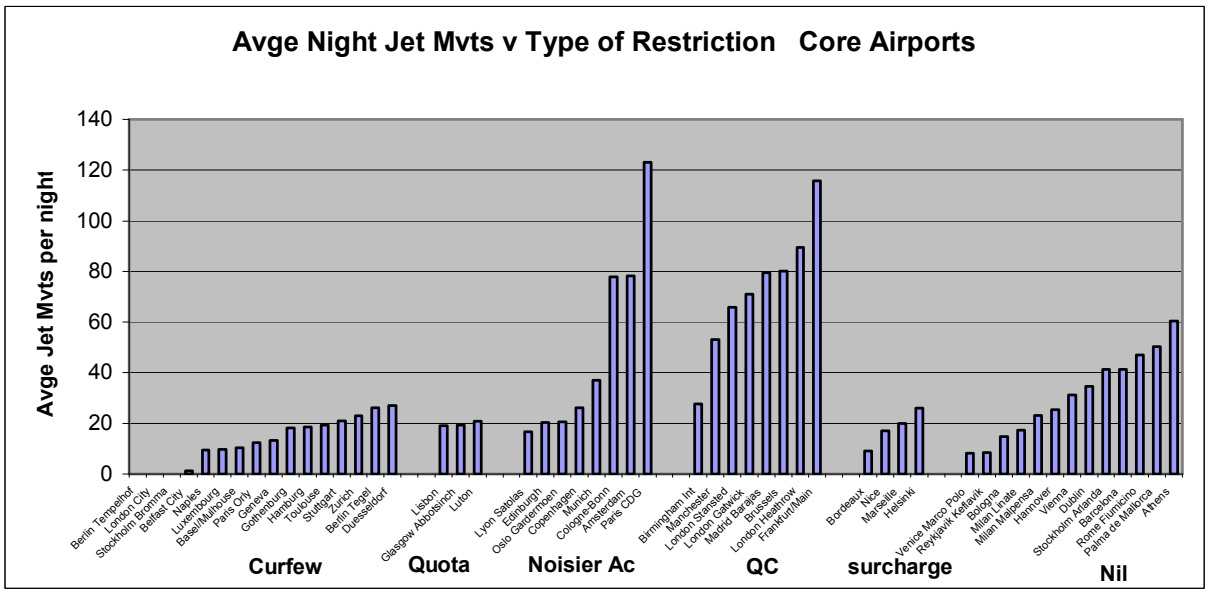
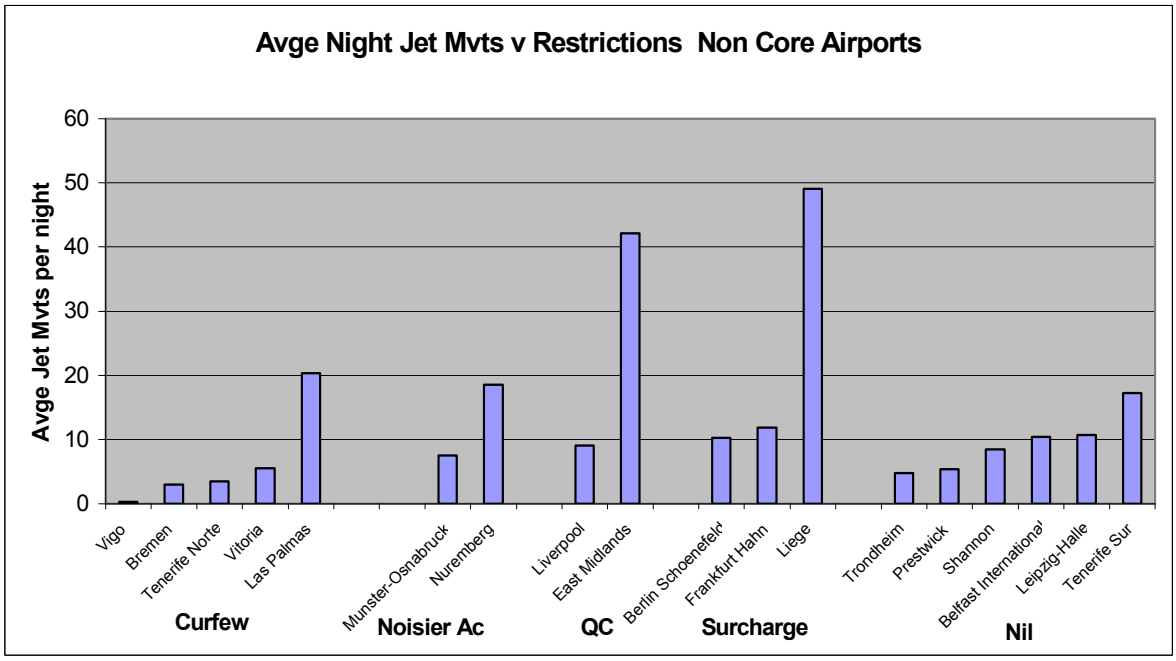


Figure 4-12 shows the average number of nightly jet movements in the period 2300 to 0700 for each of the Core list of airports, grouped by type of night restriction.

Figure 4-13 shows the same data for each of the non-Core airports (as defined above in section 4.2) for which information on restrictions is currently available.

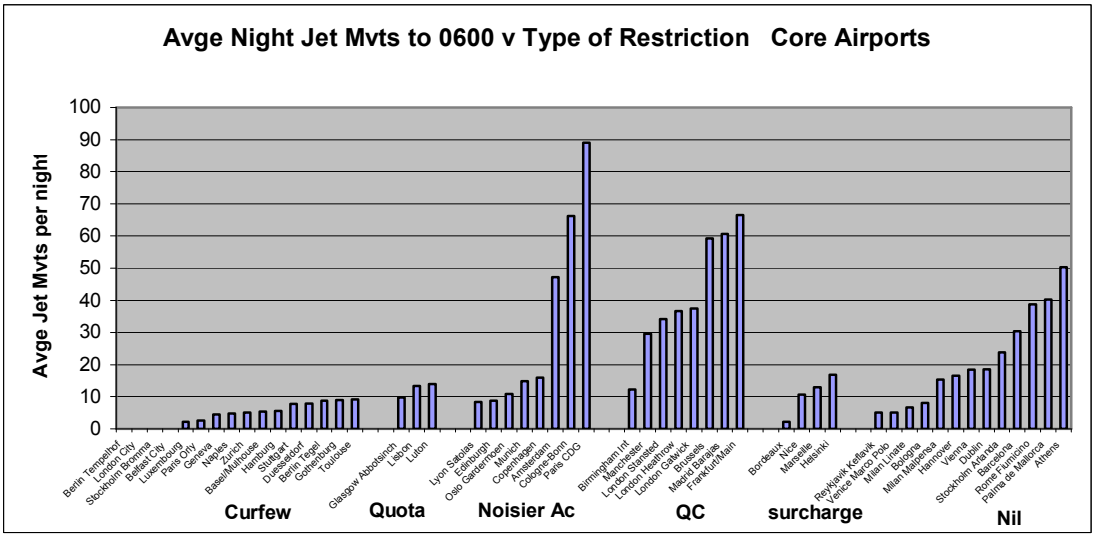
Figure 4-13



In both cases, absolute curfews are associated with the lowest levels of activity, but there is little correlation between reducing stringency of restriction and growth in average night activity in absolute terms. Airports with no restrictions at all do not show the highest activity by any means.

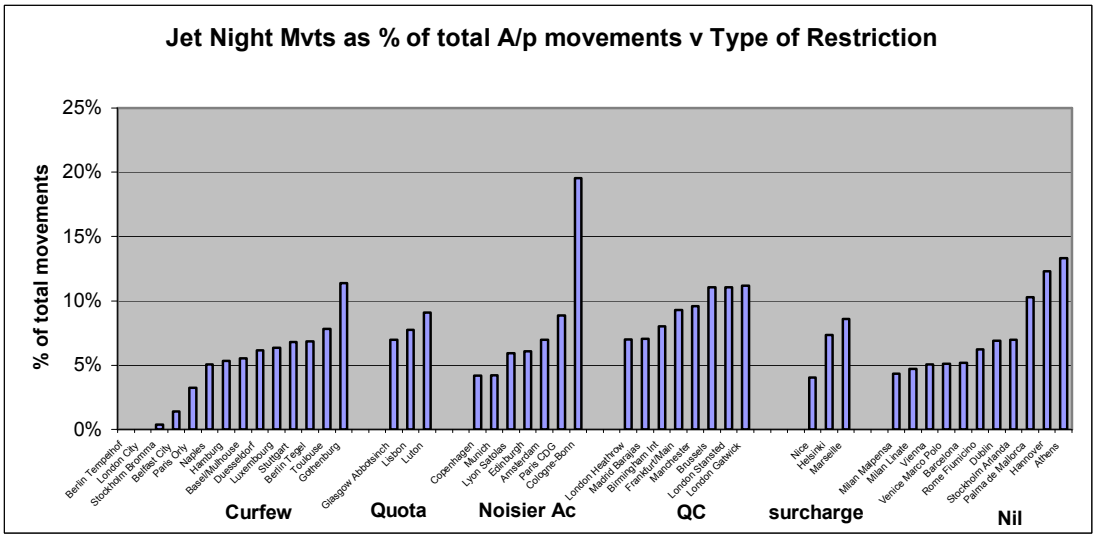
As a refinement to the data, and taking into account that very few airports impose restrictions up to 0700 (with the exception of UK airports), and that previous activity analysis (section 4.5 above) has shown the disproportionate volume of 'night' flights between 0600 and 0700, an amended chart – Figure 4-14- for Core airports shows activity between 2300 and 0600 only.

Figure 4-14



The effect of curfews is more clearly shown in this more restricted period. However, airports which only impose surcharges, or have no restrictions at all, do not have higher levels of activity than airports which restrict noisier aircraft or impose Quota Counts.

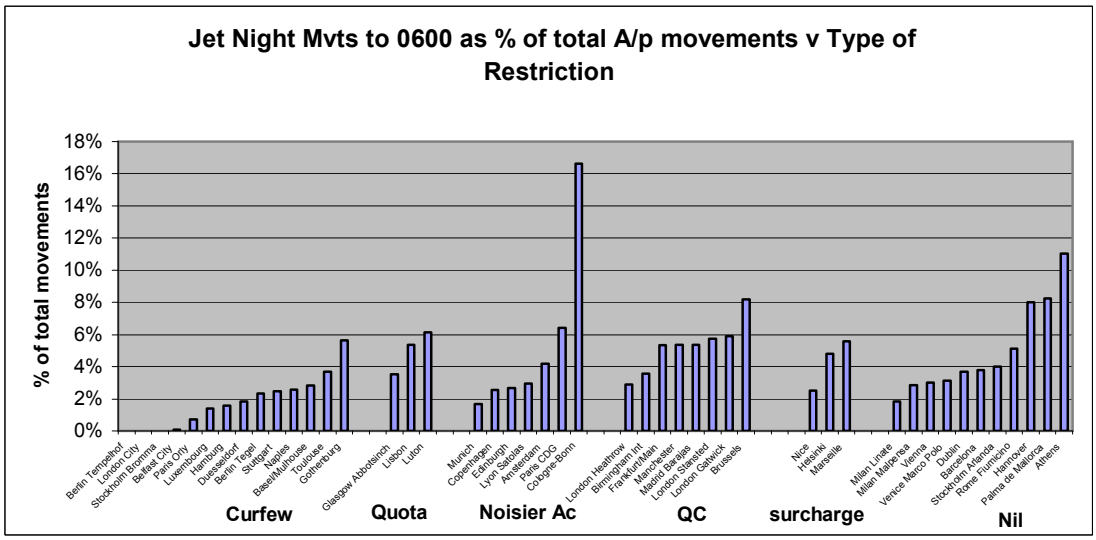
Figure 4-15



It could be argued that the above results are heavily influenced by the differences in size and importance of these airports across Europe. A better measure of night activity for this purpose, taking this into account, is the number of jet night movements as a proportion of total movements at each airport (the latter based on 2001 data covering most Core airports, but very

few non Core airports). This measure also needs refinement, to take into account that very few airports impose restrictions up to 0700, and that in any case there is a disproportionate volume of 'night' flights between 0600 and 0700.

Figure 4-16



Again there is no evidence that the type of restrictions affects ;the proportion of flights taking place at night, unless, of course, there is a curfew.

Another more detailed hypothesis is that an airport with lighter night restrictions will attract traffic away from neighbouring competing airports with stricter restrictions. Analysis within each country for those countries with relevant competing airports - Core and non Core - show a mixed pattern. Night jet movements are those between 2300 and 0600. Comparisons are shown on the basis of percentage of total airport where such data is available, otherwise on the basis of average night jet movements.

Airport	Country	Core	Restriction	Avge Night Jet Mvts
Brussels	Belgium	Core	QC	59
Liege	Belgium		surcharge	47

In Belgium there are very significant night operation at Liege - which has no operational night restriction – and also at Brussels, which has Quota Count restrictions. These airports are the hubs of two competing express operators. In practice, we are told that, up to now, the QC restriction has not seriously inhibited the operations there (though they will thwart the growth plans of the express operator, DHL, who has decided to set up a hub elsewhere), and there is no evidence of a move of traffic, whether direct or indirect between the two airports.

Airport	Country	Core	Restriction	Night Jet Mvts % total mvts
Paris Orly	France	Core	curfew	1%
Paris CDG	France	Core	No noisier Ac	6%
Toulouse	France	Core	curfew	4%
Lyon Satolas	France	Core	No noisier Ac	3%
Marseille	France	Core	surcharge	6%
Nice	France	Core	surcharge	3%

The curfew restrictions at Orly are associated with higher night activity at Charles de Gaulle. However the curfew at Toulouse, and the aircraft type restrictions at CDG, do not seem to be reflected in higher night jet activity at other relevant French airports.

Airport	Country	Core	Restriction	Avge Night Jet Mvts
Berlin Tempelhof	Germany	Core	curfew	0
Berlin Tegel	Germany	Core	curfew	9
Berlin Schoenefeld	Germany		surcharge	8
Leipzig-Halle	Germany		nil	9
				Night Jet Mvts % total mvts
Berlin Tempelhof	Germany	Core	curfew	0%
Berlin Tegel	Germany	Core	curfew	2%
Hamburg	Germany	Core	curfew	2%
Hanover	Germany	Core	nil	8%
				Avge Night Jet Mvts
Munich	Germany	Core	No noisier Ac	15
Nuremberg	Germany		No noisier Ac	13
				Night Jet Mvts % total mvts
Düsseldorf	Germany	Core	curfew	2%
Cologne-Bonn	Germany	Core	No noisier Ac	17%
				Avge Night Jet Mvts
Frankfurt/Main	Germany	Core	QC	67
Frankfurt Hahn	Germany		surcharge	7

In Germany the pattern is again mixed. The level of night jet activity at Berlin Tegel, which has a curfew, is in line with activity at neighbouring unrestricted Schonefeld and Leipzig. However, the higher level of activity at unrestricted Hanover may be related to the curfews at neighbouring Berlin and Hamburg. Munich and Nuremberg have the same type of night restriction, yet Nuremberg (a small regional non-hub airport) attracts a similar amount of night activity as the larger hub airport of Munich. Although the difference in night activity between curfewed Dusseldorf and less restricted neighbouring Cologne-Bonn is dramatic, the size of the night operation at Cologne-Bonn suggests other factors at play rather than attractiveness in relation to Dusseldorf. Finally, the level of night activity at Hahn may be only marginally associated with restrictions at Frankfurt/Main.

Airport	Country	Core	Restriction	Night Jet Mvts % total mvts
Stockholm Bromma	Sweden	Core	curfew	0%
Stockholm Arlanda	Sweden	Core	nil	4%

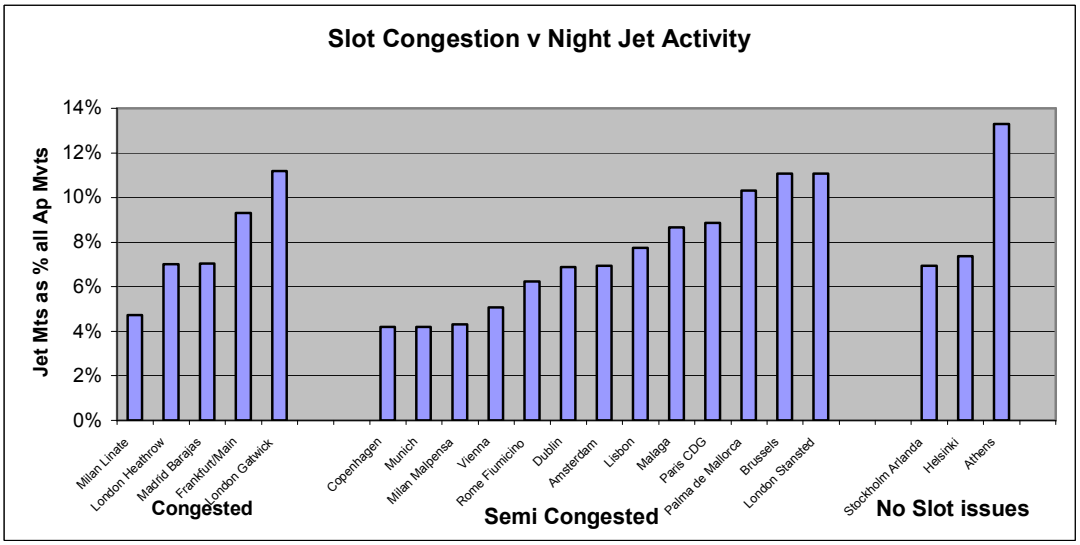
The night curfew at Bromma is associated with only a quite modest level of night jet movements at Arlanda relative to airport size.

Airport	Country	Core	Restriction	Night Jet Mvts % total mvts
Belfast City	UK	Core	curfew	0%
Belfast International	UK		nil	8%
Glasgow	UK	Core	Quota	4%
Abbotsinch				
Prestwick	UK		nil	7%
Luton	UK	Core	semi curfew	6%
London Heathrow	UK	Core	QC	3%
London Gatwick	UK	Core	QC	6%
London Stansted	UK	Core	QC	6%
Birmingham	UK	Core	QC	4%
East Midlands	UK		QC	20%

There is a clear association between the significant proportion of night activity at Belfast International and the night curfewed Belfast City airport which operates in the same catchment area. A similar conclusion might be reached relating to the limited quota-restricted Glasgow Abbotsinch compared with the unrestricted Prestwick. However, at Luton and the London airports levels of activity at each airport seem unrelated to the type of restriction. Similarly, the extraordinarily high level of night activity at East Midlands cannot be explained by reference to a similar type of restriction at Birmingham. In this case, the more benign noise climate at East Midlands may have enabled the airport to be more welcoming to night operation, and to encourage the express operators that they would face a lower risk of restrictions being imposed in the future.

An alternative hypothesis is that higher night activity might be correlated with the non-availability of daytime slots at airports, operators utilising night hours because they cannot get sufficient airport slots during the day.

Figure 4-17



NERA in their recent 'Slots' report to the EU [18] assessed the degree of slot congestion for all EU Category 1 airports. They distinguished between airports with excess demand all day (here labelled as 'Congested'), airports with excess demand at peak times (labelled 'Semi Congested'), and airports with no excess demand (labelled 'No slot issues'). Figure 4-17 above shows night (2300 – 0700) jet movements as a proportion of all airport movements for those Category 1 airports without curfews – i.e. where it would be possible to expand operations at night to compensate for limited slot opportunities during the day

It is clear that there is no relationship between the degree of daytime slot shortages and the proportion of total airport movements represented by night jet movements.

4.5.1 Conclusions

This analysis of airport night activity in Europe against the background of current operational restrictions does not reveal any discernible influence on the numbers of night flights or the proportion of flights taking place at night, other than the obvious one that a curfew leads to a lower number. A realistic interpretation is that:

Member States have decided on restrictions that take account of the particular environmental and economic position of the airports.

Operators may be able to adapt to other night noise restrictions, particularly by operating quieter aircraft, without significant overall reduction in levels of night activity, but of course we have no data on the demand that may have been suppressed..

Ultimately operators' scheduling decisions and choice of airport for night activity is driven by commercial considerations.

4.6 Airport Characteristics

In this section we analyse in more detail the different types of activity represented by night movement at the study airports, determine the importance of those activities to the airports, classify airports according to the importance of the activities, and relate them to the nature of the night restriction (if any).

4.6.1 Major airports

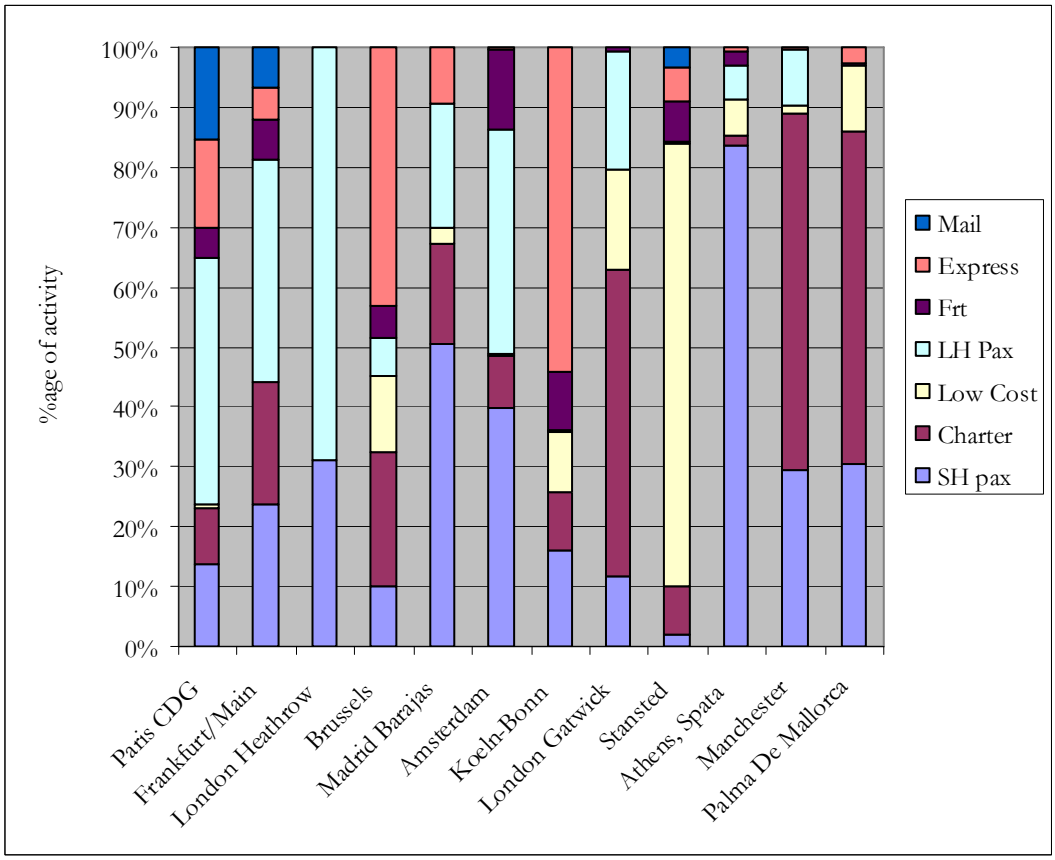
Twelve airports had on average over 50 jet movements during the night period 2300 – 0700, and were responsible for nearly 50% of all night movements observed at our study airports.

Airport Name		Restriction	Avge Mvts / nt
Paris CDG	Core	noisier ac	124
Frankfurt/Main	Core	QC	116
London Heathrow	Core	QC	90
Brussels	Core	QC	81
Madrid Barajas	Core	QC	80
Amsterdam	Core	noisier ac	79
Cologne-Bonn	Core	noisier ac	78
London Gatwick	Core	QC	71
Stansted	Core	QC	66
Athens, Spata	Core	nil	61
Manchester	Core	QC	53
Palma De Mallorca	Core	nil	51

[18] NERA:Report to the European Commission: Study to Assess the Effects of Different Slot Allocation Schemes, January 2004

As discussed in 4.2 above, all of these airports are 'Core' and liable to be covered by the Directive, and none of them are affected by the more severe types of night restriction.

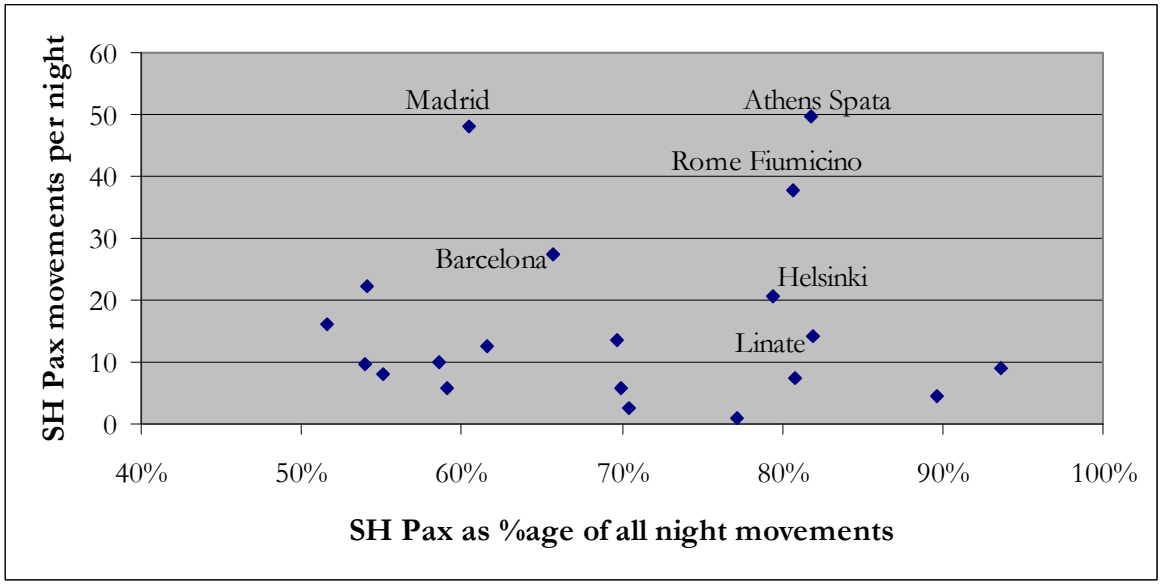
Figure 4-18 Night Activity - top 12 airports



These busiest night airports vary considerably in the types of activity. Apart from Stansted (where Low Cost operations are dominant) and Brussels, nearly all have significant short-haul passenger operations at night. The major hub airports of Paris CDG, Frankfurt/Main, Heathrow, Madrid and Amsterdam also have significant long-haul passenger night operations. Charter services form a significant proportion of Gatwick, Manchester and Palma night activity. Express flights are very important for Brussels and Cologne-Bonn; while freighter and/or mail services play a role at Paris, Frankfurt/Main, Amsterdam and Stansted. The particular types of night activity seem to have developed as an integral part of the commercial specialisation and mission at the airports.

