EUROCONTROL Trends in Air Traffic | Volume 5

Dependent on the Dark: Cargo and other Night Flights in European Airspace

EUROCONTROL

Acknowledgements

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Many thanks to Tony Leggat of CODA, for having gone through the freighters fleet with a fine-tooth comb, and thereby helping significantly in improving the STATFOR new segment market breakdown.

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Thanks also go to the team from Helios Technology, for their in-depth investigation of the topics; and to all the stakeholders who gave their time to answer our questions.

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Dependent on the Dark: Cargo and other Night Flights in European Airspace

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Foreword

EUROCONTROL, through its Statistics and Forecast Service (STATFOR), provides a range of air traffic forecasts for Europe. These forecasts allow civil aviation authorities, air navigation service providers, airspace users, airports and others in the industry to have a view of probable future air traffic demand allowing them to better focus and scale the development of their respective businesses in the short-, medium- and long-term.

In developing these growth forecasts an in-depth study is made into the state of the industry and of current trends using EUROCONTROL's unique historical database of flight movements. Recognising that these background studies could themselves be of use to the Industry, we began to make them available: first with twice-yearly reports on the low-cost carriers and then by launching the Trends in Air Traffic series in 2006 with an examination of Business Aviation.

This is the fifth volume of Trends in Air Traffic and it is dedicated to cargo and night operations in European airspace. The initial goal of the report was to better understand cargo operations in European airspace. But, as cargo operations are inextricably linked to night operations; it was decided to combine the two topics within a single report.

Like its predecessors in the Trends in Air Traffic series, this new volume aims to provide accessible and informative insights into how the air traffic industry works. It is based largely on data for 2007. Although 2008 has been a time of change for the air transport industry, the main trends that we observe (the increasing use of the night margins, and the fact that cargo operations are tightly planned) will not go out of date rapidly.

Indeed, an essential companion to the Trends reports is the STATFOR Interactive Dashboard, where monthly updates to the main statistics presented here are available. See Section 25.

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Summary

Informed observations about cargo can not be made without also understanding night operations, and vice versa. In this report, the two topics - **night and cargo** - are addressed at European level. The report begins with **two introductory sections aiming to define more precisely the data and the frame of the analyses**. Then, the first part (Sections 3 to 10) **examines night operations for all market segments** and the second part (Sections 11 to 24) **focuses on cargo operations in general, including specific insights on night operations**.

In summary, the report shows the following:

- The busiest European airports are extensively used both daytime and night-time (when this is permitted). But, there exist typical night airports, such as Köln-Bonn, Liège or East-Midlands, with an average capacity at night of 12 movements per hour for the busiest ones. (Section 3).

- Recently, carriers (especially the traditional and low-cost carriers) have stretched their daytime operations at the 'boundaries' of the night, to become more competitive. The last four hours of the day have seen traffic growing up to 10% in four years. The traffic occurring in the very early morning has also been growing much faster than during the daytime in percentage terms. (Section 4).

- Some airports have concentrated their operations during the night-time and become specialised in night operations, for example Copenhagen/Kastrup or Stockholm/Arlanda (Section 5). Some others are constrained by specific rules on operations at night (more commonly known as curfews). Of the 180 busiest European airports (with more than 50 movements per day in total), 12 % are hardly used at night (Section 7).

- In proportion, there are more medium and long-hauls flights during night-time than during daytime. Essentially this is because segments of traffic accounting for a significant part of short-haul flights (general aviation, military, regional) are underrepresented at night. (Section 6).

- The most significant segment in the night is indisputably all-cargo: nearly half of all-cargo flights take place at night. Also between 2004 and 2007 the market share of low-costs has increased. (Section 8).

- Medium weight aircraft are the most representative of the European fleet, regardless of the period of the day. At night, heavy aircraft account for a more significant share (14 %) than during the day (6 %). (Section 9).

Summary

- Night operators are regularly given direct routings (especially cargo carriers). This would be in complete agreement with flight efficiency issues, but operators are not yet in a position to file these direct routings, which prevents them from optimising their fuel and freight carriage. (Section 10).

- The air cargo segment represents a very small share of total freight moved by other transportation systems. This segment is driven by globalisation and trade and is highly sensitive to economic cycles. Nevertheless, it has strong growth prospects, because there is no other transportation mode with comparable rapidity. (Section 11).

- If the cargo segment remains quiet during the day (40 movements per hour on average), it becomes a very dynamic sector during the night. Between 19:00 and 07:00, cargo traffic is punctuated by waves of arrivals and departures reaching up to 120 movements per hour. (Section 12).

- The daily cargo operations appear to be very tightly planned, even better planned than scheduled traffic. The frequency of the cargo movements during the week depends on the type of freight but is basically regularly organised according to the business working days. (Sections 13 and 14).

- Cargo airports are either the busiest European traffic or cargo carriers' dedicated hubs. Between midnight and 05:00, 82% of the cargo departures are concentrated around 25 European airports. The lack of slots in the day also contributes to increased night cargo operations. (Section 15).

- If the cargo network is organised around a multi-hub system, it also allows point-to-point connections. The ultimate goal for the carriers is to synchronise and forward the cargo deliveries to meet their customers' time delivery requirements. One of the consequences of this is that the network is not specifically balanced directionally. (Section 16).

- Germany is the most dynamic state in terms of cargo operations, handling more than 13 % of European cargo movements. Other big contributors are the countries with highest GDP rates, such as France and the UK but also Benelux, that host the operations of significant cargo carriers. (Section 17).

- Most significant contributors outside Europe are the North-America and Middle-East regions, but the picture might be somewhat distorted as Europe is a convenient stop-over for refuelling cargo flights travelling between America and Asia. Cargo flights coming from or going outside Europe tend to be scheduled at anytime of the day (regardless of specific hours). (Sections 18 and 19).

- Cargo journeys at night are relatively short within Europe compared to overall night flights (50% of the cargo flights at night travel less than 690 km). (Section 20).

- Cargo aviation has about 130 operators in Europe; but it remains difficult to get precise numbers for the cargo carriers as they are not individual airlines. Cargo operators are a mix of pure freighters, combination carriers, joint ventures between companies etc. Nevertheless, European cargo traffic is dominated by a few major carriers (four) and their market shares (in terms of flights) are, of course, more important at night. (Section 21).

- The European cargo fleet is quite old compared to the passenger fleet: 50% of the cargo freighters are older than 23 years old (compared to 20 years old for the passenger fleet). This is explained by the high proportion of old Soviet era freighters belonging to ex-USSR states and also by the fact that 30% of European cargo aircraft are converted passenger airplanes. (Section 22).

- Cargo aircraft are mainly jet aircraft belonging to both the medium and heavy weight categories. The market is dominated by Boeing, which has a broad variety of freighters (from small jets to large freighters). During deep night, only five aircraft types account for more than 50% of the cargo movements. There is also the highest proportion of small jets and turboprops during this phase. (Section 23).

- Cargo operations are rarely subject to delays compared to other segments (only 8% of the cargo flights are delayed for Air Traffic Flow and Capacity Management (ATFCM) reasons). During deep night, as congestion problems are less significant, this proportion decreases to 1.2%. (Section 24).

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1. Introduction

Cargo and night operations are inextricably linked. So when it came to taking a first statistical look at them, it made sense to tackle them together. Air traffic has been responding in recent months to the changing economic conditions; but regularly updated statistics are available[2].

Each year the working day gets longer. Airport capacity is increasingly scarce during the day, and aircraft operators are under pressure to get the most out of each of their aircraft. So the working day is continually stretched to find runway slots, to recover from accumulated delay or to schedule that one extra aircraft rotation that will make the difference between red or black in the financial accounts.

Or at least, that is the situation for most scheduled and charter operators, who prefer the day because their passengers prefer the day. At the same time, there is a group of operators whose focus has always been the night hours. There has been an overnight postal service in many European States for a number of years, even if the type of mail being delivered has changed with time. Increasingly this operation has a night-time companion: the service economy and manufacturing industry alike both rely on next-day delivery of equipment, parts, supplies and goods to the consumer. That means someone has to carry the goods from A to B between close of business one day and start of business the next.

As a result, cargo and night operations are inextricably linked and it was clear that we should investigate them in parallel. Nevertheless our results have been grouped:

- The first segment of this report addresses **night operations in general, in comparison to day, and placing cargo operations in comparison with other types of operation**.

- The second segment looks at **cargo operations in more detail**.

In a previous airport *Trends study*[3], we noted that the subject was too large for a single document to cover entirely. Similarly for the present study, the analysis of night and cargo operations could fill an extremely large report. So here we have simply laid the foundations.

This is not the last word. We have described the situation in 2007, but 2008 has seen traffic adapt rapidly to new economic conditions, not the least of which is the sharp peak in oil prices. Regular updates on traffic – using the market segment classifications from this report - are available through the STATFOR website[2].

We hope that the statistical insights on cargo and night operations in Europe that we present here are a useful starting point, whether your perspective is one of planning, operations or, as in our case, forecasting.

2 *www.eurocontrol.int/statfor.*
3 *A Place to Stand: Airports in the European Air Network, EUROCONTROL Trends in Air Traffic* Volume 3, September 2007.

2. Some definitions

Two overlapping phases of the night are investigated: 'night' defined as 23:00-06:59, and 'deep night' defined as 00:00-04:59. Cargo flights are identified through combinations of carrier name, aircraft type and call sign.

In each of fourteen hours on an average day in 2007, European airports between them handled 2,500 – 3,500 arrivals and departures (Figure 1). But for this study we are more interested in what happens during the rest of the day: how is traffic different from daytime? What can be learned for daytime operations by looking at how the night works?

For the purposes of this study we have identified two, overlapping `phases` of the night (see Figure 2):

- Deep night includes the hours which, across Europe as a whole, each account for less than 2.5% of daily arrivals and departures. These are from 00:00 to 04:59.

- Night includes the 'deep night' hours, and extends to include three more hours when there are significantly more arrivals than departures, or vice versa. These are 23:00-23:59 and 05:00-06:59.

Occasionally, we will also refer to other phases:

- Night margin which are these three hours differentiating the night and deep night periods.

- Whole day being the 24 hour period which includes day and night, from 00:00 to 23:59.

In all four cases, when referring to arrival or departure time, we always refer to local time, rather than UTC.

The term 'cargo' can be defined in different ways (see the Glossary in Annex J). In this report, we will consider cargo to be composed of freight and mail, excluding stores and baggage.

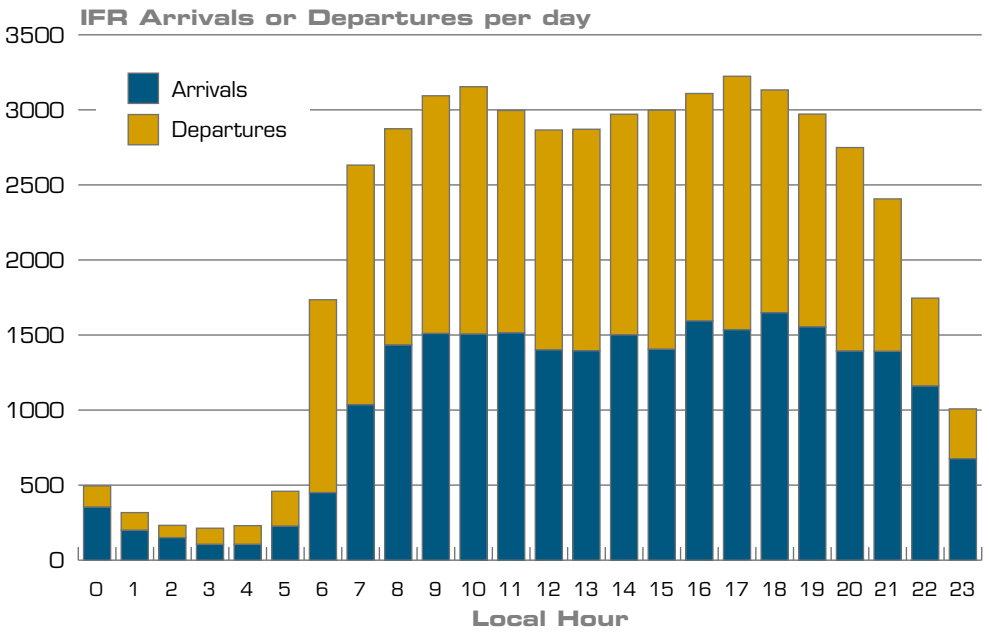


Figure 1. For most of the day, the hour-to-hour variation in traffic is quite small.

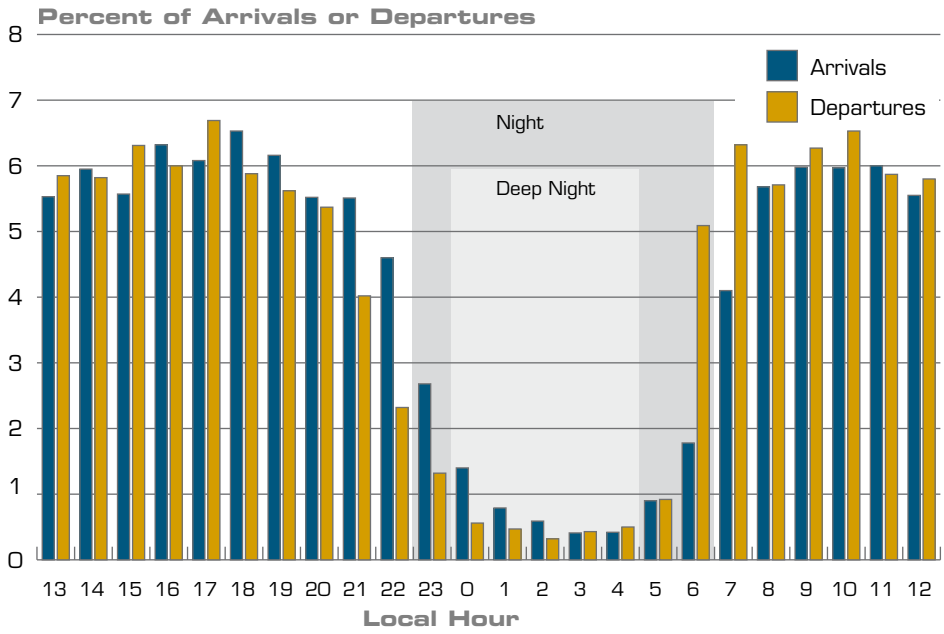


Figure 2. The 'deep night' and 'night' periods overlap.

2. Some definitions

Operationally speaking, there are basically two main types of cargo:

- General Freight[4] (85% of the international cargo traffic in terms of revenue tonne kilometres (RTK)[5]), which includes all-freight services, combined services (same aircraft used for both passengers and freight transport) as well as charter and wet-lease services (ACMI). General freight is an air shipment consisting of mostly larger commodities, using more traditional airport-to-airport services. The expected delivery time is typically measured in days. So for general freight, night flights are no more critical to the business than day flights.

- Express and Mail (15% of the international cargo traffic in terms of RTK[5]), Express includes integrators which control and manage the entire shipment from door-to-door. The expected delivery time is expressed in hours. Mail is either shipped in the belly-hold of passenger aircraft or via airlines that have a contract or ownership link to the integrator or postal service provider. For express and mail freight, night flight is intrinsic parameter of the business.

These two types of cargo are, in fact, increasingly overlapping. The distinction between time-critical and time-definite products blurs with the increasing interest of general freighters in providing additional ground or handling services in support of their air transport segment and of the integrators in carrying a broader range of general freight.

For information, low-cost carriers do not typically do cargo.

Our analysis is based on comprehensive records of all IFR flight plans for Europe. Each IFR flight is classified within one unique market segment amongst traditional, non-scheduled, all-cargo, business aviation, low-cost, military or other. As part of the study, the definition of 'all-cargo' has been refined and the flights all re-classified. This changed the previously published[6] market segment breakdown and the updated proportions of market segment breakdown can be found in Annex A. In brief, all-cargo increased from 2% to 3.2% of flights.

[4] Also called *"Heavy Freight"*.
[5] Boeing World Air Cargo Forecast 2006-2007, The Boeing Company 2006.
[6] See Figure 4, EUROCONTROL Medium-Term Forecast, Flight Movements 2008-2014, Volume 1.

There is no practical way to identify all of the cargo flights in this data; but we have selected a method that we believe to be sufficient for our statistical purposes. For our study we have classified each flight as cargo for one of the following reasons:

- It is by an all-cargo operator;
- It is by another operator, but by an aircraft type which is always all-cargo;
- It is by an aircraft type which for particular operators is a cargo type;
- It uses a call sign which particular operators assign to their cargo flights.

Note that these rules do not catch the majority of combination and quick-change aircraft and do not cover belly-hold cargo. Though it is widely recognised that a major proportion of general freight, global and European mail air cargo is transported in the bellies of passenger aircraft on scheduled services, *pure freight*[7] only will be considered for the analyses provided in this report, unless otherwise stated. Indeed, in our flight plan data there is no possibility to track freight carried in aircraft belly-holds. Global estimates[8] for 2003 were that 50% of cargo was flown in the bellies of passenger aircraft. We understand that high value express freight is less often carried in belly-holds and, therefore, the statistics here should include a large proportion of this type of freight.

Finally, Brussels/National airport is mentioned very often throughout the report because DHL was operating its main European hub from there until November 2007. The traffic pattern for Brussels/National (and also for Belgium) has changed significantly from 2008 with DHL's decision to move its main European hub to Leipzig.

[7] '*Pure freight*' refers to freight carried on dedicated freighter aircraft as opposed to freight carried in the holds of passenger aircraft.
[8] Dora Kay, *It's Time to Set Air Cargo Free*, The International Cargo Association, TIACA Times 2003.

3. Main airports of the night

The characteristic differences in traffic patterns between day and night are highlighted by Köln-Bonn, which is the busiest airport of the deep night, and yet not in the top 30 for the day.

One clear illustration of the difference between traffic patterns during the night and the day is that the top 10 airports are very different. Köln-Bonn airport is the busiest airport in Europe in the deep night (Figure 3). Indeed it has more than twice Frankfurt/Main's traffic at that time of day. However, outside the deep night, Köln-Bonn is not even in the top 30 for IFR flights.

Of the busiest countries, the main airports (Paris/CDG, Frankfurt/Main, Madrid/Barajas, Amsterdam/Schiphol etc.) are present in both lists. Outside the deep night, Heathrow is in the top three but during the deep night, it doesn't even appear in the European top 70. Athens, Istanbul and Antalya are not present in the day rankings, and yet appear in the top 10 of the deep night. Section 7 gives more on curfews and closures at airports such as London/Heathrow.

Figure 4 shows some of these differences in map form. During the day, there are six busy airports in the middle longitudes of Europe (from Rome/Fiumicino to Copenhagen/Kastrup) out of the top 15 airports. At night, between Frankfurt and Rome there are none. With this in mind, the establishment of Leipzig as a freight hub for DHL appears to be filling a gap.

	Deep Night (24 - 05)				Not Deep Night			
	Airport	Airport Name	Mvts per Day[9]	Mvts (%)	Airport	Airport Name	Mvts per Day	Mvts (%)
1	EDDK	KÖLN-BONN	61.6	4.14	LFPG	PARIS CH DE GAULLE	1454.4	2.97
2	LFPG	PARIS CH DE GAULLE	58.9	3.96	EDDF	FRANKFURT MAIN	1322.2	2.70
3	LEMD	MADRID BARAJAS	45.0	3.02	EGLL	LONDON/HEATHROW	1314.1	2.68
4	EBBR	BRUSSELS NATIONAL	44.3	2.98	LEMD	MADRID BARAJAS	1278.7	2.61
5	EBLG	LIÈGE/LIÈGE	44.0	2.96	EHAM	SCHIPHOL AMSTERDAM	1201.3	2.45
6	LGAV	ATHINAI E. VENIZELOS	38.0	2.55	EDDM	MÜNCHEN 2	1170.1	2.39
7	LTBA	ISTANBUL-ATATURK	36.4	2.45	LEBL	BARCELONA	930.9	1.90
8	LEBL	BARCELONA	34.7	2.33	LIRF	ROME FIUMICINO	894.0	1.82
9	EGNX	EAST MIDLANDS	31.5	2.12	LOWW	WIEN SCHWECHAT	748.9	1.53
10	LTAI	ANTALYA	29.4	1.97	LIMC	MILANO MALPENSA	721.1	1.47
11	EHAM	SCHIPHOL AMSTERDAM	28.9	1.95	EGKK	LONDON/GATWICK	709.3	1.45
12	EDDF	FRANKFURT MAIN	25.6	1.72	LSZH	ZURICH	698.5	1.43
13	LIRF	ROME FIUMICINO	23.3	1.57	EKCH	COPENHAGEN KASTRUP	693.4	1.42
14	EGKK	LONDON/GATWICK	22.3	1.50	EBBR	BRUSSELS NATIONAL	659.8	1.35
15	LEPA	PALMA DE MALLORCA	21.7	1.46	LFPO	PARIS ORLY	649.6	1.33
Other	-	-	941.3	63.31	-	-	34552	70.52
Total	-	-	1486.9	100.00	-	-	48998	100.00

Figure 3. Athens and Istanbul appear in the top 10 of deep night airports.

[9] i.e. in each 00:00-04:59 slice of each calendar day

The difference in airport ranking between night and day is less strong than the difference between deep night and day (see Figure 5). This is because the traffic in the night margins dominates the limited traffic in the deep night hours, and the first and last hours are more like normal day operations. The main difference from full day operations is that arrivals and departures are strongly mis-matched in the margins of the night, but this does not affect the ranking. More data about the hourly distribution of arrivals and departures is given in Annex B.

Figure 4. The main deep night airports are more to the edges of Europe than their daytime equivalents. (Deep night airports in **bold** and left-aligned).

	Night (23 - 07)				Not Night			
	Airport	Airport Name	Mvts per Day	Mvts (%)	Airport	Airport Name	Mvts per Day	Mvts (%)
1	LFPG	PARIS CH DE GAULLE	151.9	3.24	LFPG	PARIS CH DE GAULLE	1361.3	2.97
2	EDDF	FRANKFURT MAIN	124.1	2.65	EGLL	LONDON/HEATHROW	1236.7	2.70
3	LEMD	MADRID BARAJAS	122.2	2.61	EDDF	FRANKFURT MAIN	1223.7	2.67
4	LTBA	ISTANBUL-ATATURK	113.6	2.42	LEMD	MADRID BARAJAS	1201.4	2.62
5	EDDK	KÖLN-BONN	103.4	2.21	EHAM	SCHIPHOL AMSTERDAM	1137.5	2.48
6	LEBL	BARCELONA	98.6	2.10	EDDM	MÜNCHEN 2	1108.8	2.42
7	LGAV	ATHINAI E. VENIZELOS	95.1	2.03	LIRF	ROME FIUMICINO	867.1	1.89
8	EBBR	BRUSSELS NATIONAL	94.8	2.02	LEBL	BARCELONA	867.0	1.89
9	EHAM	SCHIPHOL AMSTERDAM	92.7	1.98	LOWW	WIEN SCHWECHAT	702.3	1.53
10	EGKK	LONDON/GATWICK	86.8	1.85	LIMC	MILANO MALPENSA	691.6	1.51
11	EGLL	LONDON/HEATHROW	82.9	1.77	LSZH	ZURICH	669.7	1.46
12	EGSS	LONDON/STANSTED	81.9	1.75	EKCH	COPENHAGEN KASTRUP	664.8	1.45
13	EIDW	DUBLIN	67.3	1.44	EGKK	LONDON/GATWICK	644.7	1.41
14	EDDM	MÜNCHEN 2	65.4	1.39	LFPO	PARIS ORLY	632.5	1.38
15	EBLG	LIÈGE/LIÈGE	61.0	1.30	EBBR	BRUSSELS NATIONAL	609.4	1.33
Other	-	-	3247.8	69.25	-	-	32177	70.26
Total	-	-	4689.7	100.00	-	-	45795	100.00

Figure 5. Between day and night, airport ranking is not so different.

4. Growing in the dark

Traffic at the 'boundaries' of the night is growing much faster than daytime in percentage terms. Indeed, the growth in traffic between 2004 and 2007 is more important at the margins of the classical busiest daylight hours (07:00-19:00) than during any other period of the day. This means that some carriers have extended their daytime operations (earlier start and later finish). Indeed, in terms of new flights, the last four hours of the day contributed more than 20% of all new flights. In contrast to traditional and charter operators, low-cost and business aviation growth have been significant operators in the deep night period between 2004 and 2007.

Over the last four years, growth during the busiest daylight hours (07:00-19:00) has typically been between 3% and 5% in annual terms (Figure 6). In contrast, during the last hours of the day (20:00-24:00) and in the early morning (05:00-06:00), the growth rates are between 5% and 10%.

As section 2 showed, the volume of traffic is lower not only at night but also during the few hours before and after the night. So, at first sight it is not surprising that the growth rates at these periods are faster. However, Figure 6 also shows the figures for additional movements. The hours 20:00-22:00 added nearly as many new flights as did any three hour periods in the middle of the day. In fact, over the whole year 22% of all new flights took place in the four hours between 20:00 and 24:00. In the same way, there were as many additional movements at 06:00 as at 08:00.

Figure 6 shows that parallel dips in growth happen at 07:00 and at 19:00. As stated in the Planning for Delays *Trends study*[10], most airlines plan departures from 06:00 (local time) in order to get the most out of their crew productivity (Crew Rest Regulation). As a consequence, at 07:00, there is a lack of resources which creates a trough of traffic. At 19:00, the reason is somewhat different: all aircraft are generally at the airport on the ground between two rotations. 19:00 is the end of the evening rush but not the end of the operational day as explained in the previous paragraph.

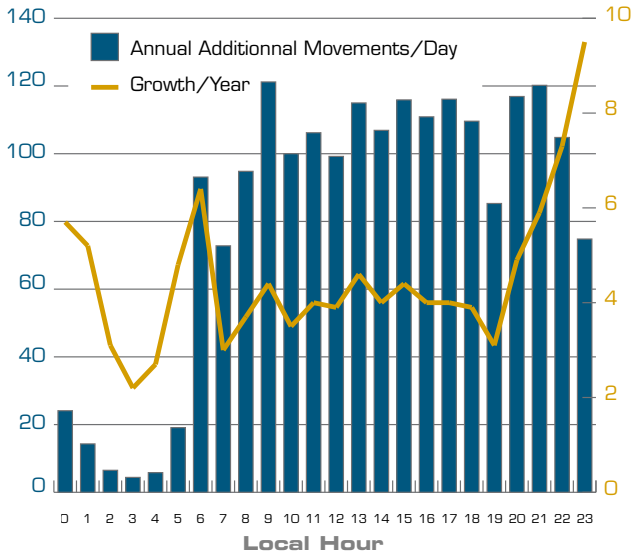


Figure 6. Growth in percentage terms is concentrated in the night hours 19:00-07:00. Even in terms of additional traffic the hours 20:00-22:00 are bringing almost as many flights as during the three busiest hours in the day.

