



# Air traffic in Germany

Mobility Report 2016



**DFS** Deutsche Flugsicherung



# The year 2016

## Air traffic in German airspace



### Safety

**Infringements of separation (en-route)** Per 1 million flight hours (RAT ABC)



**Infringements of separation (terminal)** Also includes runway incursions per 100,000 aircraft movements (RAT ABC)



### Punctuality

**ATFM delay en-route**  
Delay per flight (ATC-related)



**ATFM delay arrival**  
Delay per flight (ATC-related)



### Environment

**Horizontal flight efficiency**  
Deviation from the direct route



\*ca. 3.7 km

# 2016 was a good year for both passengers and airlines

The 5,500 staff at DFS work diligently to ensure that air traffic in Germany is as safe, punctual and environmentally friendly as possible. Key performance indicators measure how well targets in these areas and others are achieved. Overall, 2016 was a good year for both passengers and airlines. The DFS Mobility Report 2016 provides you with valuable information about important trends in the air traffic sector in Germany, Europe and around the world.





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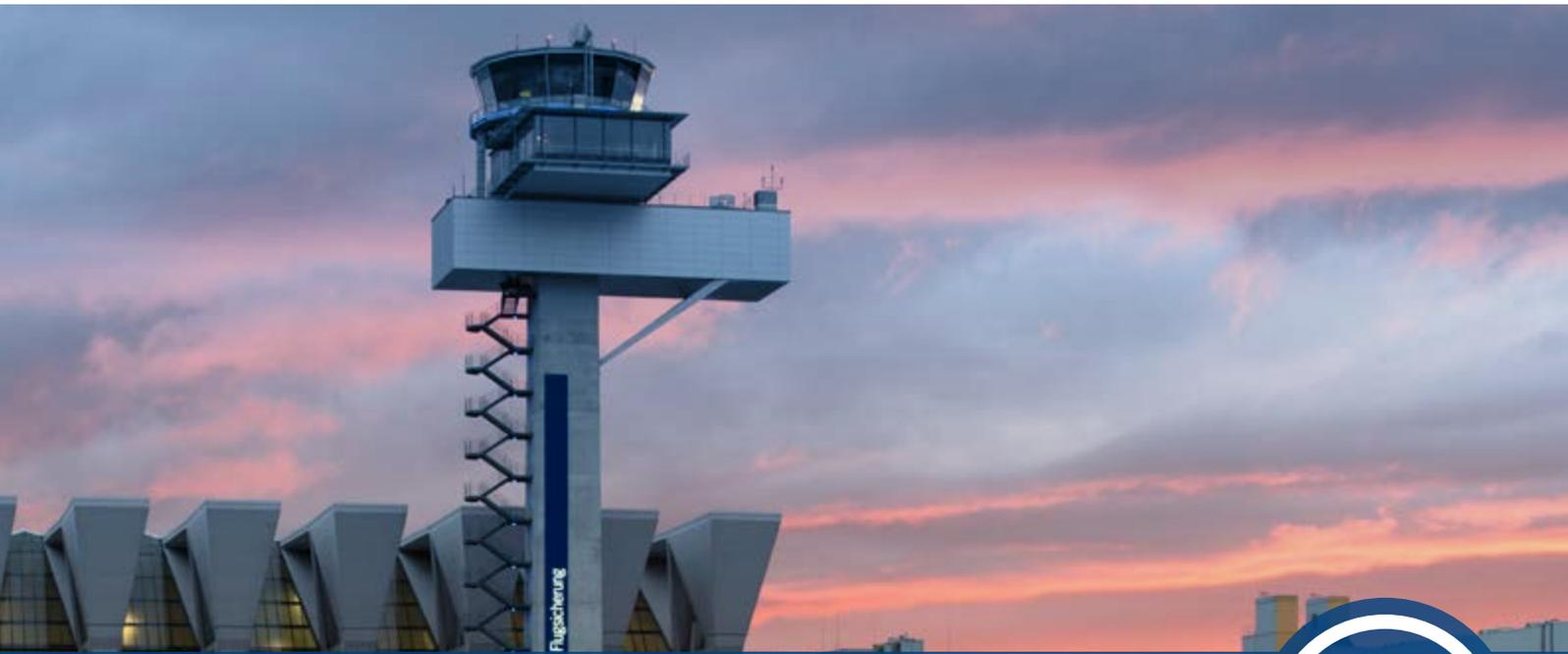
## Punctuality

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## Environment

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## One third of all flights in the EU: Air traffic in Germany



In 2016, air traffic controllers handled 3.1 million flights under instrument flight rules in German airspace, a rise of 2.6 percent over the previous year. For 2017, DFS has a new record in sight.

In 2016, 2.6 percent more flights were recorded in Germany. That means traffic grew by just slightly below the average of all EU States (+3.1%). The total number of flights under instrument flight rules (IFR) controlled in German airspace was 3,108,761. In 2016, the 28 EU Member States registered 9.21 million controlled flights. Thanks to Germany's central location in Europe, about one third of these were handled by DFS air traffic controllers.

Increasing traffic volumes in other European countries in 2016 meant that the number of flights over Germany also grew at an above-average rate. These flights now account for 38 percent of all flights in German airspace (2015: 37.5%; 2006: 34.3%). Entries to and exits from German airspace accounted for 25.8 percent each of all controlled flights. Only 10.5 percent of flights

were domestic flights. The number of IFR take-offs and landings at Germany's designated international airports grew by only 2.3 percent to reach about two million in 2016.

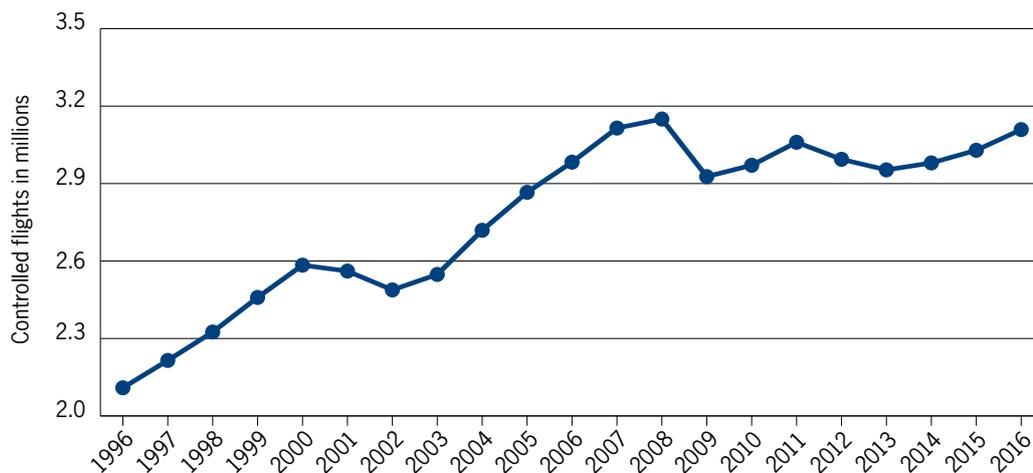
The largest growth in traffic in 2016 was recorded at Berlin Schönefeld Airport (+27.6% take-offs and landings). This growth can mainly be attributed to the low-cost carriers Ryanair and easyJet. Cologne Bonn Airport also experienced above-average growth. Some of this growth is due to an increasing number of flights by the cargo airlines UPS and FedEx that use this airport as their hub. The remainder can be ascribed to Ryanair as well as to Eurowings, the Lufthansa subsidiary that flies long-haul flights from Cologne. By contrast, regional airports experienced a decrease (-8.4%).



**38**  
**PERCENT**

of all flights in German airspace are overflights. The trend shows stronger growth in other countries than in Germany.

### Traffic numbers over the long term

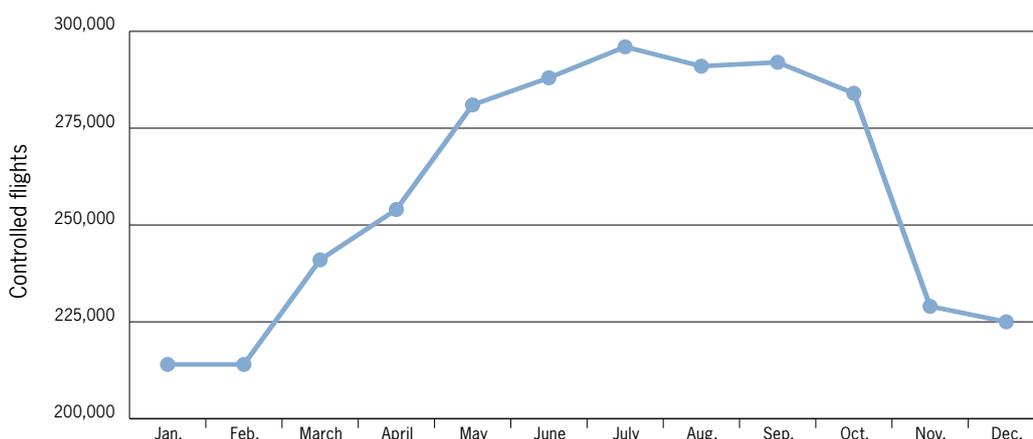


Source: DFS

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
2.109	2.215	2.325	2.459	2.584	2.561	2.488	2.548	2.719	2.866	2.983	3.115	3.150	2.927	2.971	3.060	2.994	2.953	2.980	3.029	3.109

In 2016, air traffic controllers handled 3,108,761 flights under instrument flight rules in German airspace, a rise of 2.6 percent over the previous year. This fell just short of the record set of 3.15 million IFR flights in 2008.

### Traffic by month

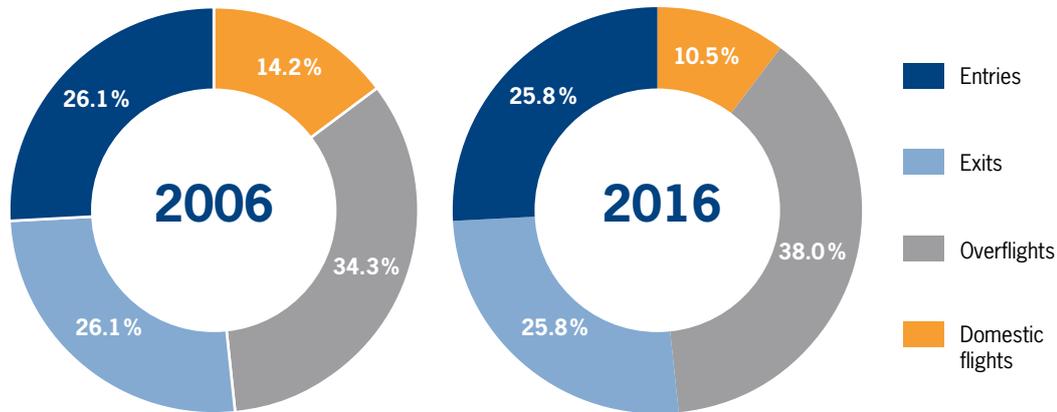


Source: DFS

Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
214,207	213,598	240,733	254,306	280,523	287,763	296,324	290,761	292,139	284,209	229,349	225,164

With more than 296,000 controlled flights, July was the busiest month of 2016. On 15 September, 10,393 IFR flights were recorded in German airspace – more than on any other day of the year.