4.6.2 Short-haul passenger operations

Figure 4-19 Airports with significant Short Haul Scheduled Passenger night activity



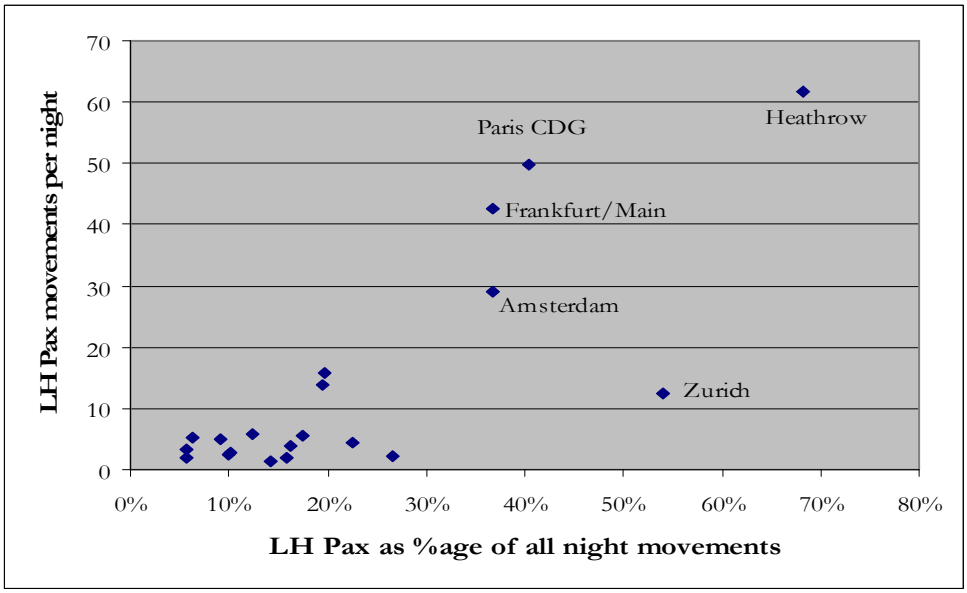
Airport		Restriction	SH Pax %	SH Pax per nt
Naples	Core	curfew	94%	9
Trondheim		nil	90%	5
Milan Linate	Core	nil	82%	14
Athens, Spata	Core	nil	82%	50
Bordeaux	Core	surcharge only	81%	7
Rome Fiumicino	Core	nil	81%	38
Helsinki Vantaa	Core	surcharge only	79%	21
Belfast City	Core	curfew	77%	1
Tenerife Norte		curfew	70%	2
Venice Marco Polo	Core	nil	70%	6
Lisbon	Core	quota	70%	13
Barcelona	Core	nil	66%	28
Oslo Gardermoen	Core	noisier ac	62%	13
Madrid Barajas	Core	QC	60%	48
Luxembourg	Core	curfew	59%	6
Nice	Core	surcharge only	59%	10
Bologna	Core	nil	55%	8
Stockholm Arlanda	Core	nil	54%	22
Gothenborg	Core	curfew	54%	10
Vienna	Core	nil	52%	16

These 20 airports, with 50% or more of short-haul passenger movements relative to total night movements, represent 44% of total short-haul passenger movements at night. Graphically it can be seen that Athens Spata, Rome Fiumicino, and Madrid are particularly noteworthy in terms of the absolute number of short-haul passenger flights per night, and the proportion of total night movements these represent. Helsinki, Barcelona and Milan Linate also show above average

number of short-haul movements or proportion of night operation which is short-haul passenger. What is apparent is that few of these airports have any serious night restriction at present.

4.6.3 Long-haul scheduled passenger operations

Figure 4-20 Airports with significant Long Haul Passenger night activity



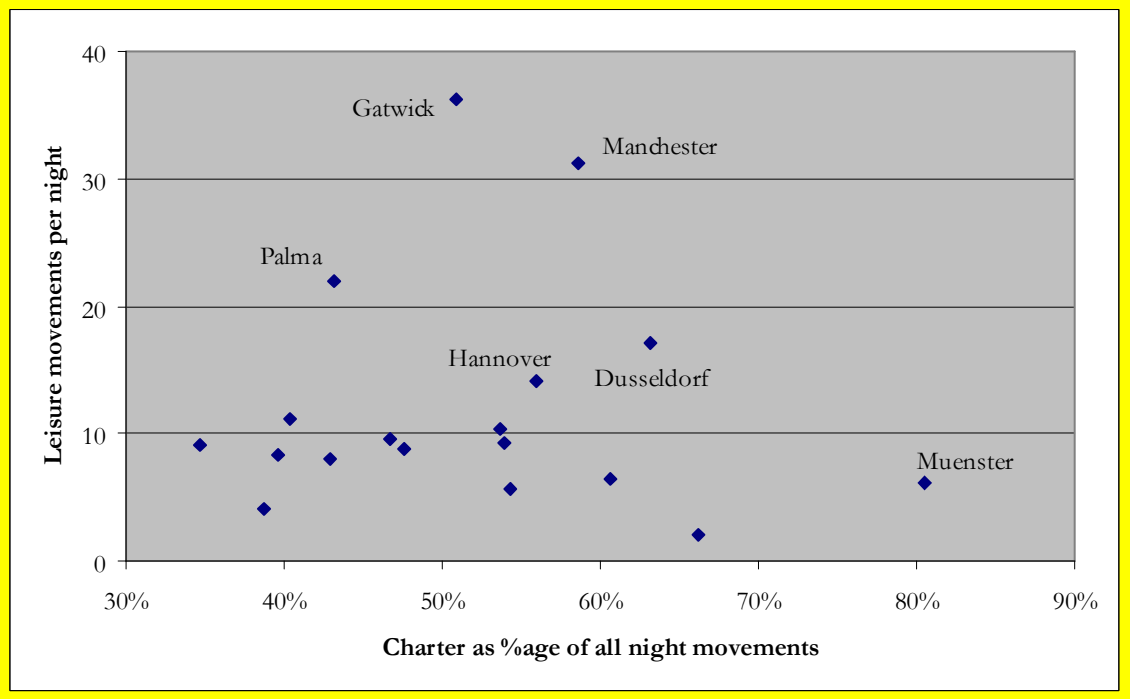
Airport		Restriction	LH Pax %	LH Pax per nt
London Heathrow	Core	QC + noisier	69%	62
Zurich	Core	semi curfew	54%	12
Paris CDG	Core	noisier ac	40%	50
Frankfurt/Main	Core	QC	37%	43
Amsterdam	Core	noisier ac	37%	29
Shannon		nil	26%	2
Lisbon	Core	quota	22%	4
London Gatwick	Core	QC	19%	14
Madrid Barajas	Core	QC	19%	15
Vienna	Core	nil	17%	5
Milan Malpensa	Core	nil	16%	4
Paris Orly	Core	curfew	16%	2
Berlin Schoenefeld		nil	14%	1
Rome Fiumicino	Core	nil	12%	6
Copenhagen	Core	noisier ac	10%	3
Helsinki Vantaa	Core	surcharge only	10%	3
Manchester	Core	QC	9%	5
Brussels	Core	QC + noisier	6%	5
Dublin	Core	nil	6%	2
Athens, Spata	Core	nil	6%	3

Of these 20 airports which have 97% of all long-haul passenger night movements, Heathrow is by far the dominant airport for this activity, both in terms of absolute number of long-haul movements, and in terms of long-haul as a proportion of total night movements. Paris CDG, Frankfurt/Main, Amsterdam and Zurich are also significant in this market - in each case the base

for major network carriers. At both Heathrow and Frankfurt it would appear that carriers are influenced by the Quota Count to give preference to long-haul services

4.6.4 Charter/Leisure

Figure 4-21 Airports with significant Charter/Leisure night activity



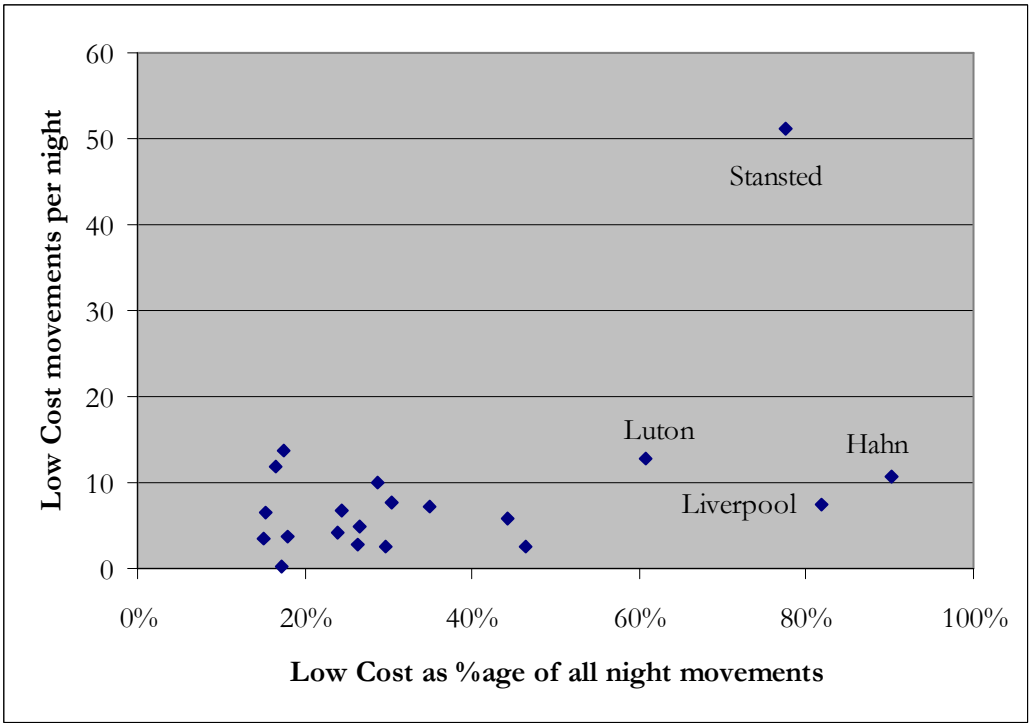
Airport		Restriction	Charter %	Charter per nt
Muenster/Osnabrueck		noisier ac	81%	6
Bremen		curfew ex mail	66%	2
Duesseldorf	Core	curfew	63%	17
Leipzig-Halle		nil	61%	7
Manchester	Core	QC	59%	31
Hannover	Core	nil	56%	14
Berlin Schoenefeld		surcharge only	54%	6
Tenerife Sur		nil	54%	9
Glasgow	Core	quota	54%	10
London Gatwick	Core	QC	51%	36
Nuernberg		noisier ac	48%	9
Las Palmas		curfew	47%	10
Palma De Mallorca	Core	nil	43%	22
Hamburg	Core	curfew	43%	8
Birmingham	Core	QC	40%	11
Stuttgart	Core	curfew ex mail	40%	8
Belfast International		nil	39%	4
Berlin Tegel	Core	curfew ex mail	35%	9
Alicante	Core	nil	30%	5
Tenerife Norte		curfew	30%	1

Of the top 20 Charter-dominated airports at night, accounting for with 60% of total night Charter movements, the Core airports of Manchester, Palma, Gatwick and Düsseldorf stand out. The

dominance of Charter/Leisure operations at a number of German airports with quite tight restrictions is noteworthy,

4.6.5 Low Cost

Figure 4-22 Airports with significant 'Low Cost' night activity

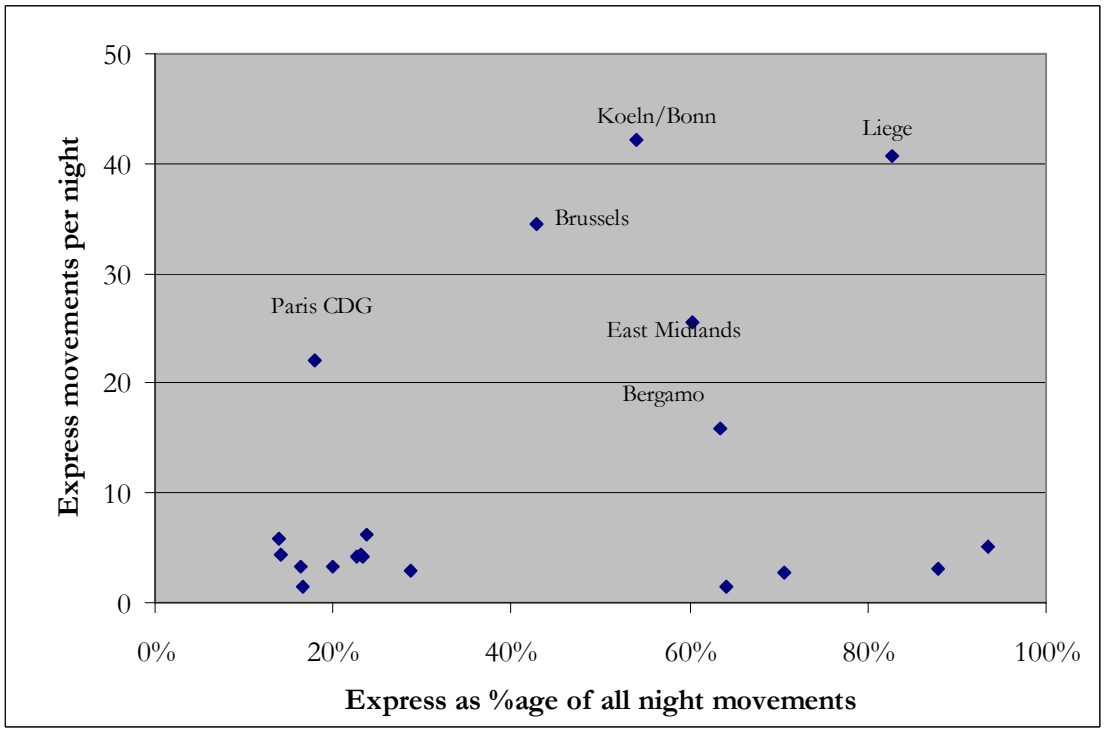


Airport		Restriction	Low Cost %	Low cost per nt
Hahn		surcharge only	90%	11
Liverpool		QC	82%	7
Stansted	Core	QC	77%	51
Luton	Core	semi curfew	61%	13
Prestwick		nil	46%	2
Geneva	Core	semi curfew	44%	6
Malaga	Core	nil	35%	7
Bergamo		nil	30%	8
Venice Marco Polo	Core	nil	30%	2
Dublin	Core	nil	29%	10
Alicante	Core	nil	26%	5
Belfast International		nil	26%	3
Birmingham	Core	QC	24%	7
Nice	Core	surcharge only	24%	4
Edinburgh	Core	noisier ac	18%	4
Amsterdam	Core	noisier ac	17%	14
Belfast City	Core	curfew	17%	0
London Gatwick	Core	QC	16%	12
East Midlands		surcharge only	15%	6
Milan Malpensa	Core	nil	15%	4

Of the top airports with 76% of total Low Cost night movements, the dominance of Stansted both in terms of absolute numbers of movements and of proportion of night activity, is quite marked. Hahn and Liverpool (both non-Core) activity at night is almost exclusively Low Cost. The curfew at Luton on departures alone – and up to 0600 only - still allows that airport to operate a significant night Low Cost operation.

4.6.6 Express

Figure 4-23 Airports with significant Express night activity



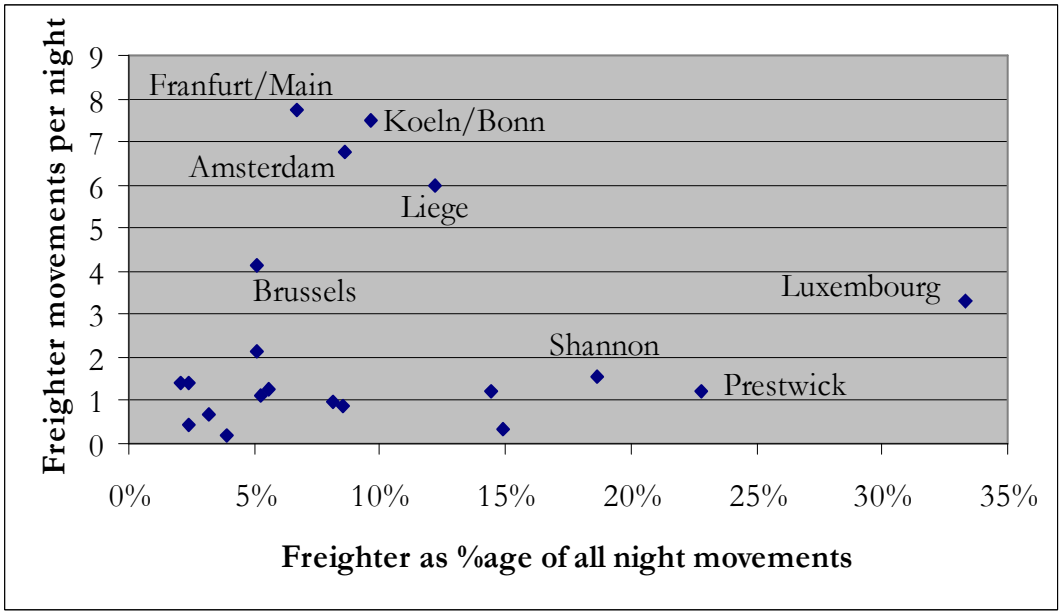
These 20 airports cover 82% of all Express night operations. The dominance of Liege, Cologne-Bonn, Brussels, Nottingham East Midlands and Bergamo in this night market is very marked, and also noteworthy is that airports with the highest proportion of Express as their main night activity are smaller non-Core ones, not subject to the Directive, and with few known night restrictions.

Airport		Restriction	Express %	Express per nt
Vitoria		curfew	94%	5
Venice Treviso		nil	88%	3
Liege		surcharge only	83%	41
Metz		nil	71%	3
Rome Ciampino		curfew	64%	2
Bergamo		nil	64%	16
East Midlands		surcharge only	60%	25
Koeln-Bonn	Core	noisier ac	54%	42
Brussels	Core	QC + noisier	43%	35
Basel/Mulhouse	Core	semi curfew	29%	3
Copenhagen	Core	noisier ac	24%	6
Gothenborg	Core	curfew	23%	4
Nuernberg		noisier ac	23%	4
Lyon Satolas	Core	noisier ac	20%	3
Shannon		nil	16%	1
Edinburgh	Core	noisier ac	16%	3
Toulouse	Core	curfew	16%	3
Paris CDG	Core	noisier ac	15%	18
Vienna	Core	nil	14%	4
Barcelona	Core	nil	14%	6

4.6.7 Freighters

Analysis of these all-freight operations combines both charter and scheduled freight operations – excluding Express (see above) and mail (see below).

Figure 4-24 Airports with significant freighter night activity

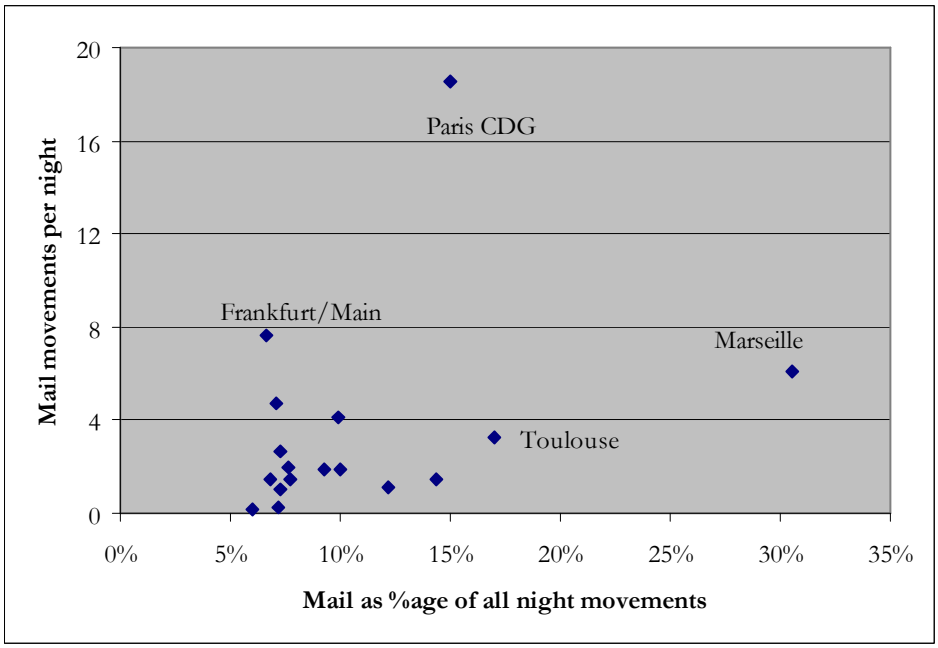


Airport		Restriction	Freighter %	Freighter per nt
Luxembourg	Core	curfew	33%	3
Prestwick		nil	23%	1
Keflavik	Core	nil	19%	2
Rome Ciampino		curfew	15%	<1
Shannon		nil	14%	1
Liege		surcharge only	12%	6
Koeln-Bonn	Core	noisier ac	10%	8
Amsterdam	Core	noisier ac	9%	7
Basel/Mulhouse/Fr	Core	semi curfew	9%	1
Hahn		surcharge only	8%	1
Frankfurt/Main	Core	QC	7%	8
Milan Malpensa	Core	nil	6%	1
Luton	Core	semi curfew	5%	1
Brussels	Core	QC	5%	4
East Midlands		surcharge only	5%	2
Vitoria		curfew	4%	<1
Stuttgart	Core	curfew ex mail	3%	1
Gothenborg	Core	curfew	2%	<1
Athens, Spata	Core	nil	2%	1
Stansted	Core	QC	2%	1

The size of freighter night activity at most of the above airports is quite limited, and these 20 airports cover 89% of all freighter night movements. At Luxembourg airport, the curfew is lifted at 0600, and 3 out of the 9 movements in the 0600 – 0700 hour are freighters.. The freighters at Koeln-Bonn, Brussels and Liege would almost certainly complement the significant Express operations described above.

4.6.8 Mail

Figure 4-25 Airports with significant Mail night activity



Airport		Restriction	Mail %	Mail per nt
Marseille	Core	surcharge only	31%	6
Toulouse	Core	curfew	17%	3
Paris CDG	Core	noisier ac	15%	19
Belfast International		nil	14%	2
Bordeaux	Core	surcharge only	12%	1
Hamburg	Core	curfew	10%	2
Stockholm Arlanda	Core	nil	10%	4
Edinburgh	Core	noisier ac	9%	2
Nuernberg		noisier ac	8%	1
Berlin Tegel	Core	curfew ex mail	8%	2
Bologna	Core	nil	7%	1
Muenchen	Core	noisier ac	7%	3
Metz		nil	7%	<1
Stansted	Core	QC	7%	5
Stuttgart	Core	curfew ex mail	7%	1
Frankfurt/Main	Core	QC	7%	8
Rome Ciampino		nil	6%	<1

The number of all-mail jet night operations is actually very limited in terms of the number of airports served and the frequency of night movements at those airports. Paris CDG stands out for the number of movements and the significance of mail in its total night operation. At Toulouse the curfew is lifted at 0600, allowing the 3 services to operate at that time. Otherwise mail services operate at less restrictive airports, particularly in France and Germany. The mail dispensation within the curfew restrictions at Berlin Tegel and Stuttgart only seem to have a limited stimulating effect.

4.7 Additional Observations

4.7.1 Smaller Aircraft

Our Eurocontrol database comprising all flights into and out of our study airports includes a significant number of jet movements not expressly covered by the Directive, i.e. subsonic jet aircraft of <19 seat and <34 tonnes.

In total they add an additional 2.7% to the number of jet movements in the period 2300 – 0700. Further analysis, outside the scope of this study, would determine whether their addition to the noise climate in Europe was greater or less than this figure i.e. whether the noise impacts of these small jets gave greater or less annoyance.

Over 95% of these small jet movements were carried out as part of air taxi or other private commercial operations. Summer activity is greater than winter activity, and although the volume of arrivals and departures are balanced, departures tend to concentrate around the 0600 – 0700 time, while arrivals are mostly in the 2300 – 0100 time slots.

The top 8 airports with significant small jet operations have average number of movements per night as follows:

	Avge per nt
Luton	6
Vienna	3
Milan Linate	3
Rome Ciampino	2
Brussels	2
Koeln-Bonn	2
Toulouse	2
Nice	2

Competent authorities may wish to consider bringing such aircraft operations into new restrictions as a priority, especially for reducing noise in the night shoulder periods.

4.7.2 Non Jet Operations

The Eurocontrol database shows that during the study periods there were an additional 21% of night movements by non jet civil aircraft in the period 2300 – 0700 over and above the jet movements.

The breakdown of these operations by activity was as follows

Scheduled passenger	29%
Air taxi etc	22%
Express	20%
Mail	18%
Freighter	11%

Summer activity is 20% greater than winter, and night departures by these aircraft exceed the number of arrivals by 30%.

The typical times of arrival and departure during the night vary between the various activities.

- Scheduled passenger – both arrivals and departures concentrated in shoulder periods 2300 – 0100, and 0600 – 0700
- Air taxi – arrivals mostly 2300 – 0100, departures in shoulder periods 2300-0100 and 0600 – 0700, but significant summer departures at 0400 – 0500
- Express – most departures in middle of night 0100 – 0500, with arrivals 2300 – 0100, and 0500 – 0600
- Mail - concentrated in early part of night, 2300 – 0200
- Freighter – constant throughout the night

It is likely that operators use these types of aircraft for two reasons

- Smaller size and specific operating economics make them more suitable for shorter, thinner routes
- They are not usually included in any night noise restrictions.
- It is probable that the size and economics are driving much of the activity for the scheduled passenger and air taxi operations.

However, the noise characteristics of these aircraft may be an additional incentive for their deployment on cargo operations. In the Express segment, non jets add considerably to the critical mass of night flights at certain of the largest airport players i.e. adding another 30% to Cologne/Bonn Express movements, 103% to Paris CDG, 10% to Liege, 40% to Vitoria and 6%

to Brussels. In the case of Brussels, these non jet flights by definition do not count toward the Quota Count, while non jets are unaffected by the restrictions at Paris CDG and Cologne/Bonn.

Limitations on jet operations at certain airports with significant Express operations may have the effect of reducing the critical mass at night, and thus putting the non-jet operation into jeopardy as well.

4.7.3 Movements 2200 – 2300

The Eurocontrol database also reveals that across all the study airports the number of recorded jet movements in the period 2200 - 2300 is equal to 40% of all jet movements in the whole of the night period 2300 – 0700. This hour of operation is clearly critical for many airline operators, and new restrictions from 2200 (e.g. extending a curfew currently 2300-0600 back to 2200) could have quite serious effects. Nearly all the Core airports unaffected by curfews have on average at least 10 movements within that hour – rising up to full runway utilisation at the busiest airports. More than 50% of these operations are the arrivals of scheduled passenger services – both long-haul and short-haul – at base airports, and in many cases they just precede a restriction which commences at 2300.

5 Direct Impacts of Restrictions

Having quantified and analysed the current night noise situation in Europe – who flies where, when and why at night, and how are they restricted – we turn now to considering the likely operational and commercial constraints on stakeholders which determine or at least influence their reactions to proposed new restrictions. Such restrictions might include curfews, QC or noise budgets and limitations on the use of certain aircraft, leading to a need for re-equipment. All such costs need to be addressed.

At its simplest, the direct effects of new restrictions could be the total loss of the traffic on the services affected. In practice of course, each airline will try to minimise the impact by amending their operations. It is on the evaluation of these that we concentrate in this section. Nevertheless, we suggest that the competent authorities might invite stakeholders to calculate the effect of assuming all the traffic is lost since:

- this will give an estimate of the maximum effect, against which the credibility of alternative scenarios can be judged
- it will in any case help to establish the basic parameters which are being dealt with.

We now turn to the consideration of the likely effects in more detail, sector by sector.

5.1 Passenger Airlines

5.1.1 Short-haul Scheduled - Problems created by new restrictions

As noted in Section 3.2, short haul scheduled service passenger jet operations in Europe during the default "night" period are largely a matter of early morning (06:00 to 07:00) take-offs and very late evening (2300 to midnight) landings. There are movements throughout the night, but at a much less intense level, and many of these are at resort and/or other airports in Mediterranean countries. Thus all-night curfews would pose problems, and so would "shoulder hour" restrictions.

Fleets tend to be relatively modern, so tougher restrictions on aircraft types should not be a particular threat, although even some aircraft might fall under the official definition of "marginal Chapter 3". On the other hand, departures generally have a higher QC weighting than arrivals, and there are more short-haul passenger jet arrivals in the core midnight to 06:00 period than there are departures. These weightings do not necessarily reflect the earning capability of the aircraft or associated type of operation, however, so reduced Quota Counts (or total movement budgets) could make relatively small short haul flights more vulnerable to cancellation than large long haul flights.

The most serious types of restriction for short haul passenger airlines would be:

- imposition of restrictions in the 06:00 to 07:00 period, particularly for departures;
- curfews starting at 23:00 or even earlier, if arrivals were banned.

5.1.2 Short-haul Scheduled - Strategies by operators to deal with new restrictions

At a hub airport, curfew restrictions including one of the prime departure periods of the day for day return business-oriented departures (especially if also fed by long-haul connections at a hub), would in our view be more likely to lead to an airline seeking to shift its operation elsewhere in the region if this is possible, than to retime, although the practical opportunities to do this may be limited. A shift outside the region is generally out of the question for short haul passenger flights as the product would no longer be the same. However, the product offered by a retimed bank of departures would be uncompetitive; and in any case slot availability in the first available non-curfew hour would probably be insufficient. Abandonment of the network might well be

considered in the last resort. At a smaller airport, more dependent on originating traffic, retiming might be an option..

Even if the curfew were applied only to jet aircraft, jet operators would be unlikely to re-equip with generally uncompetitive turboprops for the low utilisation which the affected hours would offer. Were the restriction in the form of an aircraft-targeted stringency limit, re-equipment with less marginally compliant aircraft would certainly be an option.

