

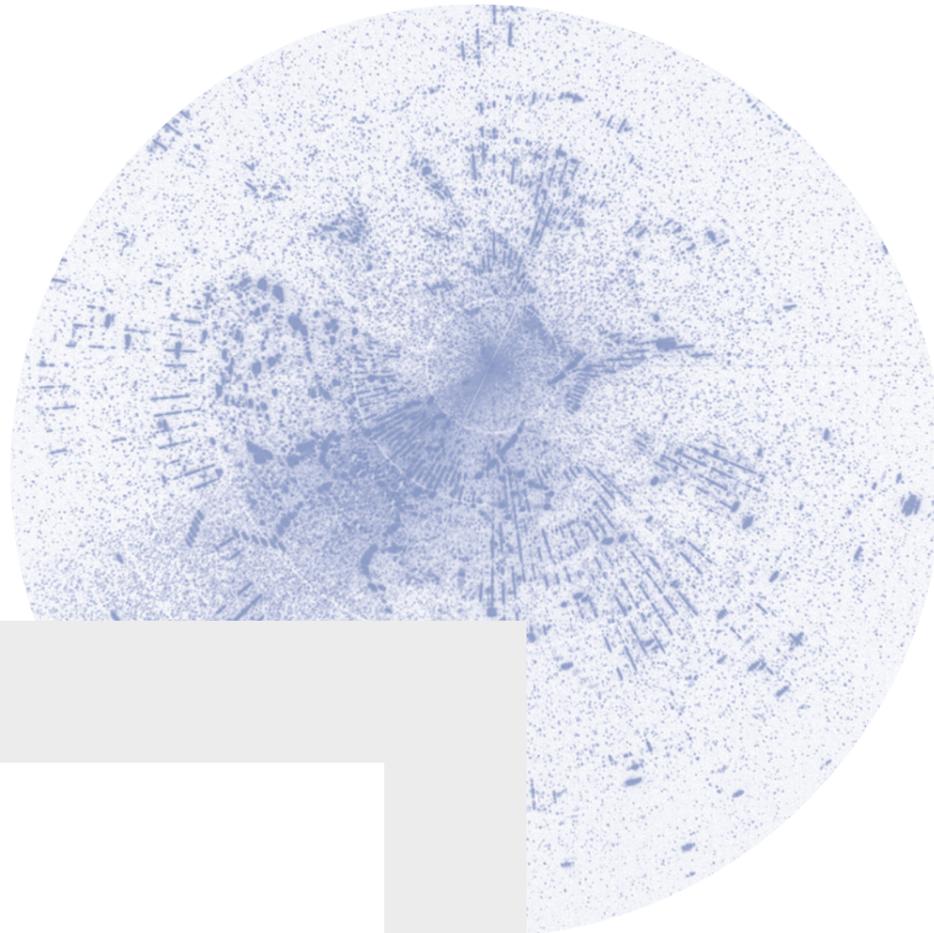


DFS Deutsche Flugsicherung

A brief portrait of the company



DFS Deutsche Flugsicherung



For a safer sky

The 1980s and 1990s heralded a period of phenomenal growth in air traffic. The number of flights that took off, landed or flew over Germany increased by an average of 9.5 percent per year. In only twenty years, the number of controlled flights in German airspace had tripled from under one million to three million. The aviation industry was synonymous with powerful and robust growth and only knew one trend: upward. Among other factors, this growth was the result of an increasing desire of the general population for more mobility in combination with inexpensive fares, especially after low-cost airlines came onto the scene in the 1990s.

Since the turn of the millennium, growth has not been so stable. As a result of the financial crisis and economic downturn, it has slowed down. Now the number of aircraft movements is growing by just over 1 percent per year. Currently, DFS controls about three million flights annually and employs 5,500 staff to ensure the safe, orderly and expeditious handling of air traffic in Germany.

The dynamism of the development may have diminished, but according to current forecasts for Germany and Europe, a long-term decline is not in sight.