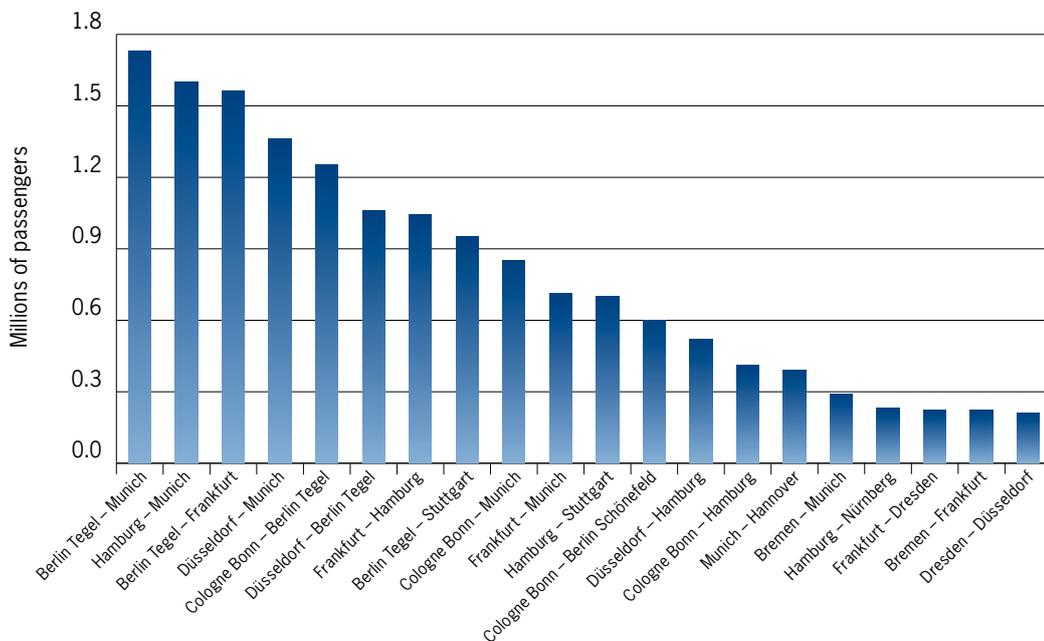
## Traffic segments



Source: DFS

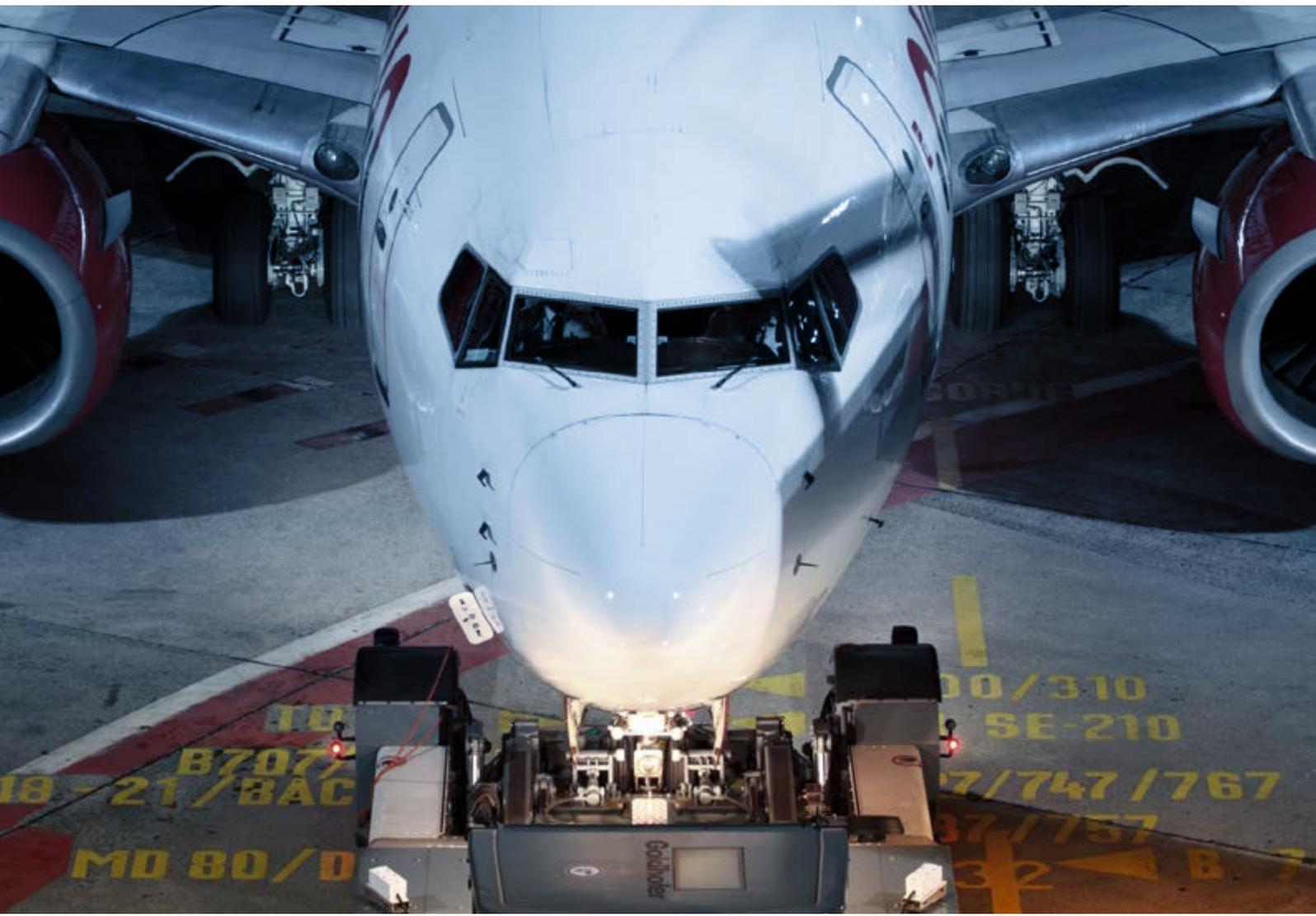
At the turn of the millennium, overflights only amounted to about 31 percent of the air traffic volume in German airspace. By 2016, this segment had increased to 38 percent. During the same period, the percentage of domestic flights sank from 18.3 percent to 10.5 percent.

## Main domestic connections



Source: German Federal Statistical Office

According to the German Federal Statistical Office, 24 million passengers travelled on domestic flights within Germany in 2016. Routes flown between Berlin – Munich, Hamburg – Munich and Frankfurt – Berlin were the most popular.



## IFR take-offs and landings at international airports

	2012	2013	2014	2015	2016	Changes in %
Berlin Schönefeld	69,227	63,092	66,881	74,355	94,886	27.6
Berlin Tegel	170,303	173,979	181,532	183,696	184,974	0.7
Berlin total	239,530	237,071	248,413	258,051	279,860	8.5
Bremen	35,547	35,107	36,538	34,211	32,861	-3.9
Dresden	25,758	22,333	23,502	22,823	22,727	-0.4
Düsseldorf	216,664	210,264	209,771	209,361	216,875	3.6
Erfurt	4,410	4,796	4,883	4,869	4,907	0.8
Frankfurt	482,079	472,549	468,915	468,027	462,742	-1.1
Hamburg	144,572	136,605	146,315	149,939	151,785	1.2
Hannover	67,481	64,157	62,914	62,320	61,797	-0.8
Cologne Bonn	125,380	119,538	122,184	127,356	135,391	6.3
Leipzig Halle	60,466	59,467	60,482	62,417	61,488	-1.5
Munich	395,210	379,107	374,110	377,082	391,521	3.8
Münster Osnabrück	19,689	16,322	17,678	17,611	16,808	-4.6
Nürnberg	53,727	51,943	49,901	48,665	49,495	1.7
Saarbrücken	10,085	9,548	8,567	9,945	9,285	-6.6
Stuttgart	120,279	114,082	113,798	118,931	118,918	0.0
<b>Total</b>	<b>2,000,877</b>	<b>1,932,889</b>	<b>1,947,971</b>	<b>1,971,608</b>	<b>2,016,460</b>	<b>2.3</b>

## IFR take-offs and landings at regional airports

	2012	2013	2014	2015	2016	Changes in %
Altenburg Nobitz*	440	300	349	-	-	-
Augsburg	6,410	6,788	6,887	6,732	6,516	-3.2
Braunschweig	12,014	12,206	11,965	11,727	10,471	-10.7
Dortmund	19,724	19,791	20,097	20,114	19,262	-4.2
Friedrichshafen	13,478	11,974	11,861	12,393	10,109	-18.4
Hahn	27,010	23,939	20,570	20,957	20,634	-1.5
Heringsdorf	1,330	1,115	1,210	984	982	-0.2
Hof Plauen	1,370	1,393	1,902	1,515	1,313	-13.3
Ingolstadt Manching	6,659	6,616	6,987	6,601	5,529	-16.2
Karlsruhe Baden-Baden	17,507	15,776	14,640	13,930	12,707	-8.8
Kassel Calden	2,691	2,950	3,345	3,788	3,792	0.1
Lahr	1,378	606	1,444	1,461	1,493	2.2
Lübeck Blankensee	5,548	5,869	4,861	4,310	2,284	-47.0
Magdeburg Cochstedt**	1,273	948	701	1,246	518	-58.4
Mannheim	5,384	4,934	5,704	6,309	6,591	4.5
Memmingen	11,068	9,175	8,933	11,298	10,541	-6.7
Mönchengladbach	5,007	4,796	5,472	5,726	5,072	-11.4
Niederrhein	16,980	18,897	13,567	13,187	12,714	-3.6
Paderborn Lippstadt	14,524	13,635	12,857	13,048	12,666	-2.9
Rostock Laage	9,582	9,777	9,381	8,449	6,866	-18.7
Schwerin Parchim	1,911	1,487	1,519	1,768	1,320	-25.3
Westerland Sylt	4,916	4,862	5,032	5,553	5,359	-3.5
Zweibrücken*	4,702	4,457	3,743	-	-	-
<b>Total</b>	<b>193,009</b>	<b>182,291</b>	<b>173,027</b>	<b>171,096</b>	<b>156,739</b>	<b>-8.4</b>

At Germany's designated international airports, 2.3 percent more flights were conducted in 2016. At the same time, the number of flights at regional airports declined. These airports are suffering the effects of the decision made by low-cost carriers such as Ryanair to increasingly operate at larger airports. These charts are based on take-offs and landings under instrument flight rules (IFR). Domestic flights count as two aircraft movements – one take-off and one landing.

\* Altenburg and Zweibrücken are no longer classified as regional airports (since 2015).

\*\* Until further notice, flight operations at Magdeburg Cochstedt Airport have been discontinued since September 2016.