5.1.3 Long-haul Scheduled - Problems created by new restrictions

Largely due to commercial (and sometimes curfew) pressures at departure points in overseas time zones, and to the importance of making inbound and onward connections, 78% of night movements of long haul scheduled passenger operations at our study airports are arrivals between 05:00 and 07:00 local. A further 7% are departures between 23:00 and midnight, but most long haul scheduled passenger departures take place outside the night period.

The most serious problems for long haul scheduled passenger services would be caused by early morning restrictions, either by curfew or total movement budgets – normal Quota Counts are not generally so onerous as the score for arrivals reflect their lower noise footprints compared with departures. However, because long haul aircraft are generally large and heavy, restrictions based on absolute (or measured) noise levels, as opposed to certification procedures in which the logarithmic formulae allow for the inevitably greater absolute noise level of a heavy wide-body, could also pose problems – such restrictions would also be contrary to ICAO recommended practice.

Restrictive operational (rather than operating) procedures can marginally affect the economics of night take-offs by large heavy aircraft on very long non-stop hauls with high payloads, as they sometimes can not comply with noise abatement climb and power cutback rules at maximum take-off weight, but that sort of restriction is rather beyond the scope of this study.

5.1.4 Long-haul Scheduled - Strategies by operators to deal with new restrictions

There is some flexibility in most cases for rescheduling. Unless there are prohibitive operating restrictions at overseas departure airports, flights from Asia can leave an hour or two later and arrive after 06:00, even after 07:00, in Europe – if slots can be found. Flights from the eastern seaboard of North America can also leave up to four hours later without impinging on any departure curfews, and thus arrive after 07:00.

However, significant rescheduling enforced by the imposition of restrictions at a single large hub airport in Europe – and long haul flights tend to serve large hubs in order to gain the critical market mass they need to achieve economic load factors – could place the base carrier(s) at that hub in a disadvantageous commercially competitive position *vis-à-vis* their competitors based at unrestricted hubs. (The restricted airports would also be at a competitive disadvantage relative to other hub airports, in attracting long haul and connecting traffic and the services to carry it, but that aspect is discussed later) There would also be inevitable slot congestion in the busy early daytime hours, and knock-on effects in that onward connecting short-haul flights might need retiming – or the first wave would be dedicated to locally originating traffic, and long-haul connecting passengers would be offered the second (mid-morning or lunchtime) wave, again claimed to put home-based carriers at a perceived disadvantage in selling overseas against competitors based elsewhere.

If the same restrictions apply to all competing airlines flying the European long haul routes (e.g. the Narita curfew and extra hour of Japanese local time difference), they do seem to be able to adapt their schedules and get over the problems of slot availability, congestion, and connections, and fly by day. Some services on the more heavily trafficked routes (Singapore, New York) fly to Europe by day, the larger the market the more "exceptional" customers who prefer the "exceptional" timing. So basically the strategic response for a home based carrier seems likely to be basically commercially rather than operationally driven (although with all routes affected,

operational constraints would gain in importance). The economic effects flowing from competitive disadvantage should be quantifiable.

Given that connecting through traffic is so important, and that airport of arrival is often not so vital for a long haul visitor as a short haul one – with Community-wide or even Member State 'open skies' bilaterals in a single European aviation market, an airline put at such a competitive disadvantage at its traditional hub might consider relocation, not only within its home country but elsewhere in the European Union. The risks of losing a major home-based carrier in this way would have to be carefully considered, as the airline would be abandoning its strongest "home" market, but the economic impacts of such action can be quantified.

A "visiting" overseas airline, however, is not placed at a competitive disadvantage by a restriction in Europe. It is in the same position as European carriers facing common constraints at Narita or Sydney, and perforce scheduling accordingly. It might see a shift of some of its route traffic (particularly short-haul connecting passengers) to unrestricted airports, but it is not disadvantaged from retaining that traffic on its own aircraft.

Should an airline's considered least-cost response to any proposed new restrictions be to fly at sub-optimal speeds (rather than reschedule or cancel flights for instance), any additional net costs including fuel and crew would certainly have to be taken into account (as reduced value added) in precisely the sort of assessment required by Directive 2002/30/EC.

5.1.5 Low Cost Airlines - Problems created by new restrictions

As previously discussed (in section 4.4 above), Low Cost airlines represent only 10% of all jet arrivals and departures across during the 2300 to 0700 night period. The majority of Low Cost airline operations take place during daytime, with very high aircraft and crew utilisation achieved due to fast turnrounds across a long operating day that typically commences around 0600 and is scheduled to finish around 2300. One exception is that some of these airlines also operate quasi-Charter/Leisure services from Northern Europe to Southern Europe, with longer sector distances. In that limited respect they resemble Charter operators more generally, the operational structure of which has been discussed in section 3.2 above. Such operations involve late departures, especially from United Kingdom airports, middle of the night arrivals and then departures at Southern Europe airports, and often very early morning arrivals back in Northern Europe airports. The larger and more established Low Cost carriers increasingly operate modern aircraft easily meeting Chapter 4 noise levels.

Low Cost carriers should be relatively unaffected by new or stricter restrictions on specific aircraft noise levels, including those based on Quota Counts.

There are two types of restrictions that may prove serious for Low Cost airlines. The first is the imposition of any curfew or strict movement quota at night at their home base or at holiday resort airports to which they operate. The second, and even more significant, is the imposition of curfews from 2200 – particularly if they include landings, and especially in the period 0600 to 0700 for departures.

5.1.6 Low Cost Airlines - Strategies by operators to deal with new restrictions

Imposition of curfews in the period 2300 – 0600 at a holiday resort airport, would require a Low Cost airline to consider switching aircraft and crews to operate at night to another destination airport, even if of lesser commercial attractiveness – either in isolation, or as a complete route switch.

However such a curfew restriction at the home base airport of a Low Cost airline would require a reconsideration of route structure. One alternative should be operating to leisure destinations at reduced frequency i.e. without the night rotation, with possible pricing adjustment to compensate for resulting underutilisation of resources. The other alternative would be ceasing operations to those leisure destinations dependent on night operation for economic viability. In the latter case

the airline would have to look for new route opportunities to absorb the surplus aircraft, crew and other resources, or increase daytime frequencies to its other existing routes – assuming absence of slot constraints.

A curfew in the period 0600 – 0700 at the home base would require a total rescheduling of departures, with an operating day squeezed into the 0700 – 2300 envelope. Similarly a curfew in the period 2200 – 2300 would require a rescheduling of arrivals, and hence of the whole operation within a 0600 – 2200 envelope. In both cases slot constraints and the need to preserve operational integrity may prevent this being achieved entirely, and carriers will have to assess their optimal strategy as a result.

5.1.7 Charter/Leisure Airlines - Problems created by new restrictions on Charter operators

Imposition of restrictions by way of specifying maximum allowable aircraft noise levels, including by way of Quota Counts, would have serious consequences for many carriers who deploy fleets of aircraft across the whole range of Chapter 3 noise emission standards - from the noisiest to the quietest.

As has been noted (section 3 above), Charter/Leisure airline operations in Europe rely for economic success quite heavily on night operations, particularly the ability to achieve three daily aircraft rotations between Northern Europe and Southern Europe. The leisure market accepts the inconvenience of middle-of-the-night arrival or departure in return for low fares that are made possible by the very high utilisation of aircraft and crews. Thus any new curfew restrictions will have a serious impact on Charter airlines, since night flying is an integral part of their operation

5.1.8 Charter/Leisure Airlines - Strategies by Charter operators to deal with new restrictions

Restriction on noisier aircraft operation at night (including by way of QC) at a 'spoke' airport may require:

- Switching of aircraft types within the carrier fleet such that the least noisy aircraft operates to that destination – if such aircraft type is in fact available within the carrier's fleet
- Dropping the night rotation, with possible pricing adjustment on the route to compensate for resulting underutilisation of resources.
- Ceasing operations to the destination and look for new route opportunities elsewhere to absorb the surplus aircraft, crew and other resources.

Restrictions on noisier aircraft at a Charter airline's base airport would require:

- Re-equipping with compliant aircraft types
- Rescheduling, insofar as slot constraints allow, to maximise aircraft arrivals and departures at the base as close to restricted hours as possible, with longer turnrounds at destination airports as necessary, and pricing adjustments where relevant.

QC restrictions at a Charter airline's base might imply:

- Reducing night rotations, especially those involving departures to the more marginal route destinations, with possible pricing adjustment on the routes involved.

Imposition of curfews in the period 2300 – 0600 at a **destination** airport would, if unavoidable through rescheduling, require a Low Cost airline to consider switching aircraft and crews to operate at night to another destination, even if of lesser commercial attractiveness – moving either a single rotation or a complete route switch.

- Such a curfew restriction during critical hours at the home base airport of a Charter airline could require a reconsideration of the total route structure:

- Operating to leisure destinations without the night rotation, with possible pricing adjustment (so far as practicable in a competitive environment) to compensate for resulting underutilisation of resources.
- Rescheduling, insofar as slot constraints allow, to maximise aircraft arrivals and departures at the base as close to restricted hours as possible, adjusting turnrounds at destination airports as far as practicable and pricing adjustments where relevant and competitively acceptable.

5.2 Freight Operations

5.2.1 Scheduled Short Haul - Problems created by new restrictions

We seem to have actually identified slightly more short haul than long haul jet freighter flights at night in our sample four week study period, despite our interview programme and published freighter schedules signalling the clear message that there are now virtually no short haul (jet) freighters in Europe. That "everything within Europe goes by flight numbered truck" may be rather an overstatement. It is of course possible that some of the short haul night movements by carriers describing themselves as "scheduled cargo airlines" which we have classified as "short haul freighters" are in fact regular operations (perhaps in part) on behalf of express carriers, or even mail contracts. However, we think that the contradiction of our findings with the general perception is also partly due to our definition of "short haul" as including Iceland for instance, as well as countries such as Israel bordering the Mediterranean, not amenable to truck shipment due to overseas distance and/or the perishable nature of the goods carried.

All in all we are concerned here with an average of about two dozen movements per night across our study area. Some 28% of short haul jet freighter night arrivals occur before midnight, numbers then taper off through the night to rally to 11% in the 06:00 early morning hour. Departures peak at 40% between 03:00 and 05:00 (after turnround or, if express is carried, after the crucial "sort") with a further 20% leaving between 06:00 and 07:00. Thus restrictions such as all-night or partial curfews at almost any part of the night would create problems, as could movement budgets or QC limits.

5.2.2 Scheduled Short Haul - Strategies by operators to deal with new restrictions

The reaction of a short haul freight operator may well be determined by the type of cargo carried and any contractual obligations which may underpin the flight. For example, a one-way contract to carry overnight perishables like newspapers or fresh produce can offer a worth while return to the operator, with potential extra profits to be made from the marginal costs of opening up any remaining capacity and/or the return leg, as a scheduled freighter service. Except possibly for Icelandic flights (and some cross-Channel turboprops) we know of no European whole aircraft short haul return night jet freighters regularly scheduled for "speculative" public sale to individual customers in the same way as scheduled passenger flights. Thus the operator's reaction will tend to be determined by the lead customer.

This reaction may range from retiming (although the nature of the underpinning product might well not permit this), through relocation, to abandonment of the operation (and perhaps use of road or rail). For example, fruit from Mediterranean countries could be flown to arrive by day – but the cost of a day's "freshness" might be greater than the extra capital and current transport costs of relocation to a competing airport without restrictions. Retiming cannot be considered for flown morning newspapers, however, and abandonment (or a use of a different mode) could be the result of restrictions on the timing of the operation.

Should the flights be oriented toward the feeding/de-feeding of long haul freighter aircraft, the fate of the short haul connecting flights would be likely to be dependent upon the effect of restrictions on the long haul element, dealt with in the next section. Short haul legs of multi-

sector long haul flights, affected by restrictions at the short haul *en route* point of call, would perhaps be most ready to consider relocation to serve the country market in question.

In all cases, not only the operating costs but also the congestion, pollution and noise effects of trucks seem a likely outcome of almost any operator reaction. That might form part of the assessors' deliberations, but is beyond our scope here.

5.2.3 Scheduled Long Haul - Problems created by new restrictions

We have identified an average of about twenty-one long haul scheduled jet movements per night across our study area, with the heaviest concentration on Frankfurt/Main. The pattern of movements is almost the obverse of the short haul scheduled freighters. Arrivals build up slowly through the night with more than one in three arriving in the 06:00 to 07:00 hour. Departures at night outweigh arrivals (so the reasons advanced for the preponderance of early morning long haul passenger arrivals apparently no longer apply); and are more evenly spread throughout the night, with a nadir (only 3%) in the 05:00 to 06:00 hour.

Thus restrictions such as all-night or partial curfews at almost any part of the night would create problems, and given the large size of the aircraft used, QC limits could be burdensome.

5.2.4 Scheduled Long Haul - Strategies by operators to deal with new restrictions

We were told in discussions at AEA that the possibility of closure of Frankfurt/Main at night had been evaluated, and that the option of relocation to Köln-Bonn in such an eventuality had been assessed as being extremely costly, but less damaging to the home hubbing scheduled freight operator than retiming to day movements (if slots can be found, presumably on the additional runway planned), despite the inter-relationship of long haul freighter and passenger belly hold connections, and the mixed nature of long haul cargo. Further, British Airways, faced by a movement budget and QC restrictions at its London – Heathrow hub, has already relocated shifted its long haul freighter operations (including short haul legs through Prestwick and Vitoria) to a Stansted base. Relocation rather than retiming or abandonment seems to be the favoured option for a home-hub long haul freight operator faced by restrictions which preclude full frequency of operations at night, or force them to compete with the carrier's own passenger flights for usable slots.

Visiting overseas freighter operators would in our view also be likely to opt for relocation of (one of) the European termini for their scheduled freighters, but probably at lower net cost as they would not lose the synergies of hubbing at home base. Overseas long haul freighters may well carry perishable produce from their home country to the European market. Those from developing countries should not be affected by stringency-related restrictions on Marginal Chapter 3 aircraft applied under Article 6 Paragraph 1 of Directive 2002/30, if operating under an exemption under Article 8 of the Directive. Other operators, including Community ones (especially if using wet-leased aircraft), might have to abandon their operation or re-equip.

5.2.5 Charter - Problems created by new restrictions on charter freight operations

As noted in Section 3.3, it is in the nature of charter operations that flights are operated when and where the customer wants them, restrictions and slot availability permitting. Our identified sample of such jet night flights is not large, averaging only a dozen movements per night, of which nearly 60% are long haul, which tend to arrive and depart at the beginning and end of the night..

Any sort of curfew, full or partial (except middle-of-the-night) could give problems for a charter freight operator at a given airport, but a movement budget or QC limit could be equally prohibitive, particularly if implemented at the operator's home base.

5.2.6 Charter - Strategies by charter freight operators to deal with new restrictions

If restrictions were applied at prospective destination airports, either the operations would not take place or the customer would be persuaded to use a different gateway or timing.

Because charter airlines respond to *ad hoc* demand, restrictions interfering with the operations of a charter freight airline at its home base would in practice probably leave no alternative to relocation other than abandonment of (at least that part of) its operation. Where an airline operates both passenger and freight charters, attention would have to be paid to impacts such as lower overall resource utilisation, even if the other aspects of its activities were not directly restricted.

5.2.7 Express - Problems created by new restrictions on express operators

As noted in Section 3.3, express operations are multi-modal integrated logistical spokes passing through a hub, and sometimes also sub-hub(s). By no means all their jet aircraft movements occur during the night, but the broad "waves" of movements identified in Section 4.4 can be summarily recapitulated here. The hours are very approximate and sub-hub or gateway activity is ignored for simplicity:

- 21:00 – midnight: take-offs from ends of spokes;
- 23:00 – 02:00: arrivals at hubs (many long haul arrivals are earlier);
- 01:00 – 04:00: unloading, sorting, reloading at the hubs;
- 03:00 – 06:00: departures from hubs (including long haul);
- 04:00 – 07:00: arrivals at ends of spokes.

There is not much flexibility in such a tightly timed competitive operation. Nonetheless, the critical restrictions for an express operator would be curfews:

- at spoke airports in the "shoulder" hours of the night, late evening and early morning – although there are a limited number of flights at each such airport;
- where those flights concentrate at a limited number of hub airports in the "middle" of the night, about midnight to 06:00, normally the most targeted period if an airport has any restrictions at all – it is clear why operators are interested in research suggesting that noise during deep sleep may be tolerable.

Since express carriers have a history of retaining aircraft for long operating lives (at low utilisation), although there has been re-engining and re-equipment, stringency-related bans on noisier aircraft may affect them, but would not necessarily close down their operation at a given airport as would a critically timed curfew. Re-equipment costs would of course affect profitability and the net effects would qualify for inclusion in assessment of such restrictions.

Night movement budgets and/or QC limits could also cause difficulties, but the point at which such restrictions became crucial, losing critical mass at a hub for instance, would be a matter for individual decision.

5.2.8 Express - Strategies by express operators to deal with new restrictions

Some restrictions (such as increased stringency or, to an extent, QC limits), might be overcome by re-equipment or re-allocation of equipment. A jet ban could leave some margin for re-equipment with turbo-props, not significantly slower over the shortest hauls. Other restrictions might be met at least in part by marginal re-scheduling. Given the competitive nature of the industry, distance/time constraints prohibit a shift of mode to road or even rail unless competitors are forced to the same solution. Overall, then, the nature of the business and its inter-connectivity is such that in the last resort the only remaining response may inevitably be:

- to shoulder hour restrictions at a given spoke airport, where more than one express carrier may be involved, relocation within the region or (if that is impossible and distance/time prohibits a switch to trucking, possible abandonment of the local market);
- to core hour restrictions at a hub airport, relocation, perhaps cross-border.

Abandonment of local or regional markets is not a likely response in our view, as at the European or the Global scale that would imply a deterioration in the product offered. However, if the restrictions were introduced over a wide region or throughout a State (even the Community), so that all competing express carriers were affected equally there, a switch to slower surface transport could occur. Such a speculative possibility is beyond our scope here.

5.2.9 Mail - Problems created by new restrictions on mail operations

Dedicated mail flights have much in common with the express business, although they are generally domestic and tend to rely upon regularly timetabled whole-aircraft charter operations, often flown using relatively small and/or turbo-prop equipment. There are exceptions of course, but a nation's mail hub is not necessarily its "public" air transport hub. The pattern of services is rather like that of express operations, with flights arriving at the hub from the ends of "spokes" for mail sorting; and then departing with mail sorted for their spoke's area. Like express operations, schedules are tight with little flexibility around the critical sorting time, as surface origin/destination collection and delivery times are crucial.

Restrictions on jet aircraft movements (other than total closure of an airport at night) might not always be as serious for mail as for other types of air transport dependent activity, as more than half the relevant night flights are by small jets and turbo-props. However, inability to use the relatively large fast jet aircraft carrying bulk mail loads would impact on the operation as a whole.

All these impacts are essentially upon the mail authorities chartering the aircraft, they would make the response decisions, which would in turn determine the fate of the airlines involved.

5.2.10 Strategies by mail operators to deal with new restrictions

If prohibitive restrictions to dedicated mail flights were applied at a spoke airport, given the relative inability to retime (without change in – even uncompetitive - mail product quality), responses might range:

- from change of aircraft type;
- through relocation if possible to an alternative within the region (local losses as for relocation of other types of operation, replaced regionally);
- to abandonment of the air "route" and substitution of surface transport, perhaps allied to a different sorting and delivery technique (local and regional airline losses as for abandonment of other types of operation, but possible replacement in another mode).

Restrictions at a mail hub (sorting point) airport would leave only modal switch as an alternative to relocation. This may already be seen in Germany, where mail flights have been progressively replaced by surface transport; stated to be in response to environmental concerns and possible future restrictions, rather than actual inability to operate at the Deutsche Post Frankfurt hub.

5.3 Smaller Aircraft, Airport Operators and Others

Non-jets and smaller jets would have to be included in the above analysis according to the industry sector in which they operate.

5.3.1 Problems created for airport operators by new restrictions

The airport operator may also suffer economic disbenefits from a change in the operating pattern at the airport. These may be related to changes in night hours of operation (including complete

curfews), changes in the type of aircraft operated at night, or reductions in night movements due to quotas of various kinds. It should be noted that some airports may be required by law to remain open for 24-hours for emergency purposes or to retain their ICAO category, so that the costs of night operations would still remain with no revenue.

5.3.2 Strategies by airport operators to deal with new restrictions

The revised operating pattern can only be established in the light of knowledge of likely strategies of airline operators to deal with the new restrictions, and will require dialogue with the operators. Reactions may then be constrained by whether the airport is publicly or privately owned, and whether it is obliged to remain open for unrestricted flights.

5.3.3 Problems created for other service providers by new restrictions

Airport services providers may also suffer economic disbenefits. These may be related to reductions in traveller purchases (e.g. car hire, retail outlets etc), or to reductions in goods and services supplied to airline or airport operators (ground handling, etc). Such reductions may be limited to the night period only, with full or partial compensatory increases in daytime volumes, or in the worst case with no compensatory increase at all – i.e. volume is completely lost.

5.3.4 Strategies by other service providers to deal with new restrictions

Such stakeholders will only be able to assess impacts objectively in the light of knowledge of likely strategies of operators to deal with the new restrictions.

6 Literature Review

6.1 Introduction

We have interpreted the task of reviewing the literature quite broadly, to include:

- the electronic and documentary research and analysis of airport activity statistics; airline activity, fleets and schedules, and airport operating restrictions (for the use and results of which see Section 4);
- the definition, acquisition and analysis of Eurocontrol data on actual night activity for two sample two-week seasonal periods in 2003 at all airports currently affected by the Directive in the study area, plus other selected airports (for the results of which also see Section 4; and
- interviews with representative stakeholder organisations (see Section 7; as well as:
- the documentary review which is the subject of this section.

It is noticeable that many of the studies revealed by our literature search have been carried out by or at least commissioned by interested parties such as airports, airlines and express operators, and/or their representative bodies. The salient points and significance of the literature are highlighted here. A more comprehensive bibliography appears at Appendix B

6.2 Policy and Legislation

For more than a decade the Commission has striven to combine support for the growth of air transport with action to minimise its environmental impact. Recognising the global nature of the industry, the Commission's approach has necessarily been broadly in harmony with the framework of international consensus expressed through ICAO.

Initially, Community policy and its expression in legislation (as well as research) focussed upon the reduction of noise at source, defining noise limits in terms of ICAO Annex 16[19], and progressively introducing non-addition and then non-operating legislation. First generation non-noise-certificated (NNC) jet aircraft were the first to disappear from Europe's airports; and then by a somewhat differently detailed process than the USA, phasing out the last few Chapter 2 aircraft by 01 April 2002, leaving only the quieter Chapter 3 ones. That was achieved by the application of Directive 92/14[20] (technically amended and updated by Directive 98/20[21]), and it was hoped that ICAO's Committee for Aviation Environmental Protection (CAEP) would continue the process by defining a significantly more stringent Chapter 4, while non-addition and in due course non-operating rules could be applied to at least the noisiest of the Chapter 3 generation of jets.

The **Commission's 1999 Communication on air transport and the environment**[22] voiced concerns that this process would not move fast enough to prevent the environmental gains of 92/14 being overtaken, and hinted that individual airports might have to impose their own

[19] Convention on International Civil Aviation, Annex 16: Environmental protection, Volume I: Aircraft noise, Part II: Aircraft noise certification, Chapter 2 *et seq.*
[20] Council Directive 92/14/EEC of 2 March 1992 on the limitation of the operation of aeroplanes covered by Part II, Chapter 2, Volume I of Annex 16 to the Convention on Intenational Civil Aviation.
[21] Council Directive 98/20/EC of 30 March 1998, amending Directive 92/14/EEC.
[22] COM (1999) 640: Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions: Air transport and the environment – towards meeting the challenges of sustainable development.

restrictions. Protective action was also taken in 1999 by means of **Regulation 925/1999**[23], to impose a non-addition rule for Chapter 2 aircraft hushkitted to Chapter 3. This caused considerable controversy. The **Commission's White Paper of 2001**[24] gave a final warning that without an effective ICAO Annex 16 Chapter 4 backed up by a phase-out programme, airports would feel forced to take individual action. Such a plethora of different local rules, with its potential impacts on airlines' ability to plan and schedule efficiently, had been something the Commission had tried to avoid in pursuing the "one rule for all" approach.

One outcome of CAEP's work was, in July 2001, the adoption by the ICAO Council of a new Annex 16 Chapter 4 standard to become effective for new aircraft in 2006 which was less demanding than Europe had hoped – indeed some 95% of aircraft already in production would meet it – and with no "transitional arrangements" (phase-out). At the October 2001 ICAO 33rd Assembly, a compromise was reached with the adoption of **ICAO Resolution A33-7**[25], the "balanced approach" to aircraft noise management.

The emphasis moved from the aircraft certification approach to a broader sheaf of measures to be applied on an airport-by-airport basis. Among its criteria are calls for cost/benefit evaluation of the noise management measures available, with stakeholder consultation; the measures to include land-use planning, noise abatement procedures, and – as a last resort – operating restrictions.

Commission Directive 2002/30[26] gave legislative force to the balanced approach in the Community, and in its Annex II specified the information to be taken into account in considering operating restrictions, including (in its Para 3.2) a requirement for cost effectiveness or cost/benefit assessment. Effects on airport users (operators, travellers and local communities) are to be considered, as are competitive effects (Para 3.3) on other airports and interested parties. This study aims at providing guidance for the consistent performance of such assessments, and a strict reading of the Directive could be taken to circumscribe the extent to which network effects have to be considered.

Certainly only the larger airports are affected – those with more than 50,000 movements *per annum* of civil subsonic jet aeroplanes over 34 tonnes or with more than 19 seats – and only operating restrictions affecting such aircraft are covered.

Directive 2002/30 is not the only piece of Community legislation related to local noise problems around airports. **Directive 2002/49**[27] includes a requirement that Member States' shall prepare noise maps for quite similarly defined "major airports" on a common basis, including L_{night} even though that may not always be an appropriate measure of effective sleep disturbance. They must by July 2008 have drawn up action plans to manage any noise problems so revealed. Such plans must conform with other legislation, including Directive 2002/30.

In conclusion we must mention that as requested by the 33rd session of the Assembly in Resolution A33-7 Appendix C, ICAO has now published guidance for airports on the application of the balanced approach as **Document 9829**[28], although further work on the guidance is to continue in CAEP, so it should remain current and responsive to changing needs. It gives examples of operating restrictions (with some potentially useful definitions) and calls for "a

[23] Council Regulation (EC) No. 925/1999 of 29 April 1999 on the registration and operation within the Community of certain types of civil subsonic jet aeroplanes which have been modified and re-certificated as meeting the standards of volume I, part II, Chapter 3 of Annex 16 to the Convention on International Civil Aviation.
[24] European transport policy for 2010: time to decide.
[25] ICAO Assembly Resolution A33-7: Consolidated statement of continuing ICAO policies and practices relating to environmental protection, especially Appendices C, E and F.
[26] Directive 2002/30/EC of the European Parliament and of the Council of 26 March 2002, on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports.
[27] Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002, relating to the assessment and management of environmental noise.
[28] International Civil Aviation Organization : Doc 9829 Guidance on the balanced approach to aircraft noise management (2004).

transparent process" when considering (any of the balanced approach) measures to alleviate a noise problem, to include provision for consultation with stakeholders (built into Directive 2002/30/EC) and provision for dispute resolution. Transparency in procedures does not (as we interpret it) necessarily breach commercial confidentiality, but the potential conflict should, we think, be recognised.

Transparency also requires a clear basis for forecasts, which are assumed by ICAO to be a necessary component in order to determine a "base case", and the impacts of noise management measures upon it. The classic cost/benefit and cost-effectiveness analytical tools of this evaluation process are described and compared; but we are considering only the assessment of the net costs of specific restrictions (known objectives with predetermined benefits), which in those terms essentially aims at an absolute measure of cost-effectiveness. Relative measures would be appropriate if the responsible authorities were considering the choice between different types of restrictions on night flights.

ICAO also considers the time-frames over which measurement should be undertaken. We discuss this in Section 8.2.2.

6.3 Quantification of Economic Impact of Air Transport

6.3.1 Distinctions

In this section we review studies on the generic impacts of air transport activity, which is normally expressed in economically significant terms at airports, as there is relatively little economic impact from overflights in the developed world. This wide body of literature is very extensive indeed. Surveys and studies of industrial location, showing the importance of air transport in the attraction of industrial and logistical investment, and the development of tourism, have been conducted over at least the last half-century. Necessarily, only representative examples, illustrating approaches that we feel are relevant for adoption and/or adaptation for night flights, are discussed here.