By continuing to develop technological systems, optimise route profiles and carefully plan new arrival and departure procedures, DFS has always been able to keep up with the prevailing traffic volume and fulfil its statutory obligations to provide safe and punctual air traffic control. Noise abatement and climate protection play an important role in our considerations as well.

The following pages explain what our day-to-day business is and what we do in addition to that, as well as which standards air traffic controllers have to comply with and how DFS is proactive at the European level for the future of air traffic control. If you are interested in knowing more about one aspect or another, go to our website www.dfs.de.

Annually, about three million flights are controlled by the 5,500 DFS staff. They ensure the safe, orderly and expeditious handling of air traffic.



The core business of DFS

What do we do?

Passengers boarding an aircraft expect to reach their destination safely and on time. The air traffic controllers of DFS ensure a smooth and delay-free flow of traffic on German airways and at airports. They control and monitor aircraft departing and landing as well as en-route. They instruct pilots to fly at the correct altitude on defined routes and to maintain the prescribed safe distances from other aircraft.

Controllers and technology – a sound partnership

Modern technology helps air traffic controllers not only in tracking the position of an aircraft but also in providing its exact altitude, speed and aircraft data. The highly specialised engineers at DFS are continuously enhancing and optimising this technology.

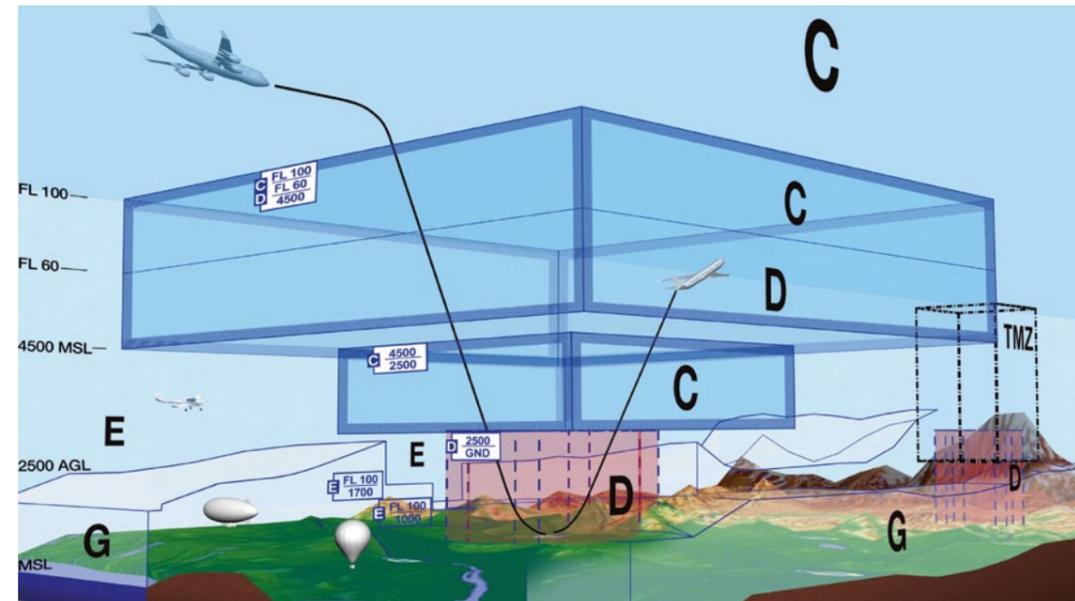
Upper and lower airspace: the Control Centre division

The Control Centre division has the most employees within the company. Staff here provide area and approach control services. All aircraft that fly through German airspace under instrument flight rules (IFR) are controlled by these air traffic controllers. IFR refers to flights which are not navigated by sight but by means of instruments.

Today, 2,000 controllers at the four DFS control centres ensure the smooth, efficient and safe flow of air traffic.

Today, 2,000 controllers at the four DFS control centres ensure a smooth, efficient and safe flow of air traffic. Each year, they control about three million flights. About half of these are flights arriving in and departing from Germany, the remainder being overflights and domestic flights. The control centres of Bremen, Munich and Langen are in charge of the control sectors in lower airspace (below 24,500 feet or approx. 7,500 metres). Upper airspace (above 24,500 feet) is controlled from the control centre in Karlsruhe.