## 10.4

### THOUSAND

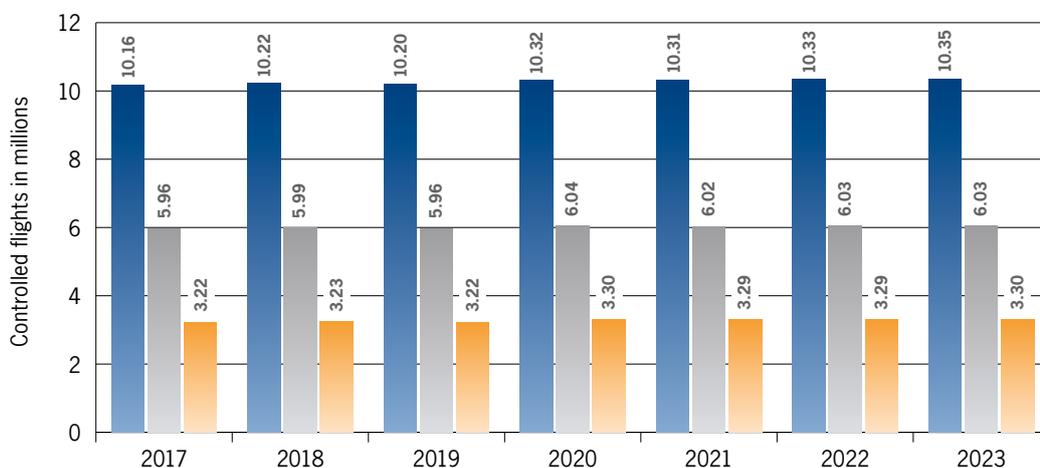
flights controlled by DFS on 15 September – the busiest day in Germany's skies of 2016.

July was again the month with the most traffic, when DFS controlled 296,324 flights. The average number of flights per month remained over 280,000 between the months of May and October. This reveals a shift in holidaymaking behaviour and the expansion of the vacation season. The day with the most flights (10,393 controlled flights) was 15 September, a time when many people still go on holiday and others resume taking business trips after their summer holidays.

controlled flights it reached in 2008. Even conservative predictions made by EUROCONTROL anticipate a peak of more than 3.2 million flights in Germany in 2017 – a new record.

In February 2017, the European Organisation for the Safety of Air Navigation (EUROCONTROL) forecast that air transport in the EU would expand by an average of 1.8 percent annually (compared with 2016) until 2023. EUROCONTROL forecast a moderately below-average annual growth rate of 1.7 percent for Germany. However, the year 2017 is expected to experience somewhat stronger growth. The prediction is for DFS to top the peak of 3.15 million con-

## Future trend for IFR traffic



Source: Low-growth forecast EUROCONTROL

Change over previous year	2017	2018	2019	2020	2021	2022	2023
Europe	1.4%	0.6%	-0.2%	1.2%	-0.1%	0.2%	0.2%
FABEC	2.0%	0.4%	-0.5%	1.4%	-0.3%	0.0%	0.0%
Germany	2.2%	0.6%	-0.5%	2.4%	-0.2%	0.1%	0.1%

EUROCONTROL recalculates its forecast twice a year with three scenarios. These include a conservative, an optimistic and a third scenario somewhere between the two extremes. The figure shows the conservative estimate (low-growth scenario) because in the past the medium-growth scenario was too optimistic.

# Terrorism drives tourists away: Air traffic in Europe

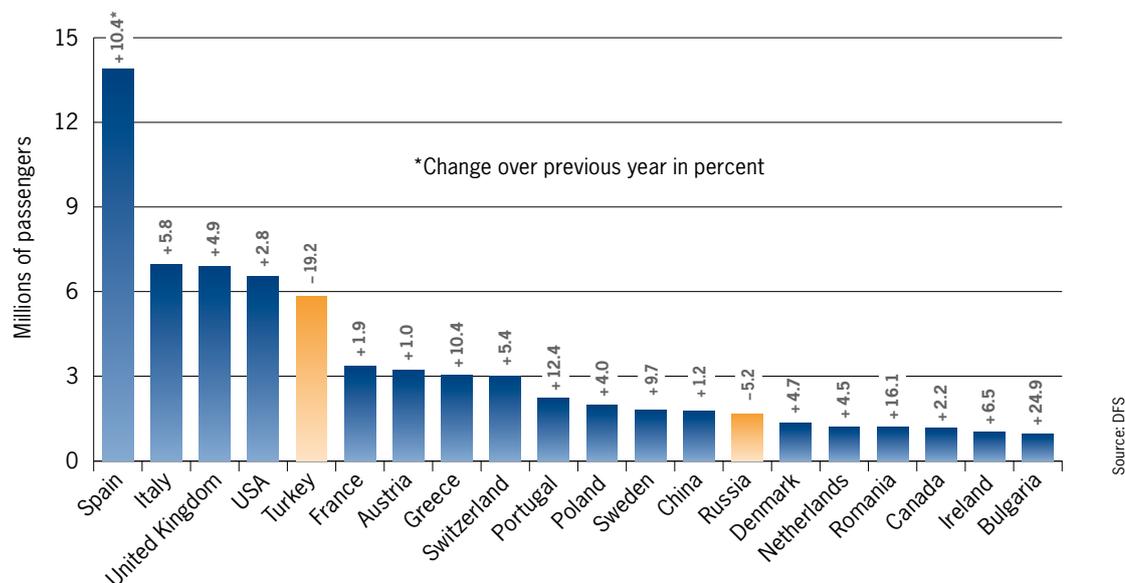
Terrorist attacks caused many holidaymakers to cancel their plans to visit Northern Africa and Turkey in 2016. This resulted in Germany's favourite destination, Spain, becoming even more popular.

Unsurprisingly, terrorist attacks frighten off tourists. In 2016, 29 percent fewer tourists flew to Northern Africa and 23 percent fewer to Turkey. A German study on vacationing and travel showed that two countries benefitted the most. The most popular destination in 2016 was Spain (+8%), and Greece experienced the largest growth rate (+18%).

Examining the number of passengers departing from German airports for non-domestic destinations reveals changes in travel behaviour. Spain remains by far the most popular destination for German air travellers, with 13.9 million

passengers travelling there in 2016. The second most popular destination was Italy. About half as many flew there, about 7 million. The United Kingdom came in at third place (6.9 million) and the United States took fourth place (6.6 million). The biggest loser was Turkey, which ranked only fifth place. In 2016, 5.8 million passengers flew to Turkey from Germany, 19.2 percent fewer than in 2015, when the country was among the most popular destinations. Recent political developments and the security situation will most likely lead to even fewer people travelling to Turkey in 2017.

## Top 20 destinations



While the number of travellers to Turkey declined, other countries, particularly Spain, benefitted. In 2016, about 13.9 million people headed for the Spanish mainland, the Canary Islands and the Balearic Islands – an increase of more than ten percent over the previous year.

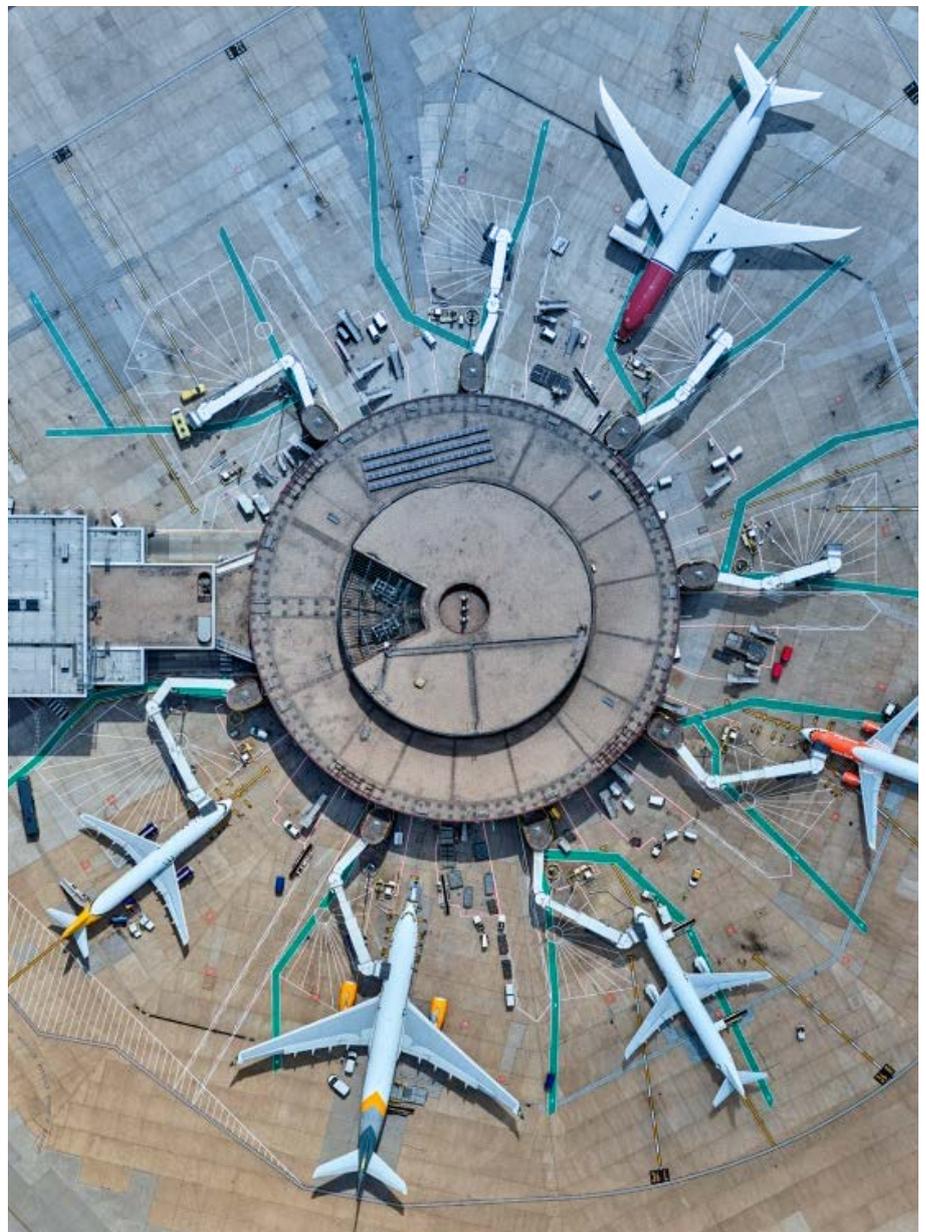


**13.9**  
**MILLION**

passengers  
travelled from  
German airports  
to Spain in 2016.