6.3.2 Quantification Techniques

Since the early 1990's a series of publications by IATA's Air Transport Action Group ATAG: Economic benefits of air transport[29], has identified the concepts of the direct, indirect and induced economic impacts of air transport globally, normally expressed in employment terms (with multipliers ranging from 0.4 to 2.4[30]) and monetary "gross output"[31]. Updates have included summaries of case studies related to the impacts of activity at airports around the world. These publications also contain useful bibliographies.

This work complemented case studies by ACI-EUROPE a dozen years ago, and (at one time jointly issued by ACI-EUROPE and ATAG) there appeared in 1993 the ACI-EUROPE Economic Impact Study Kit[32]. This modest booklet gave some still very relevant advice on the practicalities of having a regional economic impact study carried out – we must note the word "regional" and the passive grammatical construction ("having a … study carried out".) It suggests uses for such a study, and particularly stresses the evaluation of new construction projects (e.g. using its Arthur D Little consultant advisor's model devised for assessing the Berlin-Brandenburg project); and although the need for the sort of assessments required by Directive 2002/30 was not foreseen much of the basic advice remains sound. Distinctions are recognised between:

[29] IATA/ATAG: The Economic benefits of air transport – 1993 (1992 data) and later editions.
[30] The 2000 edition globally assesses 3.9 mn direct jobs plus 8.4 mn indirect = 12.3 mn x 1.25 = 15.4 mn induced, for a total of 27.7 mn jobs.
[31] The 2000 edition estimates a US$320 bn direct impact on gross world output plus US$390 bn indirect = US$710 bn x 0.9 = US$650 bn induced for a US$1,360 bn total.
[32] ACI EUROPE: Airports – partners in vital economies: the economic impact study kit, 1993 and later editions.

- collection of recorded data for direct impacts;
- surveys and the calculation of indirect impacts;
- modelling (strongly advised to be carried out with consultants or academic institutions) for the estimation of induced impacts.

Broad consensus "rules of thumb" like a thousand jobs being created per million (airport) passenger movements, and a multiplier (from direct to total employment and possible value added) of the order of two, have been derived from such mainly airport-based economic impact studies. Perhaps the main contribution of such broad rules of thumb is as a first check on claims of economic damage by interested parties whose interests are perceived as threatened by proposed restrictions – there is a prima facie need for evidence of special circumstances if the suggested impacts are too far out of line.

A rather more sophisticated approach to the macro-economic impacts of aviation is evident in the October 1999 Oxford Economic Forecasting OEF: Contribution of the aviation industry to the UK economy[33]. This study was jointly funded by the (UK) Airport Operators Association, British Air Transport Association, and what is now the (UK) Department for Transport. The work relies upon the use of a specially modified version of OEF's UK industry Model to determine aviation's 1.4% share of contributions to gross domestic product (GDP), and 0.8% of direct employment, implying above average productivity. It also estimates the following 1998 UK employment numbers and multipliers for the aviation industry (excluding travel agency staff):

- direct employment 180,000
- indirect 200,000 (multiplier direct x 1.11)
- induced 94,000 (multiplier direct and indirect x 0.25)
- total 474,000 (overall multiplier direct x 2.6). .

Forecasts are made of "the economic impact of restricting aviation" (by capacity shortages or otherwise). An 8% reduction in forecast passengers across the board by 2015 is modelled to imply a reduction in direct employment of over 9%, and a similar number of indirect job losses. However, OEF warns that that employment would not necessarily reduce permanently at the macro level, although their replacements might be lower paid and less productive. Investment and competitiveness would reduce, and GDP fall by over 0.5%.

The OEF report was criticised in a 2001 discussion paper by the Institute for Public Policy Research (IPPR) for neglecting to net off the environmental costs of aviation from the economic benefits. Like this report of ours, that was actually beyond their terms of reference.

The IPPR paper also noted that OEF were unable to identify econometrically any (implicitly causal) link between aviation, as distinct from transport as a whole, and enhanced performance of the rest of the economy – i.e. by substituting aviation for (all) transport as a variable in equations. OEF accepted that the statistical significance of such a link could not be demonstrated to 95% confidence limits (probably due to the relatively small size of the sector and the volatility of the data) but nonetheless drew the logical inference from their overall results that the productivity link is real.

OEF were criticised on similar econometric grounds by Berkeley Hanover Consulting (BHC)[34]. This controversy on the econometric modelling issues implies for us that catalytic impacts at the individual airport level, the context of our task, are less contentiously addressed and the results more readily accepted by more empirical investigation, at least in terms of employment. In terms

[33] Oxford Economic Forecasting: the Contribution of the aviation industry to the UK economy (1999) – commissioned by the AOA, BATA, and the Department for Environment, Transport and the Regions.
[34] Berkeley Hanover Consulting: the Impacts of future aviation growth in the UK, a report for the Strategic Aviation Special Interest Group of the Local Government Association (SASIG), December 2000.

of direct employment too, we take the OEF rather than the critics' view, that all employment directly affected by a change in air traffic – including retail concession employment at airports – is "direct".

BHC did however make two more detailed points of relevance to the sort of assessment we are considering. The first is that looked at on a national basis aviation can have economic disbenefits which should be netted off any valuation of its catalytic benefits – for instance, outbound tourism expenditure lost to the home country. Their second germane point (which they actually illustrate by reference to jobs associated with hunting in the UK) confirms one of our own observations appropriate to single airport flight restriction assessments. This is that job losses, particularly at the direct and catalytic levels, are in practice constrained by inertia, redundancy costs, and overhead minima (e.g. if 50 of a workforce of 100 are dismissed, the 1 pay clerk is retained). We deal with this in more detail in Section 10.4.4.

OEF went on to produce a regionally disaggregated follow-up report[35], again based on 1998 data, but not published until May 2002. Not surprisingly, this identified regional employment impacts closely reflecting the regional distribution of air transport activity (e.g. passenger movements at airports). Its data base supports and quotes the rule of thumb of "around 1 [direct] job created for every 1000 passengers using an airport". In direct employment terms, OEF recognise that employment directly dependent upon aviation activity is not necessarily located at the airport where the flying takes place, or even in the same region. For instance, British Airways maintains its London-based long haul fleet at Cardiff, and when flying routes to and from London their flights are directed by National Air Traffic Service controllers in Scotland (and elsewhere). Strictly, we would regard the latter as indirect employment since air traffic management is a bought-in service, as maintenance can be (e.g. BA's engine overhaul facility, also in South Wales, now owned by GE); which has two implications for restriction assessments:

- first it re-emphasises the need to be thorough in collecting data and to be careful to avoid double counting;
- secondly it may indicate (if OEF are too generous in their definition of "direct") that their indirect multipliers, derived from input/output tables following the supply chain, are perhaps conservative.

The range of indirect multipliers is quite striking. It varies from 0.75 at Heathrow through an illustrative average of 1.35 for most others, but 1.83 for Manchester due to substantial construction work there at the time, 1.38 being more normal. There are thus differences year to year. OEF rightly points out that multipliers vary between industrial categories of employment, a concept developed by the BIAC Sleuwaegen report at 6.3.3 below, and will thus vary between airports according to the mix of employment as well as the degree of subcontracting.

Turning to induced employment, this OEF report also distinguishes between regional employment and regional residence, the latter being generally more appropriate in this context. Total employment multipliers (total/direct) derived from the calculations and estimates in this report range from 1.7 in Greater London (where the absolute number is highest) to 8.6 in Yorkshire and Humberside (with only 3% of London's direct jobs); the overall averages are:

- Indirect/Direct: 1.08
- Induced/Direct + Indirect: 0.25
- Total/Direct: 2.6.

On figures slightly adjusted from OEF's first report, the overall multipliers are broadly confirmed, but caution is clearly counselled by the regional differences they conceal. The report goes on to

[35] Oxford Economic Forecasting: the Economic contribution of aviation to the UK: Part 2 – Assessment of regional impact (2002) – funded by a consortium of companies in the industry, assisted by a steering group comprising AOA, BATA, BAA, BA, Manchester and Newcastle airports, and the DTLR.

apply value added averages per (direct) employee to the regional figures, while recognising that there are grave dangers in not distinguishing between different types of aviation activity – long haul or short haul, passenger or freight, business or leisure passengers, and so on. Our view, developed after our case studies, is that this is impracticable at the single airport level, particularly when accounting for the effects of only some of a given airline's operations, to assign to regions in the restricted airport's country, the loss of value added from, for instance, the effective prevention of a long haul arrival by a foreign airline carrying passengers with countrywide and overseas origins and destinations.

We can bring this review of the contribution of airport activity to local, regional and national economies up to date with a recent distillation of much earlier work, and update of the 1998 edition of the study kit described above, in the January 2004 study by York Aviation for ACI-Europe: the Social and economic impact of airports in Europe[36]. To a downwardly revised estimated average of 950 on-site jobs per million passengers (workload units) the following multipliers are applied to obtain indicative employment impacts (exclusive of tourism):

- 0.5 for sub-regional indirect/induced jobs;
- 1.1 for regional indirect/induced jobs (subsuming sub-regional);
- 2.1 for national indirect/induced jobs (subsuming regional).

Thus a million passenger airport throughput generates:

- 950 jobs on site;
- plus (950 x 0.5) 475 sub-regionally, to total 1,425;
- plus (950 x 0.6) 570 regionally, to total just under 2,000 (950 x 1.1 overall);
- plus (950 x 1.0) 950 nationally, to total just under 2,950 (950 x 2.1 overall).

These figures need to be adjusted for high or low intensity of on-site employment, reflecting relative efficiencies of airport operation which can depend upon critical mass, seasonality and other factors.

The study goes on to look at simple tourism impacts (tourist air arrivals x average net expenditure), and draws some examples of gross income and value added figures from studies reviewed here and noted from elsewhere. It also reflects upon factors in choice of industrial and business location, in which the importance of airport access is a well-established truism. Overall it is a useful summary update (particularly in the multiplier quantification) and compendium of recent work by others, with a bibliography; but it is not intended to break new ground in applied economics or to replace the practical advice on data gathering from ACI EUROPE's earlier study kit.

We should also mention here that a study for the Belgian Air Transport Association is currently under way by the Solvay Business School[37] at the Université Libre de Bruxelles, under Professor Bruno van Pottelsberghe (lead author of the DHL-oriented study for BIAC discussed in section 6.4.2). Only the research project proposal was so far available to us, which itself has extensive bibliography and we are sure that the study will be a useful contribution to the literature.

6.3.3 Individual Airport Assessments

Falling, it might be said, somewhere between the deliberately simple and practical locally-oriented ACI-EUROPE study kit on the one hand, and the complex academic modelling capability required by the OEF approach, is the example of the September 2003 results of a study carried

[36] ACI EUROPE: the Social and economic impact of airports in Europe, January 2004.
[37] U.L.B. Solvay Business School: the Economic role of the aviation industry in Belgium, a research project proposal for the Belgian Air Transport Association, October 2004.

out by the French Directorate General of Civil Aviation DGAC: a Balanced approach to noise measurement at Paris – Charles de Gaulle Airport: an evaluation of operational restrictions[38].

As at the London airports, the package of measures considered is complex, but Annexes 8 and 9 are of particular interest as they outline methodologies, or rather the value assumptions employed, "for calculating the socio-economic impact of night time commercial flights at CDG". Although the DGAC document refers to the ACI EUROPE study "Employment and prosperity in Europe" of September 1998 as "the standard reference on the subject", we take this as equivalent to the updated January 2004 study for ACI EUROPE by York Aviation: the Social and economic impact of airports in Europe reviewed above. The ratios employed by DGAC at CDG are:

- for passenger transport operations:
  - 1,300 direct jobs created per million passengers transported;
  - a further 1,300 indirect and induced jobs created per million passengers;
  - a multiplier of 1.6 applied to the latter to give a total of 2,080 catalytically created jobs per million passengers; and thus (although the arithmetic seems obscure);
  - a total of 4,727 jobs created per million passengers.
- For air freight transport:
  - 272 tonnes of general cargo and mail produces one direct, one indirect and one induced, for a total of 3 jobs plus catalytic job creation;
  - 24 tonnes on express flights to create the same effect of one direct, one indirect and one induced, for a total of 3 jobs plus catalytic job creation;
  - overall, 12,300 jobs created by freight at CDG between midnight and 05:00.

The estimated airline turnover generated during the same period is calculated by:

- multiplying numbers of passengers by (hypothetically valued) mean ticket prices according to flight characteristics, from €100 to €250 per ticket;
- multiplying cargo tonnage by mean price per tonne, with express and mail valued at €10,000 per tonne against €2,700 for general cargo.

Airport management, shops, ground handling and other support service turnover are also estimated, with indirect and induced impacts (hotels, banks etc) calculated as a value per passenger; while induced impact estimates are based upon salaries and taxes. Some of the classification of direct and indirect activity looks unusual, but these are minor points compared with the comprehensive nature of the report, and grossing up of results to include the costs of responses such as aircraft replacement.

A further example is the report published on the Internet[39] in September 2003 by the Brussels International Airport Company (BIAC), which encapsulates two studies carried out earlier that year:

- Study into the economic impact of Brussels Airport on the Belgian economy, by Professor Dr Leo Sleuwaegen and Dr Koen De Backer, of Vlerick Leuven Gent Management School and K.U.Leuven
- Toward a new balance between economy and ecology, by Professor Bruno van Pottelsberghe and Steve Nysten of Université Libre de Bruxelles (ULB) in association with ECORYS Transport of Rotterdam. This latter study is in two parts, first on the principles

[38] DGAC: A Balanced approach to noise management at Paris – Charles de Gaulle Airport: an evaluation of operational restrictions. September 2003.
[39] http://www.brusselsairport.be/press/en/5507-RN-V2-ec%rapport.pdf

of such a balancing evaluation, with particular attention to night noise, followed by a case study of DHL.

Although they are presented together by BIAC, we discuss the first (Sleuwaegen) report here; and the second (van Pottelsberghe) report, with its emphasis on night flights, in section 6.4.2 below.

Both reports were written in the context of an airport with no HST connection, which had lost its home-based carrier's international hub (partly replaced), as well as a long-haul budget operation, and whose major express carrier faced opposition to its plans to expand its hub. Sleeuwaegen develops an earlier methodology to consider future employment and other economic impacts over a range of scenarios of passenger and hub development and HST connections.

The oft-quoted "rule of thumb" of 1000 **direct** jobs per 1 million passenger movements per annum (mppa) is shown to need cautious application, depending upon the type of traffic and other local circumstances. Forecasts of direct employment thus use a modification of this approach, splitting direct employment into categories (passenger-related, cargo-related, aircraft (movement)-related, and other. For each category, "employment elasticities" are derived by observation – for example, a 1% increase in mppa brings a 0.97% increase in passenger-related direct jobs, an elasticity of 0.97. The value for freight is 0.77, movements 0.46, and pax/cargo work load units (other employment) 0.86. This approach does offer an alternative or parallel way of at least prima facie checking for excessive over- or under-estimates of the sum of claimed job losses if traffic is lost due to restrictions.

Sleuwaegen uses national industry classifications and company data to determine value added per employee per sector, concluding that productivity is higher than average at the airport. Central government input-output tables are used to derive employment and (lower) value added multipliers for each industrial classification., to calculate **indirect** economic impacts – on building, equipment, food, fuel and other companies supplying "airport companies". The problem of double counting is clearly recognised.

Induced impacts (which Sleuwaegen calls "derived effects") use multipliers derived from average expenditure effects in the Belgian economy, applied to (direct + indirect) employment and value added totals. These impacts are a further step removed, and reflect largely "everyday" spending by employees and firms working at and supplying airport companies, so they are not necessarily related to particular industrial classifications. Induced impact multipliers are admitted to be subject to challenge, and Sleuwaegen counsels caution in their estimation and use.

Catalytic impacts are recognised, but their quantification relies upon the 1998 version of the York Consulting survey-based work we describe in section 6.3.2; returning to the concept of "jobs per million passengers". Tourism is singled out as having a high catalytic relationship with airport passenger traffic, and a local/regional analysis of Zaventem's catalytic influence according to by type of industry/service is presented.. The key element is that a number of catalytic jobs per mppa has to be estimated for each airport individually, ranging from some 700 for Amsterdam, through 882 for Brussels, to over 16,000 for Malaga. This is not expressed as a multiplier in the Sleuwaegen report, but multipliers have been derived to complete the following table.

Table 6.1 Overall Brussels Airport Multipliers in the Sleuwaegen Report

	Jobs		Value Added	
Direct	19.9 k	*	€ 1.38 bn	**
Indirect	17.7 k	D x 0.89	€ 1.07 bn	D x 0.77
Induced	9.9 k	D+I x 0.26	€ 0.62 bn	D+I x 0.25
Sub Total	47.5 k	D x 2.39	€ 3.07 bn	D x 2.22
Catalytic	12.7 k***	D+I+I x 0.27	€ 0.79 bn	D+I+I x 0.26
Total	60.2 k	D x 3.02	€ 3.87 bn	D x 2.80

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Notes to Table 6.1

* Total employment on the airport, broken down by industrial classification sector, changes (deltas [Δ]) being calculated from employment elasticities related to traffic loss or gain.

** Value added is calculated from value added per employee by industrial classification sector, derived from central government company data.

*** Catalyst jobs and value added calculated independently on a basis of jobs per mppa, and value added per employee, in turn derived from survey data, multiplier derived for illustration only.

Despite some minor inconsistencies in the figures quoted in the report, the methodology is clear and plausible, and offers graphic and explicable forecasts of the economic consequences of various traffic forecast scenarios over a period of years. It introduces the concept of varying employment elasticities, and of working with employment numbers disaggregated by industrial sector classification rather than by firm, which could have practical advantages for confidentiality in publishing results, as well as offering a relatively quick check on survey-derived figures. Forecasts, however, are themselves subjective and by definition uncertain.

It is important to remember that direct jobs for Sleuwaegen are all jobs at the airport – airlines, handling companies, concessionaires, and public services. So they are for us, but we do not limit the definition to the airport itself. In the context of this study we define direct jobs as those directly affected by restrictions on night flights, wherever they may physically be located (although job losses abroad are dealt with separately). This is further discussed in considering the "domino" effects identified by Professor van Pottelsberghe in the second BIAC report, at 6.4.2 below.

6.3.4 Other

We have also looked at the Report prepared for the Commission by the Brattle Group. This considered the benefits of liberalisation and greater competition to consumers through more efficient air transport services[40]. Benefits were expected through more efficient carriers, pricing synergies and the abolition of quantitative limits on output imposed by restrictive bilateral agreements. These were quantified in terms of traffic, consumer surplus and employment. Further the indirect employment effect was estimated using US input-output tables. A striking conclusion was that $1 of direct revenue would generate $0.84 of indirect impact, chiefly in aircraft manufacture, petroleum, IT and other service industries. While not a direct parallel, the study could give useful insights into the effect of restrictions. These restrictions might be quantified in a decrease in traffic, or the absence of growth in traffic, and be subjected to the same metrics developed by Brattle.

[40]The Brattle Group: The Economic Impact of an EU-US Open Aviation Area. December 2002.

6.4 Economic Impacts of Restrictions on Night Flying

6.4.1 Distinctions

The distinction between section 6.3 of this report, on the economic impacts of air transport, and this section, addressing the obverse aspect of restricting such activity, is somewhat artificial and there are clear overlaps between the two; which certainly inter-act. We have moved in this section to considerations of impacts of potential restrictions upon particular types of operations, although these may be written "in reverse" describing the benefits of such operations.

Even in this section, the studies do not always conveniently limit themselves by operational characteristics, so there are overlaps between airport-oriented and operator-oriented references, and between passenger and cargo.

6.4.2 Airport Study

The second recent Brussels Airport (BIAC) study issued with the Sleuwaegen report discussed at 6.3.3 above is that by Professor van Pottelsberghe et al, entitled "Striking a new balance between economy and ecology". The message of the study is the need to balance noise pollution and economic interest, and it concludes with a timely application of its work and that of the Sleuwaegen report to a case study of the DHL hub at Zaventem.

First however, the report has a simplified but useful summary of the relationships between sound pressure (level, frequency and average descriptors), and perception (annoyance and sleep disturbance). The historical decline in noise exposure around Zaventem (in terms of Miedema-defined annoyance levels) is shown, as is that around Schiphol (in terms of numbers of houses exposed) – the latter showing a striking inverse relationship to numbers of complaints. The report next describes the complex pattern of noise regulation around Zaventem (Federal, Bruxelles-Capitale regional and Vlaams-Brabant regional), and briefly considers other airports, noise charges and the house insulation programme at Brussels-National, also mentioning noise abatement procedures and land use planning, plus a few lines on the economic valuation of noise disbenefits.

Turning specifically to night flights, the van Pottelsberghe report enumerates the main users of the airport at night – presumably a "night" of 22:00 – 04:59 local, as defined by BIAC for regulatory purposes - thus identifying charter and express as the main types of operator affected by a (hypothetical) night ban. It then applies the Sleuwaegen methodology to forecast, by industrial category, the numbers of direct dependent jobs associated with each traffic forecast scenario, and uses multipliers derived from Sleuwaegen and OEF to estimate indirect, induced, and, in this instance, also catalytic jobs.

This report also introduces the concept of "domino effects", at least in a time context. Thus if night flights are banned for leisure operators, although that is only 33% of their three daily rotations, they may in practice have to abandon their entire operation. A similar point is made for express operations, with an estimated 25% of such flights taking place (at Brussels) in daytime as defined for this report, and up to 40% of the integrators' shipments moving by truck to/from the Brussels hub – without night capability, the entire operation would be assumed to close, at least as a hub. Our methodology gives rather wider recognition to the domino principle, which we have called network effects. Since our task is to consider the assessment of the economic impacts of specific night flight restrictions at specific airports, our recommended primary source for loss of direct employment is depositions (backed by evidence of an auditable trail through strategic response considerations) by directly affected stakeholders. We must therefore allow the inclusion of network effects in terms of both:

- time:
  - as identified by van Pottelsberghe, jobs dependent upon day flights that are not viable without complementary night flights as part of the airline's fleet integration for instance; as well as

- jobs directly dependent upon associated flights by other carriers, whose viability (or at least timing) may depend upon night flights, either connecting passengers or (again noted by van Potteldberghe) subcontracted express belly freight;

- spatial/geographic:
  - dependent jobs which may be in a nearby or distant location but not at the restricted airport, such as reservations or maintenance staff who may be redundant due to fleet or route cutbacks;
  - jobs directly dependent by night or day upon the flight affected at the "other end" of the route(s) rescheduled or abandoned, such as aircraft handling jobs at other airports (those at the restricted airport also being "direct" of course).

We regard all these as direct job losses, and apply indirect and induced multipliers to them all, except those abroad, since we regard cross-border indirect, induced and catalytic effects as beyond the scope of assessment of restrictions by any single airport.

The van Pottelsberghe report concludes with a case study of DHL's Brussels hub. Much of the descriptive material parallels our sections 3.3.3. The importance of the hub function is stressed by the high degree of dependence of the Belgian and regional economies upon import/export trade as a proportion of GDP ("open-ness ratio") and the following 2002 value added estimates are given for DHL's hub function at Brussels:

- direct € 273 mn;
- indirect (and induced?) € 121 mn - a conservative multiplier of 0.5;
- catalytic € 600 mn – using a multiplier of 2.18 (stated to be derived from OEF) on direct value added. It does not appear to be absolutely clear whether this figure subsumes indirect and induced value added.

Data on the location, turnover, and employee numbers of several companies reliant upon DHL hub facilities are also provided, with notes on their location decision factors.

6.4.3 Passenger Operations

In 1997, Coopers & Lybrand undertook a study for the British Air Transport Association (BATA): the Economic costs of night flying restrictions at the London airports[41], which considered the effects of existing capacity limitations imposed by night movement and night quota count limits constraining future growth. For each airport, characteristic operations were described and the costs per service of their having to reschedule, lose, or relocate were estimated (and discounted to 2003) for:

- long haul scheduled arrivals at LHR;
- leisure (charter) rotations based at LGW;
- express or freighter operations at STN.

In a situation of already saturated daytime capacity at LHR and LGW, these economic costs were restricted to loss of airline revenue (including losses to foreign operators), substitution costs for passengers (expressed as higher fares), additional airport access costs for passengers, and surrogate figures for losses at STN. No account was taken of employment or other effects on localities, but neither were "further operational restrictions" considered, so the context was rather different from that of Directive 2002/30 and this study. We think the BATA work is useful because it reminds assessors of the need to start with the direct costs of restrictions to operators and their customers. It further highlights the variety of restrictions which operators may face or

[41] BATA: The economic costs of night flying restrictions at the London airports; Main report and Supporting analysis, Coopers & Lybrand, July 1997.

airports may consider, including (as around London) limits both on absolute numbers of night movements, on quota counts (movements weighted for noise level), on runway direction, and on the application of changes to the combination of measures applied[42].

The BATA study also published the basic diagrams illustrating long-haul scheduled service and three-rotation leisure/charter timetable constraints which we have discussed in section 3.2 above. These arguments are still valid and were used, for example, at the UK Department for Transport Night restrictions forum: BA presentation[43] in February 2004. This set of slides takes the long-haul arrivals case forward to detail, update and quantify the importance of connecting traffic. It also states the airline's own monetary and employment estimates of the contribution of night flights to the national economy, a concept which had been explored for air transport at the local, regional and national level - without specific reference to night flights - over many years.

6.4.4 Freight and Mail Operations

The economic impacts of conventional (mixed) freight and mail flights are given values in the Paris-CDG assessment reviewed in section 6.3.3 above, and the necessity of re-organising the night flight network of the national mail operator La Poste on a more regionally-oriented basis is discussed in a context of restrictions at the traditional hub. Some relatively recent unpublished studies carried out at Frankfurt/Main (FRA) on the possible loss of night flight capability for "traditional" scheduled cargo services, are also potentially useful sources.

6.4.5 Express Operations

Since 2002, the express industry has commissioned a series of reports on the economic impact of the sector in various European countries. They cover:

- Belgium (KPMG, 2003)[44];
- Germany (IfV Köln, KE Consult, GfK and MRU; for BIEK)[45];
- France (Deloitte Consulting)[46];
- Italy (Oxford Economic Consulting and Centro Studi Confidustria, for Associazione Italiana Corrieri Aerei Internazionali)[47];
- Portugal (GTE Consultores)[48];
- UK (OEF and ATC, with the CBI, for the Association of International Couriers and Express Services)[49].

These studies do not all use the same metrics or definitions, but broadly all follow the same principles of:

- establishing the direct employment and value added (or sometimes gross turnover) of the industry in their country;

[42] For an example, see the UK DETR: Decision of December 2000 (on) Noise limits for aircraft departing from Heathrow, Gatwick and Stansted airports – a combination of nine proposals recognising that "no exact equivalence is possible between the night restrictions and the night noise limit".
[43] Night restrictions forum: Why do scheduled airlines fly at night? – presentation by Isobel Knox, British Airways Manager Operational Regulations, 27 February 2004.
[44] KPMG: Etude d'impact économique du secteur belge du courrier st du transport express, 2004.
[45] Bundesverband Internationale Express- und Kurierdienste e V: Produktivitäts- und Wachstumeffekte der Kurier-, Expresse- und Paketdienste für die arbeitsteilige Wirschaft, (Executive summary in English), 2004.
[46] Deloitte Consulting: L'impact du secteur du transport Express sur l'économie française, 2002.
[47] OEF and CSC: The Impact of express carriers for Italy's economy and competitiveness, 2004.
[48] GTE Consultores: The Economic impact of the express industry in Portugal, 2004.
[49] OEF and ATL with the co-operation of the Confederation of British Industry: The Economic impact of express carriers for UK plc, commissioned by AICES,2002.

- ascertaining by survey or modelling the indirect (sometimes apparently combined indirect and induced) employment and financial impact;
- by survey or multiplier calculation, arriving at total impact figures, which in some cases appear to include catalytic employment and financial impacts.

The summary results are thus difficult to present in a consistent format, and these differences must be borne in mind in reading the following tabulation of their key outputs, of which the notes are an integral part.