[10] *Planning for Delays*, Eurocontrol Trends in Air Traffic Volume 6, February 2009

Figure 7 shows the same data, but this time separated into different market segments (see Figure 60 Annex B). It is already well documented that low-cost and business aviation have been contributing most of the net new flights in recent years[11]. Figure 7 shows that for many hours of the day – particularly corresponding to scheduling peaks - traditional scheduled traffic has decreased. But the matching increase of low-cost (partly through growth and partly through re-labelling of existing flights) is more evenly spread during the day – showing how the pressure for maximum use of aircraft leads to a more uniform distribution of traffic.

Where flights by traditional scheduled carriers have been strongly increasing is between 21:00 – 00:00. At least two factors are contributing to this:

- The pressure on traditional carriers to reduce costs means that they are looking to fly additional rotations[12], which means extending their operational day.

- Rotational (knock-on) delays have been increasing[13], so the last hours of the day are increasingly required for catching up and ensuring aircraft are well positioned for the following day's schedule.

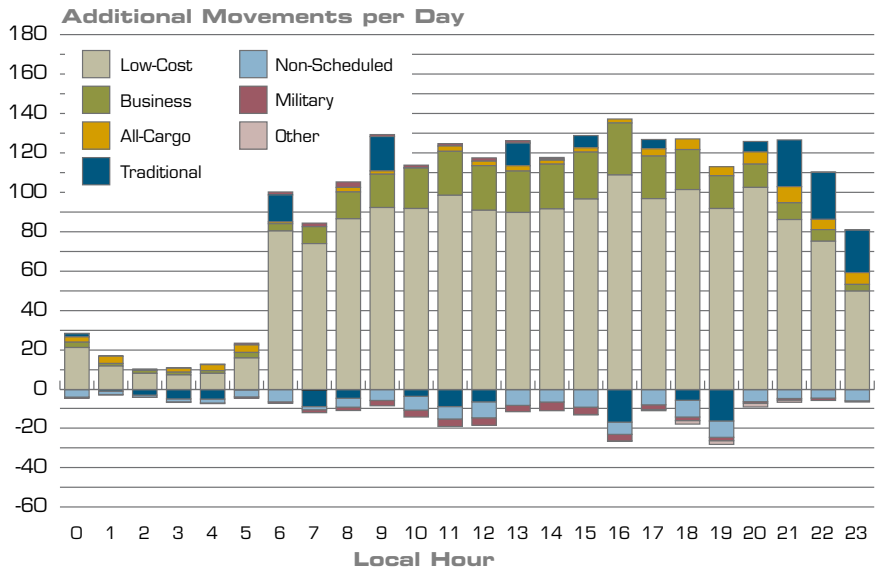


Figure 7. Traditional scheduled traffic is growing mostly in the last hours before the night.

[11] For example see *More to the Point: Business Aviation in Europe in 2007*, Eurocontrol Trends in Air Traffic Volume 4, May 2008.
[12] See for example: *End of free lunch? The responses of traditional European Airlines to the low-cost carrier threat,* 2007, Nigel Dennis, Journal of Air Transport Management 13, 313-321.
[13] CODA Delay Digest March 2008. *www.eurocontrol.int/coda*

5. Specialising in the night

The average effects of strong growth in the late evening and early hours conceals two separate trends: airports that have been growing during the day, but their traffic has been in decline in the deep night hours; and the opposite, for those that are increasingly specialising in the night.

Previous sections have discussed the difference between night and day growth and the differences between night and day airports. Here we combine the two aspects and explore how some airports are, in effect, increasingly specialising in the night.

Figure 8 shows growth at airports between 2004 and 2007. For example on the right-hand side, flights from Istanbul/ Sabiha-Gokcen (LTFJ) have grown by 25% outside deep night, and about 48% during the deep night. Figure 8 highlights three groups of large airports where different trends are happening:

- In **group 1** are a few airports that are growing – some slowly, some faster – at night, but have less traffic during the day in 2007 than in 2004. Figure 9 (left) shows the detail of this for Köln-Bonn (EDDK) which has an unusual pattern of peak traffic and where growth during the day has been mixed, but is stronger at night.

- **Group 2** has a number of large airports which have grown moderately during the day, and even more slowly at night. In fact, many of them now have less night traffic. It is not unusual for airports to negotiate agreements with local stakeholders which involve trading off reduced night flights for increased day time flights, if that matches the airport's business model.

- The final **group**, **3**, has grown during both night and day. In percentage terms, these airports have grown more strongly at night. Figure 10 shows that, in the case of Helsinki (EFHK), most new flights are during the day and the percentage at night is high only because the initial values are small.

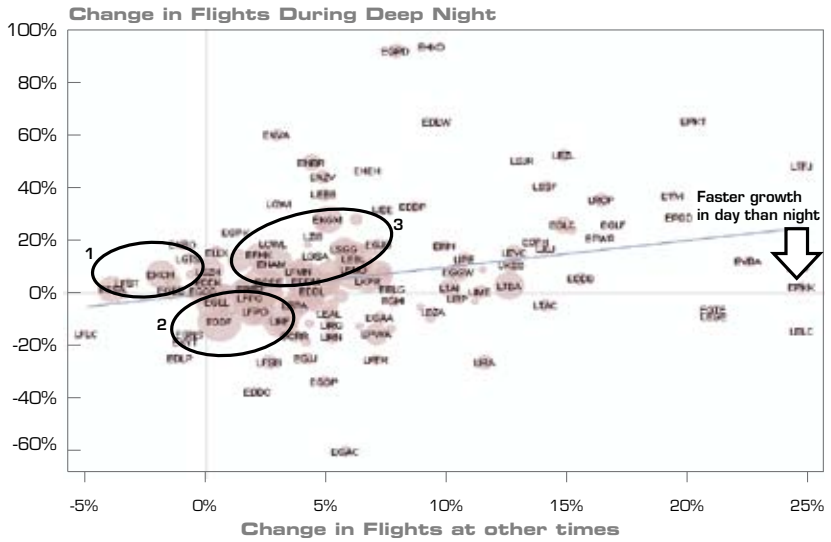
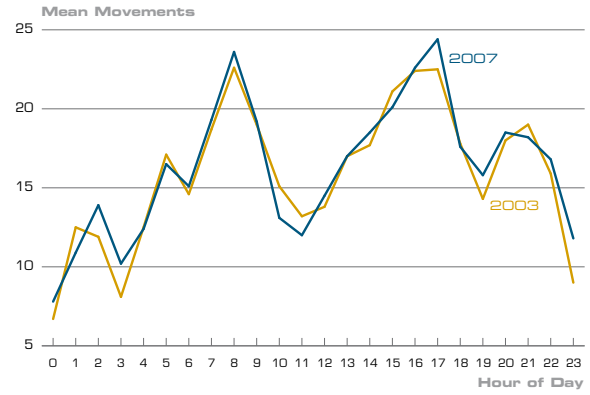


Figure 8. Comparison of growth in deep night and growth at other times. (Size of the circle indicates amount of traffic; some labels are omitted for clarity).



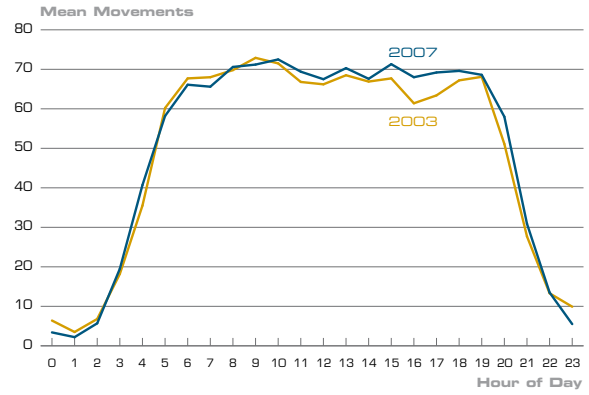
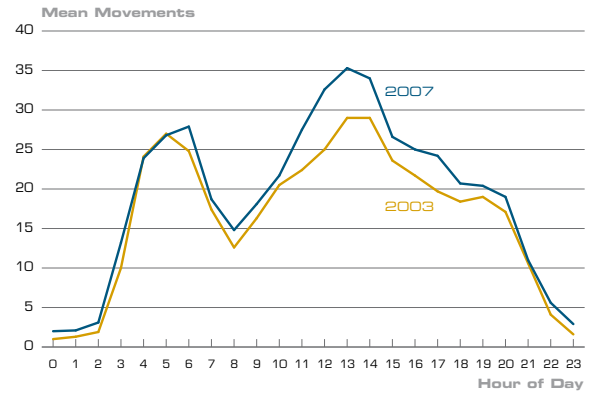


Figure 9. Köln-Bonn (EDDK, left) has an unusual pattern of traffic peaks. Frankfurt/Main (EDDF, right) has a traditional night-day pattern with slightly reduced night traffic.



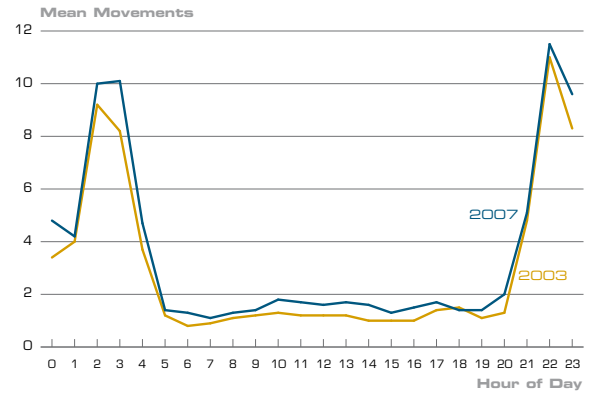


Figure 10. Helsinki (EFHK, left) grew mostly by adding to existing traffic peaks. Liège (EBLG, right), mainly focused on all-cargo operations, has a completely inverted pattern compared to the average.

6. Deep night connects continents

Night flights are almost as much concerned with connecting continents as connecting cities within Europe; whereas only 13% of departures during the day are over 2000km, around 30% of deep night departures cover that distance.

During the day (05:00-24:00), the distances flown by departures from European airports are predominantly short-haul (Figure 12): nearly 80% of flights are under 1500km. The most common distance overall is around 500km, though the peak is broad: about 30% of flights overall are in the 300-600km range and half of flights are under 700km. Longer-range departures, over 2000km, amount to only 13% of flights.

During deep night (Figure 13) there is a clear shift to longer-haul: short-haul departures are still in the majority, but with only about 60% of the total. Even though the numbers of long-haul flights are few, they increase as a proportion because the number of short flights is lower. The proportion of longer-range departures, over 2000km, is nearly 30%.

The decline at the shortest distances is principally because many of these short routes are served by regional and other traditional scheduled flights. At night there are fewer of these services. At the same time, military and general aviation are also less present in the night time traffic mix. Since these two segments have a large proportion of short flights the overall proportion of short flights is reduced.

As has been observed in other sections, the difference between night (23:00-07:00) and day is much less marked than between deep night and day (Figure 11). This is for a combination of reasons:

- The night margins have more flights than deep night so dominate the night statistics;
- The night margin flights are not so different to day flights, the main difference being the imbalance between arrivals and departures.

	Departures (000s)	Median Flown Distance (km)	Mean Flown Distance (km)
Deep Night			
Deep Night (24 - 05)	210	1067	1696
Not Deep Night	9,004	726	1210
Night			
Night (23 - 07)	885	795	1309
Not Night	8,329	722	1211
All	9,214	730	1221

Figure 11. In deep night 50% of flights are more than 1060km compared to 730km in the day (2007).

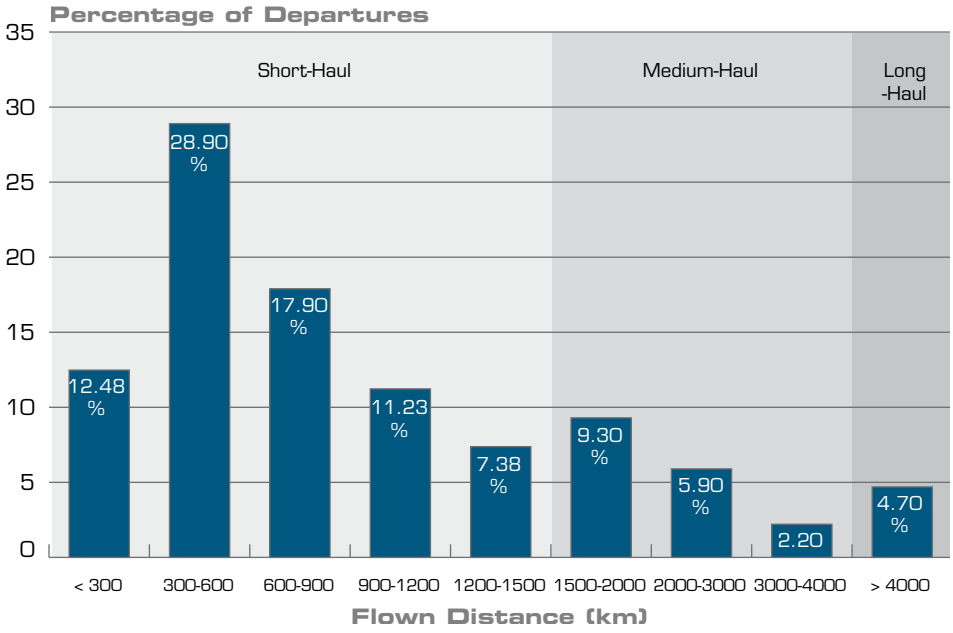


Figure 12.
During the day (05:00-24:00) flights are most commonly 300-600km, then decrease with distance (2007).

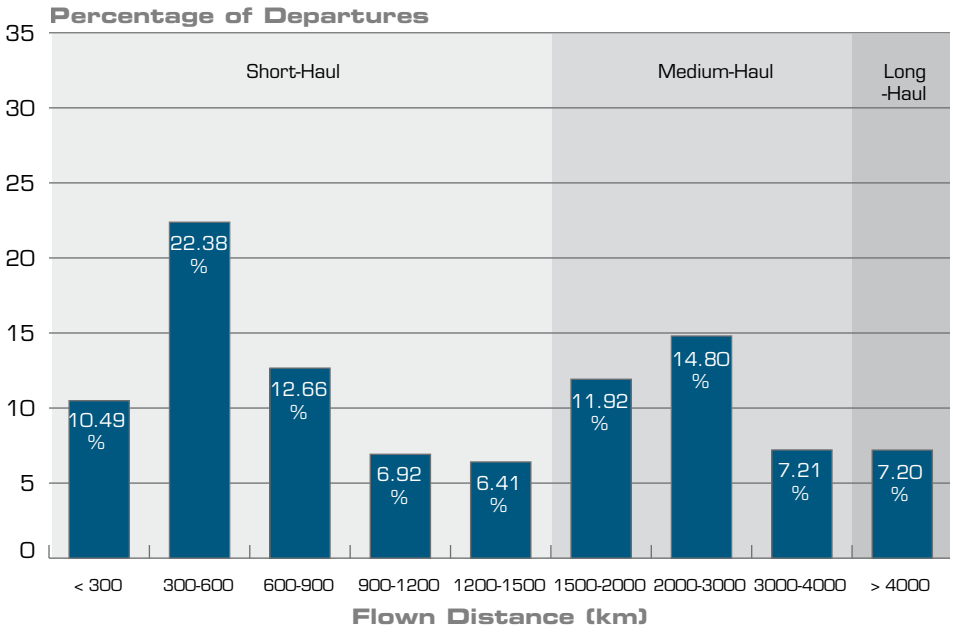


Figure 13.
In deep night (24:00-05:00) medium-haul flights are much more common (2007).

7. Curfews and closures

With or without curfews, many mid-size airports have no flights for 10-25% of the hours of the year; a dozen of these airports are quiet for a third or more of the time. Nearly one in six of the largest European airports have no traffic in the deep night for most of the year.

The patterns of curfews are many and variable: they include operating hour restrictions and charging regimes to deter out-of-hours flights, but there are often exceptions (for force majeure, local carriers, state flights, a limited number of flights/year) and so on. Summaries are available on-line[14]. Rather than try to repeat and classify such summaries, we focus here on the impact of these operating-hour limitations on traffic.

Figure 14 shows, for the busiest airports of 2007, both their busiest hour in the year and the fraction of hours where there was no recorded traffic. It is immediately noticeable that the bulk of these airports, with peak hourly flights under 30 during the year, can be quiet for 10-20% of the hours of the year, and in several cases for up to a third of the day. This lack of flights isn't always attributable to a curfew, for example Faro (LPFR) has a curfew 00:00-05:00 (21%), so the remaining 10% of unused hours is due to lack of demand. At the extremes we have:

- London/City (EGLC) and Stockholm/Bromma (ESSB) which have strict curfews and are both close to city centres.

- East Midlands (EGNX) and Tenerife/Sur (GCTS) which do not have curfews (except for certain classes of flight) and operate nearly all hours of the year.

Of the larger airports, Paris/Orly (LFPO) has a curfew for turbo-jet aircraft for about six hours per day, hence the 25% unused hours. The overall annual limit on traffic at Orly does not appear to affect the hours with traffic. Zurich (LSZH) has complex traffic rules but the overall effect is, again, nearly 25% of hours are unused.

Of the biggest airports London/Heathrow (EGLL) and Munich (EDDM) both have 14% of hours unused, corresponding to a mix of quota, curfew and aircraft type limitations.

Of the 180 or so European airports with more than 50 movements/day in total, 21 have on average less than one flight per day during the deep night, so they are to all intents and purposes closed, either for curfew reasons or because of their patterns of demand. These airports are shown in Figure 15.

[14] Full list of restrictions found on Boeing website: *http://www.boeing.com/commercial/noise/listcountry.html* (viewed 10/7/08)

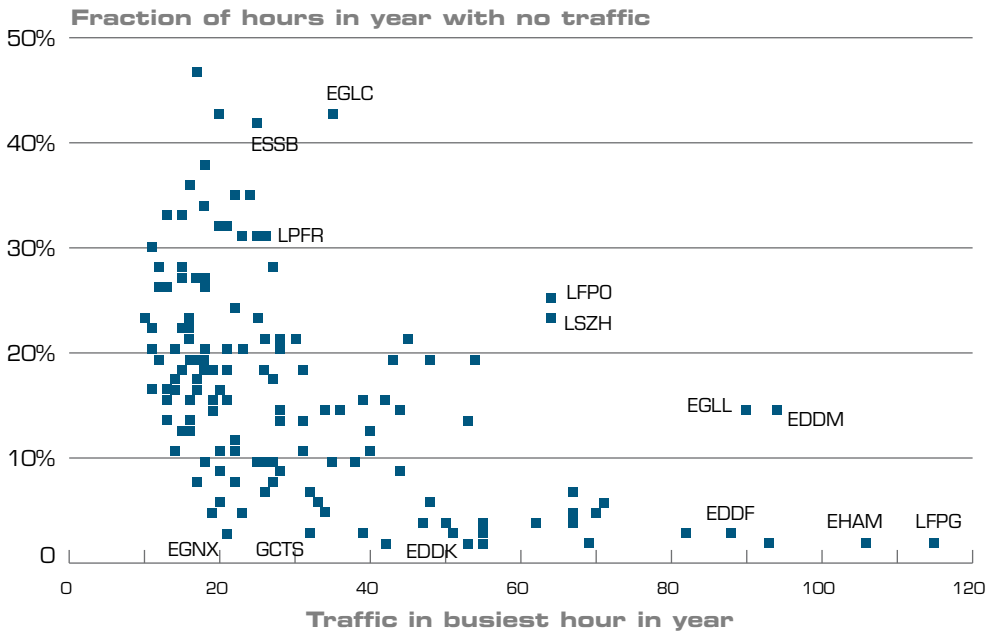


Figure 14.
For airports peaking at less than 30 movements/hour it is common to have no traffic at all for a third of the day.

Figure 15.
Dark in the dark night. 21 airports in the top 180 have less than one flight in the dark night on average. (**Bold** airports are those with 100+ flights/day).

8. Cargo, charter, low-cost

Out of all the market segments, the night is most important to cargo. More than 40% of cargo flights take place during the night and in the small hours of the morning all-cargo is the biggest market segment.

The night is most important to all-cargo flights. Out of all of the different market segments the highest proportion of its flights occurs at night: 24% in the deep night and 42% during the night (Figure 16). Only non-scheduled traffic comes close to this, with 17% of these flights during the night. Later sections will explore cargo in more detail and discuss the reasons for cargo's dependence on the dark.

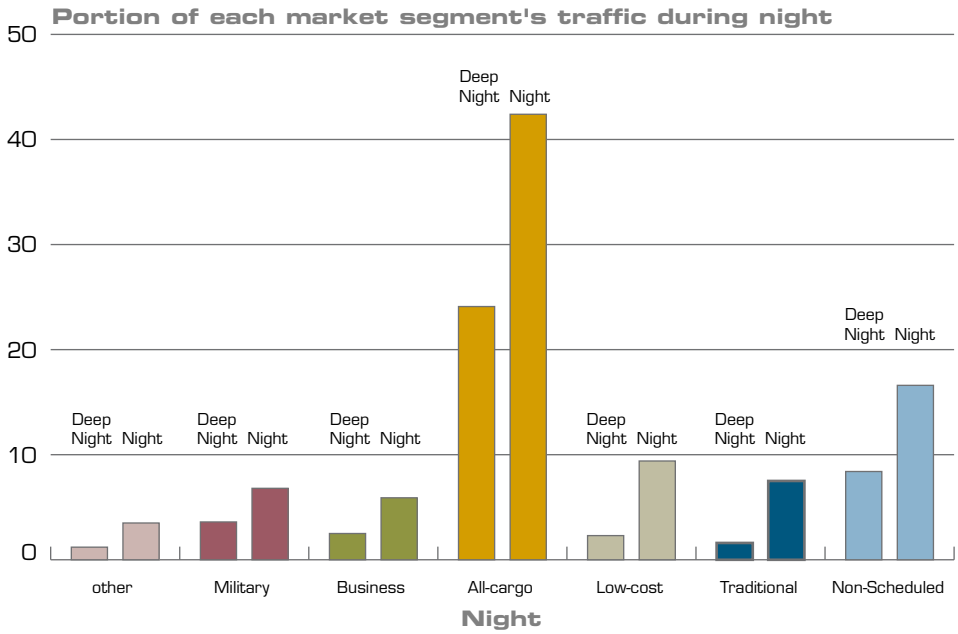


Figure 16. More than 40% of all-cargo flights take place in the night.

More details of this are shown in Figure 17. If traffic were uniformly distributed during the day, then each hour would have 4% of the traffic. In fact, for traditional, low-cost and non-scheduled market segments, each daylight hour has 5-6% of the traffic, and the deep night less than 1%. All-cargo follows the opposite pattern: its peak hours are 21:00-23:00 and even the hours of deep night have 4-6% of the flights. To compensate for this the day-time hours have only half of the expected traffic. In fact, all-cargo has a late evening and early morning peak, with a dip at 01:00-02:00 corresponding to the gaps between arrival and departure waves (more about this is discussed in Section 12).

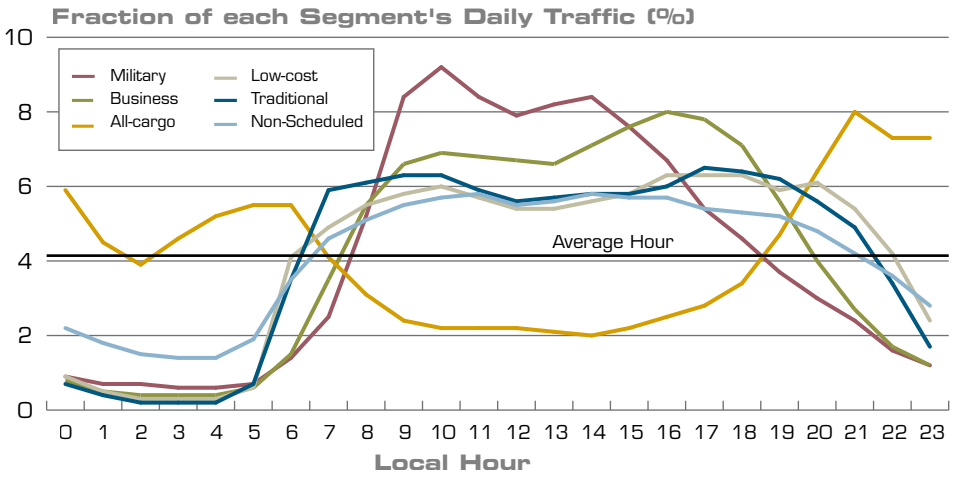


Figure 17. All-cargo's peak hours are 21:00-24:00.

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8. Cargo, charter, low-cost

The use of the dark hours is different for the different market segments:

- For traditional (and other carriers) the last hours of the day are the chance to catch up on the accumulated delays[15], in order to start with aircraft in the right place the next day.

- For low-cost, non-scheduled and increasingly for traditional carriers, the pressure to improve efficiency means using as much of the day as possible (e.g. see footnote 12)

- For all-cargo, the night is when the resources are available, and when customers need over-night shipments to be made. This is truer for intra-Europe than intercontinental traffic (see section 19).

In terms of total movements, non-scheduled and all-cargo carriers have much larger market share at night than during the day: around 17% and 26% respectively in the deep night in 2007. This is illustrated in Figure 18 which omits the 'traditional' carrier segment that would make each column up to 100%, but clearly has a much lower market share at night. On the other hand, the low-cost carriers' market share is only slightly lower in the deep night.

Figure 18 also shows how the market shares of traditional and charter (non-scheduled) carriers during the night have actually decreased between 2004 and 2007. Low-cost carriers have grown more quickly at this time of day. Regardless of the phase, the market share of all-cargo carriers remained stable between the two periods. The underlying data are provided in Annex B.

[15] These delays are called reactionary delays. They are quantified each month in the CODA Delay Digests (see *www.eurocontrol.int/coda*).