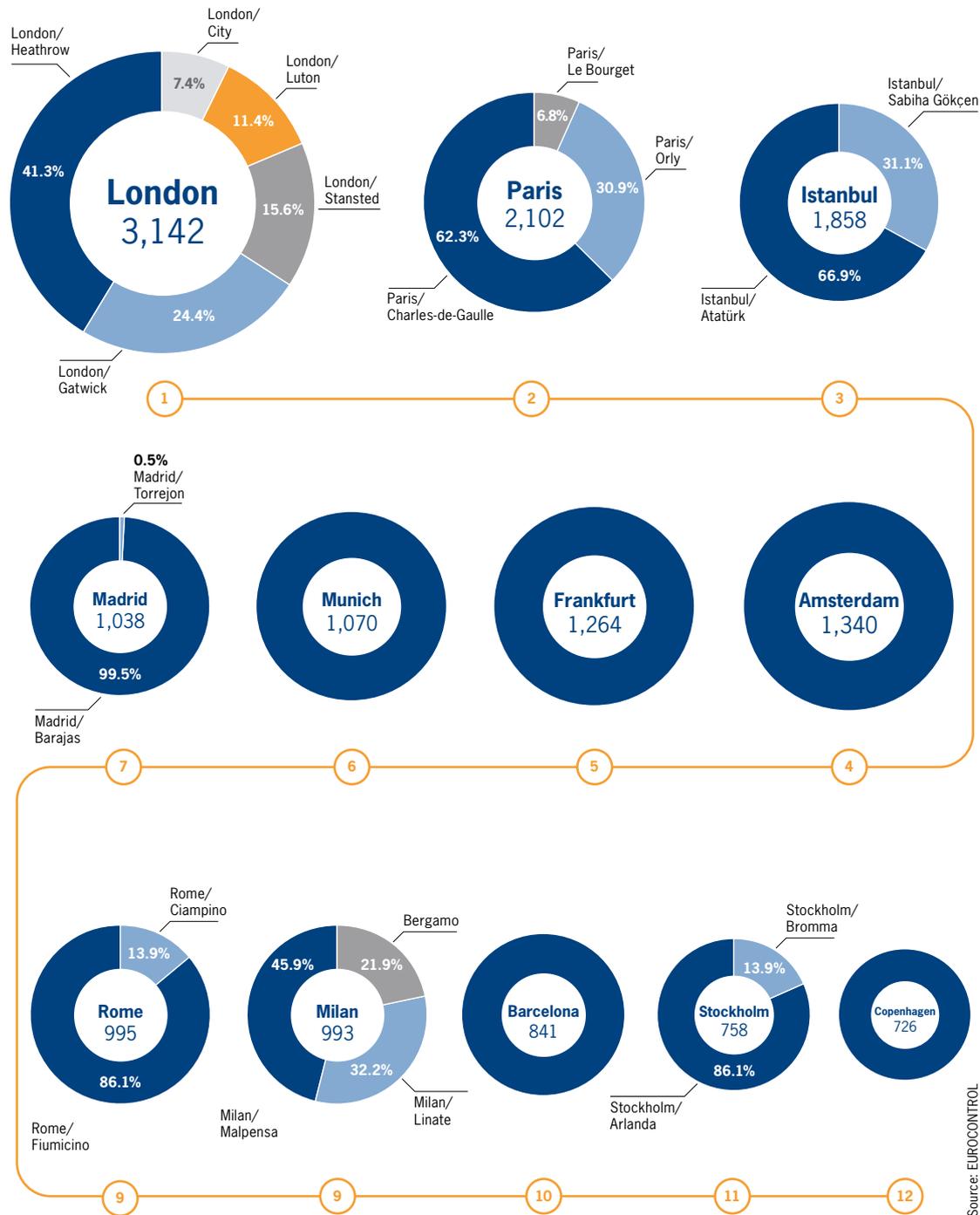
The air traffic figures of various countries were also impacted by these changes in tourist flows. According to EUROCONTROL, the traffic volume grew at an above-average rate in Spain (+7.7%), Portugal (+10.8%) and to and over the Canary Islands (+10.5%). An increase in the number of flights to and from Greece compensated for the decrease in overflights. This was caused by the decrease in traffic to Northern Africa (above all Egypt) and Turkey.

Above-average growth was also seen in Iceland (+12.4%), Poland (+7.9%), Ireland (+7.8%), the Czech Republic (+6.9%), the Netherlands (+5.5%) and the United Kingdom (+5.4%).



# European metropolitan airports

Average number of arrivals and departures per day



Source: EUROCONTROL

Europe's busiest airports are located in London. Every day, more than 3,100 flights (annual average) depart from or arrive at the city's airports of Heathrow, Gatwick, Stansted, Luton and City. These figures only consider flights under instrument flight rules (IFR). The statistics include airports located up to 50 kilometres from the city centre with at least one aircraft movement per day.



## Billions in the air: Passenger numbers

A new record was set in 2016. Worldwide, 3.7 billion passengers took to the skies, more than ever before. Germany also experienced a 3.5-percent increase in passenger numbers.



**75.9**

**PERCENT**

of all seats in  
airliners are filled.  
The load factor  
has continued  
to increase.

This large number is the equivalent of every second person in the world taking a flight in 2016. According to the International Air Transport Association (IATA), 3.7 billion passengers travelled by air in 2016. This is a new record beating the number set in 2015 of 3.5 billion. IATA also reported that the number of passenger kilometres rose by 6.3 percent (2015: +6.5%).

Germany also achieved a historic peak. In 2016, the German Federal Statistical Office recorded 201.5 million passengers. That is 3.5 percent more than in the previous year. This new record continues the trend of recent years. The number of passengers in Germany has increased at a higher rate than the number of take-offs

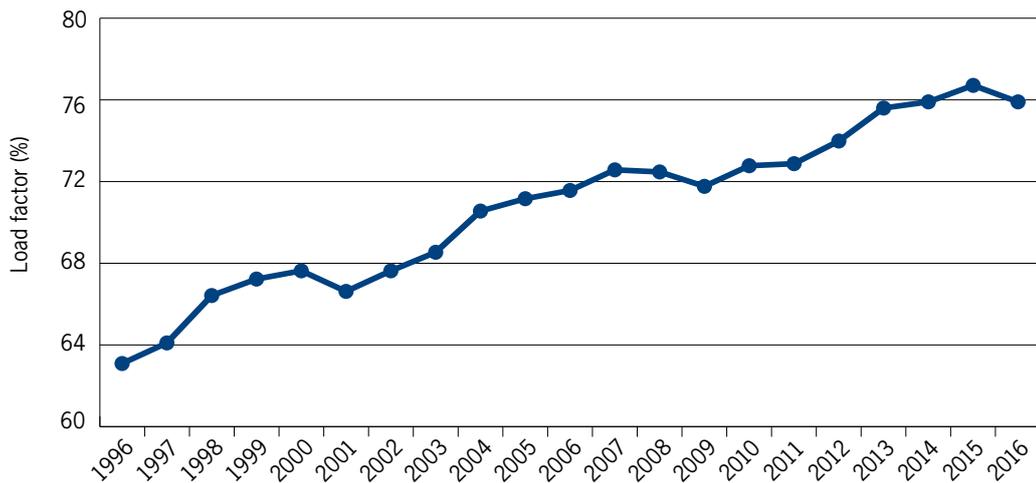
and landings (+1.4%). This is because airlines cancelled unprofitable connections and significantly increased their load factors – in some cases by offering more attractive prices.

At the beginning of the 1990s, the average load factor was about 60 percent. Since then, it has gone up continuously. The German Federal Statistical Office reported that the load factor in 2016 was 75.9 percent. This was as high as in 2014 and just below the peak value reached in 2015 (76.7%). In 2016, flights to the following holiday destinations had the highest load factors: Kos (92.2%), Rhodes (89.8%) and Fuerteventura (89.2%).

Growing passenger numbers caused an increase in air traffic density at Europe's major cities. The highest number of take-offs and landings were recorded at London's five airports. In 2016, that was an average of 3,142 per day.

Paris came in at second place with 2,102 take-offs and landings at its three airports. Both airports in Istanbul noted 1,858 take-offs and landings. Frankfurt, with its 1,264 take-offs and landings per day, ranked fifth behind Amsterdam.

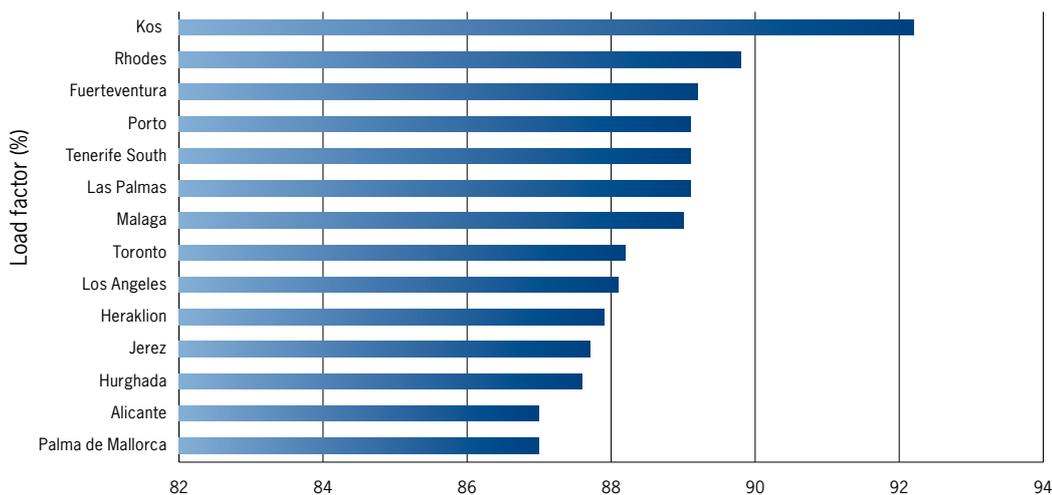
## Load factor



Source: German Federal Statistical Office

The extent to which seats are filled in the aircraft departing from and arriving at German airports has continued to increase. In 2016, 75.9 percent of all seats were occupied.

## Destinations with the best load factor



Source: German Federal Statistical Office

Flights to Greek, Spanish and Portuguese destinations had the best load factors in 2016. Overall, the load factor for flights abroad amounted to 76.7 percent. This chart shows destinations with more than 1,000 flights per year.

# Europe ahead: Air freight

**A good sign: Air freight, regarded as a leading economic indicator, rose again significantly in 2016.**



**4.6  
MILLION**

tonnes of freight were handled at German airports in 2016.

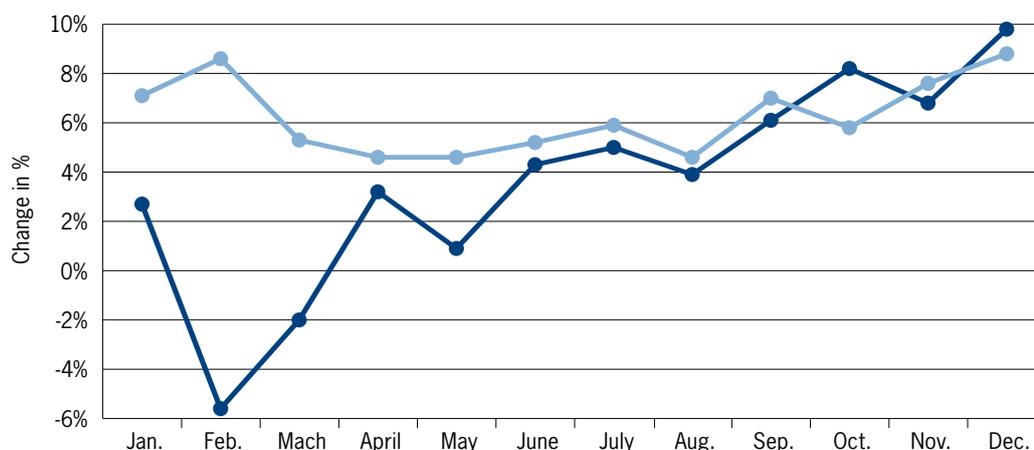
With 195 billion freight tonne kilometres worldwide, a new record was set in 2016. IATA reported an increase of 3.8 percent worldwide (2015: +2.2%). This is good news because the vicissitudes of air freight are regarded as a leading indicator of worldwide economic performance.