Table 6.2 Key Outputs of Studies on Economic Impacts of the Express Industry

Country & Author	Belgium KPMG	Germany BIEK	France Deloitte	Italy OEF	Portugal GTE	UK OEF
Sector Employees	9,500	160,000[a]	22,000	24,000	1,030	29,309
Indirect Jobs	5,500	95,000	30,000	23,000	2,692[b]	25,206
Induced Jobs		65,000	13,000			13,629
0ther Jobs	30,000[c]	-	-	-	75,500[d]	-
Total Dependent Jobs	45,000	320,000[e]	65,000[f]	47,000	79,222	68,144
Employment Multiplier[g]	4.7	2.0	3.0	2.0	76.9	2.3

Source: Consultants' analysis of studies listed.
Notes:
(a) Of which 64,000 would be lost if night flights were banned in Germany.
(b) New indirect and induced (upstream) jobs in Portugal in the next five years.
(c) Additional jobs assuming 1% of Belgian companies' turnover is express-dependent.
(d) Catalytic estimate based on estimations for four (downstream) industries in Portugal. It seems that there may be some inconsistency in interpretation here.
(e) Although it is estimated that 436,000 jobs (including 64,000 direct jobs) would be at risk if express services were restricted in Germany.
(f) Although 465,000 jobs would be at risk over 10 years if all French international express traffic were delayed 24 hours, estimate based on survey.
(g) Total dependent jobs divided by (direct) sector employees.

Unfortunately there seem to be differences in definition of what constitutes "turnover", "value added", and "contribution to the economy (or GDP)", which preclude summary comparison of the financial outputs of these studies. The terms "indirect", "induced" and "catalytic" are not always consistently used, and it is sometimes unclear whether the results derived from the use of financial multipliers refer to the indirect and/or induced benefits alone, or to the total benefits claimed to be generated (or at risk). Different hypotheses are also considered in assessing the risks to those benefits, from a precise 24-hour delay on all express shipments in France to unspecified restrictions on night flights in Portugal and a ban in Germany.

It must be remembered, however, that the reports were undertaken separately by different consultants, not necessarily to provide country-comparable figures. That is not to say that individually these studies are not useful contributions to indicate some of the ways in which the importance of the express industry to the economy – and the risks associated with its restriction - can be measured. On the contrary, they are clearly professional pieces of work., identifying through case studies the quantifiable benefits (such as reduced inventory costs) accruing to

customers of the express industry; as well as less tangible "enabling" or "catalytic" advantages (like enhanced delivery competitiveness) which may be necessary for success but do not necessarily guarantee it.

For the UK and Italy, we had the advantage of discussion with OEF, who made it clear that their results were based upon use of an "air transport enhanced" version of their authoritative econometric model of the UK economy as used in their work for the UK Treasury (and an adaptation for Italy), and they present a reasoned argument for their modelled estimate of the potential loss of GDP should night express flights stop. But in putting all the studies side by side the importance of careful and consistent definition (perhaps best exemplified by the Belgian paper) for ready comprehension of the results becomes evident.

For example, both the French and Italian studies use the graphic and helpful example of comparing the use of a scarce slot by an express flight and a passenger service.

In France:

- the "value" of an express flight is assessed at €109,000; and
- a 100% business class flight would have the same "added value"; while
- an average passenger flight with a 31% business class content has an estimated "induced added value" of €34,000.

In Italy:

- a single express service contributes about €29,000 in "catalytic economic benefits"; but
- a scheduled passenger service contributes about €10,000; while
- a typical tour charter flight has a € 0 (zero) "catalytic economic impact" (although there are direct economic and social benefits to Italy from leisure travel).

A further point to be made on the need for clear and unambiguous econometric definition is that some economists (including OEF) believe that job losses are an unsatisfactory measure of economic disbenefit at the macro level, since over time the unemployed tend to find other jobs. Locally and regionally, the economic and social costs of job losses can be not only devastating in practice, but appropriate, immediately comprehensible, and easily definable metrics for assessment.

It is appropriate to re-iterate here that the final section of the second of the BIAC (Sleuwaegen/van Pottelsberghe) reports is a case study of DHL at Brussels airport, but this has already been described at 6.3.3above.

7 Stakeholder Consultation

7.1 Airport Operators

We have conducted a dialogue with **ACI EUROPE**. Following a meeting with the Mr Philippe Joppart in Brussels, we attended a meeting of the Environmental Strategy Committee in Amsterdam which was attended by some 25 senior airport managers. We gave a presentation on the purpose of the study, our methodology and progress. The airport representatives welcomed the study and made a number of points for us to take on board. For instance, we were told that delayed flights account for some 20% of night flights at one major airport. Also, difference in time zones means that late evening arrivals in Finland and Greece will be later (in local time) than elsewhere. We were pointed to some existing studies.

7.2 Passenger Operations

7.2.1 Introduction

We approached representative organisations at the European level. Our intention, until the case study stage of work, was to avoid direct consultation with individual airlines, but some were in touch with us through their representative associations and we believe that without prejudice to those with whom we have not talked, such contacts have been helpful in giving specific illustrations of some of the generic points made on their behalf.

We have not included a specialist regional category among our nominated types of operation. It is largely subsumed within scheduled passenger operations – although the image sought by regional operations does seem to be increasingly oriented toward identification as Low Cost carriers. Regional carriers also have a feeder role, but the timing of such flights is rather determined by the requirements of the mainline operations serviced.

7.2.2 Scheduled Passenger Operations

We met with the **Association of European Airlines** (AEA), whose General Manager Infrastructure and Environment (Le Thi Mai) and her staff pro-actively encouraged AEA members to join our meeting and/or to make representations to us. This was a very constructive process, and we are most grateful for the co-operation we have received.

The AEA pointed out that their members are already affected by a variety of operational restrictions, not just time-related but also by aircraft type in cases of marginal Chapter 3 compliance. Further, they mentioned economic (night surcharge) instruments and noise abatement procedures. While we accept that these are legitimate concerns, we must work within the limitations of this study's terms of reference.

Like ACI-EUROPE, ELFAA, IACA, ERA and EEA, the AEA also drew attention to the network effects of night restrictions:

- on airline operations elsewhere that at the restricted airport; and
- on other airports and other communities, even beyond the Community.

As noted below in the context of freight operations, the multi-functional nature of AEA members' hubs was stressed, as was the global nature of their business and that of their alliance partners. Other useful points which we have kept in mind throughout the conduct of the study were:

- the use of late evening as a buffer to "soak up" delays accumulated during the day – thus numbers of night movements can exceed those planned;

- conversely, that where take-off curfews or quota limits are based on take-off time rather than block time, the effect can be to add up to half an hour earlier to the restriction, as time must be allowed for boarding delays and taxiing – note that throughout this study we have defined the hours of the night in **block time** terms;
- that 2002 and 2003 may be a-typical in terms of the number of night flights (e.g. the typical number at FRA has reportedly fallen by over one third) due to traffic declines and slow recovery since 9/11, and consideration of proposed restrictions should consider "normal" growth – unused night slots are reportedly being withdrawn at CDG for instance.

We are indebted to British Airways (whose Manager Operational Regulations attended part of our AEA meeting) for valuable insights into examples (at LHR) of the practical scheduling and operating difficulties already faced by airlines working within a noise quota system. The 30 minute departure "firebreak" mentioned above was cited, and it was noted that the theoretical corresponding gain in being able to schedule block time movements sooner in the very early morning is of limited value for local and connecting traffic. Also, we were kindly given access to the long-haul arrival scheduling examples included in BA's submission to the February 2004 Night Noise Forum (see Section 6.4.3) which we developed into Tables and Figures 3.1 and 3.2. The airline also quoted proportions of 35% to 45% for connecting traffic on long haul flights at LHR – this tends to confirm publicised proportions of total traffic at competitive hubs such as Amsterdam and Frankfurt/Main.

We were also given sight of BA's 2002 written submission to the European Court of Human Rights[50], which is not in the public domain, on night flight restrictions at LHR. The airline's own valuation of a ban on its 27 nightly scheduled LHR movements (5.4% of its 499 total daily movements there, and 35% of all airlines' night movements there) is a potential loss of 4.9 million sector passengers, – including lost return leg traffic and traffic on connecting flights – worth up to 18.4% of BA's total revenues.

Other airlines, including Air France, Finnair, and Iberia also offered and/or supplied summary night schedules data which helped us to identify types of flight and to check our statistical analyses. Lufthansa sent representatives to the AEA meeting who were most helpful on scheduled service cargo issues, and their helpful contribution is acknowledged there.

In conclusion we must mention that Air Malta, airline of an Accession State beyond the scope of this particular study, took the trouble to send us a written submission through AEA as they are of course a national flag-carrying scheduled service airline. Because of the emphasis of their operations, and the importance of tourism to Malta, we refer to this in more detail in section 6.4.3 below, on leisure traffic. Air Malta also sent us some extracts from a Master's thesis[51] which included the interesting and not often remarked upon calculation that noise abatement procedures at Malta's airport add 5 minutes to Airbus A319/320 flight time at a direct operating cash cost of the order of € 132 per movement. Thus operating procedures, as well as operating restrictions, can have a measurable cost.

7.2.3 Low Cost/Budget Passenger Operations

We talked with the Secretary General (Mrs Jan Skeels) of this quite recently established association of Low Cost airlines, the European Low Fares Airline Association (ELFAA) . As noted in Section 3, we are aware that Low Cost carriers fly from as early in the morning until as late in the evening as their markets will accept, with a few "middle-of-the-night" flights on some holiday resort routes. They certainly seek high utilisation – EasyJet in the UK report a daily average of just over 12 hours per day on each of its 18 B737-700 aircraft, approaching that of BA's 747-400 fleet which has the advantage of being able to fly through the night..

[50] ECHR: Ruth Hatton and others *v.* United Kingdom (Application No. 36022/97)
[51] Donau-Universität Krems: MBA Center: John Zammit , Guiding main carrier and airport business development – Case Study: Air Malta plc and Malta International Airport plc, 2003.

Nearly three quarters of the Low Cost movements we identified were arrivals 23:00 – 23:59 or departures 06:00 – 07:00. The special, if not wholly exclusive features of this airline category with regard to night operations include their aim to achieve fast turnrounds and low costs by serving smaller and relatively uncongested airports, where they may be the only carrier, and many of which may not qualify on size grounds for inclusion under Directive 2002/30/EC – although their home bases may well do so. Thus if a night restriction at their hubs makes a particular route untenable, the catalytic effects at the typically small spoke termini can be disproportionate.

7.2.4 Charter/Leisure Passenger Carriers

We have had the benefit of a discussion with the Director of the **International Air Carrier Association** (Ms Sylviane Lust), for which we are grateful. She has also kindly provided a set of graphs of IACA night activity, which confirms the results of our own analysis (in section 4.4.4) that:

- despite the declared importance of the "three daily rotation" pattern in northern Europe/Mediterranean services, the overall pattern of activity is heaviest in the very late evening and very early morning hours, with something of a trough in the middle of the night; and that
- this is not unique to the Charter industry, but very broadly follows the trend of night passenger traffic as a whole.

IACA represents about three dozen (mostly Community-based) airlines, together operating some 800 aircraft. Their operations, however, are by no means restricted to Europe, and they fly long haul Transatlantic as well as Asia-Pacific services. They are certainly no longer exclusively charter carriers, and while they emphasise point-to-point operations, include fully scheduled service operations and even code-share. Their common denominator is that they define their membership as "serving the leisure industry", a point we recognise in the labels we use for our classification of flights.

We were at pains to point out that for the purposes of this study we have adopted for convenience the default definition of "night" in Directive 2002/49, in order to assess current night activity and the principal reasons for it; since "night" is not specifically defined in Directive 2002/30, although airport "night flying restrictions" often cover different (shorter or longer) periods. IACA made the following important points regarding the wider implications of "labelling" a particular period as "night" even if it has no legal authority:

- crew flight time limitations can be more demanding "at night";
- social and labour-relations problems and costs can arise with ground staff asked to work "at night";
- customers tend to expect a lower fare for (short haul) flying "at night".

Thus overall, IACA feels that the industry already faces multi-layered constraints relating to operations "at night", in addition to airport operational restrictions, and would like to see a defined minimal (core) period adopted for the Community.

IACA also stressed, in common with other airlines, that operational restrictions at one airport can have network effects, bringing carriers into conflict with scheduling constraints elsewhere. Examples include:

- difficulties of scheduling long haul flights around curfews in different time zones;
- congestion delays due to shortage of daytime slots for displaced night movements;
- resource utilisation constrained if evening outbound flights can not return before morning (as shown in Figure 3.3, and equally relevant if a long haul night freighter arrival at (say) FRA is diverted to (say) CGN, "stranding" the crew with insufficient duty hours for the eventual positioning flight.).

In conclusion, the importance of Charter flights to the tourism-dependent economies of resort areas was stressed. This was well expressed by Air Malta through AEA, as noted above. Malta has a population of 400,000, but receives almost three times that number of visitors – equivalent to 2.2 million sector passengers (arrivals plus departures), in a largely seasonal business. Night flying is perceived as reducing, under market pressures, but the flexibility and resource utilisation it permits are seen as vital to leisure-oriented carriers, and the carriers' efficiency in a price-sensitive leisure industry is in turn essential to ensure that Malta remains a competitive destination. Now the same might be written about almost any island tourism-oriented economy, but (as noted by the Maltese thesis referred to above) Malta has a very high population density, the airport is in the centre of the highly urbanised island, and yet there is reportedly no "vociferous anti-noise lobby" (except regarding helicopter charters, training flights, and the annual Air Show) – no mention of antipathy toward flights bringing tourists.

This is ascribed to the implementation of at least the first three of the four strands of the "balanced approach" (reduced noise at source in Air Malta's Chapter 4 Airbus 319/320 fleet, noise abatement procedures, and land-use planning). We feel that it may also reflect the same sort of perception which our work at African airports has shown about the noise of freighters taking off with flowers and produce – the "beneficiaries do not hear aircraft noise, they hear money". The airline itself strongly urges that operational restriction assessments should (on the environmental benefit side of the equation, which is beyond our scope here) consider the local factors which determine the airport's effective noise impact; and innovatively suggests revenue-neutral differential charges as market-based incentives to minimise night noise, rather than operational restrictions.

7.2.5 Regional Airlines

As noted in our introduction to this section, we have not included regional airlines as a category of carrier appropriate to separate identification in terms of night noise impact. "Regional" is rather a generic term which can include short haul scheduled, Low Cost and Charter operations, as well as freight, express and mail. Thus the activities of members of the **European Regions Airline Association (ERA)**, are in this report subsumed in statistical and descriptive terms within night-related consideration of the types of short-haul operational and business models listed.

We have met with the Association's Director-General (Mike Ambrose) and his staff to ensure that their members' concerns are fully reflected in this way. They made the point that the network effects of restrictions at hub airports, which are recognised in direct economic impact terms in our methodology and thus subject to indirect and induced multipliers at national level, may be disproportionate in case of a regional route in two ways:

- early morning/late night mainline connecting traffic at a hub airport might be more important to the overall viability of a thin regional route than to other short haul connections;
- catalytic impacts at the ends of regional spokes could be more important than those at the hub or at the termini of other short haul connections – a city might disappear off the air transport map altogether.

The association made a number of other points, including the importance of just-in-time deliveries (which could arise in another Member State to the one imposing the restriction, the threat of retaliation from third countries and the need for the report to show "the big picture". The choice of Heathrow as the Case Study major hub was considered to be en extremely poor one; another such as Munich would have picked up the regional airline feed to the network carriers much better.

7.3 Freight and Mail

7.3.1 Introduction

We had intended to deliberately restrict our formal consultation to European level operator representative bodies at the early stages of our work , as it was not felt appropriate to go into individual situations and to talk with customers until the case studies were undertaken. We have been fortunate in securing the very welcome co-operation of these organisations, but it has led to individual operator contacts which have also proved very helpful. Those of their members with particular concerns have attended such meetings and/or followed them up with individual representations. Furthermore we have been in touch with specific operators to check schedules data and to identify flight types, and again owe thanks for the co-operation received.

We have been careful, however, only to identify particular operators with their permission or on matters already effectively in the public domain. We trust that this has not resulted in any particular operator's contribution not being properly acknowledged.

7.3.2 Scheduled Freighters

Our main contact point here has again been the **Association of European Airlines (AEA)**, whose General Manager Infrastructure and Environment (Le Thi Mai) and her staff pro-actively encouraged AEA members to join our meeting, as well as assisting in our follow-up quests for schedules information after the meeting. We do not necessarily accept all the points made by and on behalf of the industry, but we gladly acknowledge that they were made in the same constructive way as the AEA's response to the initial consultation process when Directive 2002/30 was being drafted.

It was claimed that European carriers' home hubs tend to be multi-functional, serving local and connecting passenger and cargo markets with appropriate aircraft round the clock. These functions being inter-dependent, there is no single critical mass, and no individual element can economically be moved elsewhere. One example quoted to us in support of this contention seems to indicate, however, that (capital costs apart) relocation may be preferable to rescheduling. A December 2001 study for Fraport estimated that if FRA were closed at night, the loss of revenue and extra costs to Lufthansa Cargo (excluding Lufthansa mail and passenger operations) of moving to another hub location are quantifiable and very substantial. The estimated gross revenue loss to Lufthansa Cargo if the flights could be retimed to daytime but stay at FRA, was estimated as about 70% higher than the net cost of relocation. We must also note, however, by contrast, the absence of night scheduled jet freighters at LHR, noted in Section 3.3.1 above , despite the London airport handling only marginally less cargo overall than Frankfurt. British Airways' B747 scheduled long haul freighter hub is at Stansted, where only one weekly movement (an 0630 Tuesday arrival) out of 13 turnrounds, is at night – although four departures transit Frankfurt at night, one transits Köln-Bonn at night, and one goes through Prestwick at night. This suggests that there are differences between large carriers at their main bases..

BA and LHR thus seem to be significant exceptions to the general rule stressed by AEA that inbound long haul freighter and belly-hold cargo has (like passengers) to make connections to the first wave of connecting short-haul departures as belly cargo. Coupled with passenger acceptability of departure times at overseas points (some of which have operating restrictions themselves), this tends to lead to early morning (night) arrivals at European hubs. At the other end of the day, late evening (night) can offer a buffer to soak up delays accumulated in daytime. Further, high freighter aircraft utilisation is achieved while using night slots which might not even be available in daytime.

All this implies that there often is very little flexibility in rescheduling freighters, or operating other than at their home hubs. In AEA's view, product-dedicated operations such as express, as well as freighter carriers specialising in fruit, newspapers or other specialist cargoes (often on

contract and/or charter), would find relocation easier in the event of restrictions being imposed at their hubs.

7.3.3 Charter Freighters

We have not talked to charter freighter specialists, although we do have AEA's view above that the nature of their business gives them greater flexibility when faced with operating restrictions at night. The volume of charter freighters' contribution to the European night noise climate appears to be relatively small – we found an average of only a dozen such jet movements per night across the whole study area. Further, the very operation of such flights is by definition a matter of specific customer requirements, implying that in general it is not something the carrier can decide .

Our view is that while they may have the flexibility AEA suggest relative to scheduled carriers, they will often not have the same protection of slots at night at whatever airport they seek to use on an ad hoc basis. Further, in the case of specialist perishable transport, the essence of demand for the service may well be unloading at an airport so situated as to permit surface delivery to retail outlets by a commercially competitive time, while the departure from origin may also be fixed by production constraints. A short haul example might be newspapers, for long haul it could be out of season fresh flowers and produce to morning markets.

7.3.4 Express

Our contact with the **European Express Association** (EEA) as an appropriate body representing the industry in Europe has been at the senior level of the Transport and Environment Committee, (Chairman Roland Steisel), including managers representing DHL, FedEx, TNT and UPS. As with all our meetings, we do not necessarily accept all the points made by our informants, but we are grateful for the co-operation they have extended to us. We declined their invitation to meet individually with their members to cover matters too confidential for representative discussion.

The EEA strongly emphasised that the competitive time-specific nature of their predominantly overnight integrated business made night operations absolutely essential, and left no flexibility for retiming. Some flexibility in terms of scale was acknowledged, through acceptance of night quotas, but for each hub there is a point at which critical mass would be lost. Due to the vital nature of the core "sort time" described in section 3.3.3 above, which tends to fall between about 00:30 and 04:30 local at European express hubs, EEA showed particular interest in reports of research into the hypothesis that sleep disturbance is more likely in the "shoulder hours" of the night than during the "middle of the night" period of deepest sleep.

Modal flexibility was also discussed. Express operators own, operate and charter aircraft, and use the services of scheduled carriers (freighters and belly-holds), and this – despite the existence of hubs at cargo-oriented airports like Liège – is held to militate against relocation to less populated sites. Road is a significant part of their activity, including the pick-up and delivery segments of flown express consignments. The point was made that the displacement of consignments aircraft to trucks carries its own environmental impacts. High sped rail is not seen as a viable alternative to air or road in Europe, due to track maintenance and terminal closures at night, and a claimed lack of commercial awareness by train operators (which was contrasted by one carrier to their experience in the USA).

The EEA stressed that not only do half their air movements (by definition) take place at the ends of the spokes of their hubbed routes, but that:

- such movements may well fall outside the night period, although the hubs are busiest at night, and

- the economic benefits of express activity at the ends of the spokes are dependent upon the night movements at the hubs.

The difficulties of reasonably, legally and practically limiting the assessment of night movement benefits at one airport while conscious of the benefits of corresponding movements at the airport(s) at the other end of a route or network must concern us as they do the EEA, and we return to the question at the conclusion of this report.

Not only in that context, however, the EEA would argue that any assessment of the economic disbenefits of night flight restrictions should include consultation with customers (with which we would agree), which they would define very broadly as including Chambers of Commerce and Trades Unions. We feel that it might be better to prescribe a consultation process inviting representations, rather than to delimit those bodies whose opinions must be sought. Clearly, any consultation process takes time.

The EEA believes that the most important metric in the measurement of the economic effects of night flights is dependent and/or related employment. They favour the widest possible definition of employment, to include direct, indirect, induced and catalytic effects. The Committee was unable, however, to comment upon our analysis of the series of studies carried out for and funded by the industry, on its economic impacts in Belgium, Germany, France, Italy, Portugal and the UK

We therefore accepted their invitation to meet with Oxford Economic Forecasting (OEF), authors of the Italian and UK volumes of that series of reports. Our main comments on the studies are in section 6.3 of this report, but we must note here that we were told that they were commissioned individually and that that might account for any inconsistencies of treatment.

7.3.5 Mail

We have not met with any mail carriers, per se, except insofar as at least one is an AEA member, where we learned that Deutsche Post has invested some €100 million in night post facilities at FRA within the last half decade. The Deutsche Post website in March 2004 reported the ongoing replacement of night mail flights by surface transport, so that "the number of flights transporting mail within Germany will be reduced from 23 to 20 per night".

Further, the majority of identified night mail flights are operated by aircraft not covered by the Directive.

7.3.6 Other Operators

It should be noted that operators not directly affected by operational restrictions or not covered by the Directive, for instance air taxi operators and corporate/business aircraft, as well as regional or other turbo-prop operators, could nevertheless be impacted. For example:

- Even turboprops or small/quiet jet movements are impossible if the airport is closed at night, or the restrictions may make it uneconomic for the airport to stay open.
- Their day flights could be significantly affected by loss of transfer traffic.
- Slot scarcity in the daytime resulting from rescheduling by displaced night operators could affect them.

It must also be remembered that while operations not covered by Directive 2002/30 do not receive the protection of its legal requirement for assessment of operating restrictions on 'jets', as stakeholders directly affected by the proposed restrictions any such impacts on them should be properly taken into account by the assessing authority.

8 Assessment Toolkit - Initial Methodology

8.1 Overview

The proposed 'Toolkit' has as its purpose the measurement of any economic disbenefit as a result of the introduction of a more restrictive night movement regime at any Community airport covered by the Directive. It is designed to act as a checklist of the factors and considerations which need to be taken into account in the measurement of such disbenefits, on a consistent and acceptable basis for all stakeholders, in line with the Directive requirements. In conformity with Annex II of the Directive, the toolkit will allow the competent authorities to assess the economic effects of new measures on all users of the airport, as well as local, regional and national economies.

An important principle in measuring the effect caused by a change in the operating environment is that stakeholders cannot simply base their assessment on the status quo. As is evident from the analysis of night activity in relation to the present night restrictions regimes, operators can adapt and have adapted to differing degrees of change. Each stakeholder must first therefore assess their optimum strategy to minimise any losses, and only then measure their resulting economic situation relative to the previous situation. In section 5 we put forward the types of revised strategy appropriate to different stakeholders which they should consider and evaluate.

In this section we describe the type of economic measuring tools that we initially considered should be used for this purpose, while in section 10 we put forward a more refined and practicable set of measuring tools based on the feedback we received from the stakeholders consulted during the case studies phase of the project.

The toolkit is designed to deal with a range of potential new night restrictions which might have a direct effect on the economics of night operations, specifically by constraining the number of flights, the timing of flights, or the aircraft permitted to be flown at night. It is not designed to deal with assessing the effects of operational procedures designed to reduce noise within the balanced approach, nor to measuring the consequences of revised airport pricing of night flights – the latter being outside the scope of the Directive.

The types of further restriction for which the toolkit is designed to measure economic impact are as follows:-

- Imposition of total night curfews
- Extension of current night curfews up to a full eight-hour period, e.g. to 0700, or from 2200
- Imposition of quotas on total number of movements, or on total number of departures or arrivals, or reduction in present quotas, or extension of hours during which quotas apply
- Banning of aircraft movement with noise classification above a fixed level, or reduction in currently imposed maximum noise levels, or extension of hours during which such movements cannot take place
- Imposition of Quota Counts, i.e. a count of aircraft movements against a noise quota according to aircraft noise classifications, or reduction to an existing Quota Count, or extension of hours during which Quota Counts are imposed.

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8.1.1 Scope of Toolkit

As has been noted in the literature review (section 6 above), and as required by the Directive, the assessment of any economic impact of night restrictions needs to embrace the widest extent of economic effects which it is practicable to measure.

We therefore set out to provide a methodology for measuring

- Direct impacts:- wholly or largely related to the operation at the airport
- Indirect impacts:- affecting the chain of suppliers of goods and services to the airport operation
- Induced impacts:- effect on the economy of reductions in income of direct and indirect stakeholders
- Catalytic impacts:- defined as negative effects on the economy by limiting the wider role of the airport or its operators in improving the productivity of business and in attracting economic activities such as inward investment or inbound tourism
- Effects on airline customers, either travellers or shippers/recipients.
- Competitive effects of the proposed measures on other airports, operators and other interested parties.

Under the terms of the Directive, such economic impacts should be measured at local and regional level, as well as for the Member State as a whole.

8.2 Types of Measures

8.2.1 Employment and Value-Added

Our initial approach toward detailing the metrics involved in the 'toolkit' centred on two fundamental types of measures for assessing the economic benefits of night operations, and of the economic disbenefits of further restrictions on night operations. This approach was

- in line with many studies in the literature relating to these types of evaluation (see above section 6)
- based on our long experience within the air transport industry of data availability and compatibility across all stakeholders,
- coupled with preliminary discussions as to practicality with stakeholders (see above section 7)
- and taking into account the need for correspondence with macroeconomic measures for assessments of impacts on local, regional and national economies.

The 'toolkit' to be used for measuring implications for airlines, airports, their customers and service partners and other dependent business beneficiaries ought to be based on the following parameters:-

- Employment
- Value added

The measurement of **employment** and of the implications for employment as a result of restrictions on night operations we considered would be reasonably straightforward in data availability terms for all the stakeholders involved.

The **value added** parameter requires stakeholders to bring in monetary values to assess the effect of night restrictions (net of mitigating actions). There are two methods for calculating value added

The 'production' method measures the impact on gross revenues (turnover) after taking into account any changes in the level of bought-in goods and services. This is a measure calculable from the financial data which stakeholders would have generally available, and - just as importantly - consistent with Eurostat and National Statistics estimations of value added

As an alternative stakeholders may use the 'income' approach to estimating economic effects, measuring the change in the annual wage/salary component of their expenditure (in line with manpower equivalent changes) plus changes in annual profit. This income measure approximates to GDP estimates in regional/national statistics, and can be useful for comparisons with GDP data in Eurostat and National Statistics where value added data is deficient (see below).

Our initial expectation was that stakeholders would be able to calculate both the employment and the added value effects of new night restrictions at the local, regional and national level. However, as discussed more fully in section 9 below, while conducting the case studies it became apparent that calculating added value effects at the local and regional level would be impractical.

Some studies include the effects on tax revenues in their assessment. We regard such effects as mere transfer payments, and therefore neutral. We include the whole of profits and gross staff costs, including relevant taxes, in added-value. Nevertheless, Governmental authorities may wish to include these effects in their own assessments.