In addition, specialists from the flight information service (FIS) provide advice and information to pilots flying under visual flight rules (VFR).



This visual shows an example of German airspace structure. On days with fine weather, more than 6,500 private pilots take off into the sky – but they may only use Class E and G airspace, which is not controlled by DFS. They may fly up to 10,000 ft, on their own responsibility and without obtaining clearance from DFS. Above this level and in the vicinity of major airports, airspace is divided into Class C and D airspace, which is subject to radar control. Special rules apply in these areas.

Radiotelephony and ground radar systems: the Tower division

The staff of the Tower division ensure that aircraft take off and land on time, while observing the prescribed separation between aircraft. These controllers work in the control tower. From this vantage point, they can see the aircraft and monitor activities at the airport.

Tower controllers organise the smooth flow of traffic at airports, ensuring that departing and arriving aircraft keep clear of each other. They inform pilots by radio communications about the departure routes and issue take-off and landing clearances. At night and in conditions of low visibility like fog, they are supported by ground radar at larger airports.

Aerodrome control at 16 international airports

Like the radar control centres, DFS towers are also equipped with state-of-the-art systems that meet the highest possible standards for safety. The Tower division is responsible for performing aerodrome control at the 16 international airports in Germany.

Services and data

The DFS division Aeronautical Information Management provides flight-related data, aeronautical publications and aeronautical information services. Specialist staff at the Aeronautical Information Service Centre in Frankfurt support pilots in their pre-flight planning around the clock.

Our customers

DFS is a modern service provider. Our customer base includes the major German airlines, airlines from other countries, local companies, private aviation and the German armed forces, the Bundeswehr. We set high quality standards for the services we provide. Safety is our top priority.

Training

Besides providing air traffic services at international airports and approach and area control services, DFS trains air traffic controllers at its Air Navigation Services Academy in Langen. This ensures the future safety of the skies for all airspace users.

DFS also trains military air traffic controllers in cooperation with the Bundeswehr. This training takes place in the town of Kaufbeuren in southern Germany.

Tower controllers organise the smooth flow of traffic at airports, ensuring that departing and arriving aircraft keep clear of each other.



The sky in sight

The work of tower controllers

Tower controllers work in the cab of the control tower high above the ground. As soon as the passengers have taken their seats and the aircraft is ready for take-off, the aircraft is under the control of the tower controller. The controller informs the pilot about the departure procedures and the take-off position before issuing the take-off clearance. The tower controller can directly observe the departing aircraft at the aerodrome.



At the same time, the controller ensures that no other aircraft lands or blocks the runway while the aircraft is preparing to take off. To prevent bottlenecks on the runway with the constant change between aircraft taking off and landing, the tower controller is in permanent contact with the pilots and approach controllers. Tower controllers have the most sophisticated technology at their fingertips, guaranteeing the precise coordination of these processes.

While the aircraft is departing, the tower controller enters the exact departure time into the computer. A short time later, the aircraft appears on the radar screen of the approach controllers, who work in the radar control centre and take over control of the flight. In the meantime, the tower controller guides the next aircraft to a safe landing on the runway and then along the taxiway to reach the apron.



Working in the control centre – approach and area control

The airspace over Germany is divided into flight information regions (FIR). These regions are assigned to the control centres where they are, in turn, subdivided into sectors, resembling pieces of a puzzle. Approach controllers and area controllers work in the control centre. One sector is always controlled by two air traffic controllers: the radar controller and the coordinator. While the radar controller issues instructions and clearances to the pilot via radiotelephony, the coordinator communicates with the adjacent sectors.

As soon as the aircraft has departed, the approach controllers take over the control of the aircraft from the tower and guide the aircraft onto one of the many airways in accordance with standard procedures. While doing this, they ensure that the prescribed separation minima are adhered to. In the terminal control area, the separation minima are three nautical miles (approx. 5.4 kilometres) horizontally and 1,000 feet (approx. 300 metres) vertically.