With this in mind, Europe especially has cause for hope. After freight volume went down in the previous year (2015: -0.1%), European freight underwent particularly strong growth

in 2016 with 7.6 percent. The Middle East also experienced significant growth in freight volume (+6.9%). However, the trend on the two most important freight markets, North America (+2.0%) and Asia Pacific (+2.1%), was below average.

In 2016, 4.6 million tonnes of freight and post were handled at airports in Germany, 3.4 percent more than in the previous year.

## Freight and passenger traffic



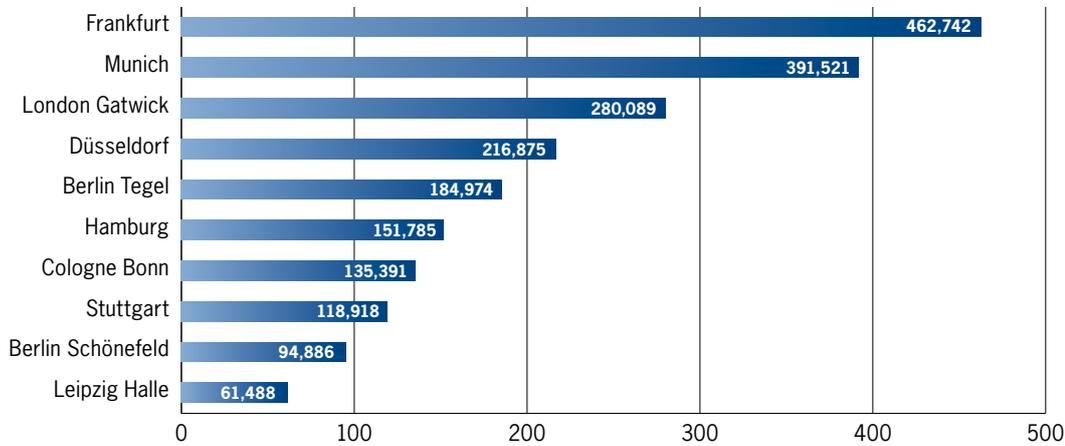
Source: IATA

Change in %	Passenger kilometres	Freight tonne kilometres
Africa	6.5	3.1
Asia Pacific	9.2	2.1
Europe	4.6	7.6
Latin America	3.6	-4.2
Middle East	11.2	6.9
North America	3.2	2.0
<b>Total</b>	<b>6.3</b>	<b>3.8</b>

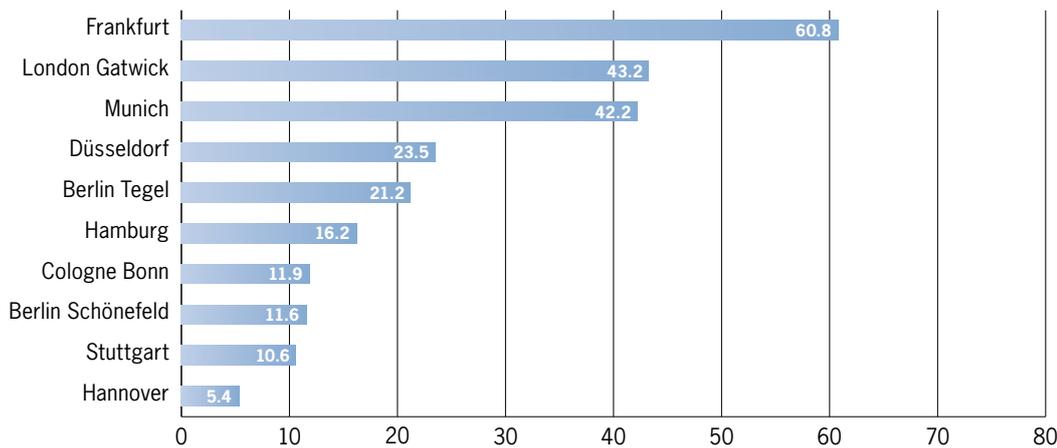
The volume of air freight increased significantly in a year-on-year comparison. The number of freight tonne kilometres – the volume of freight transported multiplied by the kilometres flown – grew by 3.8 percent, which was twice as much as the long-term average. Passenger volumes continued to grow at above-average rates, as was the case in the previous year, with an increase of 6.3 percent.

# The DFS Group and its largest airports

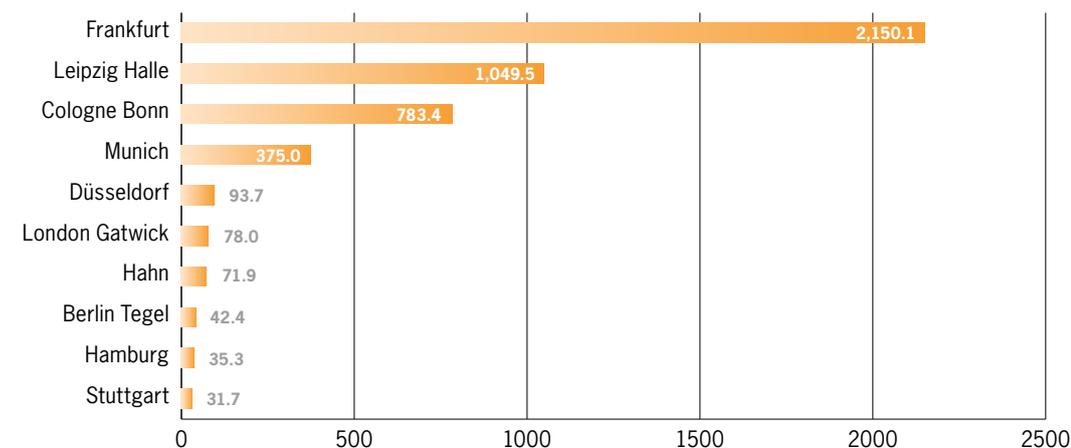
## The top 10 for number of flights (IFR departures and arrivals)



## The top 10 for number of passengers (millions)



## The top 10 for freight volume (thousands of tonnes)



More than 462,000 flights, about 61 million passengers and 2.15 million tonnes of freight were handled at Frankfurt Airport, the largest airport controlled by the DFS Group. Through its British subsidiary, the DFS Group is responsible for providing air traffic control at London Gatwick Airport – the busiest single-runway airport in the world.



## Safe and sound around the world: Air traffic safety statistics

Whoever boards an aeroplane can lean back and relax. According to IATA, the level of safety in air transport remains high.

Flying is a safe way to travel – the latest figures put out by the International Air Transport Association (IATA) confirm this. Last year, there were 65 aircraft accidents worldwide in which 268 fatalities occurred. Although this is an increase over the previous year, in relation to the total volume of traffic, it is still very small. According to IATA, more than 40 million flights were conducted worldwide – carrying 3.7 bil-

lion people. This corresponds to about half the world's population.

Every year, IATA calculates the global accident rate, which shows how low the probability of an aircraft accident is. In 2016, a serious accident occurred only every 2.6 million flights. A serious accident means that the aircraft was damaged so badly that it is not worth repairing.



By comparison, on the streets of Germany, more than 300,000 accidents with personal injuries occurred in 2016. These involved 400,000 injured and 3,200 fatalities.

The probability of becoming the victim of an aircraft accident depends a lot on the region of the world in which you are flying. The lowest accident rates are in Asia, Europe and North

America according to IATA. African airlines have improved significantly. Before last year, these airlines had a five-year average of 2.5 accidents per one million flights and were thus the worst performers. However, in 2016, they did not have one single serious accident. By contrast, the region of Northern Africa and the Middle East got worse. The accident rate there went up to 2.5 per million flights.



For every  
**2.6**  
MILLION  
accident-free  
flights, only  
one incident.

## Arriving at your destination: Safety in German airspace



137

TIMES

This is the number of infringements of separation involving DFS in 2016.

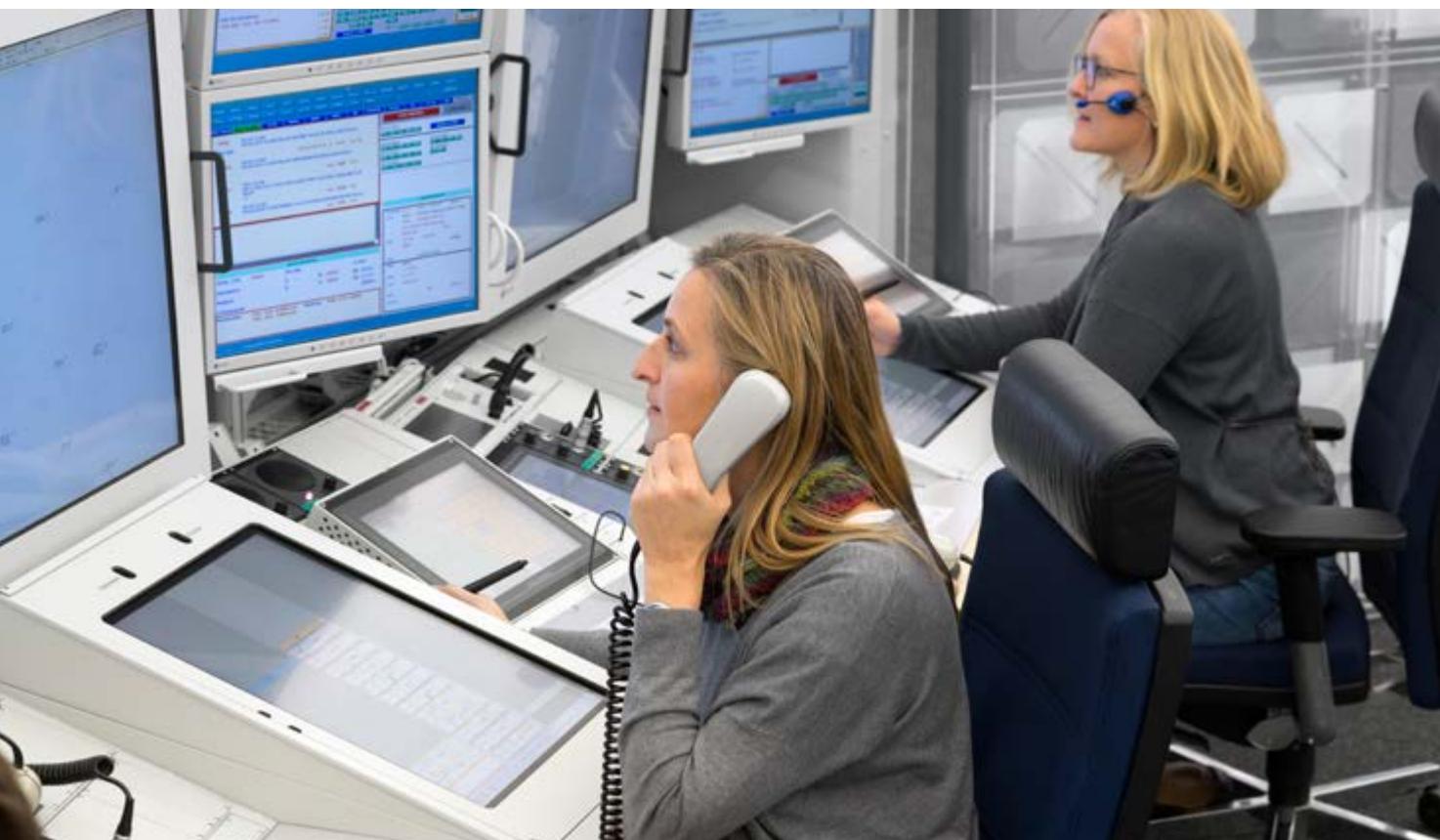
Although the traffic volume has increased, the level of safety remains high. This is not only due to the hard work of air traffic control, the airlines and airports also play an important role.