8.2.2 Measurement timeframes

To maintain consistency across all Community airports, all data should be annually based and expressed in the first instance in terms of current year prices. This will also allow for reasonable comparison with local regional and national statistics (see below). As stated above (section 5), airports and airlines are required to consider adaptation to differing degrees of change, assess their optimum strategy to minimise any losses, and only then measure their resulting economic situation relative to the previous situation. Previous to discussion with stakeholders we believed that this should initially be based on current volumes and operations only.

More relevant is the choice between time series net present value (NPV) and "snapshot" approaches. The ICAO guidance appears to prefer the more rigorous and detailed discounting of time series costs to NPV, provided that sufficiently detailed and plausible forecast data is available for the term chosen. Because we are considering assessment of a given restriction to be implemented on a known date, our view, as developed in Section 10.4.1, tends to a "snapshot" of how stakeholders would react (in terms of flights lost or retimed or relocated, and the resultant changes in employment and value added) at the time of implementation of the restriction, which is assumed to allow time for stakeholder adjustment. However, any future monetary values (particularly regarding proven development plans foregone) should be discounted. Neither would we preclude relatively short-term time series forecasts if appropriate, but rather than recommend any single one of the discount bases suggested by ICAO we would suggest that consensual use of an authoritative government or market rate may in practice be most effective.

8.2.3 Use of Multipliers

The toolkit was also designed to take into account the indirect and induced economic effects within the Member State concerned. The methodology would require calculation by the competent authorities of the effect of night restrictions on indirect and induced employment and incomes across all stakeholders based on locally available (i.e. within each State) econometric research on 'multipliers' wherever possible.

8.2.4 Cross-Border Effects

We recognise that a complication in such an assessment toolkit is its need to measure the economic impact of new restrictions on operators independent of the effects on local regional and national economies within the Member State. A key feature of the European aviation industry

is its international spread, and there may often be international or cross-border implications as a result of new restrictions. Any such economic effects cannot be measured simply in terms of local regional or national economies pertaining to the airport in question.

For example, a British-based carrier forced to cancel significant night operations to a Belgian airport may as a result cut some jobs at the Belgian airport, but may also cut air crew or cabin crew jobs based in the UK, or even some overhead staff in the UK. The loss of turnover would not just be from Belgian passengers, nor even just from UK travellers, but might include sales revenue from the USA or China.

A significant feature of the toolkit therefore is that it requires the direct measurement of total economic impacts on operators - cross-border as well as at the local, regional and country levels.

8.2.5 External economic data

As a safeguard and logic check of the results of these assessments, it was proposed that estimates of overall changes in employment and income as a result of night restrictions be measured in the context of official employment and income data, in particular data from Eurostat. Eurostat gathers (from Member State Government sources), collates and publishes comprehensive and consistent data on overall employment and income (value added and/or GDP) at local, regional and national economy levels – including by industry classification. EEA States individually publish similar data.

8.3 Measuring and Recording Economic Effects

8.3.1 Direct Impacts

Previous to consultation with operators as part of the case studies, we had set out a methodology for recording the likely direct economic effects on the various stakeholders/ operators at Community airports as a result of potential new night restrictions. Each operator at the airport, i.e. the airport operator itself, all the airlines, and all the services providers at the airport (to be identified on a case-by-case basis) would need to record the impacts in terms of loss of value added (either by 'production' or by 'income' approach) and loss of employment on a consistent basis. It was hoped they could differentiate between effects

- Directly measurable at the airport
- Other impacts in the local area – defined as sub-regions within 50km of the airport
- Other impacts in the local region
- Other impacts in the country at wide
- Other cross border impacts

It was recognised that airlines might have some difficulty in differentiating their turnover or their profit, and hence added value, by all of these classifications. However it was considered more straightforward for all operators to assess loss of employment by these classifications.

A simple template was designed to assist stakeholders in recording such direct effects.

8.3.2 Indirect and Induced Impacts

As a first stage, the direct impacts (i.e. both value added and employment) reported by all of the individual operators at the airport would be totalled by the competent authority at the local sub-region, the region and other parts of the relevant Member State. Indirect impacts, i.e. the effects on suppliers to the airport operators (other than each other), and induced impacts, i.e. the further economic effects caused by reductions in income of direct and indirect stakeholders, would then

be assessed by the competent authorities by means of 'multipliers' as discussed above (section8.2.3).

The total direct impacts for the airport itself and for the local sub-region would be grossed up by use of the 'local' multiplier to assess the cumulative impact (i.e. including indirect and induced impacts) on the local sub-area.

The totals for the airport, the local sub-region and the region would then be grossed up by use of the 'regional' multiplier to assess the cumulative impact on the region.

Finally, the totals for the airport, the local sub-region, the region and the Member State would be grossed up by the 'country' multiplier to show the estimated cumulative impact on the economy of the country as a whole.

It should be noted again that no cross border indirect or induced impacts would need to be calculated, since the Directive clearly implies that these should be restricted to the individual Member State of the airport concerned.

8.3.3 Catalytic Impacts

There is ample evidence in the literature (see section 6) that airports constitute the necessary infrastructure for a wide range of economic activities. This wider economic role is described as the catalytic impact, and typically includes improving the productivity of business, and attracting economic activities such as inward investment or inbound tourism.

Much of the quantification of this positive airport impact has been based on comprehensive survey studies. However we did not think that such general surveys across the whole economy to determine the benefits lost to the economy if night services are curtailed are appropriate for this toolkit. For most economic activities the presence or absence of night flights would only be of the most marginal significance, and any new night restriction other than complete curfews would have even less impact. It would be a wasteful application of resources for competent authorities to conduct surveys of the whole economy to identify catalytic impacts of new restrictions on night operations.

However, there are certainly two economic segments identified in the literature which are more likely to be affected by absence of night flights and where survey work may be more justified – inbound tourism and express-oriented industries/services. For the latter we considered that assessments by the relevant airlines should include the identification of individual firms affected by catalytic impacts as most appropriate where proposed restrictions would clearly affect express operations.

8.3.4 Consumer Impacts

Annex II requires competent authorities to identify the effects on airline customers - passengers or shippers - of the effects of new night restrictions. This is independent of, though may be closely linked to, assessment of effects on airports, airlines, airport-based services, other directly affected businesses, and regional and national economies. Our initial methodology would have required airlines to assess the time penalty or additional transportation costs for their own local customers affected by any operational changes as a result of new restrictions. As discussed in section 4.5 above, there is limited evidence in the European scene that the imposition of strict restrictions at one airport may lead to diversion of business to a competing airport. Annex II requires competent authorities to consider such competitive effects and take them into account.

There may, in economic theory terms, be a reduction in consumer surplus as a result of restriction on night flights, but we believe there is no practicable way for the competent authorities to measure this, other than as subsumed in the multiplier/catalytic effects as detailed above.

8.3.5 Competitive Effects

Diversion of traffic will be one of the outputs of the airline operators' consideration of responses to restrictions, and of consequent added value measurement, and the methodology allowed for such assessments to form the basis of consideration of competitive effects.

9 Case Studies

9.1 Objectives of the Case Studies

The toolkit framework presented in our Interim Report had been developed on the basis of considerable literature research to complement our own practical experience of the airport and airline industries, and supplemented by preliminary stakeholder consultation. We recognised, however, that the framework was still a theoretical construct, consistent with economic theory, but not yet tested in any detail for practicality or comprehensiveness with stakeholders. This was wisely foreseen by the study specifications, which called for a series of case studies to be carried out at a sample of Community airports to test the practicability of the methodology, and the feasibility of obtaining the data necessary for its application.

The methodological work, including stakeholder consultation and literature review, indicated that the economic impacts of aviation in general, airports, and particular sub-sectors of the air transport industry, most appropriately relied upon econometric data in terms of employment and value added for their quantification. However:

- we saw only limited measurement of value added at the local and regional level, and that tended to be derived from combining local employment with broad national or sectoral averages of value added per employee;
- we were aware of the economic argument that at the national level, and in the long term, loss or creation of employment (while a vital element in social and human terms) can be an equally imperfect measure.

Nonetheless we felt that, given careful definition and linking information requirements to Community NUTS regional and sub-regional data bases, quantification of these parameters was worth pursuing. We had prepared a basic outline spreadsheet model, for the quantification of the economic impacts of night flight restrictions, ready for appropriate employment and value added data to be checked and cumulated after collection from stakeholders by the competent authorities.

The next step was therefore to check the availability and suitability of such data; not only in terms of being "sound economics" but as reasonable and acceptable measures on which to base decisions - for decision makers and those affected by those decisions in economic or environmental ways. We did this by:

- postulating hypothetical restrictions at sample airports;
- discussing direct impacts with key stakeholders:
  - how they might react to such restrictions,
  - whether they could provide data on employment and value added changes resulting from those reactions;
- discussing catalytic impacts with bodies representative of business and industry, and tourism;
- discussing practical, procedural and methodological approach aspects of assessments with all interviewees

9.2 Selection of Case Study Airports, Hypothetical Restrictions, and Stakeholders

9.2.1 Airports

We selected three airports representative of the generic types of operation identified in the earlier stages of our work as significantly active during the default night hours of 23:00 – 07:00. As discussed in detail in section 4.6, they are each important airports – both in terms of size (among the top 12 European airports in terms of total night movements) and in terms of the night activities they support:

- Brussels National (Zaventem) – a major express hub (accounting for 43% of its night movements), but with significant scheduled service passenger (16% of its night movements), Charter (22%) and Low Cost (13%) airline operations, as well as some freighter activity; all tending to concentrate toward the beginning and end of the night period apart from express flights, which, for the reasons described in section 3.3.3 must arrive and depart around the middle of the night as described in section.
- London Heathrow - a major intercontinental hub, 99% of its night movements being scheduled passenger services, 61% of them long-haul (of which 83% are arrivals in the 05:00 – 07:00 period), and 39% short-haul (of which 84% are departures in the 06:00 – 07:00 hour.
- Palma de Mallorca (Son Sant Joan) – a major holiday destination, (Charter/Leisure movements being 43% of its night activity), but with significant short-haul scheduled service passenger activity at night (40%) and some Low Cost operations (12%), both of which we believe to be largely leisure-oriented.

The only major activity not covered by these airports is mail, but as discussed above, this is a relatively minor element in the overall mix of airport night jet activity in Europe, except at a few airports.

9.2.2 Hypothetical Restrictions

In reality, Quota Count (QC) restrictions apply at Brussels (23:00 – 06:00) and Heathrow (23:30 – 06:00), but there are no night movement restrictions at Palma de Mallorca. As a result there was scope for stakeholders to consider a range of types of hypothetical restrictions, and therefore fully cover the testing of the toolkit's ability to measure economic impacts in the light of stakeholder advice and consultation.

For each airport we postulated two hypothetical new restrictions:

- All three airports: a complete ban on jet movements between 23:00 and 07:00 local time – recognising that this sort of draconian measure, however unlikely, would represent an extreme to all stakeholders If the application of our methodology could be seen to be feasible in such a situation, it should cope with partial restrictions.
- Brussels: a ban on jet movements between 23:00 and 07:00 local time by aircraft not meeting ICAO Chapter 4 certification criteria – an aircraft-related restriction.
- Heathrow: a ban on jet take-offs only between 23:00 and 07:00 local time – a partial movement -related restriction.
- Palma de Mallorca: a complete ban on jet movements between 01:00 and 04:00 – a partial curfew.

What we saw as important was not the actual content of the partial restrictions, but the opportunity to test whether different sorts of restriction posed particular problems in terms of reaction decisions by stakeholders, or treatment by assessors.

9.2.3 Stakeholders

We put these hypotheses to:

- Airports, airlines and some of their service providers, in order to investigate the assessment of the direct, indirect (and by inference induced) economic impacts of restrictions; and
- representatives of business, industry and tourism, in order to see whether catalytic impacts could be identified.

There was of course no choice of airport authority in each case once the airports for study were selected on the bases described in 9.2.1 above. Airlines were selected on the basis of having significant night movements at the airports in question – something which can be verified from the published timetables of some of them, although confidentiality prohibits our giving statistics by carrier – and their readiness to take the time to co-operate in the study. We also made useful contact with randomly selected service providers in handling and freight forwarding.

Off airport, tourism was naturally our primary catalytic target primarily in Mallorca., where 90% of GDP is estimated to be ultimately tourism-reliant. There is no reason why local, regional or national tourism authorities should not be invited to contribute to the assessment of night flight restrictions anywhere in Europe – although they will not necessarily all have the data and expertise we found available in a region whose airport and economy are so overwhelmingly devoted to inbound tourism.

It was in Belgium that we sought the advice of both local and national business and industry bodies. This was because we had initially inclined to recommend that assessments should include the identification of individual firms affected by catalytic impacts as most appropriate where proposed restrictions would clearly affect express operations. The individual stakeholders and organisations interviewed are listed in Table 9.1 Case Studies. The primary characteristics which led us to approach them are shown, but that is not necessarily a complete description of their activities or how they see their role.

Table 9.1 Case Studies

Firm or Organisation	Characteristics
Brussels International Airport Company (BIAC)	Airport operator (Public company)
DHL	Integrated express operator, subsuming express airline activities hubbing at BRU
SN Brussels Airlines	Short and long haul scheduled service passenger services based at BRU
Virgin Express Airlines	Low Cost services based at BRU
Chambre de Commerce et d'Industrie de Bruxelles (CCIB/KHNB)	Local/regional business and industry
Verbond van Belgische Ondernemingen (VBO/FEB)	National business and industry.
BAA	Heathrow (and other airports) operator
British Airways	Long and short haul scheduled passenger services based at LHR
QANTAS	Overseas-based long haul scheduled passenger services at LHR
Expeditors International	Freight forwarder at LHR (and worldwide)
AENA	PMI (and other airports) operator
Air Berlin	German-based leisure services hubbing at PMI
Air Europa	Short haul scheduled and leisure services based at PMI
Britannia Airways/TUI UK	British based charter carrier/tour operator serving PMI/Mallorca
InEuropa Handling	Service provider at Palma (and elsewhere)
CITTIB/INESTUR	Research Institute of the Institut d'Estrategia Turistica de les Illes Balears

Source: Consultants

It is usual to thank stakeholders who have contributed their views and experience to a study, and that we have done in Section 7 in respect of the representative bodies (and some individual members) who were so helpful in the earlier stages of this study. In the context of these case studies, however, we are very glad to additionally express our appreciation of a high degree of professional co-operation at top management level among our interviewees. They took considerable time and trouble to think through the hypothetical consequences of our postulated restrictions, and to explain in confidence how they might react and express the consequences of those reactions. For that we are grateful, but the conclusions we have drawn from what they told us are our own.

9.3 Framework and Conduct of the Case Studies

9.3.1 Limitations and Confidentiality

It would obviously be unreasonable to expect participants in our case studies actually and quantifiably:

- to work through the detailed operational implications of the restrictions hypothesised - the workload and dedication of resources involved in such an exercise could in many cases only be justified by the need to do it "for real";
- to determine the operational response least damaging to their business in such a situation and declare their decision – again a complex process (involving for instance aircraft and crew rescheduling, costing, market impact assessment and so on), but even if that were practicable, they could not be expected to expose their reactions to hypothetical new restrictions, either to their customers, to their competitors or to the authorities, in case of ever facing such reality;
- calculate in the course of that process, and then disclose, the direct financial (value added) and employment impacts on their companies – once more due to workload, to confidentiality considerations, and also because of the damaging effect such disclosure might have upon human relations and perceptions of security of employment within the company.

Even to ask stakeholders to think through such implications, and to discuss them with us, albeit in a context of "merely" testing the suitability of our economic impact parameters, and the practicalities of data availability and assessment, it was necessary to give a promise of confidentiality. Unless authorised by the respondents, we do not attribute to them what we were told.

Having said all that, we are able to report that, having thought through the implications of the restrictions postulated, some stakeholders did feel able to explain off the record what their operational reactions would be, and/or embarked upon quite detailed examinations of the implications of rescheduling for example, and/or gave us access[52] to documentation including financial and/or employment data regarding hypothetical or actual recent assessments of the results of restrictions. We owe particular thanks to those respondents, and emphasise again our commitment to confidentiality in that context.

That is without prejudice to the others who for one or more of the reasons listed above did not feel able go that far, but who were able to respond by discussion of how they would tackle a real situation, of data availability, of the appropriateness of our methodology, and of practical aspects of assessment. Their help was also vital., and their responses also remain off the record.

9.3.2 Framework of the Case Studies

Our approach was to address each of the main issues for the different stakeholders by means of a structured series of key questions:

- Airlines - for given levels of new restriction:
  - what alternative minimum-loss strategies would respondents adopt in response, and how would respondents be able to satisfy the assessing authorities that the strategy adopted minimised losses?
  - how would they communicate such strategy to other airport stakeholders?

[52] Or guided us to material already in the public domain, already in or added to our Literature Review at Section 6 .

  - could they then measure the direct economic effects in terms of employment and/or value added, differentiating between local, regional, national and cross-border effects
  - could they readily identify and differentiate ultimate traffic origins and destinations differentiating between local, regional, national and cross-border?
  - could they assess the time penalty and any additional transportation costs for customers affected by the changes in their operations?
  - could they quantify any loss of incoming tourism at the relevant airport?
  - how should effects on future planned operations be taken into account, and how should future forecasts be discounted to present values?
  - could the data be provided by Eurostat NUTS areas for consistency ?
  - what multipliers would be appropriate to measure indirect and induced effects ?
  - what catalytic impacts could be specifically identified ?
  - what other issues concern respondents and/or have we failed to address ?
- Airport operators and airport service providers – for given levels of airline reaction to new restrictions:
  - the same questions, but considered in terms of operational responses such as reduced facilities or new shift patterns rather than (e.g.) relocation or schedule changes.
- Tourism – for total loss/partial loss/rescheduling of night flights:
  - is it possible to identify tourists using night flights and have they special (e.g. price or origin) characteristics?
  - what would be the operational, financial and employment effects on tourism sub sectors (hotels, transfers, etc)?
  - would it be possible to assess the loss of value added and/or employment in tourism, locally/regionally/nationally/cross-border ?
  - how should effects on future planned operations be taken into account, and how should future forecasts be discounted to present values ?
  - could the data be provided by Eurostat NUTS areas for consistency ?
  - what other issues are of concern and/or have we failed to address ?
- Business and Industry - for total loss/partial loss/rescheduling of night flights
  - can the economic impact on the business community be assessed or estimated in value added and/or employment terms, by Eurostat NUTS areas ?
  - how should longer term implications be taken into account, and how should future forecasts be discounted to present values ?
  - what other issues are of concern and/or have we failed to address ?

These questions provided a framework discussion with the stakeholders listed in Table 9.1 above.

9.3.3 Conduct of the Case Studies

The framework questionnaires, (preceded about a week earlier by an introductory letter, a copy of our credentials from the Commission, and a request for an interview appointment), and accompanied by an explanatory letter repeating our assurance of confidentiality, were sent to potential interviewees about two weeks before the planned interview. We researched the pattern of each airline's and airport's night operations from our 2003 database, and where appropriate from timetables and the Internet, before each interview.

Those in the UK extended over the September to November period, whereas those in Mallorca and Brussels were concentrated in October and November respectively. All were conducted on a face-to-face basis, almost always with two of our consultant team present, one of each pair of interviewees overlapping with the next round of consultations, to ensure consistency of approach.

At each meeting we reiterated the purpose of the study verbally, re-emphasising the hypothetical nature of the restrictions postulated, and our neutrality over the issues. We explained that Directive 2002/30/EC gave stakeholders the protection of European law to ensure that restrictions could only be imposed within the framework of the balanced approach (itself explained when necessary) and after an assessment of their economic impacts. The need for a consistent approach to such assessments, in the form of an effective and explicable methodology, was generally recognised.

Supplementary information or clarification was sometimes sought later by e-mail or telephone, and some of our records of the meetings were copied to the interviewees concerned to ensure accuracy.

Only two airlines refused our requests for co-operation, and one concessionaire service provider lacked the authority or resources to deal with it locally. We do not think that it is unreasonable to suggest that the readiness of respondents to take the time to deal with these issues at senior levels despite the hypothetical context, indicates the success of the programme of case studies, in that:

- our enquiries were clearly taken very seriously by stakeholders;
- no-one disagreed with our proposed approach in principle; but
- we learned some vital lessons about:
- the availability of data, particularly in the format drafted for our "initial methodology" (described in Section 8), and
- the practicalities of assessment procedures.
- We have incorporated these lessons in our **recommended methodology** at Section 10 of this report. First, however, we summarise stakeholders' responses in the following Section 9.4.

9.4 Stakeholder Responses

9.4.1 Airlines, Airports and Service Providers

(a) General

Because this is a report concerned with economic impacts, and their assessment in econometric terms such as employment and value added at the local, regional and national level, it must be remembered that stakeholder decision makers affected by operating restrictions do not generally express the impacts on their companies in those terms. That is not to say that they are not concerned about jobs and prosperity in the communities (markets) they serve, and they certainly care about their employees, their customers, their neighbours, and the environment. But in the context of our questions, their main (non-operational) focus was quite rightly on revenues, costs,

and profits. That is how they measure the impacts of operating restrictions, because it is upon those parameters that the survival of the airlines concerned depends.

(b) Types of Impacts

It was not only the flights that actually operate at night that would be affected. Loss of a night operation could mean the loss of the corresponding arrival or departure. As such a Low Cost operator depends on departures around 0600 and 0700 and arrivals late in the evening to achieve high rates of aircraft utilisation. Network airlines might have to abandon a route with consequential losses on connecting traffic during the day. British Airways has said that it depends for about 25% of its passenger revenue on the relatively small numbers of movements at night. At the extreme, express operators who hub during night hours, rely on those flights for virtually the whole of their operation, as has been demonstrated by DHL's recent decision to move from Brussels to Leipzig.

Other miscellaneous issues pointed out to us, and which we had not fully recognised in our assessment of the problems created for stakeholders as a result of new restrictions (Section 5) include:

- The need to avoid delayed flights encroaching into a restricted period causes airlines to schedule earlier in the evening, effectively wasting slots.
- Similarly, long-haul arrivals arriving early because of favourable winds have to be held in the air, incurring extra fuel and passenger time costs.
- Banning delayed flights could cause extra hotel, denied boarding and crew costs, and of course could lead to some passengers cancelling.
- possible loss of aircraft utilisation – perhaps the loss of a complete rotation, not just the landing or take off affected by the restriction
- loss of transfer traffic on other routes
- increased costs, for instance in positioning crew at the other end of the route or in holding delays to avoid a curfew period

(c) Alternative Strategies

All the airlines had either already determined or were confident of their ability to determine, their optimum operational responses. These were measured responses, varying according to the type of airline and the severity of restriction postulated, including:

- reluctant rescheduling of some flights with assessed market impacts
- route abandonment (not always routes directly affected by restrictions)
- relocation (not often a credible option for passenger operations due to slot availability and lack of competitive alternatives without incumbents)
- re-equipment (to the extent it is considered financially and operationally viable of course)
- going out of business (because the restrictions would make the operation inherently uncompetitive).

The responses broadly confirmed our Section 5 analysis of the problems airlines would face for varying scenarios of new night restrictions, and of the types of strategies they would devise to minimise loss. For verification, the need for an "audit trail" seemed to be generally accepted, in that airlines' proposed strategies would be "cross-examined" by assessors.

(d) Communication and Timescales

An important objective of the case studies was to discuss assessment procedures. There was no consensus as to whether assessment procedures should be quasi-judicial hearings (like UK Planning Procedures), whether public or restricted, or whether matters should be dealt with in private to preserve commercial confidentiality. What did emerge clearly were calls for the establishment of formal defined and recorded procedures, with some provision for appeal.

It became clear that the time taken to devise, evaluate, and (eventually if necessary) to implement such strategies, are critical issues. The larger and more complex the airline's operation, the longer the time and resources claimed to be required for the internal evaluation process – up to several months. For a simpler operation, the practicability of staying in business at all can reportedly be all too starkly determined using business plan models, relatively quickly.

The time required for the assessment process was thus highlighted as well but not quantified. An airline not directly affected by a new restriction can be affected by the changes proposed by one that is – loss of connecting traffic for instance. The direct impacts upon airports and airport service providers are similarly "dependent" upon (say) a major home-based carrier's operational decisions, although a certain amount of "telescoping" of internal evaluation should be possible.

Although not strictly part of the assessment process, it is relevant to it to note that implementation of new strategies such as rescheduling could take two or three seasons, due to slot requirements (assuming the requisite slots to be available at all); relocation of the ground element of any airline operation is a matter of months at least and in some cases longer; and re-equipment is subject to delivery times and training (hence EC 92/14 non-operation rules were phased). It should also be noted that airports and service providers can generally react more quickly in implementation terms than airlines.

(e) Identifying Employment Impacts

Stakeholders would have no major problems in identifying employment effects both by work location and by residence, at the local, regional and country level, as well as overall including cross-border, from their employee records. They could also identify cost savings associated with employment effects, but would want any compensatory costs payable to job losers and recruitment/training costs associated with other strategies to be taken into account.

(f) Identifying Value Added Impacts

Airlines could certainly quantify the current and forecast future financial impact (which can be expressed as value added) on their overall operations of the adoption of any given strategy – that would be an essential part of the selection of that strategy. However, they could not do this reliably on a local or regional basis (except partly in Mallorca as it is an island). That would require the unrealistic and/or artificial allocation of each element of revenue (passengers and cargo) and costs (fuel, crew, aircraft depreciation and maintenance, reservations call-centres, etc, some of which are bought in goods and services) to regions. Even knowing the profiles of their markets in terms of traffic origins from survey data, and having point-of-sale revenue information (which is not necessarily true revenue origin), is not enough without the associated costs being similarly localised. This problem encapsulates the need to take account of, and the difficulties of dealing with, network effects.

Thus disaggregated added value effects could not be practicably assessed by the 'production' method; nor by the 'income' method because profit effects are not calculable by locality/region. At most, airlines could calculate profit and added value impacts at the corporate level. This would be expressed as country level totals for carriers based in the State of the relevant airport, and possibly broken down into relevant country and cross-border impacts for other carriers.

However, because the activities of the airport operators and of the airport service providers were far more localised to the airport itself, they should be able to calculate impacts in terms of added

value at the local and country level. Nevertheless, that is of limited value without the vital component of comparable airline data.

Respondents felt that one-off capitalised costs directly resultant from the imposition of restrictions and/or their operational reactions to restrictions, (e.g. write-off of undepreciated infrastructure or equipment, and relocation costs), should be included in the calculation of losses on disposal.

(g) Customer Impacts

Most airlines felt they would be unable to assess the time penalty or additional transportation costs for customers affected by their own operational reactions to new restrictions. However, in the case of the UK, there has been developed a large scale model of passenger ground origins and destinations of passengers and the airports used. In principle, this model could estimate additional ground transport costs for affected customers under a changed scenario.

(h) Inbound Tourism

Airlines would generally have no difficulty in making an assessment of potential loss of incoming traffic disaggregated at least by flight origin as part of their evaluation of economic impacts. At least one airport interviewed publishes detailed information on incoming traffic origins. This sort of data could assist with catalytic impact assessment (see section 9.4.2 below) but there are difficulties in estimating what traffic losses mean – holidaymakers who can not fly from one home country airport may use another; if they cannot reach one resort in a host country they may go to another; in both cases by a different carrier – or even pay more to fly by day with the same carrier. It will be estimates rather than auditable facts in these cases.

(i) Future Planning

Stakeholders were particularly concerned that the effects of new restrictions on longer-term plans should be taken into account. They suggested that firm plans to obtain aircraft or other capital equipment, train crews, undertake building construction, etc could be used as hard evidence and included in calculation of disbenefits – as opposed to simple growth projections needing only simple discounting back to current values.

(j) Eurostat NUTS

Generally employment data can be allocated to Eurostat region, although the Eurostat definitions of local and regional areas could be inappropriate in a relatively small country or an island

(k) Multipliers

Respondents gave various suggestions at the national level for indirect and induced effects, such as OEF (2.0 to 2.3 cumulative) or Sleuwaegen (2.2 to 2.4 cumulative) multipliers (see Section 6), one maximum suggestion was as high as 3. There was a limited measure of agreement with our suggestion (discussed in Section 6.3.2) that multiplier rates in situations of job losses tend to be slightly lower than in job creation.

Our overall impression was that as long as their own concerns are equitably recorded and quantified in assessment, stakeholders will accept authoritatively-based academic or Government consensus on the metrics of regional and national multipliers.