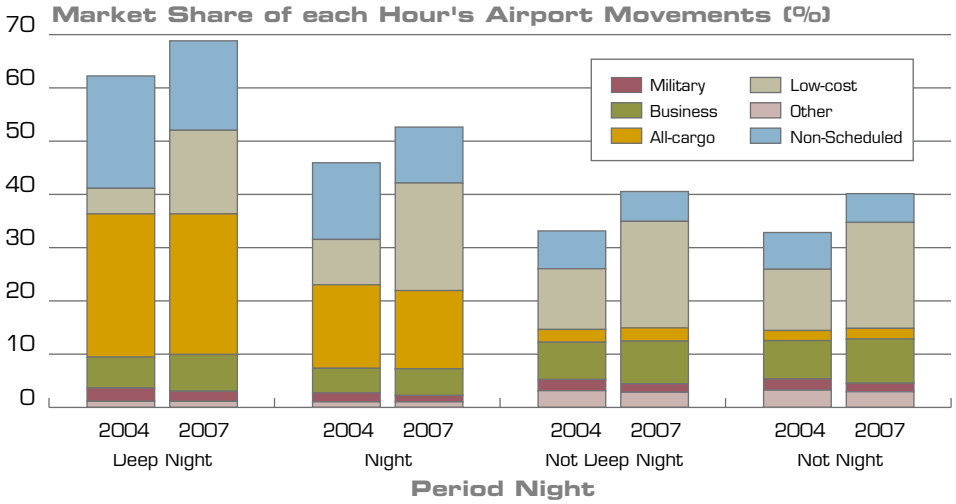

Figure 18. All-cargo, low-cost and non-scheduled make up more than 50% of traffic in the deep night.
(Traditional scheduled, if included, would make each column up to 100%.)

Figure 19 provides more detail on the data in Figure 17, which shows that, for a brief two-hour period in the deep night, all-cargo is the biggest market segment.

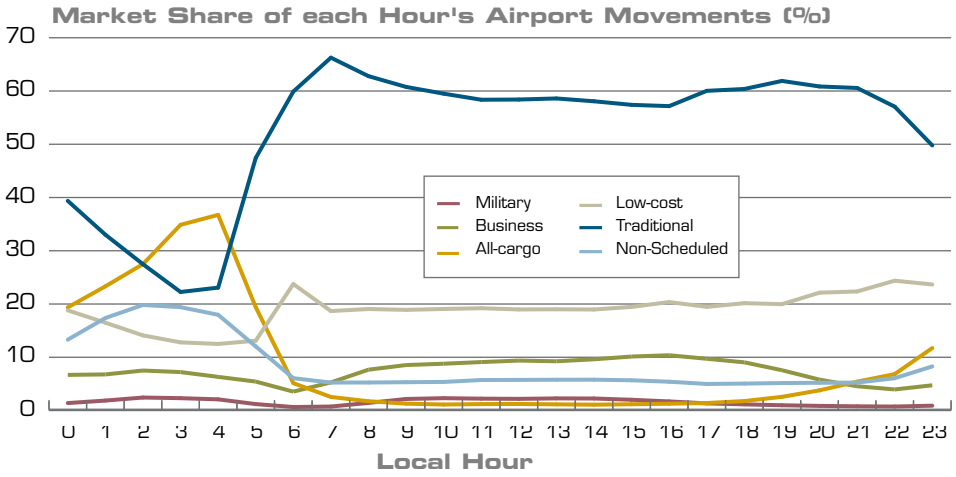

Figure 19. Between 03:00 and 05:00, all-cargo is the biggest generator of airport movements (2007).

9. Fewer heavies than before

Medium weight aircraft fly the vast majority of flights, whether by day or by night. At night, heavy aircraft are much more evenly represented, though their share of night flights is slightly smaller than four years ago.

Figure 20 shows the share of flights of each wake turbulence category (WTC) of aircraft. The 'wake turbulence category' is a way to categorise weight of aircraft and is used principally to determine how far apart aircraft should be as they land, to avoid the wake turbulence of a preceding aircraft. The predominance of 'medium' WTC aircraft was observed in the earlier airports study[16], which noted that 55% of aircraft registered in Europe in 2006 were 'medium' weight but they generated a far larger proportion of flights.

In 2004, the heavy aircraft flew 15% of flights in the deep night, as opposed to just 6.6% in the day. In fact this is close to the proportion of freighter airframes in the European fleet. The significant number of all-cargo flights is the main cause for this, with large freighters forming a significant portion of the cargo fleet (see section 23).

In 2007, there were still far more heavy flights during the day than the night. Both day and night market shares of heavy aircraft had declined, but the distinction between day and night was also less strong. The increasing market share of low-costs (discussed earlier in section 8) is behind these differences. For example, the growth of low-cost is illustrated by the growing market share for the Boeing 737-800 (Figure 21) which grew from 8.9% to 10% share of deep night flights between 2004 and 2007, while the actual number of flights by the main heavy, the Airbus A-300B2/4, declined.

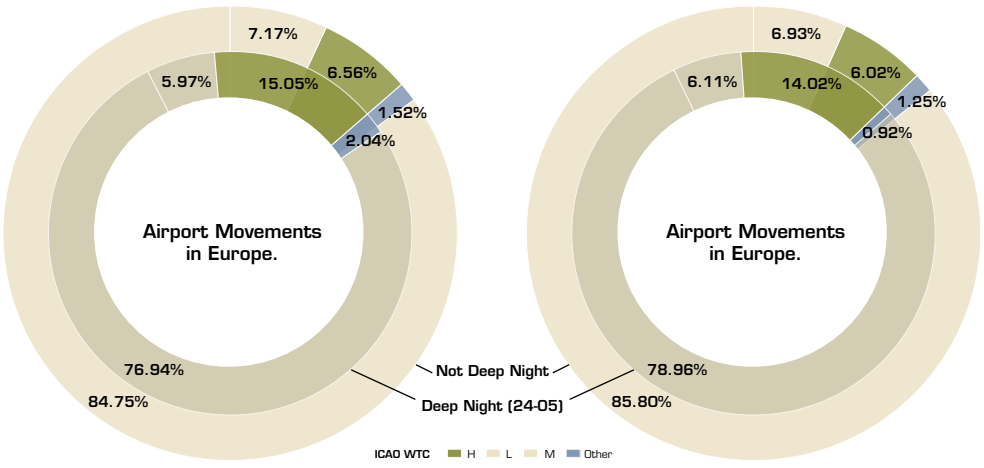

Figure 20.
In 2004, heavy aircraft had twice their day-time market share during deep night. This difference is maintained in 2007.
(left: 2004, right: 2007)

[16] *A Place to Stand: Airports in the European Air Network*, Eurocontrol Trends in Air Traffic Volume 3, September 2007 (Section 12).

	Deep Night (24 - 05)					Not Deep Night				
	Aircraft	Name	WTC	Mvts per Day	Mvts (%)	Aircraft	Name	WTC	Mvts per Day	Mvts (%)
1	A320	AIRBUS A-320	M	164.1	11.04	A320	AIRBUS A-320	M	5093.1	10.39
2	B738	BOEING 737-800	M	149.3	10.04	B738	BOEING 737-800	M	4080.2	8.33
3	B752	BOEING 757-200	M	117.8	7.92	A319	AIRBUS A-319	M	3818.2	7.79
4	B733	BOEING 737-300	M	104.7	7.04	B733	BOEING 737-300	M	2168.9	4.43
5	B734	BOEING 737-400	M	67.2	4.52	A321	AIRBUS A-321	M	1681.5	3.43
6	A321	AIRBUS A-321	M	66.3	4.46	B734	BOEING 737-400	M	1447.5	2.95
7	A319	AIRBUS A-319	M	59.0	3.97	MD82	BOEING MD-82	M	1443.9	2.95
8	A30B	AIRBUS A-300B2/4	H	44.1	2.97	AT72	ATR-72	M	1398.6	2.85
9	ATP	BRITISH AEROSPACE AT	M	30.4	2.04	B735	BOEING 737-500	M	1331.6	2.72
10	B737	BOEING 737-700	M	29.6	1.99	B737	BOEING 737-700	M	1320.5	2.69
11	MD82	BOEING MD-82	M	29.5	1.98	CRJ2	RJ-200 REGIONAL JET	M	1302.9	2.66
12	C208	CARAVAN I	L	29.5	1.98	E145	EMBRAER EMB-145	M	1149.1	2.35
13	AT72	ATR-72	M	26.5	1.78	F100	FOKKER 100	M	975.7	1.99
14	B763	BOEING 767-300	H	25.2	1.70	B752	BOEING 757-200	M	884.1	1.80
15	B462	BAE-146-200	M	25.1	1.69	DH8D	DHC-8-400 DASH 8	M	838.3	1.71
Other	-	-	-	518.5	34.87	-	-	-	20064	40.95
Total	-	-	-	1486.9	100.00	-	-	-	48998	100.00

	Night (23 - 07)					Not Night				
	Aircraft	Name	WTC	Mvts per Day	Mvts (%)	Aircraft	Name	WTC	Mvts per Day	Mvts (%)
1	B738	BOEING 737-800	M	531.3	11.33	A320	AIRBUS A-320	M	4750.7	10.37
2	A320	AIRBUS A-320	M	506.6	10.80	B738	BOEING 737-800	M	3698.1	8.08
3	B733	BOEING 737-300	M	269.4	5.75	A319	AIRBUS A-319	M	3610.8	7.88
4	A319	AIRBUS A-319	M	266.5	5.68	B733	BOEING 737-300	M	2004.2	4.38
5	B752	BOEING 757-200	M	229.6	4.90	A321	AIRBUS A-321	M	1567.7	3.42
6	B734	BOEING 737-400	M	189.0	4.03	MD82	BOEING MD-82	M	1355.4	2.96
7	A321	AIRBUS A-321	M	180.1	3.84	B734	BOEING 737-400	M	1325.7	2.89
8	B737	BOEING 737-700	M	122.9	2.62	AT72	ATR-72	M	1317.0	2.88
9	MD82	BOEING MD-82	M	118.0	2.52	B735	BOEING 737-500	M	1264.5	2.76
10	AT72	ATR-72	M	108.1	2.30	CRJ2	RJ-200 REGIONAL JET	M	1252.0	2.73
11	B735	BOEING 737-500	M	88.3	1.88	B737	BOEING 737-700	M	1227.1	2.68
12	B744	747-400,INTL.WINGLET	H	82.0	1.75	E145	EMBRAER EMB-145	M	1105.5	2.41
13	A30B	AIRBUS A-300B2/4	H	71.2	1.52	F100	FOKKER 100	M	926.3	2.02
14	B763	BOEING 767-300	H	66.0	1.41	DH8D	DHC-8-400 DASH 8	M	807.4	1.76
15	B462	BAE-146-200	M	62.2	1.33	B752	BOEING 757-200	M	772.3	1.69
Other	-	-	-	1798.5	38.35	-	-	-	18810	41.07
Total	-	-	-	4689.7	100.00	-	-	-	45795	100.00

Figure 21. Main aircraft types, by time of day.

10. Flying, but not planning, direct

In the quiet airspace of the night, operators report that they regularly are given direct routings once airborne that they are not able to file in their flight plans. This means that they save fuel by flying shorter distances, but must always take off carrying enough fuel for the filed distance. If they carry this unneeded fuel every flight, this itself wastes both fuel and payload: in particular, less cargo can be carried on each flight.

To investigate these regular, but tardy shortcuts, we have compared two route lengths:

- The length of the route in the last flight plan filed before departure. It is to satisfy this flight plan that the fuel is loaded.

- The length of the actual route flown once airborne. This takes into account any direct routings agreed between pilot and air traffic control once they are in radio contact.

The 'shortcut' is measured by how much shorter the flown route is than the filed one.

In fact, for the majority of flights there is no difference at all in length: regardless of time of day, or market segment (cargo, scheduled etc.) more than half of all flights have no shortcut. The sole exception is low-cost carriers with an average 0.4% saving in deep night (See Figure 22).

However, a sizeable minority of flights do get shortcuts. The total saving from shortcuts is nearly 300,000 km per day out of a total of over 12 million km flown. In deep night, 25% of flights get shortcuts of 2% or more and 10% of flights get shortcuts of more than 6%. The total saving for all deep night flights is nearly 16,000 km of flight each night. At all times of the day, 10% of flights are given shortcuts that save more than 3% of their planned distance.

Flown Shorter by (%) by local departure time	Other		Military		Business		All-Cargo		Low-Cost		Traditional		Non-Scheduled		All		
	Median	Q3	Median	Q3	Median	Q3	Median	Q3	Median	Q3	Median	Q3	Median	Q3	Median	Q3	P90
Not Night	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.9%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	3.0%
Night (23-07)	0.0%	0.2%	0.0%	0.4%	0.0%	0.2%	0.0%	3.1%	0.0%	1.3%	0.0%	0.0%	0.0%	0.9%	0.0%	0.8%	4.6%
Not Deep Night	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.9%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	3.1%
Deep Night (24 - 05)	0.0%	1.0%	0.0%	0.7%	0.0%	0.5%	0.0%	4.3%	0.4%	2.2%	0.0%	0.8%	0.0%	1.2%	0.0%	2.0%	6.7%
All	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.9%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	3.2%

Figure 22. Summary of shortcuts.

So flying direct adds up to a lot of saved kilometres, even if it is for the minority of flights. To gain the additional weight savings, the second step is to identify when and where the savings are regular. Figure 23 shows the top 20 all-cargo airport pairs which are most regularly given direct routings during deep night. Typically, the highest regular savings from Köln-Bonn (EDDK) to Paris/CDG (LFPG) during deep night represent a median value of 12% of the filed distance.

Recent increases in fuel price during 2008 have focused attention on flight efficiency, and some of the possible savings identified here have already been delivered. During the night, operators have adapted their filed flight plans, given more availability of conditional routes (CDRs) or direct routings.

Figure 23.
Typical all-cargo regular savings during deep night are to be found between main cargo hubs like Köln-Bonn (EDDK) to Paris/CDG (LFPG), Köln-Bonn (EDDK) to Bergamo (LIME), Brussels (EBBR) to East-Midlands (EGNX) or Toulouse (LFBO) to Paris/CDG (LFPG).
(Heavier lines indicate most regular savings.)

11. Air cargo: small share but high value

Air cargo is typically more sensitive to economic growth than is passenger traffic. Globalisation and trade have led to faster growth in cargo flights than total flights in the last four years. If the volume of cargo transported by air is the smallest share compared to other transportation modes, the value of the products transported is generally high.

In the decade from 1997 to 2007, worldwide air transport of freight increased by 55%[17] in terms of volume, based on increased demand from shippers – manufacturers, retail and consumers – for timely deliveries and on the services that were developed to meet this need.

In Europe, the total cargo traffic per year increased from roughly 257,000 to more than 297,000 flights[18] between 2004 and 2007, which corresponds to an annual average growth rate of 4.9%. The volume of air cargo traffic saw a more rapid increase than the passenger traffic levels (4.2%) over this period.

The biggest aircraft manufacturers project that the global air cargo market will grow at a faster rate than the global air passenger market for the next two decades. Airbus' most recent forecast expects air freight traffic to expand at an annual average rate of 5.8% to 2026 (international and domestic). In comparison, forecast[19] average annual passenger growth is 4.9% over the same period. The cargo market shows strong growth prospects but the long term trend is not linear (rather cyclical).

The demand for air cargo services is strongly driven by economic growth, globalisation and trade. There is a positive correlation between GDP and air freight growth as shown on Figure 24.

Nevertheless, air freight represents a significant proportion of world trade by value but not by weight. It has been estimated[20] by the International Air Cargo Association that goods transported by air account for 35% of non-land international trade but only 6% of the weight.

In 2005, air freight was only 0.06%[21] of the total freight transported in the EU25 (in terms of billion tonne-kilometres). The competition from other transportation modes such as road, sea and rail transport[21] is high, especially for domestic and intra-EU traffic.

Air cargo is a highly competitive market involving different commercial organisations including airports, airlines, freight forwarders, customs brokers, multi-function and logistics/distribution firms. On the one hand, shippers have many options of suppliers to send their products and packages. On the other hand, airlines are prepared to negotiate their rates to manage their yields and make best use of available capacity. Last but not least, criticality of time in air is a crucial element in the transport chain, especially for integrators.

Key characteristics of air cargo are origin and destination (service follows individual trade flows), commodity type, required transit time, shipment size and volume. These characteristics make the sector more difficult

[17] Analyses of the European air transport market, Annual report 2007, DLR.
[18] IFR flights in Europe (Source EUROCONTROL).
[19] See Global Market Forecast: 2007-2026 published by Airbus. Passenger growth is expressed in Revenue Passenger Kilometres (RPK) and Freight growth in Freight Tonne Kilometres (FTK).
[20] John Kasarda et al., *The Impact Of The Air Cargo Industry On The Global Economy*, The International Air Cargo Association, Air Cargo Forum, 2006.
[21] See Panorama of Transport, EUROSTAT statistical books, Edition 2007. In the EU25, road and sea transport accounted for 44% and 39% respectively of the total freight moved in 2005.

to handle than passenger service. Compared to the passenger market, the cargo market has to face different constraints: demand fluctuations are larger, aircraft capacity is more variable, booking times are smaller and the database of clients is more reduced, amongst other considerations.

Total freight and mail on board in the EU27 represented a volume of almost 11.8 millions tonnes[22] in 2007. For the same period, worldwide freight carried was 41 millions tonnes. Figure 25 shows that the distribution between flights and volume transported is very different. Five percent of EU27 freight and mail is carried on national routes in terms of volume, but 23% is domestic in terms of flights. It suggests that domestic freight (national) is mainly carried in small aircraft and also that short-range transportation of heavy freight is carried out by rail and road. Conversely, 79% of freight and mail volume is carried on cross-border routes to non-EU27 countries which represents only 29% in terms of flights. Clearly the extra-EU traffic is transported in larger aircraft.

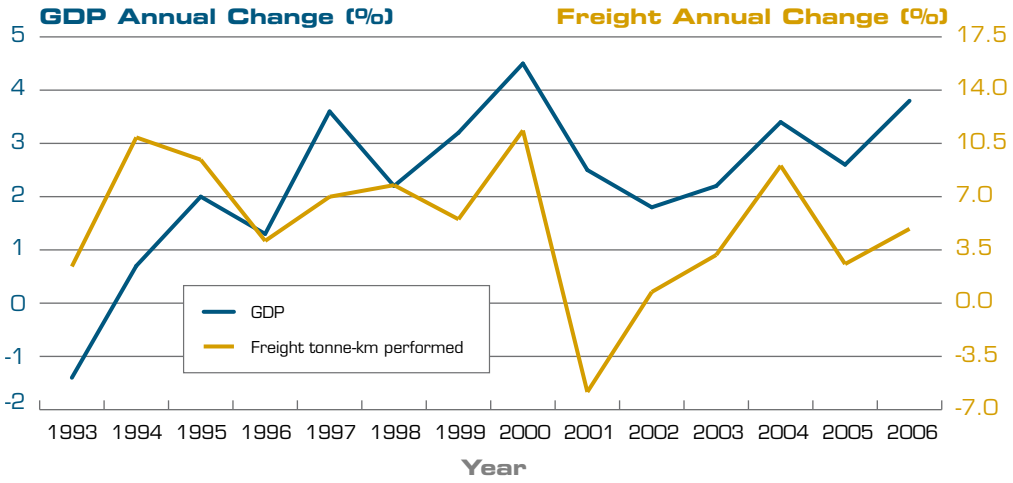

Figure 24. Growth rates of the European economy and European Air Freight. (Source: IMF and ICAO).

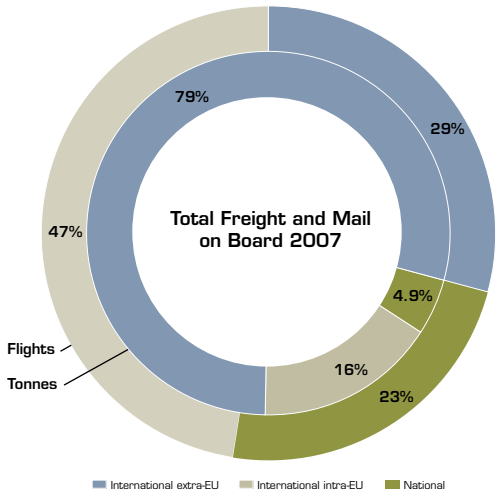

Figure 25. In 2007, freight and mail to outside the EU was 79% in terms of tonnes but only 29% of flights, showing clearly the use of heavier aircraft on long-haul. (Source: EUROSTAT).

[22] From EUROSTAT data.

12. Tightly scheduled, even if not published

The twelve hours between 19:00 and 07:00 are punctuated with a sequence of peaks and troughs in cargo movements. These waves show that cargo operators at night, especially integrators, operate to a tightly-coordinated schedule in a multi-hub network. Although not "scheduled" traffic in the published sense of passenger traffic, this order is essential to the provision of a next day service.

Cargo traffic is quite stable between 09:00 and 18:00, with on average of 40 movements in each hour. A few hours before the night period, from 19:00, this traffic grows into substantial waves of movements.

Figure 26 includes continental and intercontinental movements at all airports, so it is difficult to isolate distinct peak periods (airports alone have clearer interspersed busy and slack periods throughout the night). Nevertheless, the hourly distribution of the European cargo traffic shows several distinct waves of traffic during the night period. For departures, there are basically three peaks. The first and highest peak of departures appears in the evening from 20:00 and lasts for three hours. A second peak is identified between 03:00 and 04:00, during the deep night period. A final, smaller peak of departures shows up between 05:00 and 06:00. Dealing with arrivals, there are two noticeable peaks. The first one appears at 21:00 stretching out until midnight. A second smaller peak is observed between 05:00 and 06:00. These peaks can be explained by the fact that large integrators organise their networks on a hub-and-spoke basis for overnight package delivery. Typically, the delivery of a parcel from an "isolated" point A to another "isolated" point B would be first collected (by road) at the A spoke airport in the late afternoon (17:00), then consolidated at the regional hub in the early evening (arriving at about 21:00) and finally consolidated at the main hub around midnight. The second part of the journey (trip from main hub to point B) would begin just after midnight, stopping at the regional hub in the very early morning (arriving at about 05:00) and distributed to the spoke B (arriving at about 08:00), to get to the destination at the beginning of the "working day".

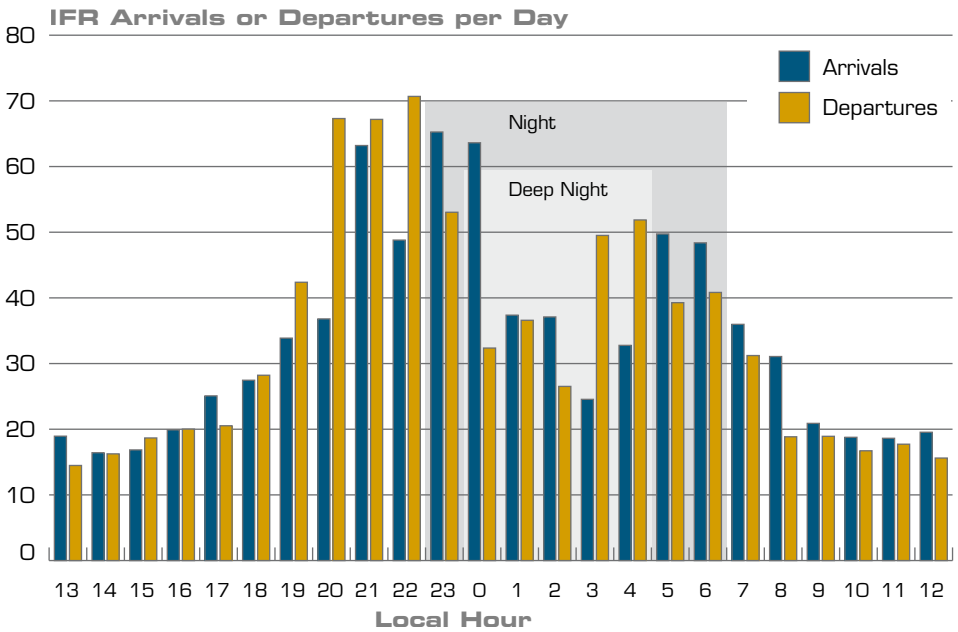

Figure 26.
Cargo traffic has peaks and troughs during the day, purposefully arranged to enable network connectivity.

On top of this continental hub-and-spoke mechanism, intercontinental cargo traffic comes in between these waves (see Figure 41 and Figure 67). Intercontinental all-cargo arrivals as well as departures account for less than six flights on average per hour. The highest proportion of intercontinental departures is found in the early evening (20:00-21:00). Looking at arrivals, peaks can be observed in the early morning (06:00), around noon (12:00-13:00) and from late afternoon (17:00) until late evening (22:00). More information on this can be found in Section 19.

The main impact of multi-hub operations is that the traffic arrives and departs in waves, timed to enable network connectivity. Figure 27 shows there are different types of waves depending on the role of the airport. Airports therefore have interspersed busy and slack periods throughout the night.

- Spokes typically have two waves, departing in the evening/early night and arriving in the early morning;
- Consolidation hubs have four waves of interspersed inbound and outbound traffic;
- Westbound intercontinental hubs have three waves – an inbound wave in early evening (to connect to the outbound intercontinental flight) and an mixed inbound/outbound wave around mid-night to connect the intercontinental inbound traffic to the continental network as well as an inbound wave in the early morning corresponding to local spoke traffic;
- Main hubs have two waves, one arriving very late at night and the other departing in the very early morning.

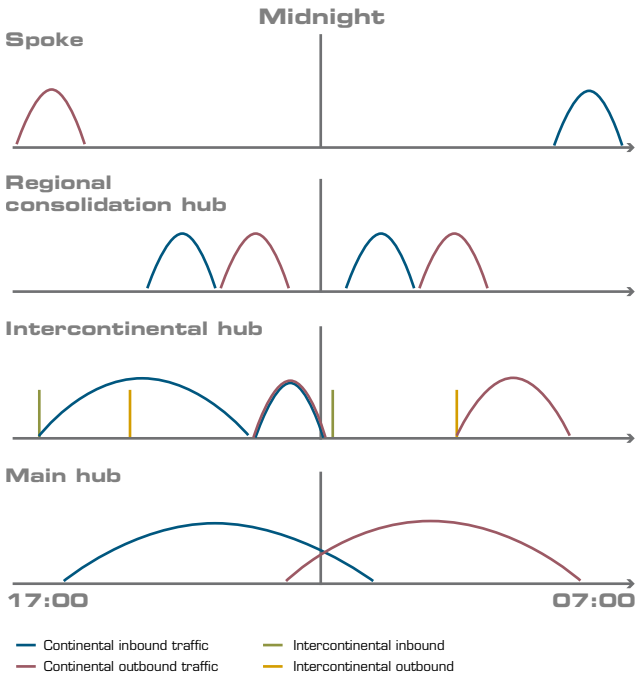

Figure 27.
Airport wave structure in a multi-hub network. The x-axis is centred around midnight (local time). The parabolas represent the quantity of traffic.

13. Few daily peaks for cargo

The daily regularity of all-cargo flights is illustrated in two ways: there are few cargo airports which have significant peaks in cargo traffic; and more than 75% of all-cargo flights occur at the same time, week after week.