Keep a safe distance – this is an important rule when driving your car on the road and even more so when flying an aeroplane. On the ground and in the air, air traffic control keeps an eye on aircraft to make sure they keep their distance from each other. To ensure safety and due to the high speeds flown in the air, these distances are intentionally set high. In the air, the vertical distance is at least 1,000 feet (300 m) and the horizontal distance is three to five nautical miles (5.6 to 9.3 km).

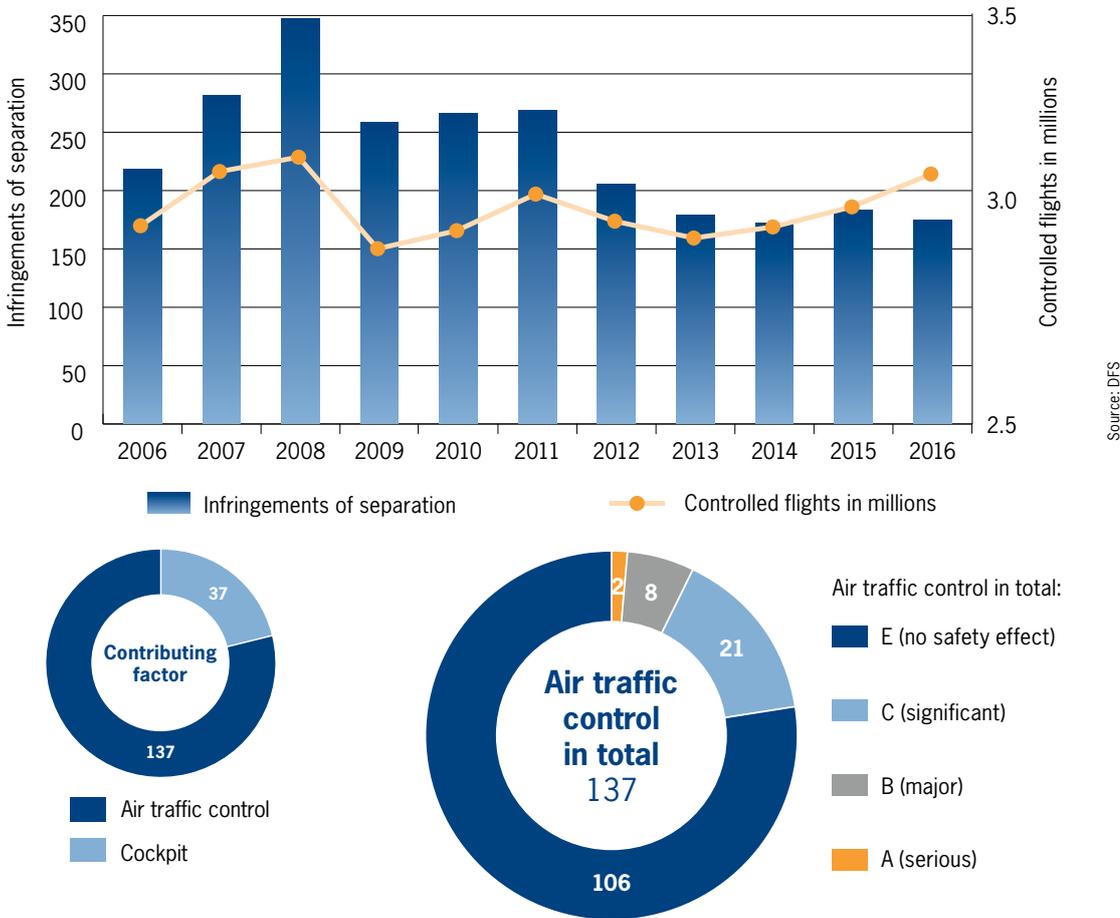
DFS monitors these distances very carefully. Each deviation from them is called an infringe-

ment of separation. All infringements of separation in which DFS played a contributing role are analysed and evaluated by the company's safety management division. There are four categories depending on the severity. They act as a type of early warning system for DFS. By thoroughly examining these individual deviations, potential risks become visible before they can have a negative impact on the safety of air traffic.

Since 2015, DFS has used a new method to evaluate infringements of separation. It is called the risk analysis tool (RAT) and was developed to be used uniformly across Europe. This tool har-



## Infringements of separation



An infringement of separation occurs when the distance between two aircraft is less than prescribed. In 2016, 174 infringements of separation were documented in German airspace. DFS was involved in 137 of these cases. The Risk Analysis Tool showed that the majority were not safety-related.

monises safety classifications so that the safety levels of countries across Europe can be more accurately compared to each other. While DFS used to have a three-level system of severity, the RAT tool uses a four-level system. It differentiates between the categories: serious, major, significant and no safety effect.

separation where DFS was a contributing factor, 106 of these had no influence at all on safety. Twenty-one occurrences were classified as significant; eight were categorised as major, and two as serious.

In 2016, 174 infringements of separation were recorded in German airspace for 3.1 million aircraft movements (2015: 183). DFS was a contributing factor in 137 of these. However, the effect on safety was negligible except for a small percentage of these. Of the 137 infringements of



80

PERCENT

of all runway incursions were caused by the cockpit crew alone.

## High level at ground level: Safety on the ground

DFS not only ensures safety in the skies above Germany. At 16 international airports in Germany, DFS air traffic controllers monitor all aircraft under their control while taxiing, taking off and landing.

Aircraft on the ground also need to keep their distance from each other to be safe. For this purpose, tower controllers monitor compliance with minimum distances that apply on the ground. Similar to infringements of separation

in the air, it is the controllers' job to make sure these distances are maintained.

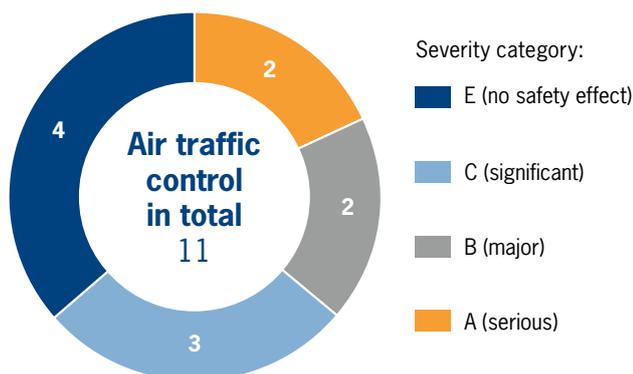
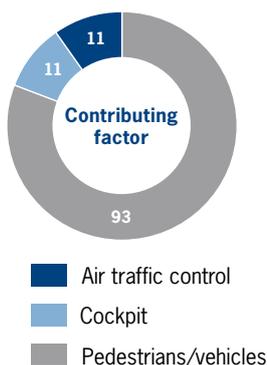
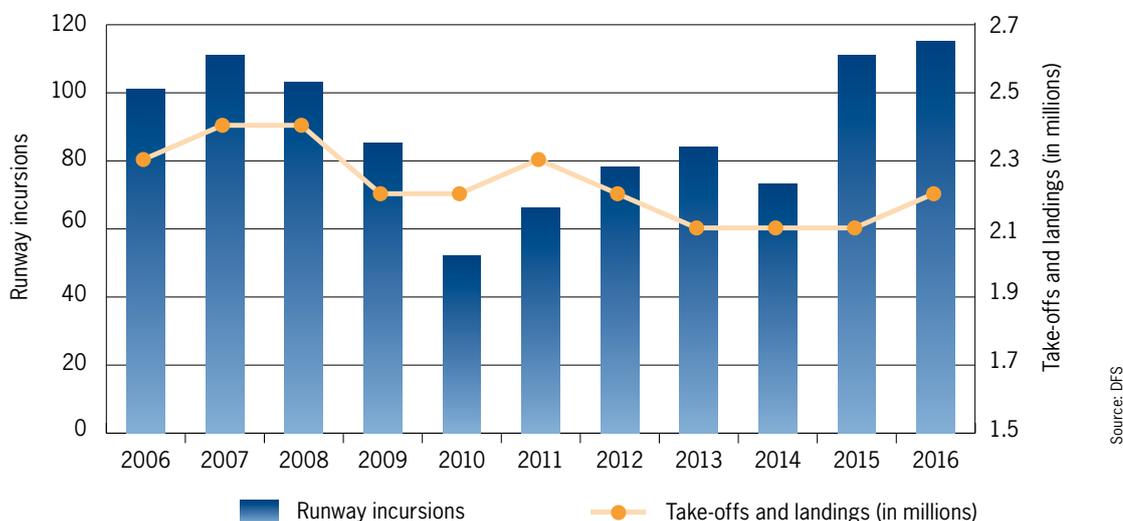
Whenever an aircraft takes off or lands, a protected area is activated in which no other

aircraft, vehicle or person is allowed to enter. If this happens, it is called a runway incursion. Regardless of whether the runway incursion actually posed a threat to safety or not, all of these cases are documented and investigated by DFS.

The new risk analysis tool (RAT), which is in use across Europe, is also used for this purpose. In 2016, 115 runway incursions were recorded from a total of two million take-offs and landings at Germany's designated international airports

(2015: 111). In more than 80 percent of these cases, the cockpit crew alone was responsible for the runway incursion. Air traffic control was a contributing factor in only eleven of these cases. Seven of these were classified as safety-related. Three of these were considered significant, two as major, and a further two as serious.

## Runway incursions



On the ground, too, minimum distances need to be maintained: In the protected area of a surface designated for the take-off and landing of aircraft, the presence of other aircraft or vehicles is not allowed. If this does happen, this is called a runway incursion.

Every runway incursion is recorded and analysed. Of the 115 runway incursions that occurred at German airports in 2016, only eleven involved DFS. The risk analysis tool determined that two of these had to be categorised as serious. As a new system of categorisation was used, the results cannot be compared with the years before 2015.

## Invasion of the drones: Unmanned aircraft systems in air traffic

Approximately 400,000 drones are currently in operation in Germany. And this number is on the increase. The number of unmanned aircraft systems (UAS, or drones) is leading to more and more conflicts in airspace.

The rise in the number of drones will not level off any time soon. By the end of the decade, DFS expects their number in Germany to rise three-fold. Every rise also increases the risk of collisions between these small aircraft and civil

air traffic. In 2016, DFS registered 64 cases in which drones impeded air traffic. This is 4.5 times more than in 2015. Most of these were recorded at Frankfurt Airport.