Airspace is not only divided into sectors but also into lower and upper airspace, according to altitude. The boundary between upper and lower airspace is usually at 24,000 feet (approx. 7,500 metres). Controllers working in area control centres (ACC) assume control of aircraft from the approach controllers and, depending on where the flight is headed, transfer the aircraft to controllers of the appropriate upper area control centre (UAC).

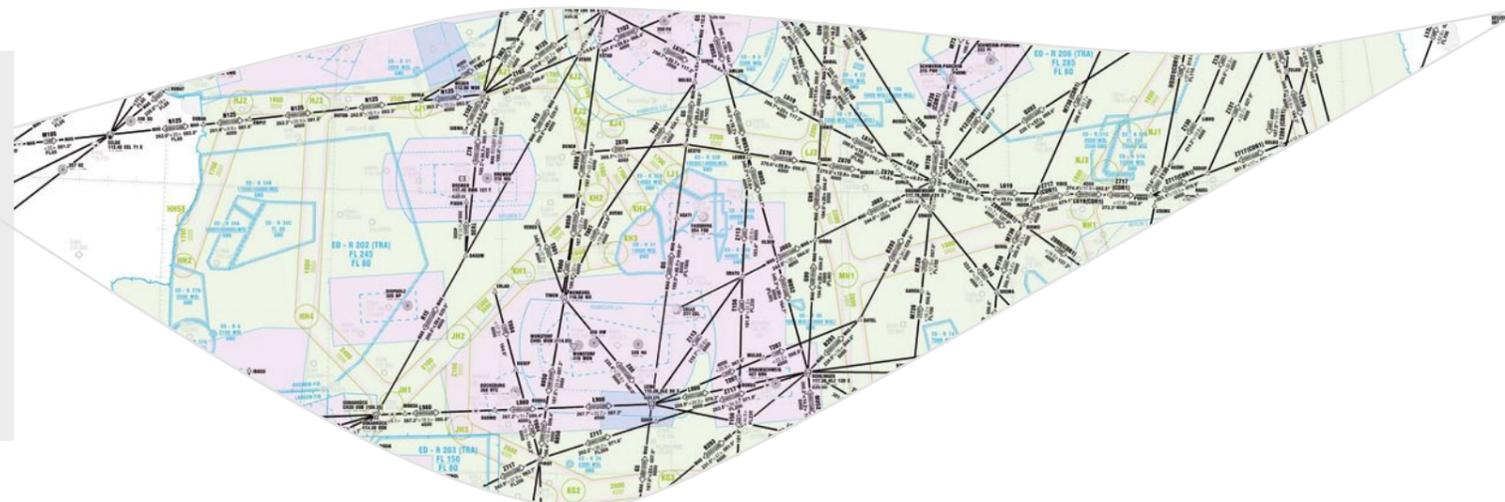
When aircraft approach their destination airport, approach controllers assume control of the aircraft. Prior to landing, approach controllers line aircraft up like pearls on a string along a virtual extended runway centreline. Then the tower controllers take over. The separation minima must be precisely observed when aircraft are on final approach so that they do not get too close or overtake each other.

The airspace over Germany is divided into flight information regions (FIR).



Civil-military integration

Since 1994, DFS has been responsible for regional military air traffic control in peacetime – the first air navigation services organisation in Europe to have this responsibility. Up until 1994, Germany had both a civil and regional military air traffic control organisation, both of which independently controlled their own airspace. Strictly separating the valuable resource of airspace meant that it was not used efficiently. Today, military and civil air traffic controllers work side by side in Germany. This means that military airspace can now be used by civil and military aircraft, as required. Only military aerodromes are under the sole control of the armed forces.



Instrument flight rules and visual flight rules

All pilots flying under instrument flight rules (IFR) in Germany are controlled by the air traffic controllers of DFS. IFR refers to flights which are not navigated by sight but by means of instruments. The controller establishes minimum vertical separation of 1,000 feet (approx. 300 metres) and minimum horizontal separation of between two and six nautical miles (approx. 3.7 to 11.1 kilometres) between aircraft. If, however, pilots fly under visual flight rules (VFR), they are responsible for maintaining separation from other aircraft themselves. Their flights are not controlled by German air traffic control and they may only use certain airspaces.