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Cargo traffic is relatively routine: transporting freight by air remains expensive, which is why most goods are sent using regular, 'scheduled' cargo flights, be they general freight or express freight and mail. Situations where urgent delivery is needed and an ad hoc flight is organised – the 'business aviation' of cargo – exist, but are quite rare.

Figure 28 illustrates the stability of the cargo traffic. The diagram focuses on airports of the size typically used by cargo operators, with up to 100 cargo or scheduled departures per day (see Annex H in the earlier airports study[23]). Each data point indicates one airport. The cargo airports are mostly on the left-hand side of the graph, highlighting the low levels of cargo traffic compared to the scheduled ones (see section 15).

Figure 28 shows that for cargo, the busiest day is usually no more than 5 or 10 flights busier than the average day in 2007; most airports lie close to the line of average = maximum. For scheduled traffic, the differences are much greater and a busy day for an airport of this size can often have twice the traffic of the average day. Some of this variation is due to the various levels of traffic between week and weekend days, for both cargo traffic and scheduled, but it is clear that cargo has relatively small peaks in daily traffic.

As section 12 discussed, for both traditional and cargo flights (and this is truer for integrators), schedules are very well coordinated in order to ensure synchronisation of transfer flights at hubs. Traditional carriers stick to this organisation during the day. Cargo carriers, especially express and mail carriers, are more focused on these schedules during the night: they need the night to connect to their hubs to ensure next day deliveries.

Ultimately, air cargo operations require documents for custom clearances which have to be prepared in advance by the carriers. As these procedures are important in the planning step, this situation also helps the cargo carriers to plan their operations well.

Another way of showing the relative "stability" of cargo traffic is Figure 29. The proportion of flights repeated (scheduled at the same time) from one weekday to another is above 75% for cargo (90% for scheduled traffic). For business aviation, this regular proportion of repeated flights is less than 5%.

[23] *A Place to Stand: Airports in the European Air Network*, Eurocontrol Trends in Air Traffic Volume 3, September 2007 (Section 12).

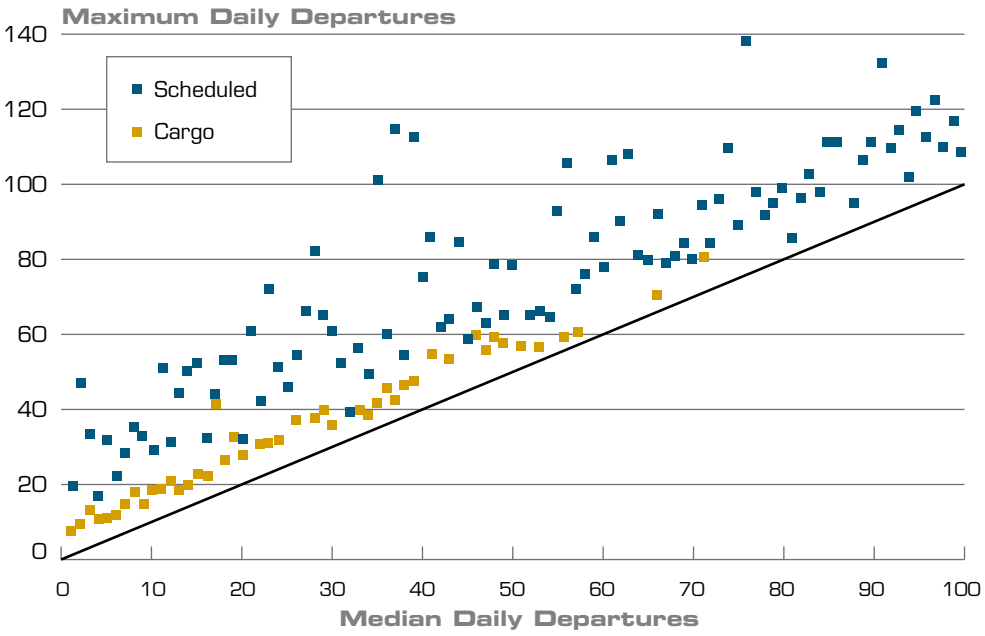


Figure 28.
Cargo rarely generates peaks of traffic: as schedules and required transit times are determined in advance, situations where urgent delivery is needed are quite rare. (Illustrated are airports with up to 100 cargo or scheduled departures per day in 2007).

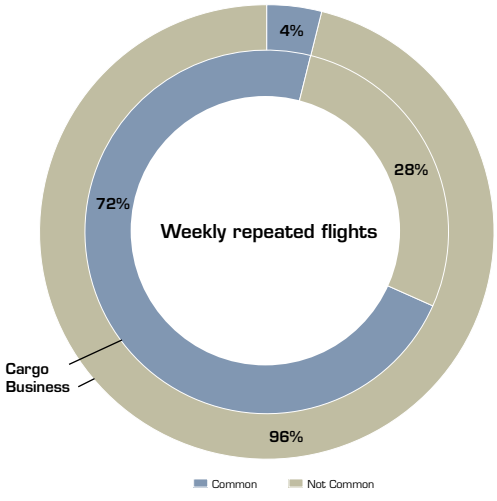


Figure 29.
Repeated[24] flights from one weekday to another. Illustrated is the proportion of common flights between two Thursdays in September 2007 (6th and 13th) for very different market segments: Business Aviation and Cargo.

[24] We considered a "repeated flight" as being a flight with the difference in departure times between the two Thursdays of less than 30 minutes.

14. Weekly variability

Relatively few cargo flows operate seven days a week. The frequency of movements during the week depends on the type of freight. Least urgent deliveries (general freight) are tailor-made and operations are organised depending on airframe schedules, loads and destinations. Most urgent deliveries (express and mail freight) are operated more regularly, especially during business working days. But cargo operations during the weekend (more specifically between Fridays and Mondays) have grown much faster than the rest of the days in percentage terms.

The weekly pattern for cargo is quite different from the pattern for scheduled flights: it is rarely an "every day operation".

When we consider one-directional airport pairs, there are about 15,000 airport pairs for cargo compared to more than 30,000 airport pairs for scheduled flights. The scheduled network has twice as many links as cargo services in 2007.

Figure 30 shows that for cargo traffic, most of these airport pairs are flown less than once a week (note the logarithmic scale). However, there are also plenty of airport pairs flown between once and five times per week, and some with daily or greater frequency. These two distinct frequency patterns are explained by the different priorities of the two types of freight:

- General freight priority is that of cost: commodity shipments are generally not urgent, and carriers operate regular routings between airport pairs which are planned twice a week or less;
- Express and mail freight priority is delivery time: carriers need to have regular routings between their hubs during the business week. The national postal service providers also operate a weekday pattern as their current obligation (from the European Commission[25]) is at least one delivery and collection, five days a week[26].

During the week, Wednesdays and Thursdays are the busiest days, again linked to business weekday activity. The traffic distribution pattern throughout the week did not change significantly in four years: weekdays are at least twice as busy as weekend days.

Between 2004 and 2007, an overall increase in daily movements of 16% (average annual growth rate of 5.3%) was observed, mainly due to the continuous growth of express services in Europe. During the same period, there was a higher than average increase in daily cargo movements from Fridays to Mondays (5.8% growth per day on average) in percentage terms. Indeed, cargo operators increasingly need extra lift on weekends to serve their key points (e.g. to provide second day delivery from Europe to Asia).

© Photo courtesy of Tony Leggat

[25] See Chapter 2 on "Universal Service" of Directive 97/67/EC of the European Parliament and of the Council of 15 December 1997 on common rules for the development of the internal market of Community postal services and the improvement of quality of service. *Official Journal L 015 , 21/01/1998 p. 0014 – 0025.*

[26] For some European countries, delivery and collection might also happen on Saturdays (e.g. France).

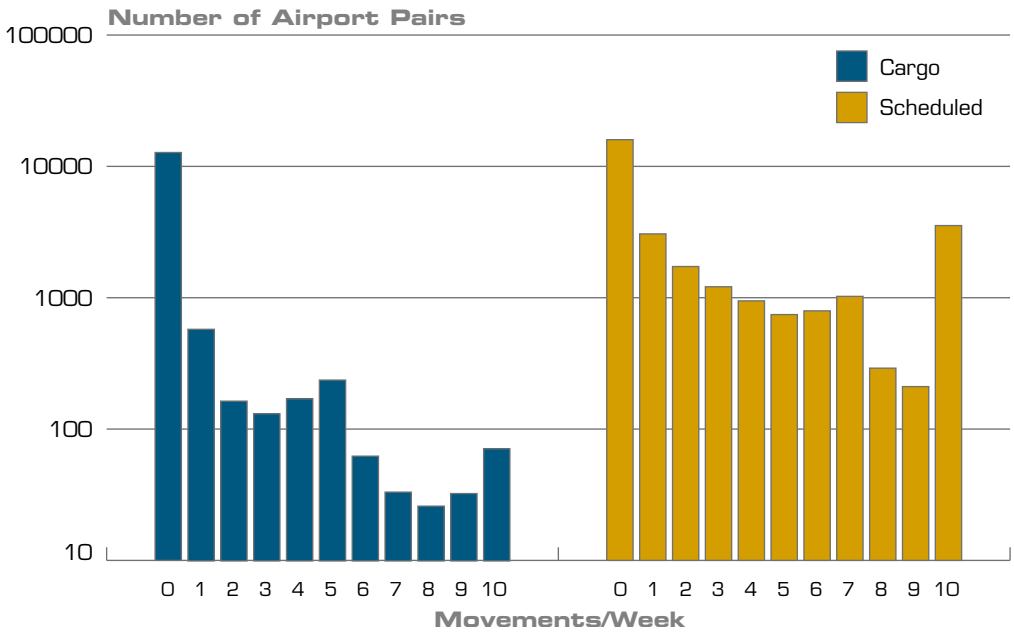


Figure 30. Movements per week per airport pair (represented on a log scale): cargo (left) versus scheduled (right). The proportions of cargo flights accounted for by the 0-5 and 6-10 movements per week categories are respectively 60% and 25%. The remainder (flights with more than 10 movements per week) are not displayed.

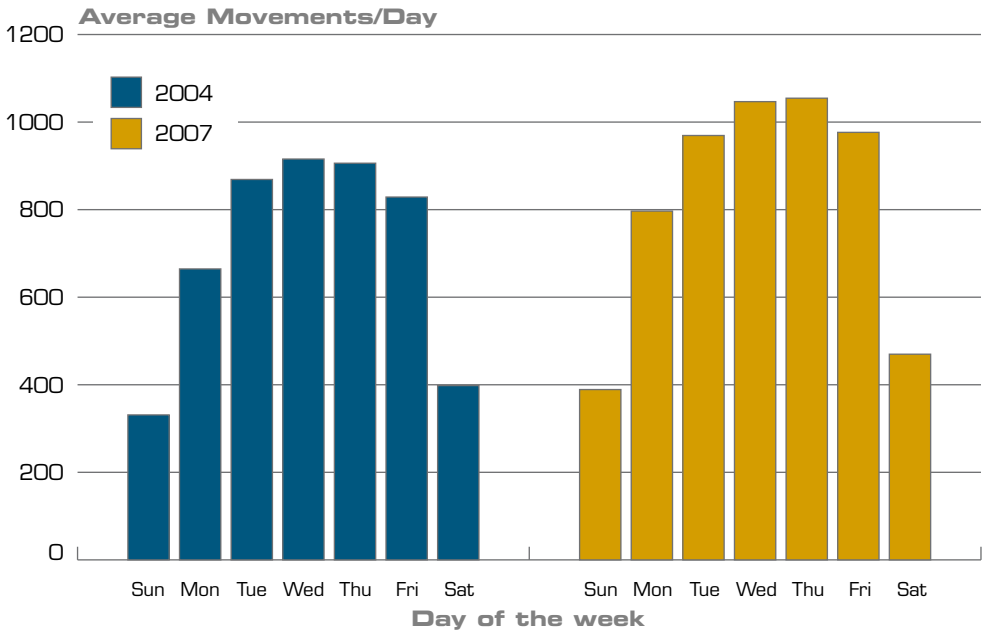


Figure 31. Busiest cargo days are typically modelled on business days (Monday to Friday). Nevertheless, during the last four years, daily growth rates have been faster for days from Fridays to Mondays.

15. Cargo airports: a concentration of hubs

75% of deep night cargo departures are concentrated at 15 European airports. These cargo airports generally belong to two different categories: they can either be the usual busiest European airports (e.g. Paris/CDG, Frankfurt/Main) having, as part of their business, cargo operations; or they can be airports specialised in cargo operations (e.g. Luxembourg, Liège), enjoying the advantage of not being affected by the major airports' capacity constraints.

Concentration of cargo and overall traffic at airports is shown in Figure 32. During the day (left-hand side) the top 100 airports account for 85% of the cargo flight departures and 77% of the overall departures. Cargo traffic is therefore more concentrated than overall traffic. This is even clearer during deep night (right-hand side): the top 25 airports manage over 80% of the cargo traffic whereas they have 60% of the overall traffic.

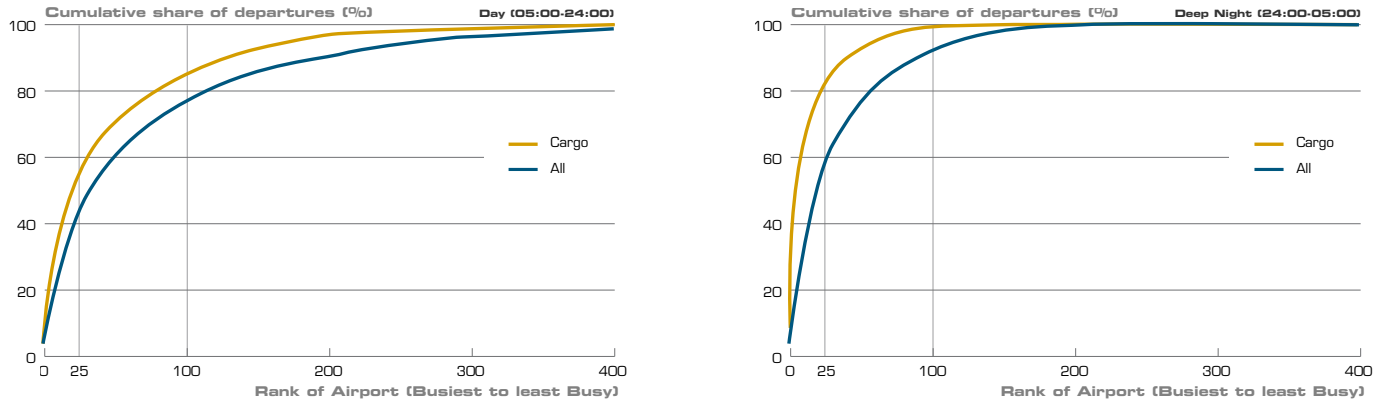


Figure 32. Cargo is a more concentrated market than that of overall traffic, especially during deep night. The top 25 cargo airports have 54% of departures during the day and 82% during deep night, whereas the top 25 airports overall have 42% and 60% of departures respectively.

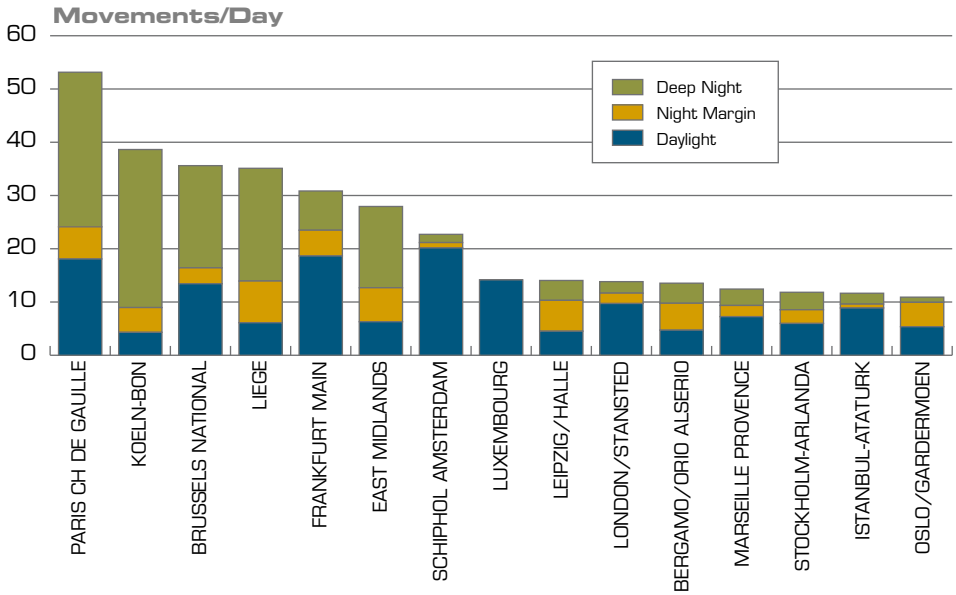
The total volume of freight and mail handled at European airports[27] was 17.5 millions tonnes in 2007. In terms of volume, European cargo traffic is dominated by four airports[28]: Paris/ Charles de Gaulle, Frankfurt/Main, Amsterdam/ Schiphol and London/Heathrow.

At state level, the sum of the loaded and unloaded freight and mail[22] was more than 1 million tonnes in the following five European countries in 2007: Germany (3.4 M), UK (2.4 M), The Netherlands (1.7 M), France (1.7 M) and Belgium (1.2 M). The importance of the main national airports in these countries for freight traffic is reinforced by the fact they ensure a high number of air passenger links. Some freight and mail is transported along with passenger traffic. Our data indicated the picture is somewhat different as belly-hold cargo is not considered.

[27] ACI-Europe Airport Traffic Statistics extracted from *European Airport Traffic Report 2007*, published in July 2008 (www.aci-europe.org).
[28] The corresponding 2005 data (source: ACI) are illustrated on Figure 15 in *A Place to Stand: Airports in the European Air Network*, EUROCONTROL Trends in Air Traffic Volume 3, September 2007.

The top 15 EU airports for cargo departures in 2007 are illustrated in Figure 33. On the bar chart, the movements are distributed according to phases in the day. The percentage indicates the distribution of the movements among these 15 busiest airports[29]. The busiest airports are mostly the freight carriers' hubs (Fedex at Paris/ Charles de Gaulle, European UPS and Intercontinental DHL at Köln-Bonn, DHL at Brussels National[30] and TNT at Liège). Apart from Frankfurt/Main, where there are restrictions in night flying (see Footnote 14), the six busiest cargo airports have most of their operations during night (between 39% for Frankfurt/Main and 89% for Köln-Bonn). London/ Heathrow does not appear in the top 15 even though it was the third busiest airport for flights, because freight carried in belly hold is not included in these statistics.

Figure 33.
Busiest cargo airports mainly use night for their freight operations (Paris/CDG, Köln-Bonn, Brussels/National), except when night restrictions are in place (e.g. Frankfurt/ Main, Amsterdam/Schiphol or London/Stansted) or when the airport is still giving priority to segments of traffic other than cargo (e.g. Amsterdam/Schiphol where cargo segment is 11% in the deep night).



Considering the congestion levels during the day, especially at busy airports like Paris/Charles De Gaulle and Amsterdam/Schiphol, pure freight (both scheduled and non-scheduled) is pushed out of day time operations at such airports and needs to be transported at available times, which is very often during the night (when possible). When night slots are not available or airports less saturated, pure freight operates normal day time schedules (e.g. Luxembourg).

[29] The all-cargo rankings may show a discrepancy in Airport Trends study because it is year 2007 and segments' classification has also recently been updated (see Annex A).
[30] Brussels was DHL's main hub when the data was collated but is now replaced by Leipzig/Halle.

15. Cargo airports: a concentration of hubs

Figure 34 gives the average number of cargo movements for the Top 15 European cargo airports per phase. When comparing Figure 34 (Top 15 cargo airports) and Figure 3 (Top 15 airports), we notice how some airports can become "specialised" in cargo operations in the deep night: at Paris/Charles De Gaulle, cargo movements account for 77% of the traffic in the deep night but only for 4.7% during the day.

Although they do handle passenger flights, Liège/Liège and East Midlands, which is the UK's busiest air cargo hub for intra-EU deliveries, specialise in pure freight operations. Liège/Liège is typically a night cargo airport having the highest percentage (95%) of night cargo departures (see Annex D).

Finally, the development of complementary cargo hubs is a way to overcome the congestion of traditional airports for operators. Smaller and more open airports appear in the top 15 deep night lists (e.g. Bergamo/Orio Al Serio). Although these may be located some distance away from the main concentrations of passengers, they enjoy a central geographic location as well as access to the road network. Other examples (Malmö/Sturup, Coventry) can be found in the night list in Annex D.

	Deep Night (24 - 05)				Not Deep Night			
	Airport	Airport Name	Mvts per Day	Mvts (%)	Airport	Airport Name	Mvts per Day	Mvts (%)
1	LFPG	PARIS CH DE GAULLE	47.69	10.90	LFPG	PARIS CH DE GAULLE	68.86	4.92
2	EDDK	KÖLN-BONN	47.53	10.87	EDDF	FRANKFURT MAIN	51.52	3.68
3	EBLG	LIÈGE/LIÈGE	41.31	9.44	EHAM	SCHIPHOL AMSTERDAM	42.53	3.04
4	EBBR	BRUSSELS NATIONAL	32.60	7.45	EBBR	BRUSSELS NATIONAL	39.04	2.79
5	EGNX	EAST MIDLANDS	27.66	6.32	EDDK	KÖLN-BONN	33.64	2.41
6	EDDF	FRANKFURT MAIN	10.51	2.40	ELLX	LUXEMBOURG	33.18	2.37
7	LEMD	MADRID BARAJAS	9.27	2.12	EBLG	LIÈGE/LIÈGE	30.06	2.15
8	LIME	BERGAMO/ORIO ALSERIO	8.80	2.01	EGNX	EAST MIDLANDS	28.27	2.02
9	LGAV	ATHINAI E. VENIZELOS	8.19	1.87	LEMD	MADRID BARAJAS	27.12	1.94
10	LFML	MARSEILLE PROVENCE	6.71	1.53	LIMC	MILANO MALPENSA	21.95	1.57
11	EGSS	LONDON/STANSTED	6.70	1.53	EGSS	LONDON/STANSTED	21.93	1.57
12	LFBO	TOULOUSE BLAGNAC	6.37	1.46	LTBA	ISTANBUL-ATATURK	21.07	1.51
13	EDDP	LEIPZIG/HALLE	6.14	1.40	LGAV	ATHINAI E. VENIZELOS	20.51	1.47
14	LEBL	BARCELONA	5.67	1.30	LFBO	TOULOUSE BLAGNAC	20.50	1.47
15	EHAM	SCHIPHOL AMSTERDAM	5.58	1.27	LFML	MARSEILLE PROVENCE	19.96	1.43
Other	-	-	166.71	38.11	-	-	918.34	65.67
Total	-	-	437.44	100.00	-	-	1398.49	100.00

Figure 34. Top-15 cargo airport list in 2007 is quite stable during the deep night and not deep night (more than 80% of the airports are present in both lists).

16. The European cargo network: connecting hubs

The cargo network is organised around its carriers' hubs, therefore it is concentrated around a limited number of routes as there are a limited number of airports concentrating on the cargo market. Western Europe, from north to south, attracts most of the important flows, especially during deep night. These flows are not necessarily balanced directionally: cargo traffic is a mix between one-directional and there-and-back.

Traffic patterns reflect the underlying demand for shipping between various geographical regions, the types of commodities involved and the way individual providers tailor their service. As with the airports, night has a special meaning for cargo: the top 20 busiest cargo routes in Europe account for 13% of the cargo movements during the day increasing to 19% during night and up to 26% during deep night.

The top 50 intra-EU airport pairs for cargo (Belfast/Aldergrove - East Midlands, Köln/Bonn – East Midlands, East Midlands – Edinburgh, Toulouse/Blagnac – Paris/CDG,… see Annex D) are shown in Figure 35 for both whole day and deep night periods. The maps are dominated by traffic between the carriers' hubs ("star-like" patterns around the busiest airports) but also show point-to-point connections. For example, some of the flows between countries and peripheral regions appear in the top 50 too (e.g. national flows such as between Crete and Greece, Corsica and France, Canaries/Balearics and Spain etc.). In these island regions, rail and road cannot compete with air connection and air transportation may be faster than sea.

The geographical distribution of the biggest flows underlines large development gaps between European regions, particularly between old and more recent Member States. The whole of Europe is quite well covered by the top 50 intra-EU flows, especially along a north-south axis, but shows almost no connections with Eastern European countries, from Estonia to Albania, at least within the top 50 cargo flows. Nevertheless, the Luxembourg-Baku flow stretches the overall picture to the far east (Baku is a regular destination for refuelling).

In the deep night, the top 50 intra-EU airport pairs are further narrowed along a north/south axis. The top 50 flows in the deep night account for 45% of the whole day top 50 flows. A good proportion of the flows are domestic (in France, UK, Italy and Greece) reducing the flight time length of the journeys (see country-to-country flows in Annex H).

16. The European cargo network: connecting hubs

Figure 35. The 50 intra-EU cargo airport pairs (2007). Flows are shaded with respect to the number of movements per phase (top: during the day, bottom: during deep night). Throughout the day, the top 50 cargo airport-pairs have between two and eight daily movements. During the deep night, the first 50 cargo flows are less loaded and have between one and four daily movements.

Extra-EU partners are addressed in Section 18.

Figure 36 shows the ratio between number of flights from A to B and number of flights from B to A by number of airport pairs. The patterns of cargo and scheduled traffic are very different. Cargo traffic shares similarities with business aviation traffic patterns (see Figure 12 in the business aviation *Trends study*[31]); made up of both a notable proportion of return trips and a high number of one-way trips. In fact all-cargo has even more one-way trips than business aviation. Cargo routings of general freight may be less driven by direct flights and transit time than passenger markets.

In 2007, the cargo segment had about 7,300 airport pairs, flown in one direction only. Moreover, on occasion it has only 0.8-0.9 return trips. Flights of certain freighter operators do not always return to the airport of origin. General freight carriers optimise the overall journey (of their aircraft) with respect to individual trade flows. A loaded aircraft is not supposed to come back to the main hub unloaded but might take the opportunity to serve another close airport and then come back to the hub. This produces directional imbalances. Shippers of cargo care about the final time of arrival, but less about technical or intermediate stops than do passengers.

There are also about 1,600 cargo airport pairs for which the movements are balanced (same number of flights from A to B compared to B to A. Out of the two categories of cargo, the integrators mostly fly there-and-back. They serve the same origin-destination airports in both directions with (sometimes) high frequencies (the highest value is more than eight daily movements between Belfast and East Midlands). This characteristic is even clearer for mail freighters: the flights operate a simple network with one or only a few sorting hubs (which, themselves, are connected to spokes) and carry out regular return trips between these spokes/hubs.