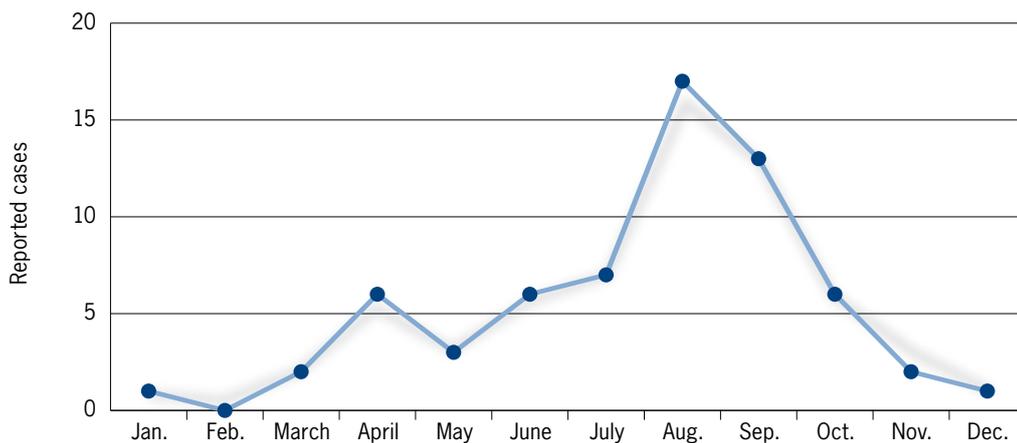


To enable the safe coexistence of unmanned aircraft systems and commercial air transport, DFS has launched a research project with the German telecommunications company Deutsche Telekom. The study is examining practical applications for locating and monitoring unmanned aircraft using the mobile telecommunications network. DFS is also cooperating with the Belgian software provider Unify to develop an app that lets drone pilots know if they are allowed to take off from their present location and what, if any, restrictions apply.

Together with the German Federal Ministry of Transport and the aeronautical authorities of the Federal States, DFS has made it easier for drone pilots to access information by setting up an internet information platform that brings together all relevant information for drone pilots.

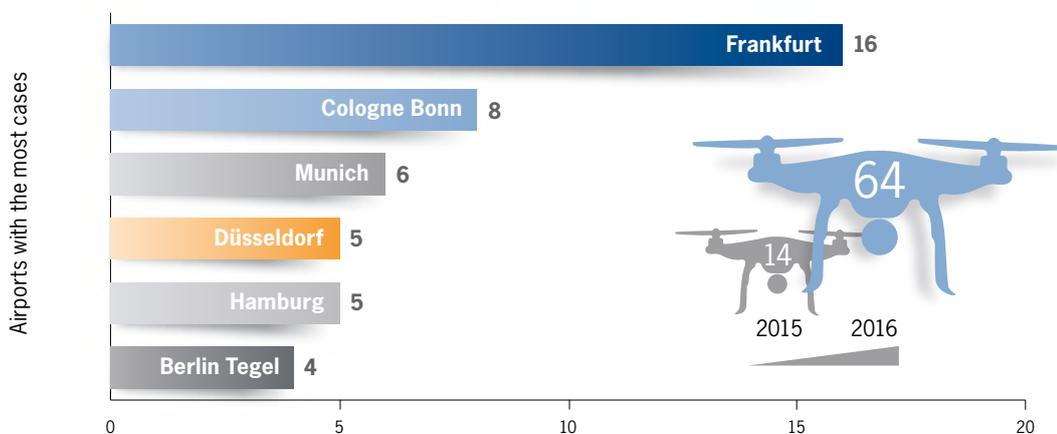
[www.safe-droneflight.de](http://www.safe-droneflight.de)

### Civil aircraft impeded by drones



**64**  
TIMES

That is how often drones impeded civil aircraft in 2016.



Source: DFS

An increasing number of drones goes hand in hand with an increasing number of cases in which unmanned aircraft systems come too close to regular air traffic. In 2016, DFS registered 64 such cases – about five times as many as the previous year.



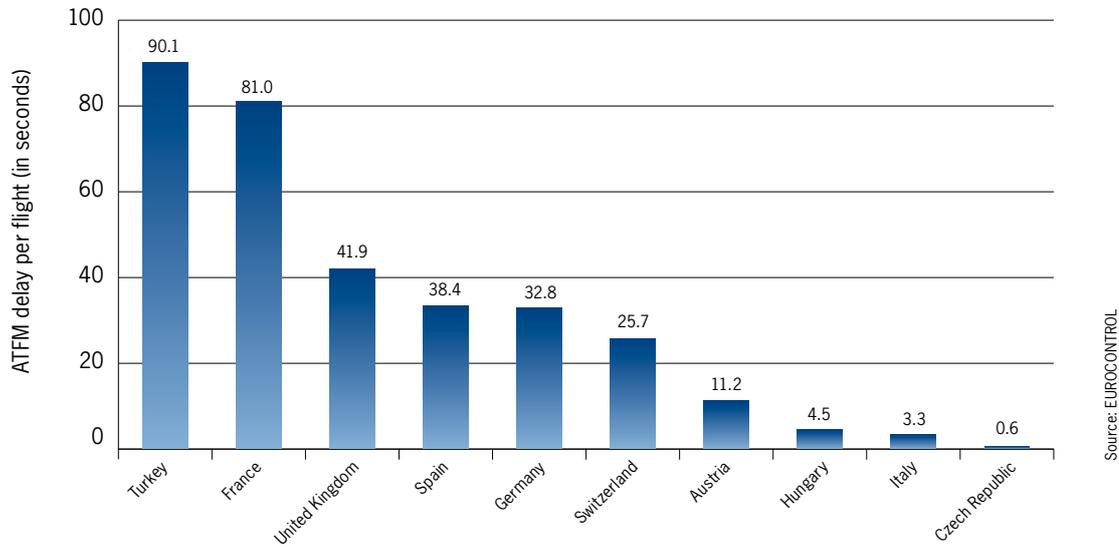
## A tight schedule: Delays in air traffic

Four out of every five flights in Germany reach their destinations without any noteworthy delays. While there are many causes of delay, the portion attributable to air traffic control is negligible.

Waiting for connecting passengers, de-icing, deviating around thunderstorms, or bottlenecks at the gate are some of the many reasons why aircraft cannot take off or land on time. Passengers have to accept that their flights will sometimes be delayed. No other mode of transport has processes that are so closely interlinked. No other mode of transport is so dependent on the weather. This makes it all the more surprising that the majority of flights actually arrive at their destinations on time. In 2016, 80 percent of all flights in Europe arrived at their destinations without any major delay. A third of flights actually arrived ahead of time. Only every fifth flight reached its destination with more than 15 minutes delay.

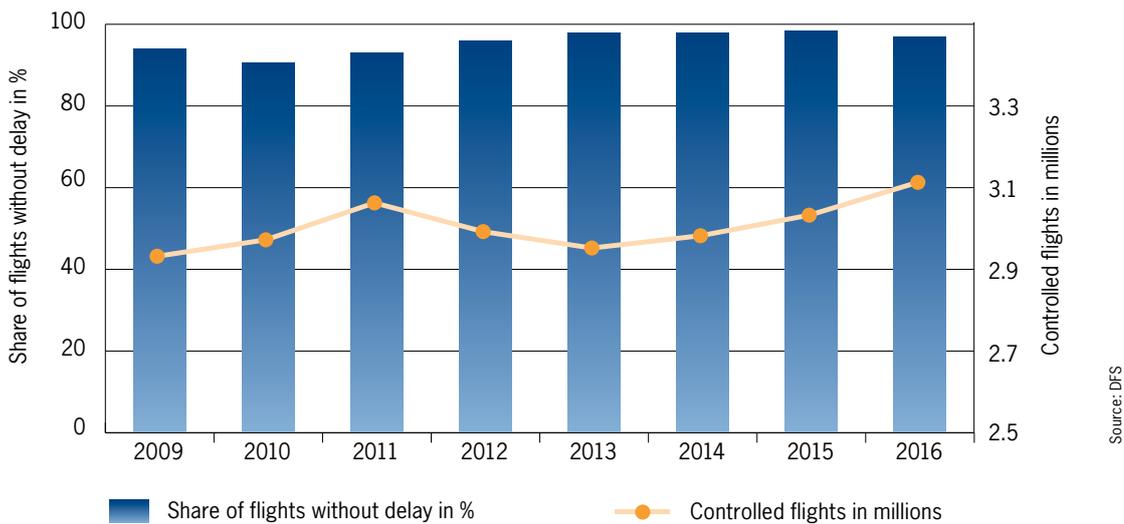
The main reason for such delays are the knock-on effects of prior delays cascading through the day to impact later flights. These delays are often caused by the wait for passengers, baggage or new crew. An evaluation by the Central Office for Delay Analysis (CODA), a EUROCONTROL division, came to this conclusion after analysing pilot reports. Roughly every second time there is an air traffic delay in Europe, it has been caused by the airlines themselves. One fifth of delays can be attributed to airports, while one tenth is due to bad weather. European air navigation service providers generate only 13 percent of delays.

## Punctuality in comparison

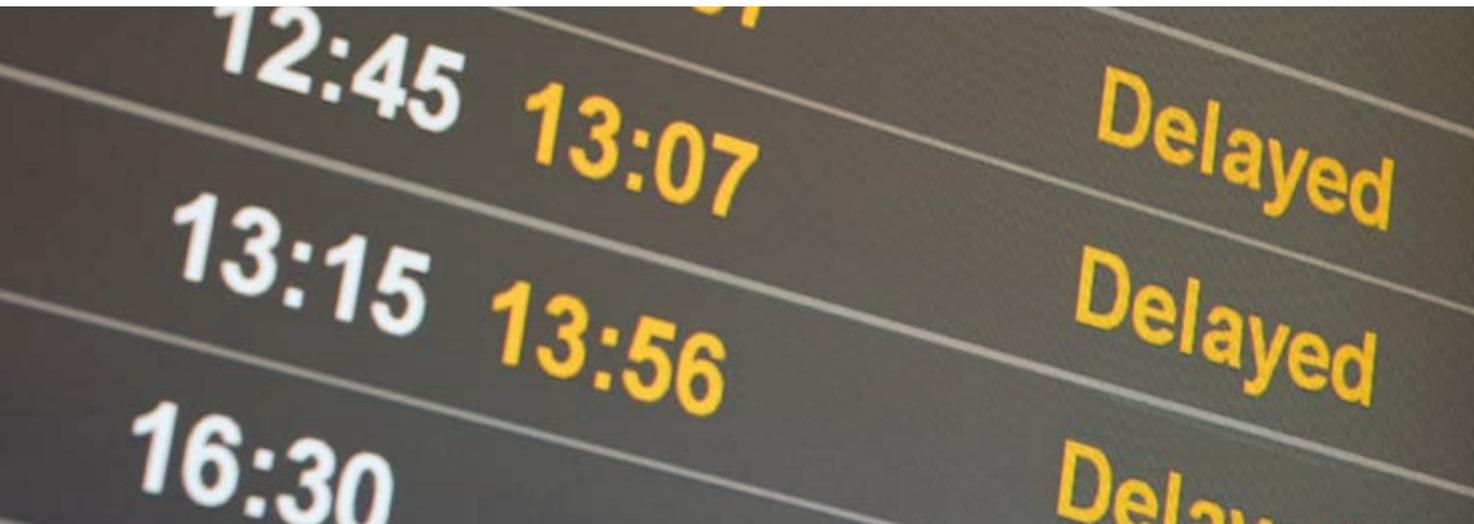


The average delay time caused by air traffic flow management (ATFM) was nearly 33 seconds per flight in German airspace. Only about 13.8 seconds of the delay were caused by air traffic control. The chart shows punctuality statistics for the ten European countries with the highest traffic volumes.