(l) Catalytic Impacts

Few examples of night-service dependence were suggested by airlines or airports (except the obvious tourism association in Mallorca). Business and industry, and tourism, responses are however discussed at 9.4.2 below.

(m) Other Issues: Flexibility

Although this is rather related to restriction design and enforcement than to restriction assessment, the matter was raised by an airline and (attributably) by BIAC as a major issue. They

made the point that "zero tolerance" in the application of night restrictions can lead to disproportionately high costs for airlines – and their passengers – in case of delays. We had already acknowledged this in Section 7.2.2, but found it remarkable that it should be specifically raised and quantified during the case studies.

(n) Other Issues: Value and Prioritisation of Slots

An airport raised the issue of the value and status of slots which cease to exist because of new restrictions. The issue of Slots legislation and practice (Council Regulation 95/93 etc) is beyond our scope here, but we must recommend that the Commission services investigate and clarify in any guidance material based on this report:

- When restrictions lead to reduction in operations – in effect removing slots from use, how are such losses to be allocated between operators
- whether an airline deprived of a slot by operating restrictions have the right to cite its commercial value as a lost asset in assessment calculations (we are inclined to think not, as that value merely reflects the profitability of the service using it, already taken into account in our methodology),
- whether that airline has a legal right to priority in allocation of any slots available in unrestricted periods, in case of rescheduling.

9.4.2 Tourism Authority Responses: Catalytic Impacts

(a) Night flight tourists

The capability for analysis of the very detailed airport traffic and tourism survey data available (in Mallorca at least) by professional staff shows that night arrivals can indeed be identified by price and origin, and to some extent by spend (for which average data by origin alone is readily available).

(b) Tourism sub-sectors

Operational effects of rescheduling would be mainly on transfers, not hotels and other sub-sectors; operational and financial impacts of tourism losses would affect all sectors severely.

(c) Economic impacts

Regular surveys of gross tourism expenditure by purpose, season and origin; and employment records (including seasonal employment sourcing) should enable value added and employment impacts of losses of tourism numbers to be calculated, although (in Spain) local/regional analysis input/output tables are somewhat dated and national averages might not be wholly appropriate locally.

There are also some historic anomalies in tourism employment/arrivals deltas.

(a) Future Planning

Not an issue in a tourism reception area permanently at peak capacity, where emphasis is on diversification and longer stays.

(b) NUTS

Not always appropriate – e.g. more than one resort/island in same region.

(c) Other issues: Estimating tourism losses

Tourism authorities would have to rely on communication of airline reactions to restrictions and traffic loss. Problem in estimating whether such losses are trans-regional/national/total is estimating alternative tourist destinations – perhaps within reception country.

9.4.3 Business and Industry Responses: Catalytic Impacts

(a) Identifying catalytic clusters and impacts

In our case study, a "catalytic catchment area" or "economically influenced area" was readily identifiable, given good data bases and professional expertise (in Belgium at least). Cumulated turnover and employee numbers were available. That is not the same thing as quantifying value added and employment losses for given night flight restriction scenarios, but by applying employee number and/or turnover filters, a manageable survey population could be established.

(b) NUTS

Data is not necessarily on a NUTS basis. Further, there can be significant differences between region of residence and region of work, especially in an airport's conurbation catchment area. A further complication can be the allocation of impacts when airports, with significant commuting, are near the boundary of NUTS regions so that impacts are recorded "artificially" rather than by catchment area.

(c) Other Issues: Procedures

(a) It may be possible for the assessor to enlist the help of a Chamber of Commerce and/or national business representative organisation in the data acquisition on catalytic effects about companies affected by changes in airline operations consequent upon imposition of restrictions, if they have survey capability.

10 Recommended Methodology

10.1 Outline

In this section we draw together all the elements in our study, based on literature review, discussions with industry representatives and especially the case studies, to present a recommended methodology for adoption by competent authorities in Member States. It is presented in the format of a series of steps that they should take, outlining the tasks they must undertake or supervise, the interaction with stakeholders at the affected airport and beyond, and the assessment procedures and recommended metrics. Many of the points made to us by stakeholders on procedural matters, and which we have developed, such as the need for transparency, for appropriate investigative and implementation timescales, and for provision for appeal, are already recognised in Recitals 20 to 22 of the Directive and given force in Articles 10 to 12.

10.2 Procedures

10.2.1 Responsibilities of Competent Authorities

It is recommended that competent authorities should carry out some preliminary consultation and analysis with potentially affected stakeholders to agree the nature of the restrictions to be evaluated.

The competent authority should then set out clearly the proposed night restriction for which economic impact is to be measured. The authorities should clarify the extent to which there would be flexibility within the restrictions, e.g. to allow for aircraft delays etc, since this may have a profound effect for some operators

They should communicate the procedures for assessment required by Annex II of Directive 2002/30 to relevant stakeholders via local airport consultative committees and other machinery.

Competent authorities should allow themselves a period of up to six months to carry out the assessments, since revised strategies to minimise loss would take time to plan and then to implement, given the timeframes suggested by stakeholders in order to re-plan their operations to minimise economic loss and to calculate any resulting disbenefits,

There should be a minimum three season (a year and a half) interval between any proposal to restrict night hours and the actual imposition of restrictions if economic disbenefits are to be minimised. It is recognised that some airlines and airport operators have longer planning time horizons.

The competent authorities should require an evaluated (or "nil") response from all airlines and service providers currently at that airport, as well as from the management of the airport at which restrictions are proposed (even if that authority is delegated to the airport management), within the timescales suggested below.

Formal procedures for assessments should be defined, including duties of both disclosure (when appropriate) and confidentiality (when appropriate). Dates and attendance criteria should be set, rules of evidence established, and records kept. Provision of some sort of appeal process seems inevitable, with reasonable time limits. While judicial review may seem disproportionate, even lengthier court challenges based on competition law might be faced in practice.

The competent authorities should undertake some form of audit to assure themselves that appropriate strategies to minimise losses have been properly considered, taking into account the analyses set out in Section 5 of this Report. They should also supervise that the resulting economic effects reported by respondents are directly the result of revised strategies to cope with

the new night restrictions. In section 10.3 below we set out the major economic effects by industry sector which we would expect stakeholders to have measured, and this can act as a checklist for the competent authorities.

They must then take responsibility (taking academic or other professional advice as required) for calculating the indirect and induced economic effects associated with the direct economic effects reported by stakeholders, as set out in section 10.4.5 below.

At the same time - once the airport, aircraft operator and service provider reactions are known - they should invite quantified representations (by means of public notices on an appropriate scale) from business and industrial representative organisations locally and nationally including Chambers of Commerce, local and regional tourism bodies, as well as any specific firms or regional bodies identified by airlines as particularly impacted by revised operating plans, to assess catalytic effects. Section 10.5 provides more detail on this process.

Finally competent authorities should conduct a 'sense check' of all the data put to them, by comparing economic effects with overall regional and national economic data in Eurostat NUTS, and with 'rule of thumb' measures linking levels of air transport activity with employment and GDP.

10.2.2 Responsibilities of Airlines

Airlines should be given sufficient time to:

- Consider problems created by new restrictions and to
- Devise appropriate strategies to deal with new restrictions to minimise losses, measure the resulting economic effects, and communicate revised plans to other airport stakeholders via local airport consultative committees and to the competent authorities.

Airlines whose home base airport would be subject to new restrictions, and also long-haul operators, may require a number of months to review alternative plans, evaluate slot implications, review maintenance arrangements etc. We suggest that a period of up to three months should be allowed for this process in such cases.

Airlines must communicate revised plans, including aircraft movements and traffic levels, to the airport operator and other airport service providers via local airport consultative committee. Clearly airline operational responses are going to have to be made available to other airlines, service providers, and potentially catalytically affected firms, in order that they can see whether they are affected. This may raise issues of competitive confidentiality, as an aircraft operator may not want its rivals at other airports to know its intentions if the restrictions are applied. However, it is difficult to see how this can be overcome if the operator concerned wants all impacts arising from the restrictions to be fully taken into account. As already noted, an airline not even flying during the restricted period can be impacted by loss of traffic or congestion.

Airlines will also have to

- Provide an audit trail to competent authorities as required
- Provide competent authorities with information on potential corporate customers likely to suffer economic damage (for later survey of catalytic effects)
- Provide competent authorities with data on likely changes to traffic flows, especially as relating to incoming tourism

10.2.3 Responsibilities of Airport Operators and Service Providers

Airport operators and other airport service providers should be given sufficient time to consider problems created by new restrictions as well as the revised plans of airlines. They should devise appropriate strategies to deal with new restrictions to minimise losses, measure the resulting

economic effects, and communicate revised plans to other airport stakeholders via local airport consultative bodies.

10.3 Checklist for Assessing Economic Impacts by Industry Sector

10.3.1 Scheduled Passenger Operations – Short Haul

Direct economic effects will of course vary in intensity according to the type and extent of restriction imposed, and the response of the airline and/or airlines affected, which may in turn depend upon the importance of the airport to the route network as a whole. For instance, restriction of the first departure of a thrice daily service by a "visiting" airline is less serious to that airline than restriction of the whole "first wave" of departures by the home-based carrier. The assessment will thus differ from the risk of retiming of one service with some loss of traffic at one end of the spectrum to the potential loss of a based carrier at the other extreme,.

The direct economic effects on the airline(s) of any restrictions should however be measurable or reasonably estimated within the framework of the toolkit by considering the following impacts, according to the function of the restricting airport in the airline(s)' network:

- if the restriction is imposed at an airline's 'base' or hub airport:
  - possible loss of aircraft utilisation – perhaps the loss of a complete rotation, not just the landing or take off affected by the restriction
  - loss of transfer traffic on other routes
  - increased costs, for instance in positioning crew at the other end of the route or in holding delays to avoid a curfew period
  - loss of route(s) turnover (net);
  - reduction in value of bought-in goods and services
  - reduction in direct employment at that airport, including :
    - crew (cockpit and cabin) unless they can be redeployed
    - ground handling (if self-handling)
    - other operational staff based at the airport
    - airport-based sales staff; and
  - other airport-based employees;
- any of the above directly-related impacts occurring elsewhere on the airline(s)' route network, such as loss of connecting long-haul traffic to/from the restricting airport, as well as reductions in value of bought-in goods and services and/or job losses; particularly at the airport(s) at the other end of routes affected, even if these are abroad (cross-border);
- any direct impact on net added value or employment for the airline(s) elsewhere; for example abandonment of a number of routes could reduce the number of central reservations staff, or even reduce the fleet (and its ownership or lease costs, as well as employment at the maintenance base).

- if the restriction is imposed at what is (for a given airline) a 'spoke' airport:
  - all of the above other than "based" crew costs or other basing costs, although the main difference is of course likely to be in the extent, scale and severity of the network effects which will probably be much less. The restricting airport may of course be a hub or "base" for one airline, and the end of several sets of "spokes" or point-to-point routes for several other airlines.

It should be noted that if only a "one-way" operation is affected by a restriction introduced for a given time period at one airport, be it a departure (at 0630 for instance) or an arrival (at 2315 for

example), the reverse leg of the rotation may often but not invariably be similarly affected, except in the case of marked seasonal directional flows. This is not dependent upon the scheduling of a particular aeroplane or even a specific aircraft scheduling cycle, it is rather that if passengers are not offered a journey from A to B, they will not return from B to A – and vice versa for passengers originating at B

Note also that if a route (or based route network) is relocated rather than abandoned, the net effect on the airline worldwide may be a balance of traffic losses at one airport being replaced by almost equivalent gains at another in a different locality, region, or even country (at a once-for-all capital cost). Within the same country, the traffic and revenue impacts on the airline may therefore add to zero on current account although capital costs may be incurred and operating costs may also vary considerably. The competent authority still has the task of making its decision taking into account the local and regional "subtotal" of effects as well as the national country (or even international) net grand total. There is a unique situation in dealing with the location of these effects for domestic operations, generally relevant only for short-haul scheduled service (and dedicated domestic mail) operations. Network effects of value added and employment "at other airports" and elsewhere are then, by definition, within the same country, and cumulative.

10.3.2 Scheduled Passenger Operations – Long Haul

Assuming that the type of restriction considered is one which effectively prevents the arrival of large long haul aircraft in the very early morning at major hub airports – the flexibilities alluded to above could probably cover most other situations, and there little opportunity for re-equipment – the direct economic effects are likely to reflect the identity of the airline(s) affected and its response :

- if the restriction affects a home based carrier at its hub, the impacts of rescheduling will centre upon :
  - possible loss of aircraft utilisation – perhaps the loss of a complete rotation, not just the landing or take off affected by the restriction
  - loss of transfer traffic on other routes
  - increased costs, for instance in positioning crew at the other end of the route or in holding delays to avoid a curfew period
  - net changes in route(s) turnover;
  - possibly additional crew employment and aircraft ownership/lease costs due to less efficient use of resources on long haul and/or connecting flights.
- the same carrier, if deciding to relocate, could face capital costs plus, on current account :
  - net loss in route turnover at the restricting airport, replaced elsewhere (perhaps cross-border) ;
  - reduction in value of bought-in goods and services for operation at the restricting airport but replaced elsewhere, perhaps cross-border;?
  - reduction in direct employment at that airport, in the same categories as for short-haul route loss, but with the likelihood of job transfer or replacement job creation elsewhere, perhaps cross-border.
  - a "visiting" overseas operator might face some loss of net revenue on the route serving the restricting airport, but would have the opportunity to recoup it at other (perhaps cross-border) airports.

10.3.3 Low Cost Airlines

Direct economic effects should be measurable in a similar manner to those for other short-haul scheduled operations affected by new night restrictions.

At a 'base' airport:

- possible loss of aircraft utilisation – perhaps the loss of a complete rotation, not just the landing or take off affected by the restriction
- increased costs, for instance in positioning crew at the other end of the route or in holding delays to avoid a curfew period
- Loss of route(s) turnover (net)
- Reduction in value of bought-in goods and services for operation at the airport
- Reduction in direct employment
    - Crew (cockpit and cabin)
    - Ground handling
    - Other operational staff based at the airport
    - Airport sales staff
    - Other airport-based employees

At other airports

- Loss of route(s) turnover (net)
- Reduction in value of bought-in goods and services
- Reduction in direct employment
    - Ground handling
    - Other operational staff based at the airport
    - Airport sales staff
    - Other airport-based employees

10.3.4 Charter/Leisure Airlines

Direct economic effects should be measurable in a similar manner to those for other short-haul scheduled operations affected by new night restrictions.

At a 'base' airport

- Loss of route(s) turnover (net)
- Change in value of bought-in goods and services for operation at the airport, including leasing costs of aircraft
- Reduction in direct employment
    - Crew (cockpit and cabin)
    - Ground handling
    - Other operational staff based at the airport
    - Airport sales staff
    - Other airport-based employees

At other airports

- Loss of route(s) turnover (net)
- Reduction in value of bought-in goods and services for operation at the airport
- Reduction in direct employment
    - Ground handling
    - Other operational staff based at the airport
    - Airport sales staff

- Other airport-based employees

10.3.5 Scheduled Freight Operations – Short Haul

The direct economic effects on the carrier affected are likely to reflect the response selected by the carrier, in turn determined by extraneous factors as discussed above. It is therefore appropriate only to suggest the sort of measurable economic effects likely to flow from a variety of responses, with the *caveat* that individual cases may need special treatment and investigation :

- rescheduling, while perhaps unlikely, implies :
  - net changes in route(s) turnover, as the scheduled freighter product is no longer optimised to the market;
  - possibly additional crew employment and aircraft ownership/lease costs due to less efficient use of resources;
- relocation would bring :
  - capital costs plus, on current account, possible added operating costs;
  - net loss in route turnover at the restricting airport, replaced elsewhere (probably in the same region or at least the same country, but perhaps cross-border) ;
  - reduction in value of bought-in goods and services
- abandonment would have the same effects at the restricting airport as relocation, but without replacement elsewhere.

10.3.6 Scheduled Freight Operations – Long Haul

European long haul scheduled freighter airlines tend to be substantial flag carriers (or operators on their behalf) with a major home base. The direct economic effects on them of relocation from such a base due to restrictions on their night operations will include:

- capital costs plus, on current account, possible added operating costs;
- net loss in route turnover at the restricting airport, replaced elsewhere (most probably in the same region or at least the same country, and unlikely but possibly cross-border) ;
- reduction in value of bought-in goods and services
- reduced direct employment at that airport, in the same categories as for other route losses, but with the likelihood of job transfer or replacement job creation elsewhere.

Fleet renewal by any carrier serving a stringency-restricting airport would possibly lead, in the long term, to enhanced value-added on current account (in return for capital investment), due to use of generally more efficient aircraft.

10.3.7 Charter Freight Operations

Unless an airport has an established (or planned) niche in the market as welcoming freight charters in a reception gateway role, the possible impacts at prospective destinations can not be assessed or predicted.

At a freight charter airline base, abandonment or relocation would mean :

- net loss in route turnover at the restricting airport, perhaps replaced elsewhere, possibly cross-border;
- reduction in value of bought-in goods and services but perhaps replaced elsewhere;
- reduced direct employment at that airport, in the same categories as for other route losses, but with the likelihood of job transfer or replacement job creation elsewhere in case of relocation.

10.3.8 Express

A key factor in assessing express operations is that they are integrated, so that not only purely aviation activities are directly affected, but the whole integrated process, including surface collection/delivery activity and sorting within the same organisation, which is not necessarily the case with respect to passenger operations, or other cargo flights. It is therefore improbable for an express operator, for practical as well as commercial reasons, to reschedule if it cannot operate at its peak night hours.

At a spoke or a hub airport, relocation would mean for the express airline - and directly for its "parent" express integrator :

- net loss in route(s) turnover at the restricting airport, replaced elsewhere net of any penalties of sub-optimal geographical situation after relocation, perhaps cross-border;
- reduction in value of bought-in goods and services but replaced elsewhere;
- capital relocation costs and possibly changes in operating costs – some routes to/from a relocated hub would get longer, others shorter; whereas relocation to a different spoke airport could cause changes in surface feeder costs.

10.3.9 Mail

At any airport, change of aircraft type for dedicated mail (or other) services has minimal economic effects, the impact is (up or down) on airline operating costs. It is conceivable that the new type might require more (or fewer) loaders, handlers, or maintenance workers.

At a spoke or a hub, relocation has the same effects on the airline as noted for other types of airline activity –direct loss of added value and employment, but its replacement elsewhere. For a spoke losing its mail flight(s) the replacement is likely to be within the region; for a mail hub any replacement location is probably not practicably conceivable as being extra-territorial.

Abandonment of the operation, at spoke or hub, implies for mail (as an essential service inevitably with some form of State control or intervention) the replacement of air services by surface transport. The airport and airline (direct and multiplier) turnover and job losses are absolute, but replacement by another mode means direct (and multiplier) turnover and job creation at local, regional and national levels. It might mean more trucks on the road, or the re-introduction of rail-borne sorting offices, but while dedicated mail flights might stop, the mail itself will not.

In all cases, international mail is likely to still be carried by air, in freighters or as belly cargo; so airports will still have an involvement with the postal services.

10.3.10 Airport Operators

The airport operator may also be able to make savings in operating costs from the lower volume of traffic. In general these may be expected to be small, since the airport operators' costs are largely fixed if the airport stays open. This can only be established according to the particular circumstances.

There is a peculiarity with airport economics in that:

- airport charges can be seen as taxes and therefore merely a transfer payment not to be taken into account in a cost/benefit analysis
- associated with this is the ability of the airport operator to recoup a loss of income by raising fees to other users; thus the cost of lower night time income might be higher costs to daytime users.

- the true costs to an airport operator might come from having to increase capacity during the day (or advance capital expenditures); airport fees for night flights are unlikely to reflect such costs

These issues will have to be faced on a case by case basis. In principle, the airport operator should assess any reduction in income from landing fees etc charged to operators in the light of operators' revised plans, together with the associated loss of commercial (non-aeronautical) revenues. In an iterative process they may seek to compare their assessments with those noted by the airline operators (though not included by the operators in their added value assessments in order to avoid double counting). As for the airline operators, if the new restriction relates to curbs on noisier aircraft, then re-equipment with consequent capital and operational impacts can be an option. In addition they should note and advise airport service providers of their estimates of any reductions in rentals or commission fees paid to the airport operator (but not include such estimates in their added value assessments in order to avoid double counting).

10.3.11 Other Airport Services Providers

Airport services providers should assess any reduction in goods and services supplied to operators in the light of operators' revised plans, and in an iterative process they may seek to compare their assessments with those noted by the operators (though not included by the operators in their added value assessments in order to avoid double counting). This should include estimates of any reductions in rentals or commission fees paid to the airport operator

- Loss of turnover of sales to travellers
- Loss of turnover on services provided to airlines or the airport operator
- Reduction in value of bought-in goods and services.
- Reduction in direct employment
- Manpower equivalent due to shift or overtime changes
- Headcount

10.4 Measurement Issues

10.4.1 Measurement timeframes

We believe that to maintain consistency across all Community airports, all data should be annually based and expressed in terms of current year prices. This will also allow for reasonable comparison with local regional and national statistics. The assessment should be based on the difference between current planned operations (in terms of volumes, revenue, expenditure, employment etc.) two years hence, and revised plans based on minimising the economic effects of the potential restrictions proposed by the competent authorities. This 'snapshot' approach has the benefit of relative simplicity for most stakeholders, with ease of calculation, and not subject to the vagaries and uncertainties of future scenarios which competent authorities would then have to subject to some form of risk assessment.

However, some stakeholders may wish to demonstrate impacts over a longer time horizon. This would be particularly relevant when a major step-change in night restriction is envisaged, e.g. complete curfew. For changes to genuine future planning to be taken into account, tangible evidence of intent must be shown. There may be difficulties in dealing with issues of commercial confidentiality here, perhaps covered by provision for "closed sessions" of assessment. Firm plans to obtain aircraft or other capital equipment, train crews, undertake building construction, etc could be used as hard evidence and included in calculation of disbenefits – as opposed to simple growth projections needing only simple discounting back to current values. A maximum

five year timeframe is recommended. The longer timeframe can also be useful to ensure that reduced 'normal' growth due to loss of competitiveness is properly captured, but it must be recognised that stakeholder consensus on forecasts can be difficult to achieve in practice. The advantages and disadvantages of both snapshot and time series approaches are recognised in the context of the implementation of the balanced approach.

10.4.2 Economic effects

All stakeholders should measure direct economic effects on themselves relative to future plans two years ahead (or up to five years in circumstances noted above) in terms of employment by local/regional/country/cross border, and added value by country / cross border, and a suggested template reporting form shown below can be used for recording

The employment measure should preferably be expressed in two forms

Headcount: i.e. the annual average total number of persons who are employed for pay or profit whether full time or part time for at least one hour – in line with ILO definition of employment as used in Eurostat employment data, and who would not be employed as a result of restrictions on night operations (net of actions taken by stakeholders to mitigate any negative effects).

Manpower equivalent: i.e. the annual average equivalent number of fulltime employees after taking into account the effects of part time, shift and overtime working – and any reduction in such equivalents as a result of restrictions on night operations (net of actions taken by stakeholders to mitigate any negative effects). The manpower equivalent is a more accurate base for assessing income and other economic effects of employment changes.

The value added parameter requires stakeholders to bring in monetary values. There are two methods for calculating value added

The *'production'* method measures the impact on gross revenues (turnover) after taking into account any changes in the level of bought-in goods and services.

As an alternative stakeholders may use the *'income'* approach to estimating economic effects, measuring the change in the annual wage/salary component of their expenditure (in line with manpower equivalent changes) plus changes in annual profit.

Initial expectations that all stakeholders would be able to calculate both the employment and the added value effects of new night restrictions at the local, regional and national level have not been borne out. Employment would therefore be the only metric applicable across all stakeholders and at all geographic levels. Value added as a metric would have to be restricted to impacts at the Member State level, and to total impacts (including network effects) on the affected stakeholder as a whole.

Provision should be made for capital cost items such as write-off of infrastructure or equipment investment, or the need for new investment specifically attributable to the introduction of restrictions. These might be expressed as annualised profit changes or one-off disbenefit events. It would also be legitimate to include the effects of employment severance costs, relocation disruption, etc in calculation of lost profit and therefore lost value added.

10.4.3 Financial effects

(a) Direct economic impacts on airlines can be expressed in terms of:

- employment, by locality, region, at national level, and cross-border
- revenue, disaggregated costs and (pre or post-tax profits) – effectively in calculable value added terms – only at the corporate level, which might be taken as national for home-country-based carriers and cross-border for others.

Initial expectations that all stakeholders would be able to calculate both the employment and the added value effects of new night restrictions at the local, regional and national level have not been borne out. Employment would therefore be the only metric applicable across all stakeholders and at all geographic levels. Value added as a metric would have to be restricted to impacts at the Member State level, and to total impacts (including network effects) on the affected stakeholder as a whole. Direct economic impacts on airports and airport service providers can more readily be expressed in both employment and financial/value added terms, but this is of limited usefulness without comparable airline data.

Provision should be made for capital cost items such as write-off of infrastructure or equipment investment, or the need for new investment specifically attributable to the introduction of restrictions. These might be expressed as annualised profit changes or one-off disbenefit events. It would also be legitimate to include the effects of employment severance costs, relocation disruption, etc in calculation of lost profit and therefore lost value added.

10.4.4 Recording of Direct impacts.

A method for recording of Direct impacts shown below.

Effect of New restriction eg Curfew extended to 0700

		Impacts on Operators					
		Airport Operator	Airline A	Airline B	Airport services provider A	Airport services providerB	**Direct total**
Direct							
At airport	*Employment*	*26*	*2*	*4*	*6*	*14*	*52*
Other Local	*Employment*	*3*		*1*	*2*		*6*
In Region other	*Employment*		*1*				*1*
In Country other	*Employment*	*1*	*0*				*1*
Country total	Turnover E(m)	15	4	25	5	9	58
	B-I-G-S E(m)	4	1	7	1	2	15
	Added value E(m)	11	3	18	4	7	43
	Employment	*30*	*3*	*5*	*8*	*14*	*60*
Cross Border total	Turnover E(m)	0	0	30	0	0	
	B-I-G-S E(m)	0	0	8	0	0	
	Added value E(m)	0	0	22	0	0	
	Employment	*0*	*0*	*10*	*0*	*0*	
Grand total	Turnover E(m)	15	4	55	5	9	
	B-I-G-S E(m)	4	1	15	1	2	
	Added value E(m)	11	3	40	4	7	
	Employment	*30*	*3*	*15*	*8*	*14*	

B-I-G-S = Bought-in Goods and Services

In this example, we show how at an airport with two airlines, and two airport service providers, each would estimate changes in added value and in employment, and record effects within the Member State and cross-border.

10.4.5 Indirect and Induced Effects

Indirect impacts, i.e. the effects on suppliers to the airport operators (other than each other), and induced impacts, i.e. the further economic effects caused by reductions in income of direct and indirect stakeholders, should be assessed by means of 'multipliers' as discussed above (section 7.3.4).

As a first stage, the direct impacts (i.e. both value added and employment) on individual operators at the airport, and other direct impacts on operators at the local sub-region, the region and other parts of the relevant Member State will have been totalled as indicated above.

These totals for the airport itself and for the local sub-region would then be grossed up by use of the 'local' multiplier to assess the cumulative impact (i.e. including indirect and induced impacts) on the local sub-area.

The totals for the airport, the local sub-region and the region would then be grossed up by use of the 'regional' multiplier to assess the cumulative impact on the region.

Finally, the totals for the airport, the local sub-region, the region and the Member State would be grossed up by the 'country' multiplier to show the estimated cumulative impact on the economy of the country as a whole.

It should be noted again that no cross border indirect or induced impacts would need to be calculated, since the Directive clearly implies that these should be restricted to the individual Member State of the airport concerned.

The simple template example below on the right hand side demonstrates how this process might have operated and be recorded.