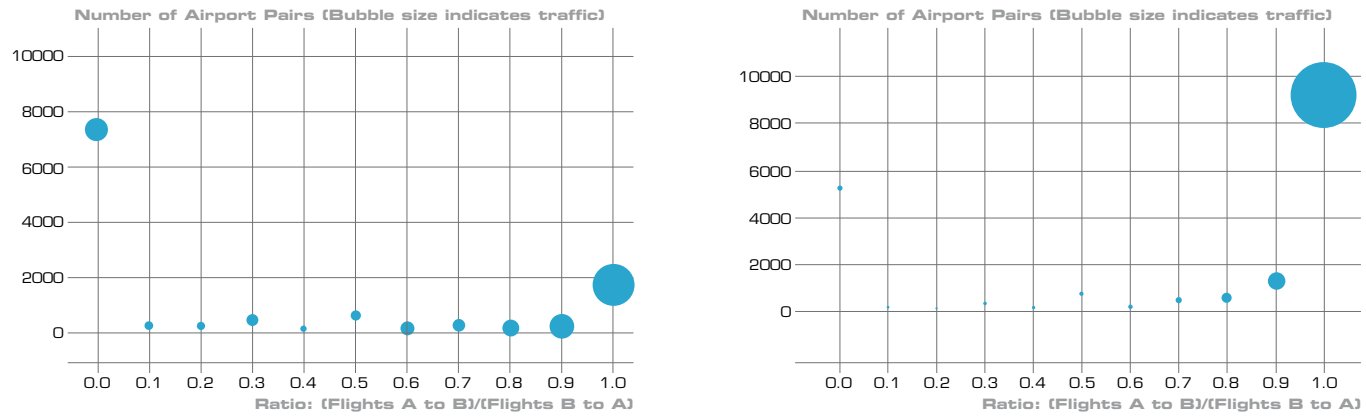


Figure 36. Cargo traffic (left) is not as balanced directionally as scheduled traffic (right). Nearly all scheduled traffic has the same number of trips from A to B compared to B to A. For cargo traffic, few airport pairs are there-and-back and most of them are flown unidirectional.

[31] *More to the Point: Business Aviation in Europe 2007*, EUROCONTROL Trends in Air Traffic Volume 4, May 2008.

17. European cargo: driven by trade

Within Europe, the biggest contributors to air cargo are also the biggest economies. Germany, with its central position within Europe, has the largest share of European all-cargo movements. Germany is closely followed by Belgium/Luxembourg, France and the UK. These states are not only the most dynamic ones in terms of trade but are also, for reasons of their size, history and 'exposure', the ones who receive the most intercontinental flights.

As noted in section 11, air cargo within the EU27 is a small portion of total tonnage: in 2007, it represented about 20% of the total freight and mail on board in the EU27 (see Figure 25). Within Europe, Germany is the most important country[32] of origin/destination for shipments carried by air. Its strategic central location within Europe, its opening-up to the Eastern part of Europe and its big cargo hubs—Frankfurt/Main, Köln-Bonn (intercontinental hub), Leipzig (new hub)—are the principal reasons for its strong position (see the development of the hubs in Annex D).

Figure 37 shows the top 20 European countries for cargo movements. Germany (13.5% of the movements) is closely followed by Belgium & Luxembourg. The latter, although combined with Belgium in our statistics because their airspace is combined, is significant in terms of air freight despite its very small size. This is caused by the presence of a successful airline – Cargolux – having its home base in Luxembourg with the country acting as a European gateway and transit hub for freight. Then, France, UK, Italy and the Netherlands share between 4% and 8% of the total movements. The cumulated share of these six biggest contributors in terms of cargo movements accounts for 50% of the total cargo movements. The remainder is distributed across 36 states in small proportions. In Figure 37, the smallest contributors have been merged within "Other", and for most of them, cargo movements are mainly overflights, as shown on Figure 38.

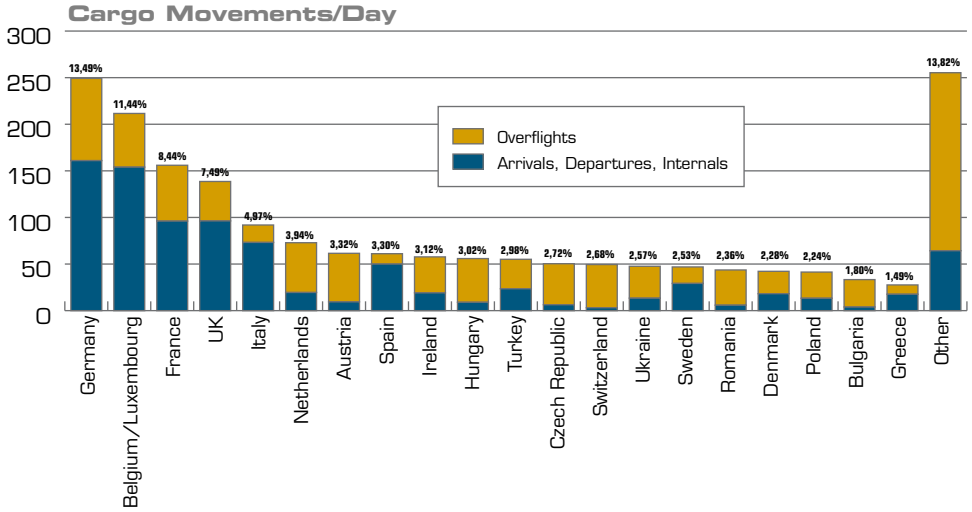


Figure 37. Germany has the largest share of cargo movements in European airspace (2007). Percentage indicates the total share of movements.

[32] Statistics in Focus, Freight and mail transport by air in the EU in 2005, EUROSTAT transport 79/2007.

The geographical distribution of the Europe movements per flow (Arrivals/Departures, Internals or Overflights) is shown in Figure 38. The busiest states, in terms of movements, match closely the biggest economies, notably the four following countries: Germany, France, United Kingdom and Belgium/Luxembourg. Overflights account for more than 50% of all-cargo flights in many smaller Central and Eastern states, and the proportion of internal flights is logically close to zero. On the contrary, bigger countries located on the borders of Europe see more than 50% of their traffic as domestic (Spain, Portugal, Sweden, Finland, Norway and Greece).

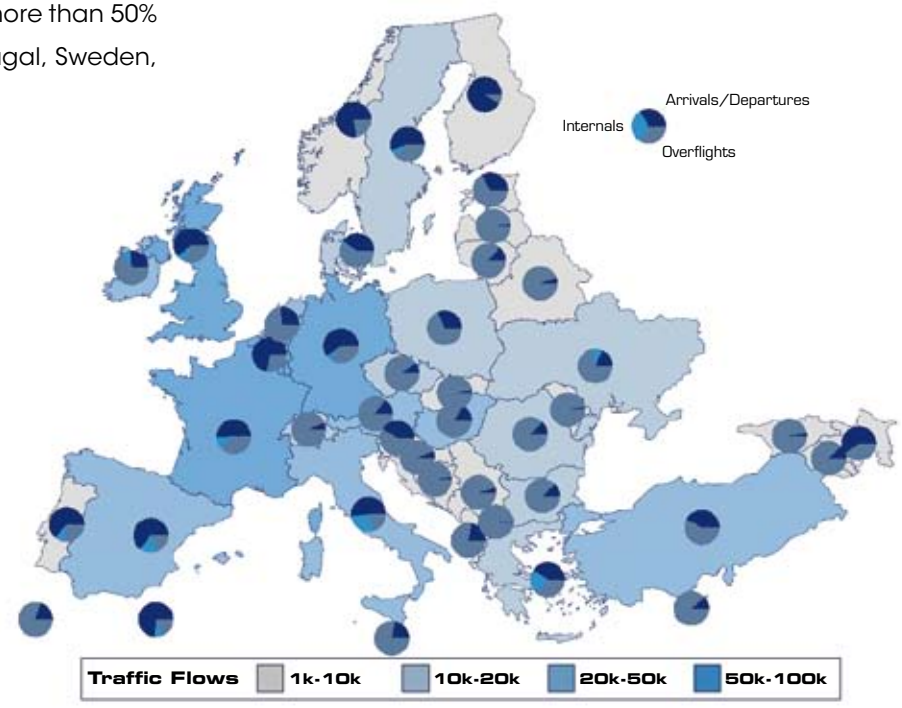


Figure 38.
Annual totals of all-cargo flights in European airspace, with indication of the relative size of each flow, 2007.

18. Outside European cargo partners

The cargo market is dominated by extra-European traffic, which is 80% of the traffic in terms of weight (see Figure 25). North America and Asia, respectively led by the United States and China, are the two largest cargo markets connected to Europe. In spite of some circular, global flows, international inbound and outbound flows with respect to the European partners are quite balanced, both in terms of weight and flights.

In 2007, 95% of air freight and mail in the EU27 was international (intra- and extra-EU[27]) corresponding to 11.3 millions tonnes in terms of freight and mail loaded and unloaded (from EUROSTAT data). The most important EU27 partner is the US followed by China (respectively 30% and 10% of the extra-EU27 traffic in terms of tonnes of freight and mail loaded and unloaded), as shown on Figure 39. In the EU27, the total proportion of international loaded cargo in tonnes is 53%, a little higher than the unloaded proportion (47%).

In terms of departing flights, Figure 40 shows the percentage of inbound and outbound all-cargo flights to and from Europe. The main connection with regard to air cargo transport is observed between Europe and North America.

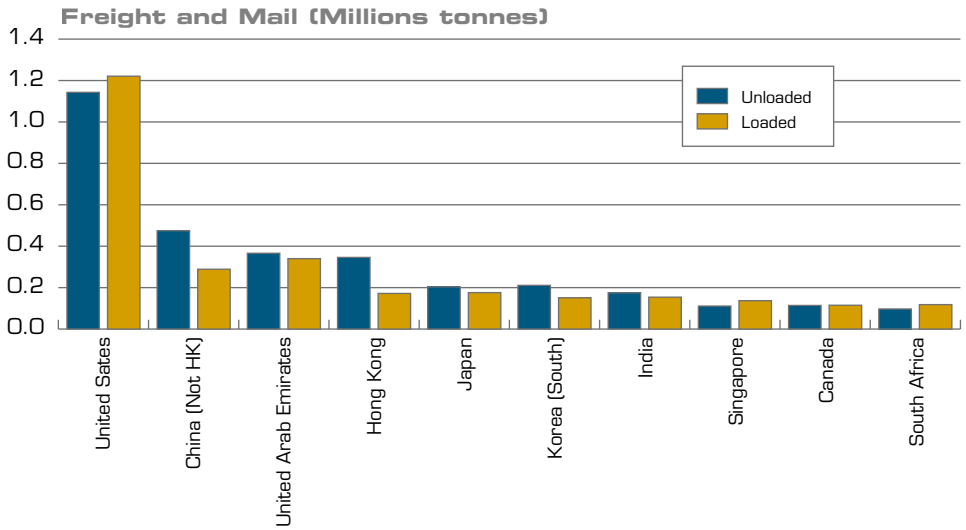


Figure 39.
2007 Cargo weight loaded and unloaded between the EU and the top ten partner countries.
(Source: EUROSTAT)

The percentage of outbound flights to the East (Far and Middle) is slightly higher than the inbound one. Conversely, the percentage of inbound flights from the West (Atlantic) is somewhat higher than the outbound ones. The higher number of incoming flights is notably due to the fact that cargo flights from the North-Atlantic stop (in some cases without unloading, but for refuelling) in European intercontinental hubs (e.g. Frankfurt/Main, Köln-Bonn in Germany or East-Midlands in the UK) which are well placed for technical stops in logistics between North-America and Asia.

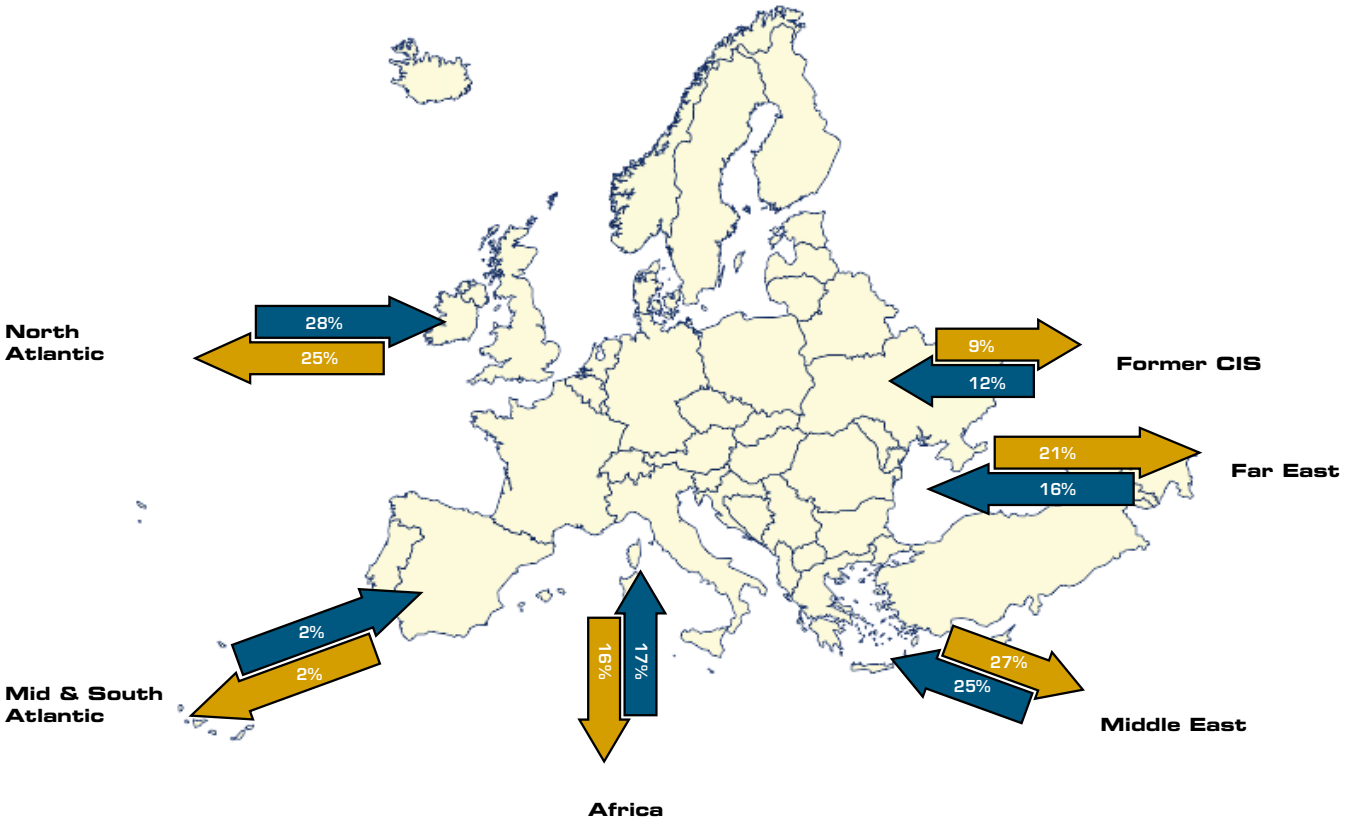


Figure 40. International extra-EU freight transport 2007 by zones (in terms of departures). North-Atlantic is the most important partner zone, followed by the Middle-East and Far-East. Inbound and outbound flows are quite well balanced. (Source: EUROCONTROL)

19. Everywhere at anytime

Long-haul passenger traffic has distinct peaks and troughs that depend on the continent. All-cargo arrivals and departures are much more evenly distributed throughout the day.

In 2007, extra-EU cargo traffic accounts for 30% of the total cargo flights (Figure 25). This is not the major share of the cargo traffic, notwithstanding, the hourly distribution of cargo movements throughout the day show specific characteristics of this market segment.

Typically, the key characteristics relevant to air passengers demand are quite different from the air cargo characteristics because they rely on different preferences.

The traditional carriers avoid planning night/deep night departures/arrivals because this does not suit passengers' preferences. When it happens, it generally concerns long haul journeys and the night schedule takes advantage of time differences between two continents (e.g. passenger flights to Middle East might leave Europe around midnight in order to arrive in the morning, locally).

Cargo operators do not show the same concerns for their loads. The cargo segment is under some other obligations (definite delivery commitment, change of aircraft, cost of transhipment handling etc.) and intercontinental hauls are flown anytime, regardless of the destination or provenance.

The following figure (Figure 41, see also Figure 67) compares the hourly distribution of both cargo and scheduled daily movements according to the hour of the day, for different extra-EU regions.

Where do they come from?

Even if there are far fewer flights, all-cargo traffic observes a very different pattern from scheduled traffic: the provenance of the flights is relatively balanced both across the regions and through the day. Scheduled traffic is organised to suit the passengers' rhythm and the opening hours of airports: flights rarely leave or arrive during the night; flights from the Atlantic arrive in larger proportion between 07:00 and 12:00. For cargo on the other hand, the busiest time for trans-Atlantic arrivals is late evening.

Where do they go?

The distribution of European flight destinations throughout the day differs depending on which segment they belong to. Scheduled flights tend to leave for the other side of the Atlantic between 09:00 and 16:00, and the night is very quiet. On the other hand, all-cargo departing flights, just as for all-cargo arrivals in Europe, follow a fairly uniform distribution through the day. For graphs corresponding to flights departing in Europe and arriving outside of Europe, see Annex E.

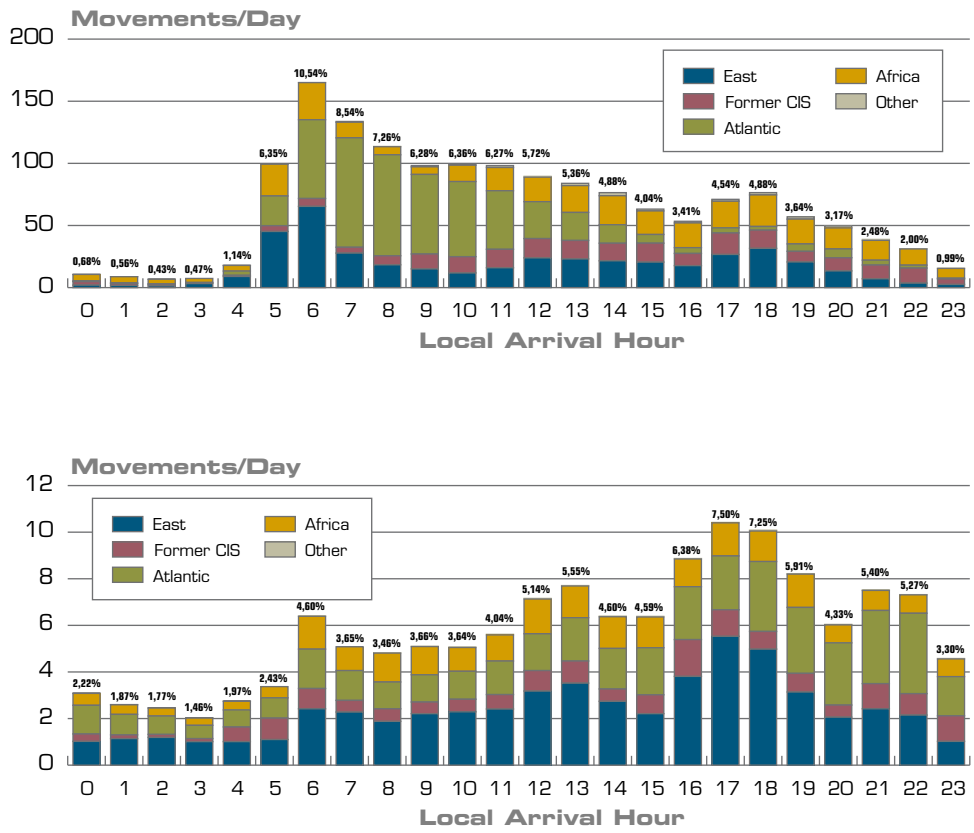


Figure 41. The hourly distribution of extra-EU cargo traffic is very different from scheduled traffic. Flights departing from outside Europe and flying to Europe (top: scheduled / bottom: cargo).

20. Not that far

As stated in Section 17, the market for all-cargo flights is concentrated in the northern European countries (Germany, France, UK and Netherlands). As a consequence, air cargo within the European market consists of relatively short haul lengths. 50% of the cargo flights are less than 720km regardless of the phase of the day.

Regardless of the phase of the day, about 75% of cargo flights are short-haul flights (less than 1500 km) with the most common distance being 300-600 km. Medium and long-haul flights account for small proportions of total cargo journeys, respectively 12% and 13% (Figure 42).

During the deep night (23:00-07:00), the proportion of short-haul cargo flights increases (about 80% of the departures are less than 1500 km) at the expense of medium and long-hauls (respectively 11% and 9%). This increase of short-hauls is explained by the high proportion of short legs within Europe between integrators' hubs, concentrated around a limited number of states, in the deep night (see Figure 35).

Contrary to overall traffic, for which distances tend to be longer at night (see Figure 13), there is a trend for 'distance reduction' for cargo traffic during the night: for cargo, as the last section explained, the intercontinental traffic is spread relatively uniformly, but there are many short flights at night.

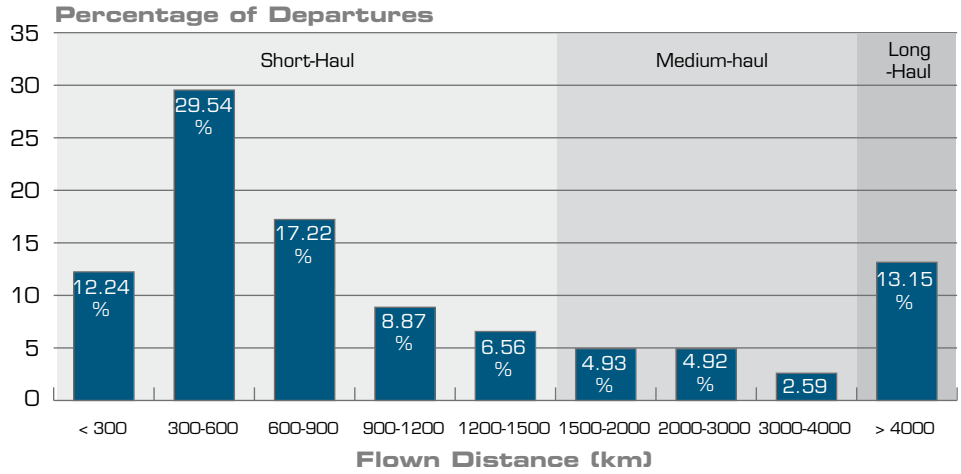
Figure 43 shows the average distances for the all-cargo departures at different phases of the day. The median distance flown by cargo carriers is 717 km, with relatively little difference between night and deep night (respectively 691 km and 706 km). Unlike the other market segments, for which distances flown are longer at night, cargo carriers do not distinguish between lengths of hauls with respect to the phases of the day.

During deep night, cargo median distances are shorter (706 km) than overall traffic distances (1067km, see Figure 11). This is explained by the following facts:

- Most active cargo airport pairs during deep night are located in the European core area[33] (short hauls observed Figure 35),
- When passenger carriers fly deep night, it is mostly for long haul departures. On the contrary, international cargo outbounds and inbounds are flown anytime, regardless of the destination or provenance (Figure 41 and Figure 67).

Mean distance flown for cargo journeys is about 1850km during the day and is reduced by 27% during the night period (Figure 43). About 70% of the European cargo flights are intra-European traffic, concentrated around a limited number of hubs. On top of the above mentioned explanation, this distance reduction at night is also due to the fact that the proportion of cargo is more significant during this phase and therefore dominates the night statistics.

[33] Core area is made of 6 states: Belgium, The Netherlands, Luxembourg, France, UK and Germany.



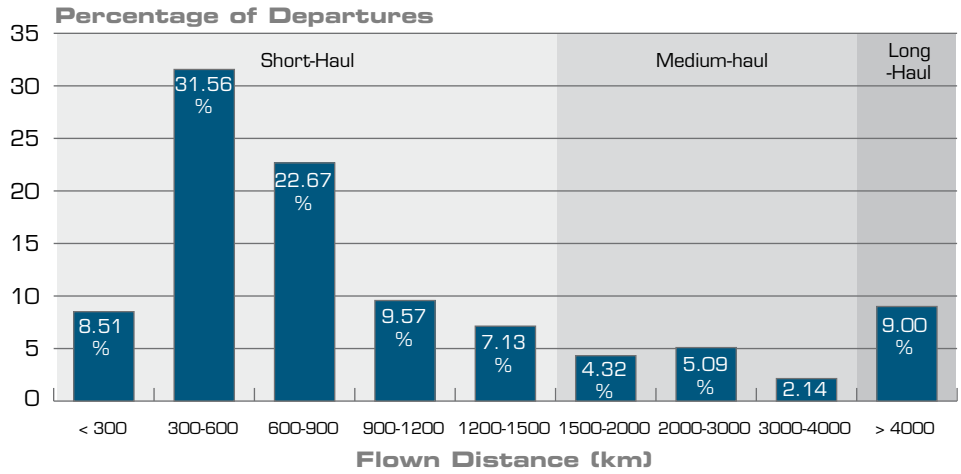


Figure 42.
Cargo distances flown during the whole day (top) and the deep night (bottom) periods.

	Departures (000s)	Median Flown Distance (km)	Mean Flown Distance (km)
Deep Night			
Deep Night (24 - 05)	72	706	1376
Not Deep Night	226	724	1732
Night			
Night (23 - 07)	120	691	1349
Not Night	177	757	1848
All	297	717	1646

Figure 43. All-cargo flights have comparable median distance regardless of the phase of the day: 50% of the flights are less than 700 km.

21. Cargo operators: small and heterogeneous market

In 2007, European cargo carriers labelled as freighters include more than a hundred operators. The European cargo market is dominated by two principle airlines which equally share 10% of cargo flights. The market is more concentrated during deep night when the same two firms share a total of 30% of flights. Apart from a few freighters, that are significant both in terms of market share (number of flights) and fleet, the remainder of the market is fragmented between a relatively high number of small operators.

There are various types of providers in the air cargo market: pure freighters, wet-lessors, combination airlines, charters, integrators etc. As a consequence, naming them just as 'operators' paints a rather simplistic picture. The contribution of each carrier is sometimes difficult to identify due to the various wet-lease agreements made by the operators.

In this section, only the 'all freighters' are taken into consideration (see definition in Section 2). As a consequence, the picture of cargo operators depicted in this report is somewhat distorted as most of the air cargo is carried by combination carriers, such as the traditional airlines.

Last but not least, for this section, the following section and the supplementary data in Annex G, some operators that fly under different callsigns have been merged, for example:

- EAT consists of European Air Transport and DHL UK,
- TNT Airways consists of TNT Airways, Panair and Mistral Air,
- FAT consists of Farnair Switzerland and Farnair Hungary.