## Traffic and punctuality



The percentage of delayed flights in German airspace is very small. Only 3.2 percent of flights were affected by ATFM measures in 2016, for example due to bad weather, capacity bottlenecks at airports or high traffic volume.



47

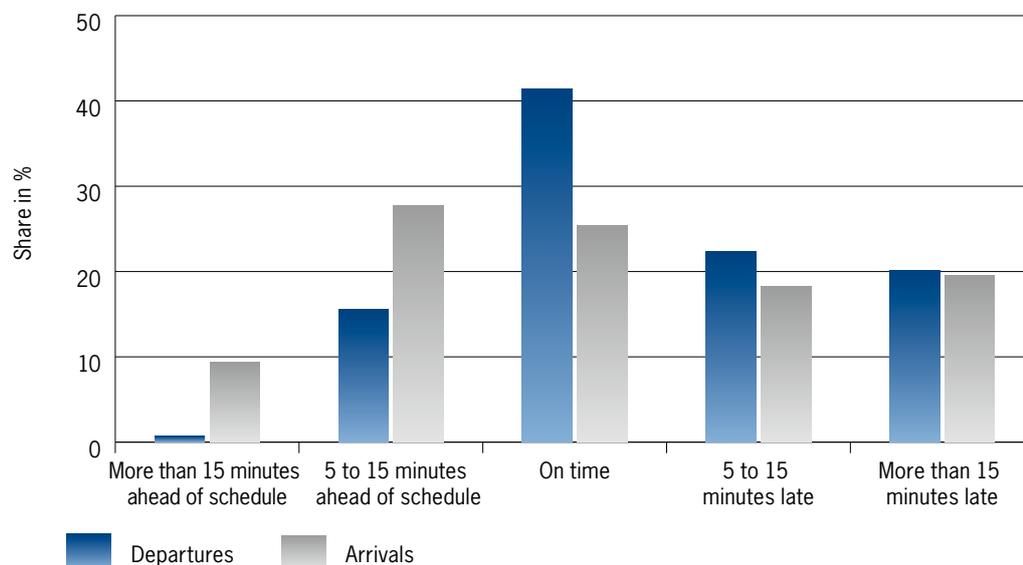
PERCENT

of all delays in Europe are caused by airlines.

Punctuality in European air traffic fell only slightly below last year's figure. The average arrival delay in 2015 was 9.9 minutes; in 2016, it rose to 11 minutes. The Central Office for Delay Analysis stated that the main reasons were bad weather and labour disputes. In addition, the percentage of flights that were subject to air traffic flow management measures (ATFM) – due to

factors such as capacity bottlenecks – increased as well. This meant that in 2016, the average ATFM delay in German airspace was about 33 seconds (2015: 19.2 seconds). Of these, only 13.8 can be attributed to air traffic control providers.

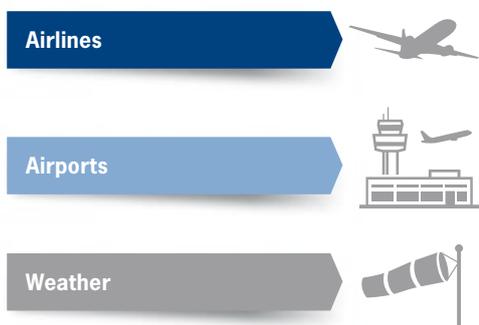
### Punctuality in Europe



Source: EUROCONTROL/CODA

Every fifth aircraft in Europe takes off with more than 15 minutes of delay, for example due to delays in ground handling or due to bad weather. By contrast, every third aircraft actually arrives at its destination ahead of schedule.

## Causes of delays – departures



Source: EUROCONTROL/CODA

Paris Charles-de-Gaulle	
Airlines	57%
Airports	10%
Weather	4%
Air navigation service providers	12%
Security	10%
Other	7%

Madrid Barajas	
Airlines	52%
Airports	19%
Weather	5%
Air navigation service providers	11%
Security	8%
Other	5%

London Heathrow	
Airlines	66%
Airports	20%
Weather	5%
Air navigation service providers	3%
Security	4%
Other	3%

Amsterdam	
Airlines	45%
Airports	32%
Weather	6%
Air navigation service providers	11%
Security	2%
Other	4%

Frankfurt	
Airlines	38%
Airports	25%
Weather	11%
Air navigation service providers	6%
Security	8%
Other	12%

Munich	
Airlines	51%
Airports	9%
Weather	14%
Air navigation service providers	5%
Security	11%
Other	9%



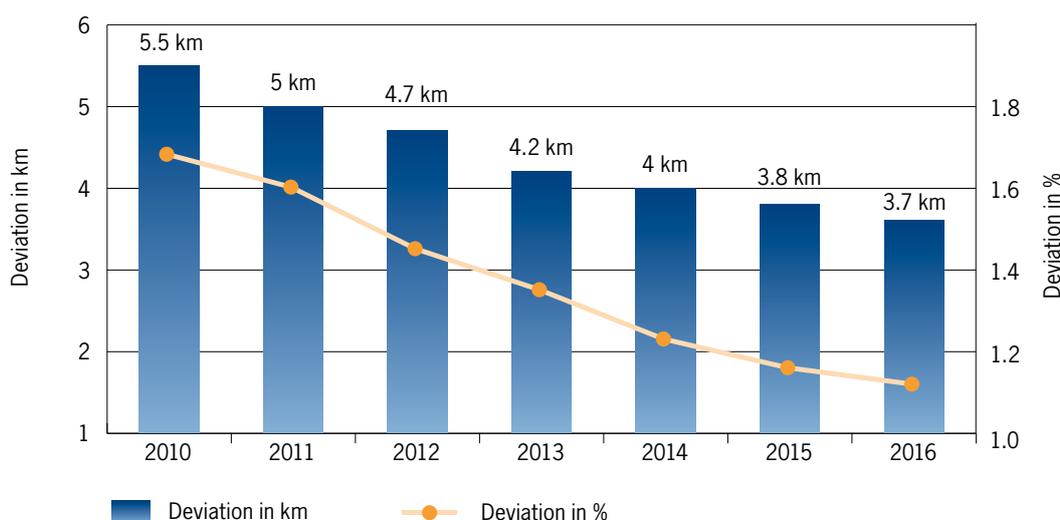
## Saving fuel, reducing noise: Air traffic and environmental protection

Optimised flight routes save fuel, cause less harm to the environment and reduce noise disturbance. DFS comes very close to achieving the optimal route length and does its utmost in the area of noise abatement. DFS is always on the lookout for new ways of lessening the noise impact of flight operations.

DFS air traffic controllers guide the aircraft under their control to their destinations safely and punctually. They select the most direct route possible to be as environmentally friendly as possible. This is not a straightforward task. In airspace as busy as German airspace, it is virtually

impossible for every flight to reach its destination without deviating slightly from the shortest route. Evaluations of flight tracks, however, show that DFS comes very close to providing the optimum flight path. The average route flown by aircraft in German airspace in 2016 was just 1.12 percent

### En-route flight efficiency



Source: DFS

DFS air traffic controllers guide the aircraft under their control to their destinations safely, punctually and on the most direct route possible. The routes assigned by DFS controllers in 2016 were only 3.7 kilometres longer than the shortest possible route. This is not much in comparison to the length of the whole flight. Taking the average distance flown of 325 kilometres, this makes a deviation of only 1.12 percent.

longer than the most direct route. That is equivalent to an average deviation of 3.7 kilometres.

The development of optimised descent profiles is a further measure that benefits the environment. In a joint effort with European partners and airlines, more than 30 arrival profiles have been improved at the airports of Basel, Berlin Tegel, Frankfurt, Geneva, Munich, Stuttgart, Strasbourg, Vienna and Zurich. These profiles allow aircraft to remain at higher altitudes for a longer time. The optimal descent profile has been designed for each aircraft type, allowing it to approach the airport with the least amount of engine power as possible. This reduces noise disturbance as well as fuel consumption.

Even though the airlines play a much more important role in noise reduction than air traffic control, DFS has nevertheless been doing everything in its power to improve the situation. One way DFS reduces noise disturbance is to consider noise abatement concerns while planning flight procedures. Sophisticated simulations examine which route is the best for noise abatement. In

addition, DFS has introduced continuous descent operations (CDO) at all its large airports. These approach procedures generate particularly low noise levels. In contrast to conventional approach procedures, which contain phases in which the aircraft levels off, the aircraft using CDO glides at the same rate of descent until it lands. This uses less engine power.

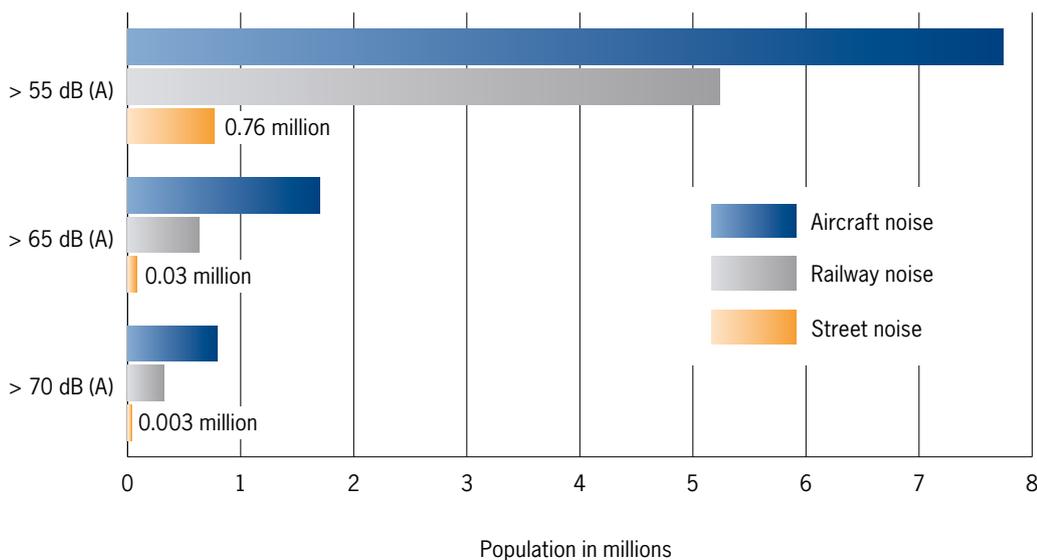
Furthermore, DFS is always on the lookout for new ways of lessening the noise impact of flight operations. At Frankfurt Airport, for example, DFS has invested in technology to complement the existing instrument landing system (ILS). Known as the ground-based augmentation system (GBAS), it enables satellite-based approaches. With GBAS, aircraft can approach the airport at a steeper angle of 3.2 degrees, which reduces the noise for people who live below the approach paths. The downside is that most aircraft are not yet equipped for this technology. When the airlines eventually install GBAS equipment in their fleets, this technology will make a noticeable difference in the level of noise disturbance on the ground.



**3.7**  
**KILOMETRES**

is the average length of deviation from the shortest route.

## Traffic noise in Germany



Source: German Federal Environment Agency

The German Federal Environment Agency regularly measures and records how many people are affected by traffic noise in Germany. According to their studies, 10.2 million people are exposed to street noise and 6.2 million to railway noise with a level greater than 55 decibels. The group affected by aircraft noise is much smaller, only 791,000.



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