Procedures and technology

Flight procedures: safe, efficient and as green as possible

DFS is not only responsible for ensuring that aircraft use defined routes at the appropriate altitudes and maintain the prescribed safe distances but also for planning these routes. All this is a very complex process. It must take into account the applicable legal provisions and includes planning arrival and departure procedures as well as ensuring environmental protection.

Flight procedures are developed in keeping with national and international rules and regulations. The documents "Aircraft Operations" and "Air Traffic Management" published by the International Civil Aviation Organisation (ICAO) provide the primary basis for this. The German Aviation Act (LuftVG) stipulates that flight procedures be planned in such a way as to ensure the safe, orderly and expeditious handling of air traffic at any time. These provisions lay down binding standards which must be complied with.

The planning activities of DFS also incorporate noise abatement issues. This often means that conflicting priorities have to be balanced. On the one hand, flight routes should be as direct as possible so that aircraft reach their destinations on time and also in an environmentally friendly manner, by saving fuel and thus reducing CO2 emissions. In order to protect the population in the vicinity of airports from excessive noise exposure, however, procedures planners often have to define longer arrival and departure routes, which again lead to higher fuel consumption and more CO2 emissions.

But it is not DFS alone who decides which routes are optimal and most advantageous for noise protection. DFS takes part in a complex process which includes discussions with the local noise abatement commissions that support DFS in questions of aircraft noise and environmental protection. Additional stakeholders in this process are the Federal Supervisory Authority for Air Navigation Services (BAF), the Federal Environment Agency (UBA) and the Federal Ministry of Justice (BMI). After considering and evaluating all relevant factors and options, the Federal Supervisory Authority for Air Navigation Services (BAF) determines and publishes all new routes.

Air navigation services technology

Aircraft fly along defined airways. Unlike the traffic on the ground, pilots are not guided by traffic signs. Assisted by high-precision technology, air traffic controllers in the radar control centres prevent traffic jams in the air and ensure that pilots maintain the required separation from other aircraft.

Primary and secondary radar

The entire airspace over Germany is under radar surveillance. There are two basic types of radar: primary radar and secondary radar. Primary radar antennas transmit electromagnetic pulses which are reflected by the aircraft and returned to the antenna. In this way, the position of the aircraft in the air can be determined. The secondary radar antenna also transmits electromagnetic signals. These signals activate the aircraft's transponder, which transmits a coded pulse consisting of a four-digit number that is automatically decoded and informs the controller of the identity and flight level of the aircraft.

The air navigation services systems in operation today provide the controller with altitude, speed and aircraft data, as well as other important information. The systems also relieve controllers of routine tasks so that they can fully concentrate on the air situation.

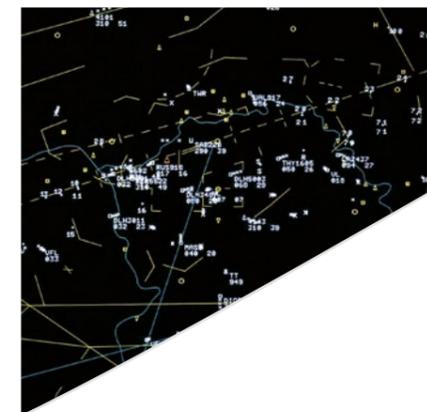


DFS engineers are constantly developing these systems further. New systems allow flight plan data to be calculated even more precisely and provide an optimised display of these data for the controller.

In addition, communications, navigation and surveillance systems are used for en-route and approach navigation. There are over 200 systems covering Germany. This number includes about 50 instrument landing systems at the 16 designated international airports.

Flight information service

The Control Centre division offers an additional service to pilots flying in German airspace under visual flight rules: flight information service (FIS). The pilot receives all information required for the flight, such as air pressure and weather conditions on the route. Information about the activation times of restricted areas and the current weather conditions at the destination airport are also provided. If required, traffic information can also be given. Pilots can communicate via a nation-wide radio network set up by the Control Centre division.





At its Air Navigation Services Academy in Langen, DFS trains its air traffic controllers.