Nevertheless, our dedicated airframe database showed that European pure freight aviation has about 130 operators in 2007. It accounts for 37% of the worldwide freighter operators. In terms of fleet, European freighters account for 30% of total worldwide freighters (see Section 22).

Figure 44 shows the fraction of operators sharing the cargo flights during the whole day and during deep night. During the whole day, the corresponding two main European operators share equally around 10% of the market (in terms of flights). Unsurprisingly, these two very active airlines belong to 'integrators' and are also the European largest operators in terms of fleet (see Annex G).

During deep night, the market is more concentrated: both companies have extensive overnight operations and increase their shares to 18% and 14% of the market. They are followed by another integrator and a private airline (which flies exclusively for an integrator) both with 8% of the market.

Apart from these major airlines, the market (in terms of number of flights) is shared amongst a high number of small operators: more than 80% of the operators share less than 1% of the traffic.

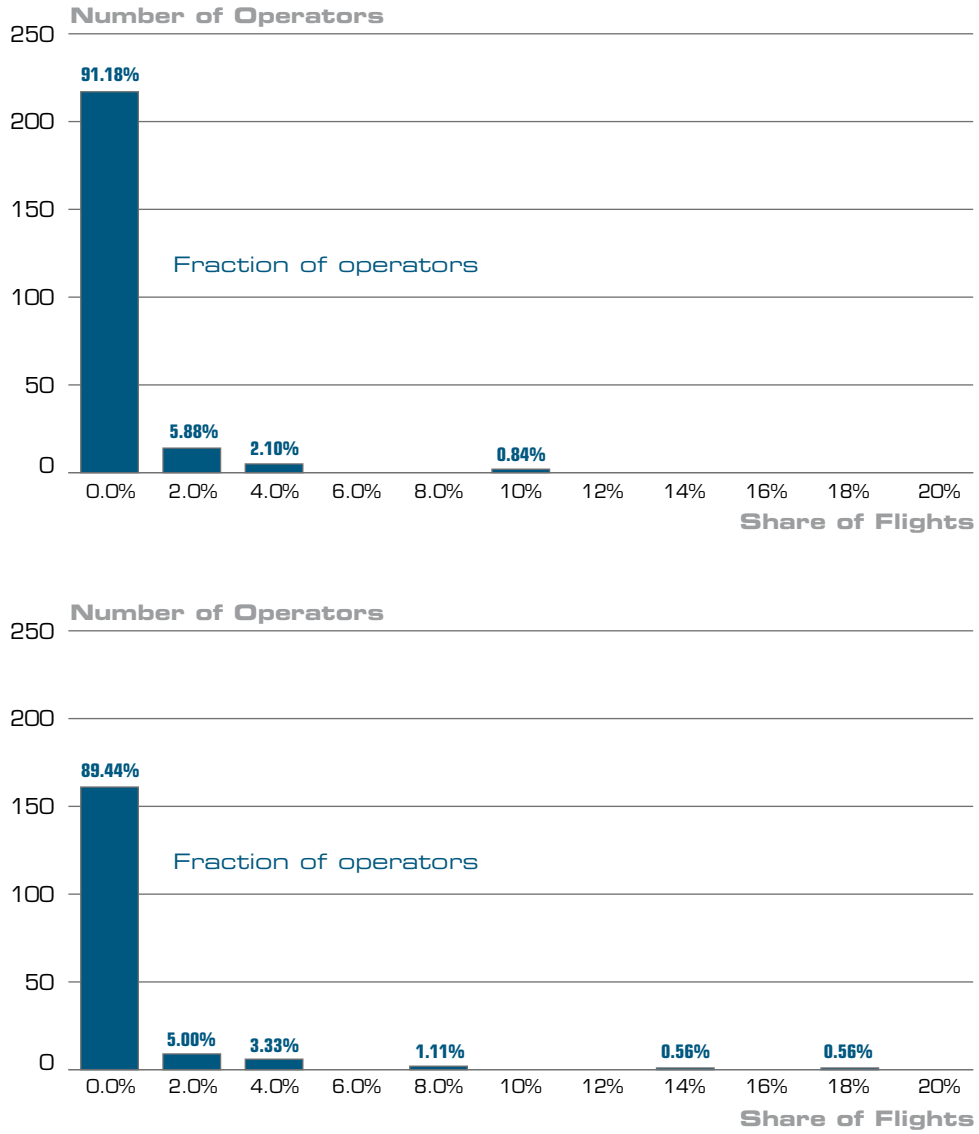


Figure 44.
Share of cargo operators during whole day (top) and deep night (bottom). There are few operators with 10% market share or more.

22. Quite an old European fleet

The European all-cargo fleet consists of about 600 aircraft with more than 130 operators. Most operators have small fleets: about 70% of the European cargo operators have between one and four aircraft. At 24 years, the average age of the European freighters fleet is quite old, this being essentially due to the presence of old Soviet freighters belonging to ex-USSR countries. The relatively old age of the fleet is also attributed to the significant number of passenger aircraft converted to freighters.

The total European freighter fleet is composed of about 600 aircraft, which is a little more than 40% of the worldwide fleet[34]. Figure 45 shows that 38% of operators of these aircraft have between two and four aircraft.

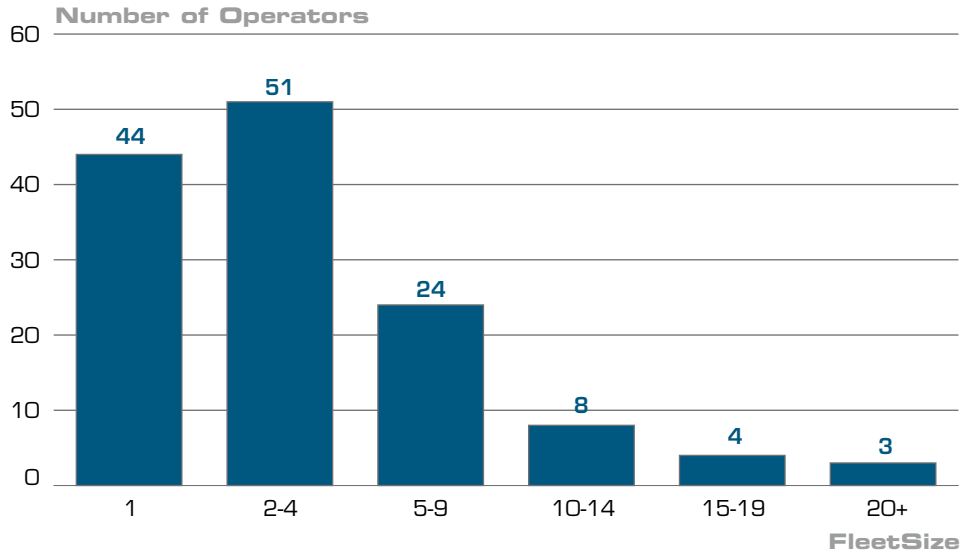


Figure 45.
Size of the fleet for European aircraft operators.
(Source: EUROCONTROL, 2007)

The median ages and the sizes of individual fleets for each state are shown in Figure 46. Ukraine has the largest fleet but a high proportion[35] of these are Soviet freighters which may not be allowed to fly within the EU. Ukraine is followed by the UK and Belgium (about 60 aircraft each), Spain (43) and Germany (34).

The average age of the European cargo fleet is 24 years, somewhat older than the average age of the worldwide cargo fleet (22) but significantly older than the passenger fleet (about 20). The difference between the worldwide and European cargo ages is partly due to the large number of older Ukrainian cargo aircraft. The difference between passenger and freighter ages is not surprising since a significant proportion of the cargo fleet are passenger aircraft that have been converted into freighters[36]. In Europe, 30% of the freighters are converted.

[34] This section refers to aircraft operated by European operators. A larger group of aircraft will fly regularly from European airports.
[35] Since October 2008, Ukraine started to cancel the Airworthiness Certificate of its oldest freighters.
[36] Although there are several programmes to upgrade these aging aircraft to modern avionics specifications (e.g. MD10 conversion programme to upgrade DC10).

If the contribution of the Ukraine fleet is discounted within the sample:

- the average age of the European freighters fleet is lowered to 22 years becoming aligned with the worldwide average age, and;
- the proportion of converted freighters in Europe increases to 38%.

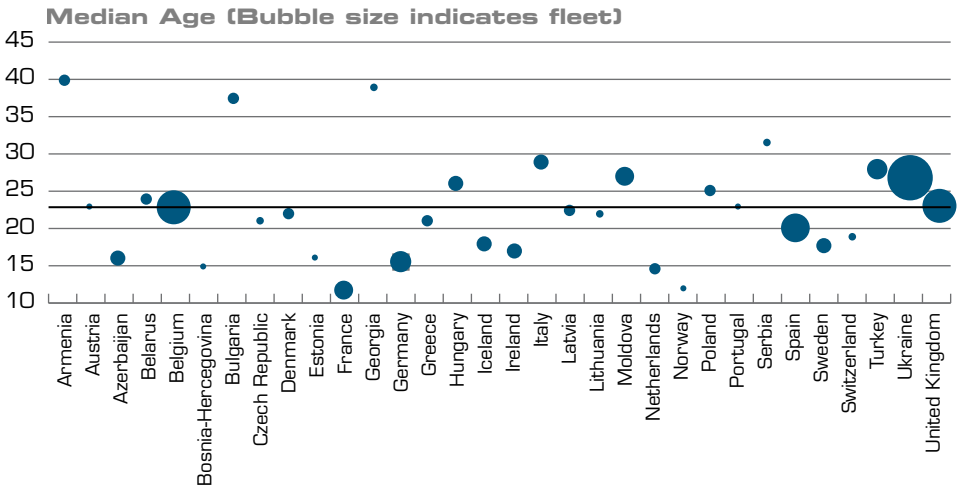


Figure 46.
Italy has one of oldest European all-cargo fleets, and Ukraine has a large number of older freighters. (Reference horizontal line indicates the median age (23) of the European fleet).

Figure 47 shows the distribution of freighters by age and by type of engine. The proportion of the all-cargo fleet which is 35 years old or older accounts for 16%. Unsurprisingly, there are relatively few jets in this group. More surprisingly perhaps, there are no converted aircraft in this 'older than 35' fleet, because turboprop conversions are relatively rare.

The European[37] proportion of converted aircraft is divided into 30% of jet conversions and 8% of turboprop conversions. Amongst the converted jets, 50% of them are older than 22 years. The corresponding median age of the non-converted jets is 18 years.

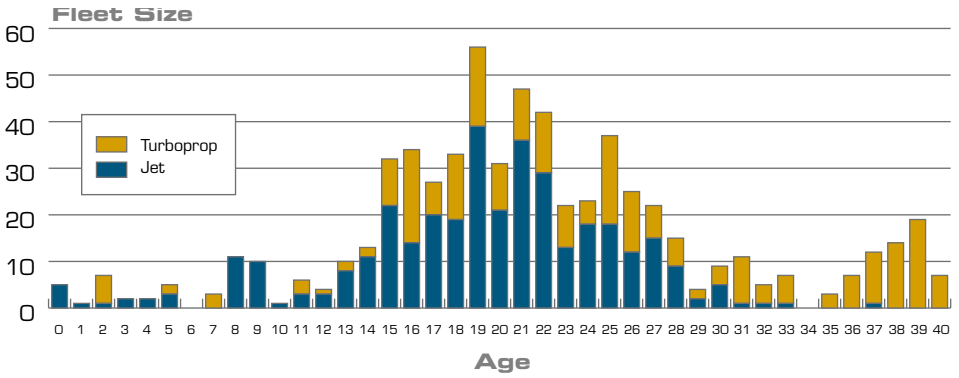


Figure 47.
Distribution of the European all-cargo fleet by age and engine type. The aircraft aged more than 35 years are turboprops, with a few exceptions.
(Source: EUROCONTROL 2007).

[37] Excluding Ukraine.

23. Cargo aircraft type trends

Seven types of cargo aircraft each make 5% or more of the European cargo flights. The deep night cargo 'fleet' is more concentrated around five aircraft types (each having at least 5% share). Six of the top 10 types are from Boeing. The cargo turboprop market is represented in lower proportions than the jet market, even if the cumulative contribution of turboprops and small jet aircraft remains important during night operations.

© TNT Airways.

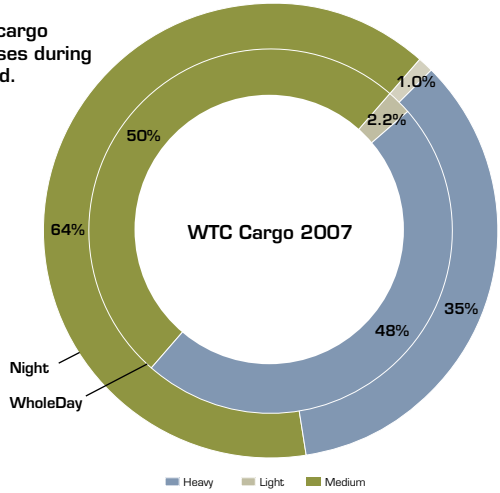
Figure 48 shows the distribution of cargo aircraft by WTC categories. In 2007, the European freighters fleet is a mixture of medium (50%) and heavies (48%) for categories of aircraft types. During the night, the proportion of heavy aircraft decreases, partly due to the decrease of long-haul flights (see Section 20).

Figure 49 shows the 20 aircraft types that fly the most in Europe carrying cargo during the whole day and during the deep night phases.

In Europe, the top five most used aircraft are B733, B744, B752, MD11 and A30B. Many of these have been retired from passenger service and converted to freighters. These aircraft types are widely used by air cargo carriers and integrators. There are more Boeing aircraft than Airbus aircraft within the European cargo fleet (487 Boeing aircraft versus 273 Airbus aircraft), as this is reflected in both the European and the world-wide fleet. The active cargo fleet during whole day is mostly jet aircraft, with a small proportion of turboprops and hardly any piston (see Annex F).

From Figure 49, the top 20 cargo aircraft type list is quite stable, regardless of the phase of the day. Indeed, 17 of the top 20 whole day cargo aircraft type list are also within the top 20 deep night cargo aircraft type list. Nevertheless, the rankings are slightly different and the contribution of small jets and turboprops is more important at night (e.g. B462, B463 and ATP, AT72, AN26, AN12). These aircraft are likely to be used for cargo transportation between small local airports and regional hubs during the night.

Figure 48.
Medium WTC cargo aircraft increases during the night period.



Aircraft types that are used on long-haul routes mainly for passenger transportation also play a significant role in night operations (Figure 12). As indicated in the last paragraph of Section 2, around 50% of cargo is transported in the belly-hold of passenger aircraft[38]. Long-haul freighters can be found as well (B747s and B767s) though they might be underrepresented in the deep night sample due to the shortness of this phase.

Nevertheless, Boeing forecasts predict that the proportion of cargo carried in the belly holds of passenger airplanes will decrease, because dedicated freighters can deliver more flexible and time-definite service. This should be a market for new dedicated long-haul freighters[38], that is to say cargo versions of B777, B747-8 but also A380.

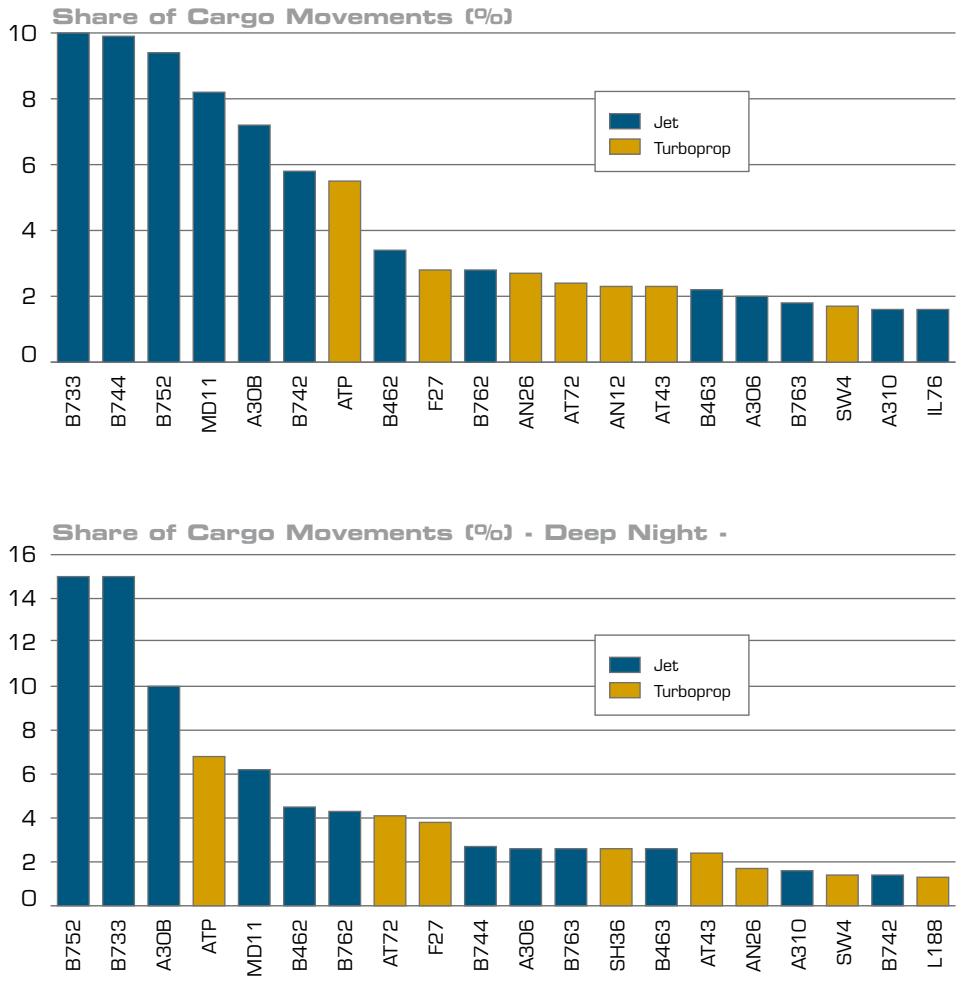


Figure 49.
Biggest proportion of cargo aircraft during the whole day (top) and deep night (bottom). The cargo flight market during deep night is more concentrated than during the day: only five aircraft types account for more than 50% of the cargo movements.

[38] Current Market Outlook 2008-2027, Boeing, 2008.

24. Cargo operations rarely delayed

As cargo flights mostly operate during quiet hours and often from specialist airports, they are less 'exposed' to air traffic flow management delays (ATFCM delays). As a result, in 2007, about 1% of cargo movements were delayed during deep night, half the rate of total traffic, and only 8% were delayed during the whole day. When cargo flights are delayed, the average minutes of delay per delayed cargo flight remains the same regardless of the period of the day (13 minutes). Nevertheless, this ATFCM cargo delay has increased in four years, especially during deep night. The significant amount of additional traffic (overall) observed in the night periods between 2004 and 2007 seems to have penalised the relative fluidity of the cargo traffic.

Two sorts of delays are often studied. The Central Office for Delay Analysis (CODA[13]) is the authoritative source of data on both, collating data from the CFMU and from airlines.

- Air Traffic Flow and Capacity Management (ATFCM) delays, which are applied to prevent overloads of air traffic control at airports or en-route. Data are available for all IFR flights.
- The total delay from all sources. This includes ATFCM delay, plus delays due to operational problems of airlines or at airports, such as late baggage, security delays, etc. Data on these delays are available for a large sample of scheduled flights from CODA. ATFCM delays may be only 20% of the total.

Data on total delay for cargo operators are not complete (a few operators report on the delays they experienced), which is why we decided to restrict the data to ATFCM delays. Figure 50 shows statistics on ATFCM delay in 2007.

Cargo flights are obviously less often delayed (8%) than the other segments (the overall average is 20%). Indeed, the proportion of cargo movements within the overall traffic is rather low (3.2%) and so is the fraction of cargo flights delayed compared to other segments. But the average minutes of ATFCM delay per movement is smaller (1 minute) than any other segment (more than 2 minutes). When cargo flights are delayed, the length of the delays per movement (13.2 minutes) is longer than scheduled flights (11 minutes). In 2004, the length of the delays per movements for both cargo and scheduled flights were about the same (10 minutes). So, the delays have increased with time for all segments and, for cargo flights, they seem to be concentrated in a few instances.

During deep night, cargo flights are very rarely delayed. However, again, once a cargo flight is delayed, the length of the ATFCM delay is similar to the average and comparable to the scheduled delay length. It is important to note that 2004 ATFCM delay for cargo movements was 3.5 times smaller (3.5 minutes) than the 2007 data during deep night. As Section 4 reported, additional flight rotations operated during this period seem to have counteracted the "relative fluidity of the cargo night operations" experienced in the past, especially at airports (Figure 51).

Type	Fraction of Movements Delayed	ATCFM Delay/ Movement (minutes)	ATFCM Delay/ Delayed Movement (minutes)
Cargo	7.9%	1.0	13.2
Other	15.3%	2.1	13.9
Scheduled	22.0%	2.4	11.0
Total	20.4%	2.3	11.4

Type	Fraction of Movements Delayed	ATFCM Delay/ Movement (minutes)	ATFCM Delay/ Delayed Movement (minutes)
Cargo	1.2%	0.2	12.6
Other	2.4%	0.3	11.1
Scheduled	3.5%	0.4	12.2
Total	2.3%	0.3	12.0

Figure 50. Delays by segments and by period of the day (left: whole day, right: deep night), 2007 data. The fraction of cargo movements delayed remains low.

Figure 51 shows that in 2007 cargo traffic had a roughly even split between ATFCM delays due to airport and en route capacity issues during the day. But, during deep night, airport capacity issues appear to affect cargo traffic more than capacity issues in en route airspace. As stated in Section 15, cargo operations partly take place at the usually busiest European airports.

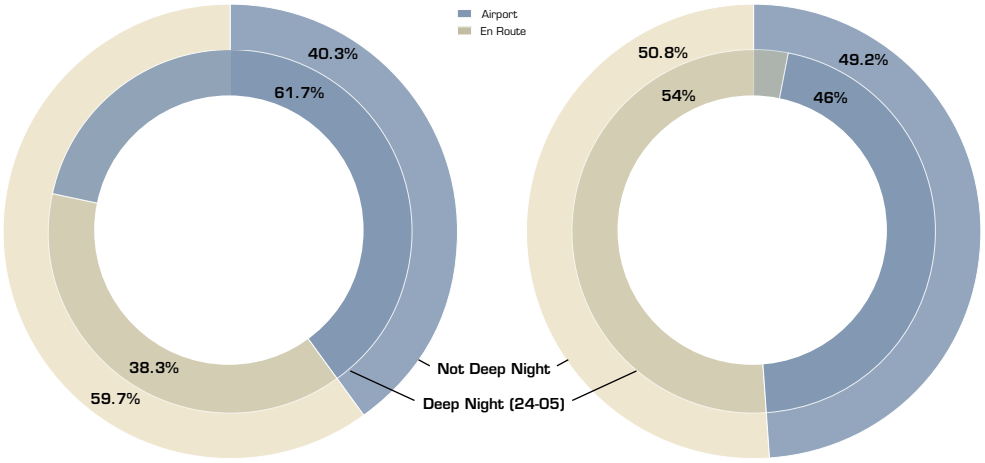


Figure 51. Cargo movements are more affected by capacity issues at airports during deep night (left: cargo, right: scheduled), 2007 data.

25. Summary and further work

While night traffic is only a small proportion of total traffic (10% of total movements) and while most of the night traffic is actually concentrated at the margin of the night, night flights are very important part of the European air transport system.

The reasons for operating at night differ significantly depending on the operator type. While night flights are crucial for some carriers, they are secondary for others.

Operating early morning departures and late arrivals is an important feature for passengers' night flights (especially low-cost and traditional airlines). These 'margin' portions of the night have seen their traffic growing very fast over the last four years. Extending the length of daytime operations is a means of maximising operator yields which results in increasing aircraft utilisation. It is also a means (with late arrivals) to cope with cumulated delays.

When looking at the freight segment, night utilisation is somewhat different. It has to be noted that in our data we could not take into account 50% of the general freight which is carried in the belly-holds of passenger aircraft. However, for the remaining fraction of cargo traffic examined, night flights are:

- where there is some 'room' available for flying (no more capacity problems within the network) and;
- when available time can be used to transport commodities/shipments in order to respect next-day delivery commitments.

The in-depth analysis of the cargo segment revealed that cargo operators basically make the most of the periods when passenger traffic is not dominating. Cargo operations are extremely well coordinated around strategic hubs in order to respect the finite time-delivery commitments.

Even if the overall economic contribution of night cargo operations is considerable, there are some constraints (environmental constraints, airport restrictions, constraints for crew members etc.) which make the segment difficult to handle.

However, there are potential issues that could make night operations easier to handle from both the operators and regulators viewpoints. These basically aim at improving the efficiency of the European ATC system where night time operators generally feel they have to conform to the restrictions which are defined for daytime operations. Different procedures and measures should be proposed for night operations (e.g. availability of restricted zones during the night).

This report is published at a time when the aviation sector is being hit by an ongoing financial crisis and has to face difficult decisions. Freight, being a leading indicator for economic growth, has experienced a sharp decline[39] in September 2008 (7.7% decrease compared to the previous year) a situation that has not been seen since September 2001. The economic situation was rather different when the first lines of this report were being written.

This report is not the final word. We will return to cargo and to night operations in later publications in the *Trends* series. Meanwhile, the **STATFOR Interactive Dashboard[40]** provides monthly updates of major flight statistics, including more detail on the all-cargo segment amongst others.

[39] IATA Cargo eChartbook Q3.
[40] *www.eurocontrol.int/statfor*

Annexes

A. Definitions

Traffic data - new breakdown into segments:

The updated classification of the market segment breakdown, shown in Figure 52, resulted in slight changes with respect to the previously published[41] segments' distribution.

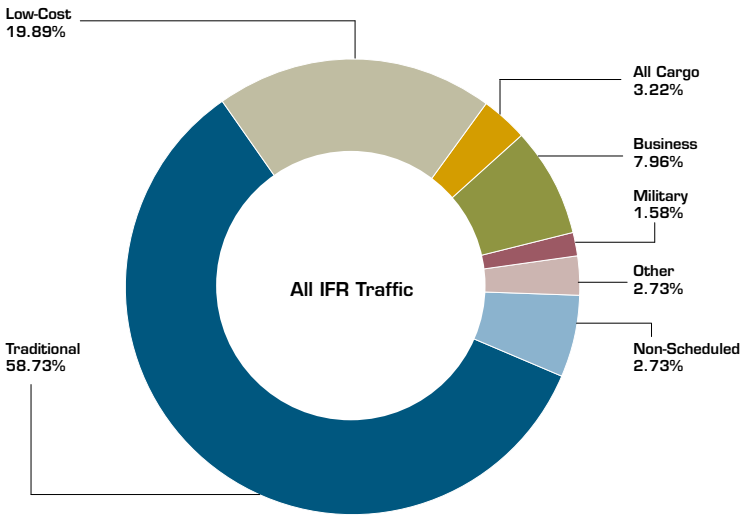


Figure 52. 2007 IFR Traffic new market segment breakdown: proportion of all-cargo traffic is more than 3%.