Effect of New restriction eg Curfew extended to 0700

		Direct total	Cumulative impacts, Direct + Indirect/Induced		
			+ Local (multiplier 0.5)	+Regional (multiplier 1.0)	+National (multiplier 2.2)
Direct					
At airport	*Employment*	*52*	*78*	*104*	*166.4*
Other Local	*Employment*	*6*	*9*	*12*	*19.2*
In Region other	*Employment*	*1*		*2*	*3.2*
In Country other	*Employment*	*1*			*3.2*
Country total	Turnover E(m)	58	Total **Local**	Total **Regional**	Total **National**
	B-I-G-S E(m)	15			
	Added value E(m)	43			*137.6*
	Employment	*60*	*87*	*118*	*192*
Cross Border total	Turnover E(m)				
	B-I-G-S E(m)				
	Added value E(m)				
	Employment				
Grand total	Turnover E(m)				
	B-I-G-S E(m)				
	Added value E(m)				
	Employment				

B-I-G-S = Bought-in Goods and Services

Consensus should be sought on regional and national direct to indirect + induced employment multipliers, using academic or other authoritative sources. However, given the results of econometric research, particularly the most recent ACI-EUROPE/York Aviation study, national multipliers which do not lie between 2.0 and 2.5 should be treated with some caution. Similarly, in the absence of other information, multipliers of around 1.0 at the regional level, and 0.5 at the local level may be used as the default value. We think slightly lower rates might be more appropriate for job losses than those used for job creation.

10.5 Other Issues

10.5.1 Catalytic Effects

The assessment of catalytic effects on business and industry as a result of restrictions on flights, can be enhanced by the identification of firms affected by airline operational responses to the restrictions. They may be close to the airport, or nominated by the airlines themselves as known service-dependent customers. They may, however, lie at the far end of connecting (domestic) routes.

This could be particularly important if the airlines subject to restrictions at a hub airport might decide that a service to/from a regional hub might be dropped, threatening the whole viability of that route with serious consequences for the region concerned.

Measures to find them should include local notification of the right to make representations, encouragement of airlines to nominate key customers using flights affected, and business/industry organisations such as Chambers of Commerce at local and national level. They

may be able to undertake some relevant survey work on behalf of the assessing authority, but data access and professional capability to identify catalytically dependent firms and industry clusters may not consistent across Europe.

Tourism organisations should also be contacted where appropriate. They may well, in major tourism destination regions (or at national level), have authoritative historic data on tourism numbers, origins, spending; and employment, as well as the capability to quantify direct impacts and to work through value added and employment impacts through multipliers. There are, however, practical difficulties in arriving at net losses of tourists advised by airlines affected by restrictions, as they may go to other resorts. We have the impression that tourism authorities (where tourism is a major contributor to GDP) are likely to have airport and survey data to be able to establish local impacts of "lost" tourism numbers, but might have to rely upon airlines/tour operators to advise those numbers. One problem of extending that to the regional or national level (or to future years) is that of estimating where "lost" traffic might go. A local loss due to a flight cancelled or transferred to another resort might be offset elsewhere by that same traffic gained – or it might go abroad.

10.5.2 Use of Overall 'Control' Totals

Cumulative individual company responses are, however, unlikely to give a satisfactory total picture at local, regional and national level. There is a danger that surveys and representations will not give a comprehensive picture, particularly among small and medium sized enterprises (SME). Rules of thumb related to airport throughput , in terms of jobs per work load unit or other traffic-related employment and value added multipliers, backed by authoritative research (as discussed in Section 6.3) can provide a useful indicative "control total" estimate of catalytic employment and value-added impacts.

10.5.3 Regional and National Level Effects

Eurostat NUTS areas are indeed an authoritative and convenient method of regional and sub-regional definition, particularly valuable when correlated with regional economic data on the same basis. They should however be used with care in relatively small countries (where they can quickly agglomerate to national boundaries) or in islands where local impacts can be artificially dispersed.

For comparisons at local level, it is recommended that sub-regions substantially within a 50 kilometre distance from the airport perimeter circle be considered the local catchment area – particularly for employment measures.

Where local knowledge of transport links suggest a wider or more specific definition of the local catchment in terms of Eurostat sub region then this alternative would be perfectly acceptable. A full analysis and breakdown of the relevant Eurostat and EEA regional and sub-regional (i.e. local within 50km) as well as national structure appropriate to each of the Core airports is shown in Appendix C.

At the intermediate regional level, Eurostat breaks employment and value added down by industry classification. This can provide a useful check when assessing the catalytic effects of any changes to night operations. The ACI EUROPE/York Aviation study identified certain sectors of industry that are most dependent upon air service accessibility. When considering catalytic effects, the reasonableness of estimates of catalytic losses should be assessed against the overall employment and income levels within the relevant industry classifications.

10.5.4 Consumer Effects

It is impracticable in general to assess with any accuracy the direct economic impacts on passengers (e.g. hours of delay at average time values), of operational changes to airline services resulting from night flight restrictions, because consumers have quasi-infinite choice – not to

travel, to travel to a different airport, or at a different time, and so on – no-one knows where "lost" traffic goes. However, competent authorities may make use of relevant economic models where these are available. Consumer surplus reductions will be subsumed in the multiplier/catalytic calculations, as explained in section 8.3.4.

Impacts upon consumers of cargo services – express in particular – can however be substantial, and as stressed in section 10.5.1 above should be rigorously investigated and evaluated.

10.5.5 Unquantifiable Effects

Finally, the authorities will need to draw up a list of a number of effects that may be unquantifiable:.

- We recommend that the Commission Services should investigate and advise assessors of the Community legal position on the consequences of slots (in historic or planned use by an operator) which cease to exist due to the imposition of a restriction. There may also be issues as to priorities for allocation of replacement slots during the day.
- A possible threat of retaliation from a third country might need to be evaluated.
- Competent authorities, in assessing the reasonableness of economic disbenefits, should of course take into account current and any known future restrictions at airports within the same local or regional catchment areas, including in neighbouring Member States.

Appendix A Study Specifications

TENDER SPECIFICATIONS
ATTACHED TO THE INVITATION TO TENDER

Invitation to tender No. TREN/F3/10-2003 concerning

Study on the economic impacts of night flights in Europe

1. Introduction and background of the study

There is currently no specific EU legislation on night flights: but EC Directive 2002/30/EC of 26 March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports, regulates operating restrictions of a partial nature, i.e. those restrictions which do not apply 24 hours per day but are limited to specific times, e.g. night time.

EC Directive 2002/30/EC requires a common framework for rules and procedures for the introduction of operating restrictions at Community airports. Article 4 (2) requires that the competent authorities take account of the likely costs and benefits of the various measures, as well as airport-specific characteristics. This assessment must take into account the most immediate effects and also the broader socio-economic consequences of the proposed measures.

A recurrent concern by many residents living around airports has been the effect of night flights on the overall noise climate. Residents find these flights particularly intrusive and this may be attributed to a reduction of the overall background noise levels, and the reduced frequency of the night services, thereby making each event more obviously intrusive. The environmental impact of night flights has been considered elsewhere but is an important element of this study.

On the other hand, the business community has become increasingly reliant on overnight services for the carriage of documents and service parts. This is a high growth area for air transport and the operators claim that their activity has become an essential and valuable contributor to the Community GDP. Leisure users are also concerned as many charter operators rely on night time operations to maximise the use of their equipment, which they claim feeds in to lower costs for consumers.

Some attempts have been made to quantify the benefits but further research is needed to establish a reliable methodology to assess the economic benefits of night flights and to test it on the basis of a selected number of airports in Europe.

In that perspective 3 broad categories need to be explored:

- In the first place identification of the economic sectors which are dependent upon night flights, including an analysis of their relative importance for the economy in general.

- Secondly, an analysis of the possibilities to shift the activities concerned to day-time operation or to other modes of transport.
- Thirdly, an estimate of the impact on the regional and/or national economy of night flight operations as an element of economic growth.

Since current night-flight restrictions vary between airports in Member States, as well as between States, it is important to have an overview of the different ways in which such restrictions are implemented (e.g. by type of operation, number of movements, noise characteristics, noise cap for the airport, etc.). A more flexible attitude towards night flights may have contributed to the development of certain airports as hubs for overnight freight operators, such as DHL, FedEx, TNT and UPS. Policy changes in the field of night flight restrictions may have a much stronger impact on those types of airport.

Another difference between airports is the result of a different timings of the restrictions. Some airports may be totally shut during the hours when a night flight ban is effective, and this could also have consequences for delayed departures and arrivals, an element which may also influence the decisions of airlines when selecting an airport for daytime operations.

2a. Purpose of the study

The study aims at establishing a framework for estimating the economic benefits of night flights and the economic impacts of any possible changes to an existing regime governing night flights at Community airports. The study should investigate the different economic aspects which relate to night flights.

A deliverable from the study will be guidance to the Member States and to local authorities to assist them in preparing the analysis which is prescribed by Annex 2 of Directive 2002/30/EC, prior to the introduction of operating restrictions as well as for providing the basis for possible future EU legislation.

The study must therefore provide the tools for analysing the economic role of night flights and indicate their importance for facilitating production and trade on a consistent basis throughout the Community.

The research to be undertaken shall include a review of the relevant literature, identify gaps in the literature and suggest methodological approaches to a number of case-studies.

The results from the study should be capable of answering the following type of questions:

- How important are night flights to different market sectors and what are their operationally important night time hours for each sector? How important is it for each sector to be able to operate at specific times and how would changes in timing affect value to the regional and national economy?
- Are day flights a substitute for night flights?
- How are operators affected by small changes in the definition of night, being longer or shorter, by say an hour or two? The effect upon each sector should be quantifiable.
- How do changes in the availability of night flights influence the location of business?
- How do changes in the availability of night flights enhance the performance of business?
- How do changes in the availability of night flights affect the speed of service delivery of freight and does this affect their viability?

- How much more would a charter flight cost without night flights?
- What are the effects of night flights on the costs and service quality of cargo, mail or express deliveries?
- To what degree might a small change to operating practices make a large difference to the environmental impact?

2b. Methodological requirement of the study

The study has to make an assessment of the economic importance of night flights on the basis of a methodology capable of identifying in sufficient detail the benefits to different parties and the costs involved.

Requirements of the study can be split into two larger parts, i.e. the development of a common methodology and the application of the methodology on a representative sample of European airports.

The methodological work required can be further split:

- derivation of a common methodology providing an analytical framework
- determination of the data required to apply the methodology and the feasibility of obtaining these data

In the methodological part of the study the possibilities for different units of benefit might considered (e.g. monetary units versus quantitative terms).

In a second part of the study the methodology will be tested at a sample of Community airports with a view to demonstrate its practicability and at the same time make already available representative information for a number of typical airport situations.

The methodology must be capable of identifying in sufficient detail the different benefits to different parties, including:

1) Airports and airport based services (e.g. the impact on the attractiveness of an airport's range of destinations and frequency of service and on the provision of ground handling services).
2) Airlines; breakdown by sectors to include:
   (a) scheduled passengers
      i. long haul
      ii. short haul full service
      iii. no frills
   (b) charter/Leisure passengers
   (c) freight
   (d) parcels/mail services

   The airline analysis enabled by the methodology should include the marketing/revenue effect of convenient times for passengers, freight, parcels/mail services; the utilisation of aircraft and other assets.
3) Airline customers, (broken down by each of the sectors identified in (2) above)

4) Business (e.g. non-aviation firms who benefit from avoiding an overnight stay; value of next day/timed deliveries of components/goods)
5) Regional and national economy (e.g. wider benefits affecting the general attractiveness of the regional and the national economy such as to employment and business opportunities, including the encouragement of foreign direct investment, and tourism)
6) Environmental impacts

3. Reports and documents

An interim report shall be submitted not later than **4 months** after the signature of the contract. The draft final contract would be expected not later than **8 months** after the signature of the contract and the final report **10 months** after signature of the contract.

The work of the consultant will be followed by a steering committee composed by Commission services and to which external aviation experts may be invited by the Commission.

The consultant will also be asked to attend one meeting between the Commission and Industry and Member States in Brussels. This will be on top of the three meetings mentioned under "Timetable" below.

Timetable

The work will start on the date of signature of the contract: the start date.

Shortly after the start date a kick-off meeting will be held in Brussels in order to settle details of the study to be undertaken and to discuss the action plan.

A second meeting will be held in Brussels following the reception of the interim report in order to discuss the first results of the study and further action.

A third meeting in Brussels will follow the submission of the draft final report describing the work carried out, to discuss the Commission's comment on the report.

Appendix B Bibliography

Select Bibliography: The Economic impacts of Night Flights in Europe

Reference	Date	Website	Scope	Summary
Technical Context				
International Civil Aviation Organisation Convention on International Civil Aviation Annex 16 : Environmental Protection Volume 1 : Aircraft Noise Part II Aircraft Noise Certification Chapter 2 *et seq* (Also tech manual)	3rd edn 1993 and Supplemt 2003	http://www.icao.int/icao/en/env/noise	Noise	Basic reference on aircraft noise certification
Policy and Legislation				
Council Directive 92/14/EEC of 2 March 1992 on the limitation of the operation of aeroplanes covered by Part II, Chapter 2, Volume I of Annex 16 to the Convention on International Civil Aviation (Also amending Directive 98/20)	1992 (1998)	http://www.europa.eu.int/eur-lex	Aircraft	Phase-out of Chapter 2 aircraft at European airports
Council Regulation (EC) No. 925/1999 of 29 April 1999 on the registration and operation within the Community of certain types of civil subsonic jet aeroplanes which have been modified asnd recertificated as meeting the standards of Volume I, Part II, Chapter 3 of Annex 16 to the Convention …	1999	http://www.europa.eu.int/eur-lex	Aircraft	The hush-kit Regulation, repealed by Directive 2002/30/EC
Directive 2002/30/EC of the European Parliament and of the Council of 26 March 2002, on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports.	2002	http://www.europa.eu.int/eur-lex	Airport Noise Management	Embodiment of the Balanced Approach in Community law.

Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002, relating to the assessmemnt and management of environmental noise.	2002	http://www.europa.eu.int/eur-lex	Airport Noise Management	Legal basis for noise mapping around airports using Lnight and defining the default night period as 2300-0700 local.
COM (1999)640 Communication from the Commission to the Council *et al* : Air Transport and the Environment - Towards Meeting the Challenges of Sustainable Development.	1999	http://www.europa.eu.int/	Airport Noise Management	Possible developments to maintain progress toward sustainable mbility.
Commission White Paper : European Transport Policy for 2010 - Time to Decide.	2001	http://www.europa.eu.int/comm/dgs/energy_transport	Airport Noise Management	Air transport section warns of consequences of failure of ICAO stringency.
ICAO Assembly Resolution A33-7 : Consolidated Statement of Continuing ICAO Policies and Practices relating to Rnvironmental Protection.	2001	http://www.icao.int/icao/en/env/a33-7	Airport Noise Management	Appendix C Outlines the Balanced Approach.
Airport Noise and Restrictions				
Anotec : Study on Current and Future Aircraft Noise Exposure Around Community Airports	2004	http://www.anotecc.com/projects	Airport Noise Management	Complementary Commission study on quantification of noise exposure and population.
Boeing Company : Airport Noise Regulations Information : Website	Current	http://www.boeing.com/commercial/noise/flash.html	Airport Noise Management	Comprehensive inventory of worldwide airport operational restrictions
UK CAA : Review of the Quota Count System : Re-analysis of Differences between Arrivals and Departures	2002	http://www.caa.co.uk/docs/68/dap_ercd_0204_QCReview.pdf	Airport Noise Management	Analysis of arrivals and departures and the effects of alterations in patterns.
UK Government : Department for Transport : Noise Limits for Aircraft Departing from Heathrow, Gatwick and Stansted Airports : Decision of Dec.2000	2002	http://www.dft.gov.uk/srellent/groups/dft_aviation/documents	Regularory Impact Assessment	Fully explored technically and operationally, with environmental benefits, but user costs witheld for confidentiality.
University of California - Berkeley : Institute of Transportation : Airport Noise Symposium	2003	http://www.its.berkeley.edu/techtransfer/events/air/2003	Airport Noise Management	Very good overview of the economics of airport noise management

Air Transport and Airports : Economic Impacts				
Oxford Economic Forecasting : Contribution of the Aviation Industry to the UK Economy	1999	http://www.oef.com	Economic Impacts	Modelled econometric approach, also exploring value added as a metric, and introducing catalytic benefit concepts.
International Air Transport Association (IATA) : Air Transport Action Group (ATAG) : Economic Benefits of Air Transport	2000	http://www.atag.org/	Economic Impacts	Direct, indirect and induced benefits identified. 3rd update.
Washington State : Dept of Transportation : Economic Impacts of Washington Airports	c.2001	http://www.wsdot.wa.gov.gov/aviation/EconomImpacts/	Economic Impacts	Interesting US example of aviation impact benefit evaluation.
Airports Council International : ACI - Europe : The Social and Economic Impact of Airports in Europe	2004	http://www.aci-europe.org/	Economic Impacts	Direct, indirect, induced and catalytic economic benefits described and detailed. Case studies identified.
Brussels International Airport Company (BIAC) : Brussels Airport : Toward a New Balance between Economy and Ecology : A Study into the Economic Impact of Brussels Airport on the Belgian Economy (by) Prof. Dr. Leo Sleuwaegen et al.	2003	http://www.brusselsairport.be/press/en/5507-EN-V2-ec%rapport.pdf	Economic and Environmental Impacts	Three sections, focussing respectively on : - Overnight express services - Modelling of economic impact of the airport - Night flight impacts and their noise perception By distinguished economista, particularly relevant to BIAC support for DHL expansion at BRU
Belgian Air Transport Association (BATA) : Economic Role of the Aviation Industry in Belgium (by) Prof. B van Pottelsberghe (Solvay Business School)	2004	Contact : bruno.vanpottelsberghe@ulb.ac.be	Economic Impacts	Research proposal, study in progress Oct 2004.
Night Flight Restrictions : Economic Impacts : Passenger Operations				
British Air Transport Association : Economic Costs of Night Flying Restrictions at the London Airports	1997	http://www.bata.co.uk/pub	Economic Impacts	A Coopers & Lybrand report focussing upon long-heul arrivals and inclusive tour charter rotations, with indicative airline costs of restriction.
(UK Govt Dept for Transport) : Night Restrictions Forum, Feb 2004 : British Airways Slide Presentatn :. Why do Scheduled Airlines Fly at Night ?	2004	http://www.britishairways.com	Economic Impacts	Unpublished illustrations of the importance of night arrivals for long-haul passenger operations, some direct and network quantification.
Night Flight Restrictions : Economic Impacts : Cargo & Express Operations				
Air Cargo System: Princeton University	1982	http://www.wws.princeton.edu/cgi-bin	Economic Impacts	Slightly outdated, but rigorous academic analysis of impact of potential night restrictions on cargo carriers in USA,
Oxford Economic Forecasting : Economic Impact of Express Carriers for UK plc	1999	http://www.euroexpress.org/	Economic Impacts	One of a series of recent reports for the EEA (or equivalent national bodies) quantifying impacts through employment and in various financial terms. This study uses the OEF model of the UK economy also used for Treasury .
Deloitte Consulting : L'Impact du Secteur du Transport Express sur l'Economie Francaise	2002	http://www.euroexpress.org/	Economic Impacts	One of a series of recent reports for the EEA (or equivalent national bodies) quantifying impacts through employment and in various financial terms. An express slot is valued more highly than a passenger flight slot.

KPMG: Etude d'Impact Economique du Secteur Belge du Courrier et du Transport Express	2004	http://www.euroexpress.org/	Economic Impacts	One of a series of recent reports for the EEA (or equivalent national bodies) this example being the most clear and precise in defining and quantifying employment and value added impacts at the direct, indirect and induced levels.
BIEK : Produktivitaets- und Wachstumeffekte der Kurier-, Expresse- und Pketdienste fuer die Arbeitsteilige Wirtschaft (En. Exec. Summary)	2004	http://www.euroexpress.org/	Economic Impacts	One of a series of recent reports for the EEA (BIEK equivalent national body) quantifying impacts through employment and in various financial terms.
OEF & CFC : The Impact of Express Carriers for Italy's Economy and Competitiveness	2004	http://www.euroexpress.org/	Economic Impacts	One of a series of recent reports for the EEA (or equivalent national bodies) quantifying impacts through employment and in various financial terms.
GTE Consultores : Economic Impact of the Express Industry in Portugal	2004	http://www.euroexpress.org/	Economic Impacts	One of a series of recent reports for the EEA (or equivalent national bodies) quantifying impacts through employment and in various financial terms. High multipliers seem to be derived for catalytic effects in this example.
Night Flight Restrictions : Economic Impacts : Metrics				
US Dept. of Commerce: Regional Economic Accounts	2004	http://www.bea.doc.gov/bea/regional/data.htm	Benefits	Very useful guide to alternative methodologies, albeit with US bias, esp. regional multipliers, also various useful articles
EU: Eurostat	Jan-04	http://europa.eu.int/comm/eurostat/	Benefits	Key source of economic data with explanations of sources and methodologies, relevant to regional analyses within EU. Annual Statistical Yearbook updated 2002/3
Night Flight Restrictions : Economic Impacts : Methodology				
Airports Council International ACI - Europe : Partners in Economic Impact Study Kit	1993	http://www.aci-europe.org/	Economic Impact	Excellent basic checklist for use by an airport undertaking economic impact study. Basic tips for data collection, surveys and multiplier calculations. Not designed to assess the effect of restrictions but still useful.
ICAO Doc.9829 : Guidance on the Implementation of the Balanced Approach to Aircraft Noise Management	2004	Referred to in http://www.icao.int/icao/en/nr/2004/pio200402	Cost/Benefit	Cost/benefit and cost/effectivenes methodologies.
Night Flight Restrictions : Economic Impacts : Case Study				
France : Directorate General of Civil Aviation : A Balanced Approach to Noise Management at Paris - Charles de Gaulle Airport : an Evaluation of Operational Restrictions.	2003		Cost/Benefit Example	Direct, indirect, induced and catalyric jobs and turnover sffects are assessed, including fleet renewal, for a noisy aircraft partial night ban; discounted 10 years.

Appendix C Eurostat Economic Data

NUTS Local areas and Regions for Eurostat / EEA data

Core Airport Name	IATA Code	Country Code	Region Code	Region Name	Local Areas Code	Local Areas Name
Vienna	VIE	**AT**	**12**	Niederösterreich	**127**	Wiener Umland/Südteil
		AT	**13**	Wien	**130**	Wien
Brussels	BRU	**BE**	**1**	RÉGION DE BRUXELLES-CAPITALE	**10**	Région de Bruxelles-Capitale
		BE	**2**	VLAAMS GEWEST	**24**	Prov. Vlaams-Brabant
		BE	**3**	RÉGION WALLONNE	**31**	Prov. Brabant Wallon
Cologne-Bonn	CGN	**DE**	**A**	NORDRHEIN-WESTFALEN	**A2**	Köln
Frankfurt/Main	FRA	**DE**	**7**	HESSEN	**71**	Darmstadt
Munich	MUC	**DE**	**2**	BAYERN	**21**	Oberbayern
Berlin Tegel	TXL	**DE**	**3**	BERLIN	**30**	Berlin
Duesseldorf	DUS	**DE**	**A**	NORDRHEIN-WESTFALEN	**A1**	Düsseldorf
Hannover	HAJ	**DE**	**9**	NIEDERSACHSEN	**92**	Hannover
Stuttgart	STR	**DE**	**1**	BADEN-WÜRTTEMBERG	**11**	Stuttgart
Hamburg	HAM	**DE**	**6**	HAMBURG	**60**	Hamburg
		DE	**F**	SCHLESWIG-HOLSTEIN	**F0**	Schleswig-Holstein
		DE	**9**	NIEDERSACHSEN	**93**	Lüneburg
Copenhagen	CPH	**DK**	**0**	Danmark	**001**	København og Frederiksberg kommune
		DK			**002**	Københavns amt
		DK			**003**	Frederiksborg amt
Palma de Mallorca	PMI	**ES**	**53**	Illes Balears	**530**	Illes Balears
Madrid Barajas	MAD	**ES**	**30**	COMUNIDAD DE MADRID	**300**	Madrid
Barcelona	BCN	**ES**	**51**	Cataluña	**511**	Barcelona
Malaga	AGP	**ES**	**61**	Andalucía	**617**	Málaga
Helsinki	HEL	**FI**	**18**	Etelä-Suomi	**181**	Uusimaa
Paris Charles de Gaulle	CDG	**FR**	**10**	Île de France	**101**	Paris
		FR			**105**	Hauts-de-Seine
		FR			**106**	Seine-Saint-Denis
		FR			**108**	Val-d'Oise
Lyon Satolas	LYS	**FR**	**71**	Rhône-Alpes	**716**	Rhône
Toulouse	TLS	**FR**	**62**	Midi-Pyrénées	**623**	Haute-Garonne
		FR			**627**	Tarn
		FR			**628**	Tarn-et-Garonne
Marseille	MRS	**FR**	**82**	Provence-Alpes-Côte d'Azur	**824**	Bouches-du-Rhône
		FR			**825**	Var
Nice	NCE	**FR**	**82**	Provence-Alpes-Côte d'Azur	**823**	Alpes-Maritimes
		FR			**821**	Alpes-de-Haute-Provence
Paris Orly	ORY	**FR**	**10**	Île de France	**101**	Paris
		FR			**105**	Hauts-de-Seine
		FR			**107**	Val-de-Marne
		FR			**104**	Essonne
		FR			**102**	Seine-et-Marne

Athens Eleftherios Venizelos	ATH	**GR**	**3**	ATTIKI	**30**	Attiki
Dublin	DUB	**IE**	**2**	Southern and Eastern	**021**	Dublin
Shannon	SNN	**IE**	**2**	Southern and Eastern	**025**	South-West (IRL)
Rome Fiumicino	FCO	**IT**	**E4**	Lazio	**E43**	Roma
Milan Linate	LIN	**IT**	**C4**	Lombardia	**C45**	Milano
Milan Malpensa	MXP	**IT**	**C4**	Lombardia	**C42**	Como
Naples	NAP	**IT**	**F3**	Campania	**F33**	Napoli
Venice Marco Polo	VCE	**IT**	**D3**	Veneto	**D35**	Venezia
Luxembourg	LUX	**LU**	**0**	Luxembourg (Grand-Duché)	**00**	Luxembourg (Grand-Duché)
Amsterdam Schiphol	AMS	**NL**	**3**	WEST-NEDERLAND	**310**	Utrecht
		NL			**324**	Agglomeratie Haarlem
		NL			**325**	Zaanstreek
		NL			**326**	Groot-Amsterdam
		NL			**327**	Het Gooi en Vechtstreek
		NL			**331**	Agglomeratie Leiden en Bollenstreek
Lisbon	LIS	**PT**	**17**	Lisboa	**171**	Grande Lisboa
Stockholm Arlanda	ARN	**SE**	**01**	Stockholm	**010**	Stockholms län
		SE	**02**	Östra Mellansverige	**021**	Uppsala län
Gothenburg	GOT	**SE**	**0A**	Västsverige	**0A2**	Västra Götalands län
London Gatwick	LGW	**UK**	**I**	LONDON	**I22**	Outer London - South
		UK	**J**	SOUTH EAST	**J2**	Surrey, East and West Sussex
London Heathrow	LHR	**UK**	**I**	LONDON	**I11**	Inner London - West
		UK			**I23**	Outer London - West and North West
		UK	**J**	SOUTH EAST	**J11**	Berkshire
London Stansted	STN	**UK**	**I**	LONDON	**I21**	Outer London - East and North East
		UK	**H**	EAST OF ENGLAND	**H23**	Hertfordshire
		UK			**H33**	Essex CC
Manchester	MAN	**UK**	**D**	NORTH WEST	**D3**	Greater Manchester
		UK			**D2**	Cheshire
East Midlands	EMA	**UK**	**F**	EAST MIDLANDS	**F1**	Derbyshire and Nottinghamshire
		UK			**F2**	Leicestershire, Rutland and Northamptonshire
Birmingham International	BHX	**UK**	**G**	WEST MIDLANDS	**G3**	West Midlands
Glasgow Abbotsinch	GLA	**UK**	**M**	SCOTLAND	**M3**	South Western Scotland
Edinburgh	EDI	**UK**	**M**	SCOTLAND	**M2**	Eastern Scotland
Luton	LTN	**UK**	**H**	EAST OF ENGLAND	**H2**	Bedfordshire and Hertfordshire
Geneva	GVA	**FR**	**71**	Rhône-Alpes	**718**	Savoie
		FR			**711**	Ain
		CH	**1**	Région lémanique	**13**	Genève
		CH			**11**	Vaud
Basel/Mulhouse Euroairport	BSL	**FR**	**42**	Alsace	**422**	Haut-Rhin
		FR	**43**	Franche-Comté	**434**	Territoire de Belfort
		CH	**3**	Nordwestschweiz	**31**	Basel-Stadt
		CH			**32**	Basel-Landschaft
		CH	**2**	Espace Mittelland	**23**	Solothurn
Zurich	ZRH	**CH**	**4**	Zürich	**4**	Zürich