Commercial services, partners and subsidiaries

DFS markets its expertise and air traffic control systems around the globe. It is also setting up air navigation services facilities in other countries from Europe to the Middle East and Eastern Asia.

At its Air Navigation Services Academy in Langen, DFS trains its air traffic controllers.

Technicians and engineers are trained here to work on state-of-the-art air traffic control systems. Other air navigation service providers also take advantage of the expertise and technology of the Academy to train their air traffic controllers. In many cases, these training relationships have been in place for many years.

DFS Aviation Services GmbH

The world of air navigation services is undergoing radical change – from a technical, operational and political point of view. In response to these changes, DFS has established a subsidiary called DFS Aviation Services GmbH. As part of the DFS Group, it can offer its customers the expertise and technical know-how of one of the largest and most advanced air navigation service providers in the world. Its portfolio includes the provision of air navigation services, consultancy, systems and training. In addition, it is responsible for approach control at eight regional airports in Germany. The four largest of these are the airports of Frankfurt Hahn, Dortmund, Karlsruhe Baden-Baden and Niederrhein Weeze.

European Satellite Services Provider (ESSP)

DFS is developing the European Satellite Navigation System (EGNOS) in cooperation with six

other European air navigation service providers. DFS is represented by its DFS European Satellite Services Provider Beteiligungsgesellschaft, which makes financial contributions and provides infrastructure facilities.

FCS Flight Calibration Services

Calibration flights are conducted to check the precision of the signals transmitted by navigation aids. DFS holds shares of the company FCS Flight Calibration Services, which is headquartered in Braunschweig, along with the Swiss air navigation services, skyguide, and the Austrian air navigation services, Austro Control. FCS is a competent and reliable partner for all flight calibration requirements.

Air Navigation Solutions Ltd. (ANS)

ANS is a subsidiary of DFS Aviation Services and is based in the United Kingdom where it provides air navigation services. It is currently active at London Gatwick Airport and will be operating at Edinburgh Airport from 2018. It also offers ancillary consulting services.

GroupEAD – European AIS Database

EUROCONTROL, the European Organisation for the Safety of Air Navigation, set up the European Aeronautical Information Service Database to provide standardised worldwide aeronautical information. DFS, the Spanish air navigation services organisation ENAIRE and an Austrian manufacturer of air traffic control systems were commissioned to jointly create this database.

European cooperation: SES, FABEC, SESAR

For more capacity in the European sky

Even though the sky seems to be boundless, clear boundaries do exist in airspace. Creating an airspace irrespective of boundaries between countries is the aim of the Single European Sky initiative launched by the European Commission in 1999. Today, airspace is mainly organised along national borders and not along actual traffic flows. And what is more, European air traffic is controlled by 39 different air navigation service providers (ANSPs) using different technologies and flight procedures when controlling more than 9.5 million flights per year.

The restructuring of airspace aims at harmonising procedures, protecting the environment, reducing costs of ANSPs and airlines, creating synergies in research and development as well as in the procurement of new systems and the provision of training.

Nine functional airspace blocks (FABs) are committed to reaching these objectives. Airspace blocks geographically extend over several countries, but the States maintain their national sovereignty. The largest and most complex FAB is the Functional Airspace Block Europe Central (FABEC). The heart of the continent boasts 55 percent of all flights in Europe, i.e. 5.5 million flights within an area of 1.7 million square kilometres. DFS along with its civil and military partners from Belgium, France, Luxembourg, the Netherlands and Switzerland have joined forces in FABEC.

The idea behind the FAB initiative is to enhance capacity, to eliminate bottlenecks and to make air transport safer.

The SESAR project also forms part of the Single European Sky initiative. It is the associated technological component and aims at harmonising the different air traffic management technologies. The European Union, EUROCONTROL and 15 other partners are pursuing this goal. DFS is one of them.

The A6 Alliance was formed in 2011 by six air navigation service providers that are members of the SESAR Joint Undertaking. Meanwhile others have joined. The Alliance's role is to create synergies while focusing on SESAR development, deployment, execution as well as on strategic areas of common interest.

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