[41] See Figure 4, EUROCONTROL Medium-Term Forecast, Flight Movements 2008-2014, Volume 1

A. Definitions

General cargo definitions:

General definitions aiming at describing different categories of cargo are illustrated in Figure 53 and Figure 54. In these two figures, we refer to UTC time.

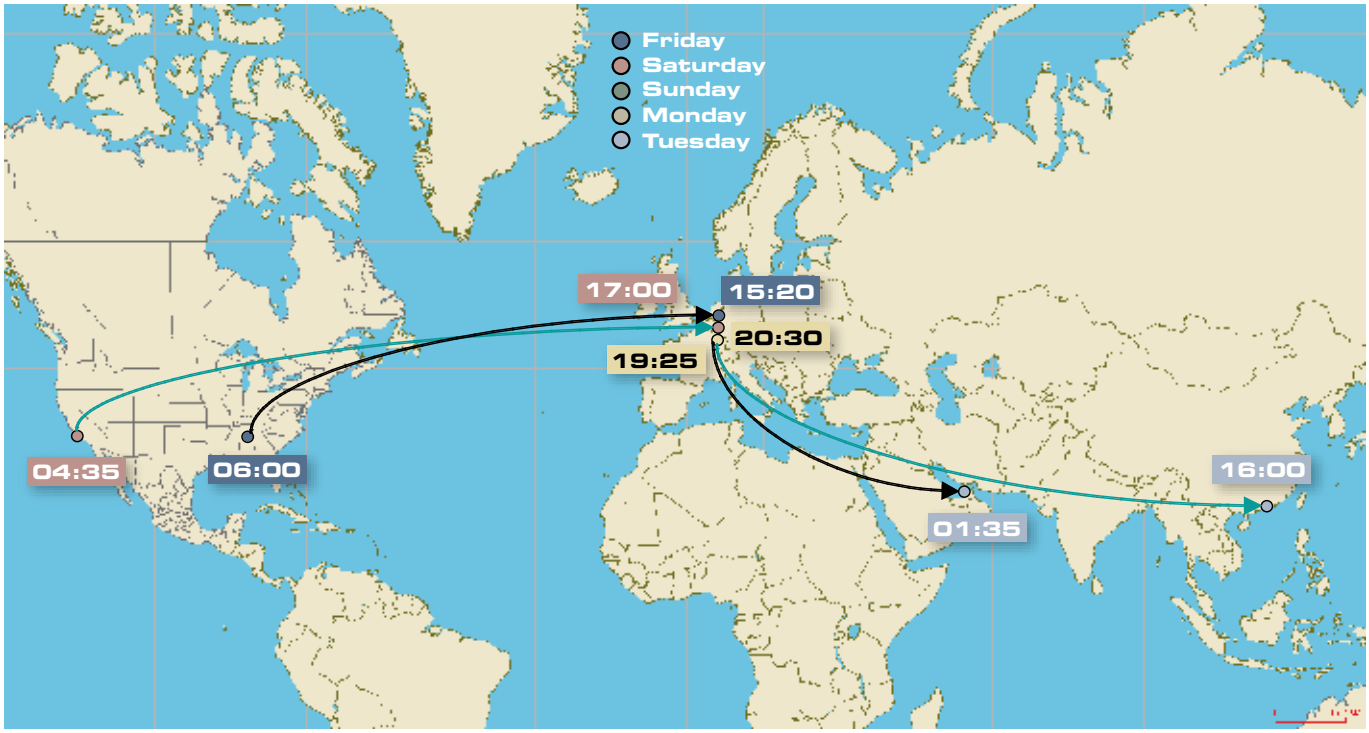


Figure 53. General freight is the air shipment of mostly larger commodities. Delivery commitment is measured in days/weeks.

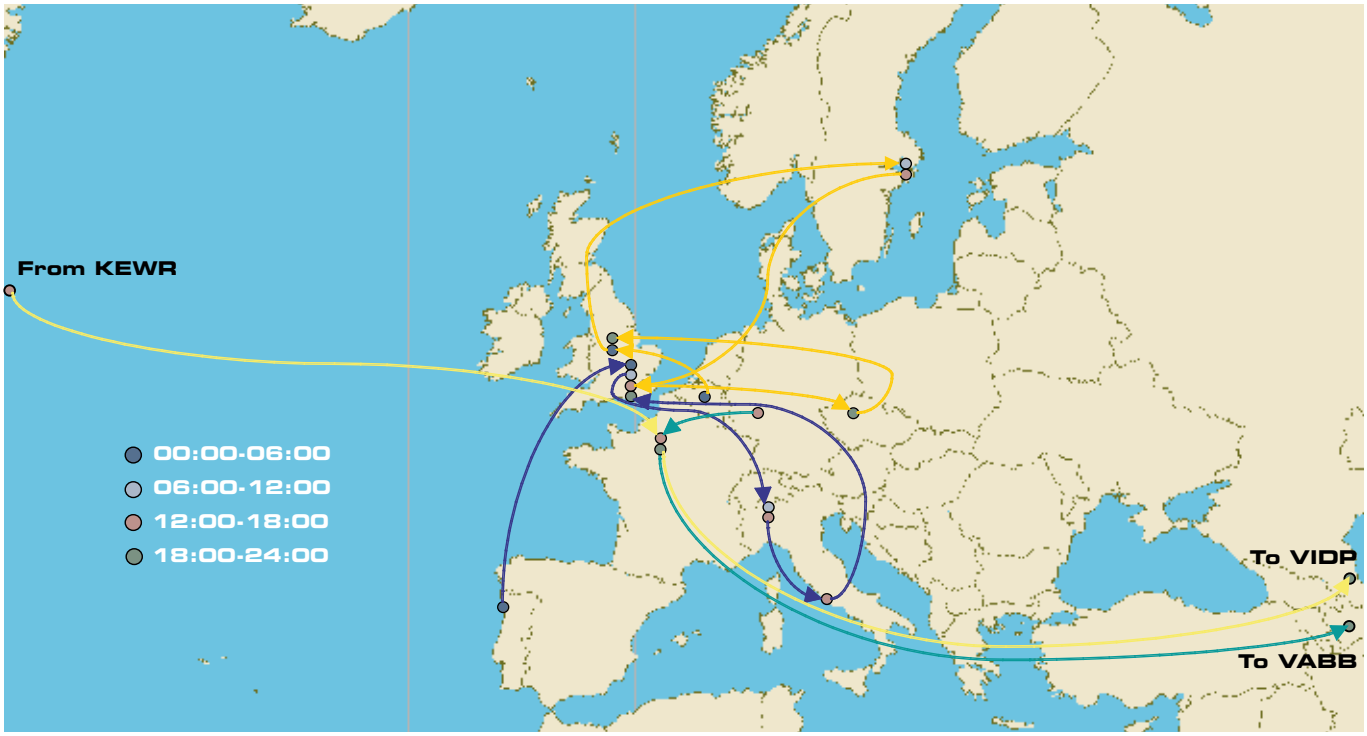


Figure 54. Express (and mail) freight is the air shipment of parcels for which delivery can be urgent. The Express air leg only is shown but the integrators provide additional ground or handling services in support of their air traffic. Delivery commitment is measured in hours/days.

A. Definitions

Definitions related to IFR Traffic data:

The cargo segment of traffic is a complex mix of operators. This means that identifying cargo operations in our archives of flight-plan data is also a complex task, and there is no perfect solution. This annex lists in detail the definition that has been used for the statistics presented in this report.

In summary, a flight is classified as cargo for one of the following reasons:

- It is by an all-cargo operator.
- It is by an aircraft which is always all-cargo.
- It is by an aircraft type which for particular operators is a cargo type.
- It uses a callsign which particular operators assign to their cargo flights.

Note that these rules mostly do not catch combination and quick-change aircraft and do not cover belly-hold cargo.

In detail the groups are as follows. In some cases, codes are included of operators or types that are no longer current; this is to permit classification of flights from earlier years. Also, the US carriers list considers aircraft capable of flying transatlantic or known to operate intra-EU.

ICAO Code	Operator name	Country
ABR	Air Contractors	Ireland
ABW	Airbridge Cargo	Russian Federation (CIS)
ABX	ABX Air	USA
ACE	Air Charter Express (Cargo Plus Aviation)	Ghana
AEN	Aeroland Airways	Greece
AHU	ABC Air Hungary	Hungary
AIN	African International Airways	South Africa
ALR	Algarvilara	Portugal
AMK	Amerer Air	Austria
ANM	Antares Airtransport	Germany
APW	Arrow Air	USA
ATN	Air Transport International - ATI	USA
AZE	Arcus-Air Logistic	Germany
BBD	Bluebird Cargo	Iceland
BCS	European Air Transport - EAT	Belgium
BDI	BenAir	Denmark

ICAO Code	Operator name	Country
BGA	Airbus Transport International	France
BPS	Budapest Air Services	Hungary
CAO	Air China Cargo	China
CBB	Cargo B	Belgium
CCG	Central Connect Airlines	Czech Republic
CCL	Continental Cargo Airlines	Ghana
CHY	China Air Cargo	China
CIU	Cielos del Peru	Peru
CKK	China Cargo	China
CKS	Kalitta Air	USA
CLX	Cargolux Airlines International	Luxembourg
CNB	CL Cityline Hungary	Hungary
CRG	Cargoitalia	Italy
CSH	Shanghai Airlines	China
CWC	Centurion Air Cargo	USA
DHL	Astar Air Cargo	USA
DNU	DOT - Danu Oro Transpotas	Lithuania
DSR	DAS Air Cargo	Uganda
EIA	Evergreen International Airlines	USA
EXN	Exin Aviation Operations	Poland
EXT	Nightexpress	Germany
FAH	Farnair Hungary - (Farnair Europe)	Hungary
FAT	Farnair Switzerland AG	Switzerland
FDX	FedEx - Federal Express	USA
FKS	Focus Air	USA
FPO	Europe Airpost	France
FRN	Farnair Netherlands	Netherlands
FWL	Florida West International Airlines	USA
FYA	Fly Ant	Spain
GCO	Gemini Air Cargo	USA
GEC	Lufthansa Cargo Airlines	Germany
GEV	Gestavi	Spain
GRV	Ver Avia	Greece
GTI	Atlas Air	USA
GWL	Great Wall Airlines	China
HDA	Dragonair	China
ICL	CAL - Cargo Air Lines	Israel
JAE	Jade Cargo International	China
JBR	Job Air	Czech Republic
JEC	Jett 8 Airlines Cargo	Singapore
JON	Johnsons Air	Ghana
KZU	Kuzu Cargo	Turkey
LCO	LAN Cargo	Chile
LVR	Aviavilsa	Lithuania
MBV	Aeriantur-M	Moldova
MDF	Swiftair Hellas	Greece

A. Definitions

ICAO Code	Operator name	Country
MJL	Jet Line International	Moldova
MKA	MK Airlines	United Kingdom
MNB	MNG Airlines	Turkey
MNL	Miniliner	Italy
MSA	Mistral Air	Italy
MSX	EgyptAir Cargo	Egypt
MUA	Murray Aviation	USA
MXU	Maximus Air Cargo	UAE
NCA	Nippon Cargo Airlines	Japan
NPT	Atlantic Airlines	United Kingdom
OVA	Aeronova	Spain
PAC	Polar Air Cargo	USA
PCK	Air Pack Express	Spain
PNR	Panair	Spain
RCF	Aeroflot Cargo	Russian Federation (CIS)
RGN	Gestair Cargo	Spain
RPX	BAC Express Airlines	United Kingdom
RUN	ACT Airlines	Turkey
SEH	Sky Express	Greece
SMJ	Avient Aviation Zimbabwe	Zimbabwe
SOO	Southern Air	USA
SQC	Singapore Airlines Cargo	Singapore
SRR	Star Air	Denmark
SWN	West Air Sweden	Sweden
SXP	SprintAir	Poland
TAC	Turbot Air Cargo	Senegal
TAY	TNT Airways	Belgium
TDX	TradeWinds Airlines	USA
TIS	Tesis Airline	Russian Federation (CIS)
TSE	Transmile Air Services	Malaysia
TSY	Tristar Air	Egypt
TUP	Aviastar-TU	Russian Federation (CIS)
TVI	Tiramavia	Moldova
UAB	United Arabian Airlines	Sudan
UAK	AVIANT - Kiev Aviation Plant	Ukraine
UKL	Ukraine Air Alliance	Ukraine
UKS	Ukrainian Cargo Airways	Ukraine
UNS	UPS - Unsped Paket Servisi	Turkey
UPS	UPS - United Parcel Service	USA
VCX	Ocean Airlines	Italy
VLO	VARIG Logistica S/A	Brazil
VRE	Volare Air	Ukraine
WLX	West Air Luxembourg	Luxembourg
WOA	World Airways	USA

Figure 55. All-cargo operators.

Engine Type	ICAO ID	Manufacturer	Full Type Description	WTC
Jet	A124	ANTONOV	An-124	H
Jet	A225	ANTONOV	An-225	H
Jet	A3ST	AIRBUS	A-300ST	H
Jet	AN72	ANTONOV	An-72, An-74	M
Jet	IL76	ILYUSHIN	Il-76	H
Turboprop	AN12	ANTONOV	An-12	M
Turboprop	AN22	ANTONOV	An-22A	H
Turboprop	CVLT	CONVAIR	CV-580	M
Turboprop	F27	FOKKER	F-27 Friendship	M
Turboprop	SH36	SHORT	SD3-60	M

Figure 56. All-cargo aircraft types.

ICAO Code	Operator name	Country	Condition	ICAO ID	Engine Type	Manufacturer	Full Type Description	WTC
AAR	Asiana Airlines	Korea (South)	operations by	B744	Jet	BOEING	747-400	H
ACA	Air Canada	Canada	operations by	MD11	Jet	MCDONNELL DOUGLAS	MD-11	H
ADB	Antonov Airlines	Ukraine	operations by	AN26	Turboprop	ANTONOV	An-26	M
ADR	Adria Airways	Slovenia	operations by	SF34	Turboprop	SAAB	SF-340	M
ADR	Adria Airways	Slovenia	operations by	F27	Turboprop	FOKKER	F-27 Friendship	M
CCE	Cairo Aviation	Egypt	operations by	T204	Jet	TUPOLEV	Tu-204	M
CSN	China Southern Airlines	China	operations by	B744	Jet	BOEING	747-400	H
ELY	El Al Israel Airlines	Israel	operations by	B742	Jet	BOEING	747-200	H
EVA	EVA Air	Taiwan	operations by	MD11	Jet	MCDONNELL DOUGLAS	MD-11	H
GJT	Gir Jet	Spain	operations by	B742	Jet	BOEING	747-200	H
JEM	Emerald Airways	United Kingdom	operations by	A748	Turboprop	HAWKER SIDDELEY	HS-748	M
MPH	Martinair	Netherlands	operations by	B742	Jet	BOEING	747-200	H
MPH	Martinair	Netherlands	operations by	B744	Jet	BOEING	747-400	H
MPH	Martinair	Netherlands	operations by	MD11	Jet	MCDONNELL DOUGLAS	MD-11	H
PSW	Pskovavia	Russian Federation (CIS)	operations by	AN26	Turboprop	ANTONOV	An-26	M
SAA	South African Airways	South Africa	operations by	MD11	Jet	MCDONNELL DOUGLAS	MD-11	H
SWT	Swiftair	Spain	except operations by	MD83	Jet	MCDONNELL DOUGLAS	MD-83	M
TPA	Tampa Cargo	Colombia	operations by	MD11	Jet	MCDONNELL DOUGLAS	MD-11	H
TUP	Aviastar-TU	Russian Federation (CIS)	operations by	T204	Jet	TUPOLEV	Tu-204	M
UAE	Emirates	United Arab Emirates	operations by	A310	Jet	AIRBUS	A-310	H
UAE	Emirates	United Arab Emirates	operations by	B744	Jet	BOEING	747-400	H
UCR	Aero Charter Ukraine	Ukraine	operations by	AN26	Turboprop	ANTONOV	An-26	M
UGN	Yuzhnaya Avia	Ukraine	operations by	IL18	Turboprop	ILYUSHIN	Il-18	M
VDA	Volga Dnepr Airlines	Russian Federation (CIS)	operations by	B742	Jet	BOEING	747-200	H
WDL	WDL Aviation	Germany	operations by	F27	Turboprop	FOKKER	F-27 Friendship	M

Figure 57. Operators operating these specific aircraft types are of cargo type.

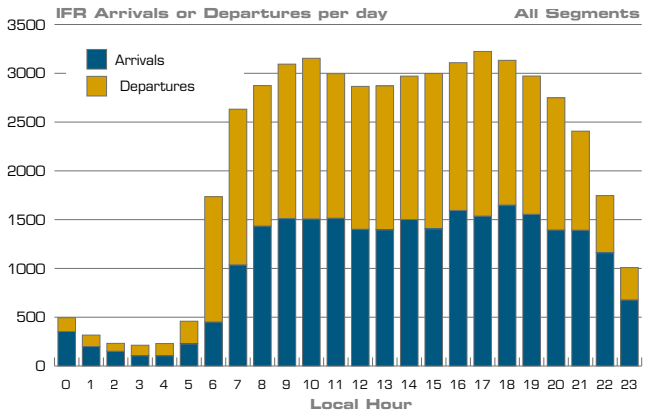
A. Definitions

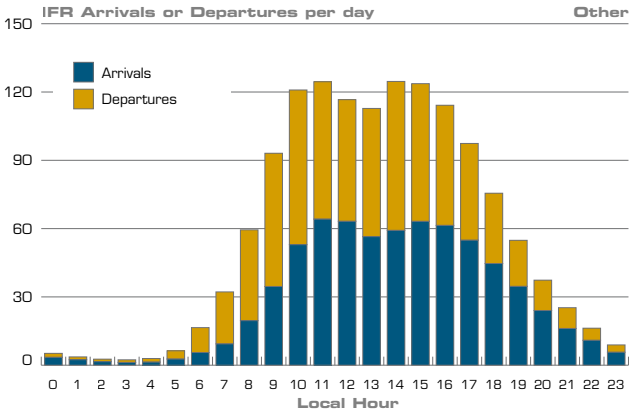
ICAO Code	Operator name	Country	with callsign
AFR	Air France	France	AFR6xxx
AIC	Air India	India	AIC198
AIC	Air India	India	AIC199
ANZ	Air New Zealand	New Zealand	ANZ6xxx
AWC	Titan Airways	United Kingdom	AWC0xx+letter
AZA	Alitalia	Italy	AZA9xx
BAW	British Airways	United Kingdom	BAW3xxx
CAL	China Airlines	Taiwan	CAL5xxx
CPA	Cathay Pacific Airways	China	CPA0xx
ETD	Etihad Airways	United Arab Emirates	ETD9xx
ETH	Ethiopian Airlines	Ethiopia	ETH371x
EXS	Jet2	United Kingdom	EXS0xx+letter
ICE	Icelandair	Iceland	ICE7xx
JAL	Japan Air Lines International	Japan	JAL6xxx
KAL	Korean Air	Korea (South)	KAL9xx
KLM	KLM Royal Dutch Airlines	Netherlands	KLM1xx+letter
MAS	MAS - Malaysian Airlines System	Malaysia	MAS6xxx
QFA	Qantas	Australian	QFA7xxx
RJA	Royal Jordanian Airlines	Jordan	RJA03x
SVA	Saudi Arabian Airlines	Saudia Arabia	SVA9xx
THY	Turkish Airlines - THY	Turkey	THY6xxx

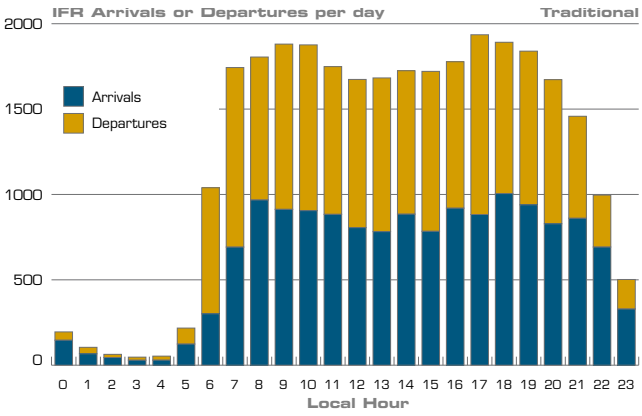
Figure 58. Operators operating these specific callsigns are of cargo type.

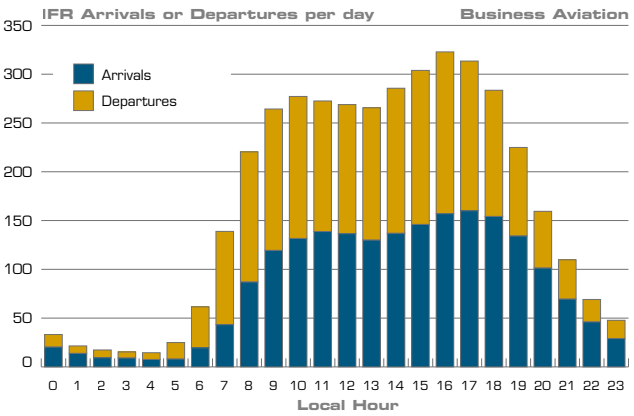
B. Market segments – traffic by time of day and by phase

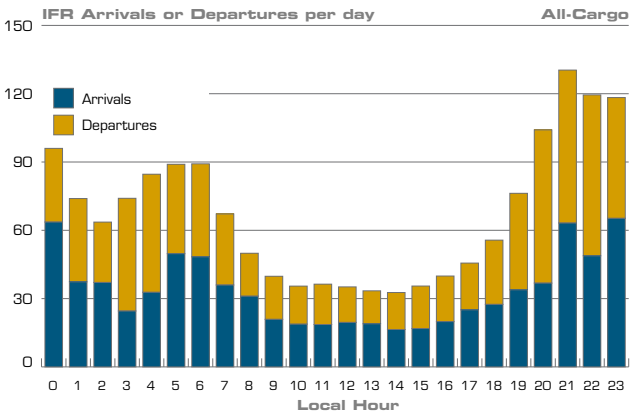
Figure 59 provides graphs of hourly movements for each market segment (underlying data for figure from section 2).



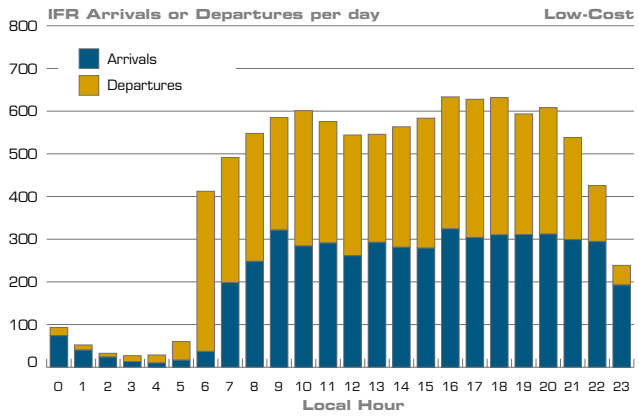


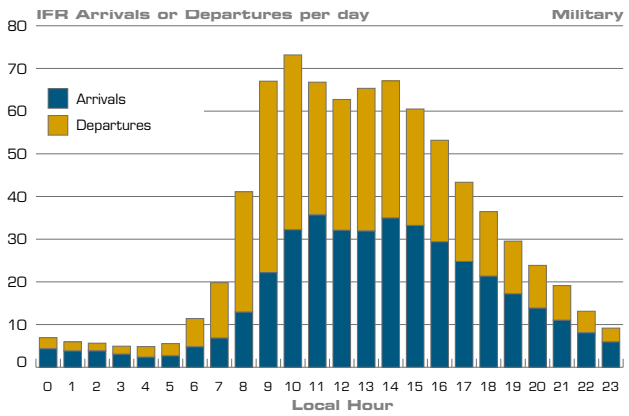






B. Market segments – traffic by time of day and by phase





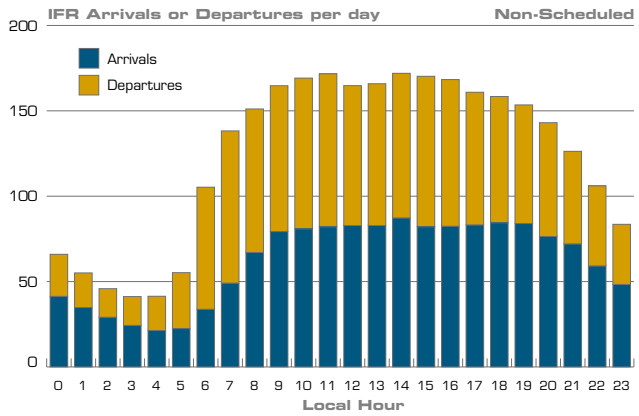


Figure 59.
Hourly arrivals and departures by market segments in 2007 (source: EUROCONTROL. Vertical scales varied to emphasise different profiles).

Figure 60 provides tables containing the underlying data for figures from section 8.

	Deep Night		Night		Not Deep Night		Not Night	
	2004	2007	2004	2007	2004	2007	2004	2007
	Share (%)	Share (%)	Share (%)	Share (%)	Share (%)	Share (%)	Share (%)	Share (%)
Other	1.1	1.1	1.0	1.0	3.1	2.8	3.2	2.9
Military	2.5	1.9	1.7	1.2	2.1	1.6	2.1	1.6
Business	5.8	6.9	4.6	5.0	7.0	8.0	7.2	8.3
All-Cargo	26.9	26.4	15.7	14.7	2.4	2.5	1.9	2.0
Low-Cost	4.8	15.7	8.5	20.2	11.4	20.0	11.5	19.9
Traditional	37.7	31.2	54.3	47.4	66.9	59.6	67.2	59.9
Non-Scheduled	21.1	16.8	14.4	10.5	7.1	5.6	6.9	5.4

Figure 60. Low-Cost and Business Aviation are the two market segments which shares have increased regardless of the phase between 2004 and 2007 (source: EUROCONTROL).

C. Summary of cargo traffic per state

Figure 61 provides tables containing the underlying data for section 17.

	Country Name	Total Mvts (%)
1	Germany	13.5
2	Belgium/Luxembourg	11.4
3	France	8.4
4	UK	7.5
5	Italy	5.0
6	Netherlands	3.9
7	Austria	3.3
8	Spain	3.3
9	Ireland	3.1
10	Hungary	3.0
11	Turkey	3.0
12	Czech Republic	2.7
13	Switzerland	2.7
14	Ukraine	2.6
15	Sweden	2.5
Other	-	24.0
Total	-	100

Figure 61.
Top 15 countries for cargo movements at airports (2007).

D. Summary of cargo traffic per airport

	Night (23-07)				Not Night			
	Airport	Airport Name	Mvts per Day	Mvts (%)	Airport	Airport Name	Mvts per Day	Mvts (%)
1	LFPG	PARIS CH DE GAULLE	72.39	9.36	LFPG	PARIS CH DE GAULLE	44.17	4.16
2	EDDK	KÖLN-BONN	64.44	8.34	EHAM	SCHIPHOL AMSTERDAM	39.45	3.71
3	EBLG	LIÈGE/LIÈGE	59.30	7.67	EDDF	FRANKFURT MAIN	39.24	3.69
4	EBBR	BRUSSELS NATIONAL	44.64	5.77	ELLX	LUXEMBOURG	27.48	2.59
5	EGNX	EAST MIDLANDS	37.86	4.90	EBBR	BRUSSELS NATIONAL	27.00	2.54
6	EDDF	FRANKFURT MAIN	22.78	2.95	LEMD	MADRID BARAJAS	19.57	1.84
7	LEMD	MADRID BARAJAS	16.83	2.18	LTBA	ISTANBUL-ATATURK	19.03	1.79
8	LIME	BERGAMO/ORIO ALSERIO	15.11	1.95	EGSS	LONDON/STANSTED	18.26	1.72
9	EDDP	LEIPZIG/HALLE	12.54	1.62	EGNX	EAST MIDLANDS	18.06	1.70
10	ESSA	STOCKHOLM-ARLANDA	12.28	1.59	LFBO	TOULOUSE BLAGNAC	17.09	1.61
11	LFML	MARSEILLE PROVENCE	12.15	1.57	LIMC	MILANO MALPENSA	17.08	1.61
12	LGAV	ATHINAI E. VENIZELOS	12.11	1.57	EDDK	KÖLN-BONN	16.73	1.57
13	LEBL	BARCELONA	11.64	1.51	LGAV	ATHINAI E. VENIZELOS	16.60	1.56
14	EKCH	COPENHAGEN KASTRUP	10.67	1.38	LFML	MARSEILLE PROVENCE	14.52	1.37
15	EGSS	LONDON/STANSTED	10.37	1.34	LHBP	FERIHEGY-BUDAPEST	12.71	1.20
Other	-	-	357.93	46.30	-	-	715.91	67.35
Total	-	-	773.03	100.00	-	-	1062.90	100.00

Figure 62. Top 15 airports of cargo night departures (2007). Disparity between night and not night airports is higher than for the deep night phase.

Rank	Airport	Airport Name	2007 Cargo Deps/Day	2004 Cargo Deps/Day	Cargo Growth	2007 % Cargo	2007 Busiest Cargo Day
1	LFPG	PARIS CH DE GAULLE	53.2	48.5	9.7%	7.0%	53
2	EDDK	KÖLN-BONN	38.6	32.5	18.7%	19%	47
3	EBBR	BRUSSELS NATIONAL	35.6	34.1	4.4%	10%	40
4	EBLG	LIÈGE/LIÈGE	35.1	23.2	51.5%	82%	39
5	EDDF	FRANKFURT MAIN	30.8	18.7	64.6%	4.6%	29
6	EGNX	EAST MIDLANDS	27.9	19.2	45.4%	30%	28
7	EHAM	SCHIPHOL AMSTERDAM	22.7	20.9	8.5%	3.7%	31
8	ELLX	LUXEMBOURG	17.0	14.0	21.2%	21%	22
9	EDDP	LEIPZIG/HALLE	14.0	2.1	561.7%	23%	18
10	EGSS	LONDON/STANSTED	13.8	13.1	5.7%	4.9%	18
11	LIME	BERGAMO/ORIO ALSERIO	13.5	11.6	16.8%	16%	16
12	LFML	MARSEILLE PROVENCE	12.4	8.2	51.1%	8.8%	14
13	ESSA	STOCKHOLM-ARLANDA	11.8	10.1	17.1%	4.0%	14
14	LTBA	ISTANBUL-ATATURK	11.6	12.0	(3.2%)	3.5%	15
15	ENGM	OSLO/GARDERMOEN	10.9	2.2	396.1%	3.5%	10

Figure 63. Top 15 airports of cargo departures (2007 compared to 2004).

Rank	Airport	Airport Name	2007 Cargo Deps/Day	2004 Cargo Deps/Day	Cargo Growth	2007 % Cargo	2007 Busiest Cargo Day
1	LFPG	PARIS CH DE GAULLE	35.1	34.3	2.2%	55%	53
2	EDDK	KÖLN-BONN	34.3	29.9	14.7%	57%	47
3	EBLG	LIÈGE/LIÈGE	29.0	18.8	54.4%	95%	39
4	EBBR	BRUSSELS NATIONAL	22.2	21.2	4.7%	45%	33
5	EGNX	EAST MIDLANDS	21.6	15.2	42.6%	65%	28
6	EDDF	FRANKFURT MAIN	12.2	7.6	60.1%	27%	15
7	EDDP	LEIPZIG/HALLE	9.5	0.1	6476%	52%	18
8	LIME	BERGAMO/ORIO ALSERIO	8.8	8.0	9.6%	54%	11
9	EKCH	COPENHAGEN KASTRUP	6.4	5.6	13.7%	31%	11
10	ESSA	STOCKHOLM-ARLANDA	5.9	6.5	(10.1%)	22%	9
11	ENGM	OSLO/GARDERMOEN	5.5	0.0	- %	19%	9
12	LFML	MARSEILLE PROVENCE	5.2	3.0	72.6%	29%	6
13	ESMS	MALMÖ/STURUP	4.6	4.0	16.6%	46%	10
14	EGBE	COVENTRY	4.6	6.0	(23.0%)	60%	8
15	EGSS	LONDON/STANSTED	4.1	3.0	38.5%	11%	7

Figure 64. Top 15 airports of night cargo departures (2007 compared to 2004).

Rank	Airport	Airport Name	2007 Cargo Deps/Day	2004 Cargo Deps/Day	Cargo Growth	2007 % Cargo	2007 Busiest Cargo Day
1	EDDK	KÖLN-BONN	29.7	24.3	22.2%	81%	47
2	LFPG	PARIS CH DE GAULLE	29.0	29.5	(1.7%)	84%	53
3	EBLG	LIÈGE/LIÈGE	21.2	15.5	36.7%	98%	39
4	EBBR	BRUSSELS NATIONAL	19.2	17.3	10.7%	94%	33
5	EGNX	EAST MIDLANDS	15.3	10.6	43.7%	92%	28
6	EDDF	FRANKFURT MAIN	7.4	4.2	76.1%	46%	15
7	EGBE	COVENTRY	3.9	5.0	(22.4%)	88%	8
8	LIME	BERGAMO/ORIO ALSERIO	3.8	3.4	10.6%	78%	9
9	EDDP	LEIPZIG/HALLE	3.7	0.1	4167.9%	60%	18
10	ESSA	STOCKHOLM-ARLANDA	3.3	4.3	(23.9%)	40%	9
11	LFML	MARSEILLE PROVENCE	3.1	2.6	17.5%	71%	6
12	LIRF	ROME FIUMICINO	2.4	3.5	(32.5%)	20%	6
13	EGSS	LONDON/STANSTED	2.2	1.8	20.3%	47%	7
14	LTBA	ISTANBUL-ATATURK	2.0	2.3	(10.3%)	15%	6
15	LEMD	MADRID BARAJAS	1.8	1.5	17.6%	8.8%	6

Figure 65. Top 15 airports of deep night cargo departures (2007 compared to 2004).

D. Summary of cargo traffic per airport

	Airport Name	Airport Name	Mvts per Day	Top 15 AP pair traffic (%)
1	BELFAST/ALDERGROVE	EAST MIDLANDS	8.4	11.8
2	KÖLN-BONN	EAST MIDLANDS	6.9	9.7
3	EAST MIDLANDS	EDINBURGH	6.1	8.5
4	TOULOUSE BLAGNAC	PARIS CH DE GAULLE	5.0	7.0
5	LUXEMBOURG	BAKU/HEYDAR ALIYEV	4.9	6.9
6	MAKEDONIA	ATHINAI E. VENIZELOS	4.6	6.5
7	BRUSSELS NATIONAL	EAST MIDLANDS	4.6	6.5
8	MARSEILLE PROVENCE	PARIS CH DE GAULLE	4.5	6.3
9	WIEN SCHWECHAT	OSTRAVA	4.3	6.1
10	KÖLN-BONN	BERGAMO/ORIO ALSERIO	4.3	6.0
11	BRUSSELS NATIONAL	BERGAMO/ORIO ALSERIO	3.9	5.5
12	LONDON/STANSTED	PARIS CH DE GAULLE	3.7	5.2
13	BILLUND	STAVANGER/SOLA	3.5	4.9
14	KÖLN-BONN	ISTANBUL-ATATURK	3.4	4.7
15	TRONDHEIM/VAERNES	OSLO/GARDERMOEN	3.3	4.6
All	-	-	71.4	100.0

Figure 66.
The top 15 intra-EU airport pairs (2007). East-Midlands, the UK mini-hub for intra-European cargo traffic, features in the top 3.

E. Intercontinental cargo and scheduled daily movements

Figure 67 provides graphs of hourly distribution of daily departures of cargo and scheduled flights going outside of Europe (these are the figures referring to Section 19).

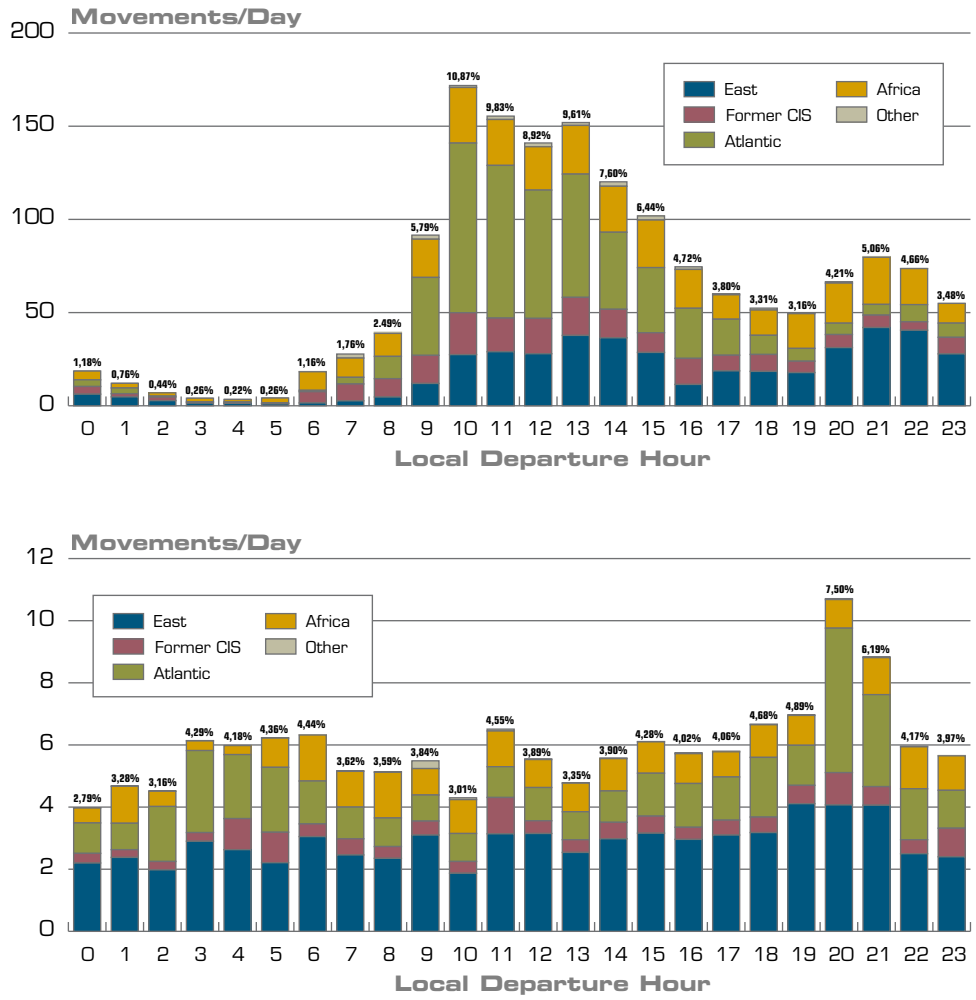


Figure 67. Flights departing in Europe and arriving outside of Europe (top: scheduled / bottom: cargo).

F. Summary of cargo traffic per aircraft type

In 2007, the top 15 cargo aircraft types accounted for 77% of all cargo departures during the day and 83% of all cargo traffic during the night.

		ICAO Aircraft Type	Num. Engines	2007 Cargo Deps/Day	2004 Cargo Deps/Day	Change
1	Jet	B733	2	99.2	48.9	103.1%
2	Jet	B744	4	95.0	58.8	61.4%
3	Jet	B752	2	89.9	98.6	(8.8%)
4	Jet	MD11	3	78.3	38.2	105.0%
5	Jet	A30B	2	69.0	55.5	24.5%
6	Jet	B742	4	55.5	58.1	(4.6%)
7	Turboprop	ATP	2	52.5	15.7	235.1%
8	Jet	B462	4	32.4	23.1	40.2%
9	Turboprop	F27	2	27.0	53.7	(49.8%)
10	Jet	B762	2	26.9	0.0	- %
11	Turboprop	AN26	2	25.5	18.9	35.0%
12	Turboprop	AT72	2	23.3	12.8	82.2%
13	Turboprop	AN12	4	22.2	23.8	(6.5%)
14	Turboprop	AT43	2	21.9	9.1	142.1%
15	Jet	B463	4	20.7	21.2	(2.4%)
Other	Jet	-	-	121.5	130.9	(7.2%)
	Piston	-	-	0.0	0.2	(100%)
	Turboprop	-	-	61.6	140.3	(56.1%)
All		-	-	922.7	807.8	(14.2%)

Figure 68. Top 15 cargo departures by ICAO aircraft types (2007 compared to 2004).

		ICAO Aircraft Type	Num. Engines	2007 Cargo Deps/Night	2004 Cargo Deps/Night	Change
1	Jet	B752	2	48.9	54.1	(9.6%)
2	Jet	B733	2	43.2	23.0	87.7%
3	Jet	A30B	2	31.5	27.3	15.1%
4	Turboprop	ATP	2	25.9	8.6	201.5%
5	Jet	B462	4	18.6	13.1	41.8%
6	Jet	MD11	3	17.8	6.4	180.2%
7	Jet	B762	2	14.8	0.0	- %
8	Turboprop	F27	2	12.8	29.8	(56.9%)
9	Turboprop	AT72	2	11.3	6.2	81.4%
10	Jet	B744	4	10.7	5.6	90.2%
11	Jet	B463	4	10.4	12.6	(17.4%)
12	Jet	A306	2	8.9	6.4	39.7%
13	Jet	B763	2	8.6	5.3	63.8%
14	Turboprop	AN26	2	7.3	5.1	42.2%
15	Turboprop	SH36	2	6.3	14.1	(55.0%)
Other	Jet	-	-	21.7	25.4	(14.5%)
	Turboprop	-	-	22.1	43.9	(49.7%)
All		-	-	321.0	286.9	11.9%

Figure 69. Top 15 night cargo departures by ICAO aircraft types (2007 compared to 2004).

G. The largest European cargo fleet by operators

		Nb Aircraft
	Operator	
1	European Air Transport (EAT)	50
2	TNT Airways	38
3	Ukrainian Cargo Airways	24
5	Air Contractors	19
	Lufthansa Cargo Airlines	19
6	MNG Airlines	15
10	Atlantic Airlines	14
	Farnair Group	14
	Swiftair	14
	West Air Sweden	14
11	Air France	13
13	Antonov Airlines	12
	WDL Aviation	12
14	MK Airlines (UK)	11
15	Air Atlanta Icelandic	10

Figure 70. Top 15 European registered cargo fleet (2007).

The DHL share is represented by BCS (European Air Transport) and DHK (DHL Air UK) which are wholly-owned subsidiaries of DHL.

H. Main country-to-country flows of cargo by engine type

Rank	Jet				Turboprop			
	Between	And	Mvts per Day	(%) of This Type	Between	And	Mvts per Day	(%) of This Type
1	France	France	77.8	6.4	UK	UK	100.4	18.4
2	Germany	North Atlantic	35.4	2.9	France	France	33.2	6.1
3	Belgium/Luxembourg	UK	34.2	2.8	Greece	Greece	29.8	5.5
4	Italy	Italy	32.5	2.7	Italy	Italy	28.8	5.3
5	Belgium/Luxembourg	North Atlantic	32.4	2.7	Sweden	Sweden	25.4	4.7
6	Belgium/Luxembourg	Middle-East	31.5	2.6	Spain	Spain	18.4	3.4
7	Belgium/Luxembourg	Germany	31.2	2.5	Germany	Germany	17.4	3.2
8	Germany	UK	30.4	2.5	Norway	Norway	17.0	3.1
9	UK	North Atlantic	30.2	2.5	Poland	Poland	15.7	2.9
10	UK	UK	28.8	2.4	France	Germany	14.8	2.7
11	Belgium/Luxembourg	Italy	26.8	2.2	Germany	UK	10.1	1.8
12	Belgium/Luxembourg	France	25.7	2.1	Ireland	UK	9.3	1.7
13	Netherlands	Middle-East	24.4	2.0	Hungary	Romania	9.2	1.7
14	Germany	Middle-East	24.3	2.0	France	UK	8.5	1.6
15	Belgium/Luxembourg	Spain	22.4	1.8	Germany	Poland	7.8	1.4
Other	-	-	735.7	60.1	-	-	198.7	36.5
All	-	-	1224.0	100.0	-	-	544.6	100.0

Figure 71. Top 15 country-to-country flows for cargo movements in 2007.

Rank	Jet				Turboprop			
	Between	And	Mvts per Night	(%) of This Type	Between	And	Mvts per Night	(%) of This Type
1	France	France	38.8	6.8	UK	UK	60.5	18.6
2	Italy	Italy	18.7	3.3	France	France	16.7	5.1
3	Belgium/Luxembourg	UK	17.4	3.0	Greece	Greece	15.6	4.8
4	Belgium/Luxembourg	Middle-East	15.3	2.7	Spain	Spain	14.0	4.3
5	Germany	UK	15.2	2.7	Italy	Italy	10.4	3.2
6	UK	UK	14.4	2.5	Germany	Germany	10.4	3.2
7	France	Germany	12.0	2.1	Sweden	Sweden	10.4	3.2
8	Germany	Turkey	10.9	1.9	Poland	Poland	9.8	3.0
9	Netherlands	Middle-East	10.8	1.9	Norway	Norway	9.3	2.9
10	Germany	North Atlantic	10.4	1.8	Hungary	Romania	8.8	2.7
11	France	UK	10.1	1.8	France	Germany	6.5	2.0
12	Belgium/Luxembourg	North Atlantic	10.0	1.8	Germany	Poland	6.4	2.0
13	Spain	Spain	9.2	1.6	Netherlands	UK	6.1	1.9
14	Belgium/Luxembourg	Italy	9.1	1.6	Germany	UK	6.0	1.8
15	Belgium/Luxembourg	Spain	8.8	1.5	Denmark	Denmark	5.3	1.6
Other	-	-	357.2	62.8	-	-	129.4	39.7
All	-	-	568.4	100.0	-	-	325.7	100.0

Figure 72. Top 15 country-to-country flows for cargo movements in 2007 during the night phase.

Rank	Jet				Turboprop			
	Between	And	Mvts per Deep Night	(%) of This Type	Between	And	Mvts per Deep Night	(%) of This Type
1	France	France	31.5	11.9	UK	UK	18.4	12.7
2	Belgium/Luxembourg	Germany	16.8	6.4	Spain	Spain	17.5	12.0
3	Belgium/Luxembourg	France	13.7	5.2	France	France	12.9	8.9
4	Belgium/Luxembourg	UK	12.3	4.7	Greece	Greece	11.2	7.7
5	Germany	UK	11.8	4.5	Sweden	Sweden	10.3	7.1
6	Belgium/Luxembourg	Italy	10.8	4.1	Italy	Italy	7.8	5.4
7	Belgium/Luxembourg	Spain	10.2	3.9	France	Germany	7.1	4.9
8	UK	UK	7.5	2.9	Ireland	UK	5.0	3.4
9	Italy	Italy	7.2	2.7	Germany	UK	3.9	2.7
10	Germany	Italy	6.8	2.6	France	UK	3.7	2.6
11	Germany	North Atlantic	5.8	2.2	Belgium/Luxem-bourg	UK	3.6	2.5
12	Germany	Spain	5.7	2.2	Norway	Norway	3.3	2.3
13	France	Germany	5.4	2.0	Canary Islands	Canary Islands	3.0	2.1
14	France	UK	5.1	1.9	Germany	Germany	3.0	2.0
15	France	Italy	5.0	1.9	Germany	Switzerland	2.7	1.9
Other	-	-	108.7	41.1	-	-	31.5	21.7
All	-	-	264.3	100.0	-	-	145.1	100.0

Figure 73. Top 15 country-to-country flows for cargo movements in 2007 during the deep night phase.

I. Main intra-EU cargo airport-to-airport flows

	Airport Name	Airport Name	Mvts per Day	Top 15 AP pair traffic (%)
1	KÖLN-BONN	EAST MIDLANDS	5.0	11.1
2	BELFAST/ALDERGROVE	EAST MIDLANDS	4.1	9.0
3	BRUSSELS NATIONAL	EAST MIDLANDS	3.8	8.4
4	TOULOUSE BLAGNAC	PARIS CH DE GAULLE	3.6	8.0
5	EAST MIDLANDS	EDINBURGH	3.6	8.0
6	BRUSSELS NATIONAL	BERGAMO/ORIO ALSERIO	3.3	7.2
7	KÖLN-BONN	BERGAMO/ORIO ALSERIO	3.0	6.7
8	BRUSSELS NATIONAL	KÖLN-BONN	2.7	5.9
9	MARSEILLE PROVENCE	PARIS CH DE GAULLE	2.5	5.6
10	BRUSSELS NATIONAL	LONDON/LUTON	2.5	5.5
11	BRUSSELS NATIONAL	LEIPZIG/HALLE	2.4	5.3
12	LYON SATOLAS	PARIS CH DE GAULLE	2.3	5.0
13	KÖLN-BONN	PARIS CH DE GAULLE	2.2	4.8
14	LIÈGE/LIÈGE	NUERNBERG	2.2	4.8
15	KÖLN-BONN	MALMÖ/STURUP	2.1	4.6
All	-	-	45.4	100.0

Figure 74.
Top 15 airport-pair flows for cargo movements in 2007 during night.

	Airport Name	Airport Name	Mvts per Day	Top 15 AP pair traffic (%)
1	KÖLN-BONN	EAST MIDLANDS	4.2	12.3
2	TOULOUSE BLAGNAC	PARIS CH DE GAULLE	3.1	8.9
3	BRUSSELS NATIONAL	EAST MIDLANDS	3.0	8.7
4	BELFAST/ALDERGROVE	EAST MIDLANDS	3.0	8.7
5	BRUSSELS NATIONAL	KÖLN-BONN	2.7	7.7
6	MARSEILLE PROVENCE	PARIS CH DE GAULLE	2.4	7.1
7	KÖLN-BONN	BERGAMO/ORIO ALSERIO	2.3	6.8
8	BRUSSELS NATIONAL	BERGAMO/ORIO ALSERIO	2.1	6.1
9	LYON SATOLAS	PARIS CH DE GAULLE	1.7	5.0
10	LIÈGE/LIÈGE	WIEN SCHWECHAT	1.7	4.9
11	EAST MIDLANDS	PARIS CH DE GAULLE	1.7	4.9
12	BRUSSELS NATIONAL	LEIPZIG/HALLE	1.7	4.8
13	KÖLN-BONN	LEIPZIG/HALLE	1.6	4.8
14	EAST MIDLANDS	EDINBURGH	1.6	4.6
15	BRUSSELS NATIONAL	LONDON/LUTON	1.5	4.5
All	-	-	34.3	100.0

Figure 75.
Top 15 airport-pair flows for cargo movements in 2007 during deep night.

J. Glossary

ACMI (Aircraft, Crew, Maintenance and Insurance): Form of charter whereby the lessor provides minimum operating services including aircraft, crew, maintenance and insurance, and the lessee provides the balance of services along with flight numbers.

Cargo:

- when used by the airline industry (in the broad sense), it means any property (freight, express and mail) transported by air except baggage. *This corresponds to the definition used in the present document.*
- from ICAO: any property carried on an aircraft other than mail, stores and accompanied or mishandled baggage. *Be careful, this is not the definition used in the present document!*

Combination aircraft: a transport aircraft capable of carrying both passengers and cargo on the main deck, often in varied configurations.

Consolidator: an entity that provides consolidation services, joining multiple shipments into a shipment for tender to an air carrier. An Air Freight Forwarder performs the function of a consolidator.

Forwarder: An international freight forwarder is an agent for the exporter in moving cargo to an overseas destination. These agents are familiar with the import rules and regulations of foreign countries, the export regulations of the country's government, the methods of shipping, and the documents related to foreign trade. Export freight forwarders are licensed by the International Air Transport Association (IATA) to handle air freight.

Freight: in the present document, Freight = Cargo – Mail

Freight "on board": All freight on board an aircraft upon landing at an airport and at take off from an airport. *Direct transit freight is included and it is counted at both landing and take off.*

J. Glossary

Integrated carrier (integrator): A carrier that provides door-to-door air cargo transportation using its own or contracted airplanes and motor trucks, and performs this service under the authority of a singe airway bill.

Loaded or Unloaded (freight): Any freight loaded onto or unloaded from an aircraft. Direct transit freight is excluded.

Mail: Dispatches of correspondence and other objects carried on an aircraft, which have been dispatched by and intended for delivery to postal administrations. Express freight and express parcel shipments are excluded.

Payload: load capacity of an aircraft including fuel, crew, passengers, freight, cargo equipment, (maximum takeoff weight minus basic empty weight).

- gross payload: the weight of the cargo including cargo equipment (Unit Load Device)
- net payload: the weight of the cargo itself

Quick change aircraft: an aircraft designed to allow a quick change of configuration from passenger to cargo and vice versa. Such aircraft may also have enhanced freight carrying capabilities, including, for example, enlarged doors.

UTC: Universal Time Coordinated.

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