Prepared for the future

DFS developments for the future and the latest traffic figures
Dear reader

DFS Deutsche Flugsicherung controls one of the most complex and busiest airspaces of the world. We accomplish this every day with a high standard of safety, especially because we place great importance on the training of our air traffic controllers. But not just that, we also employ state-of-the-art technology with sophisticated design so that an increasing amount of air traffic can be handled safely and efficiently.

With this edition of our magazine “transmission”, we would like to give you an overview of our investments in the future and to report on the latest traffic figures from 2013. For example, we are especially proud to have received the first certification worldwide for satellite-based approach procedures under CAT I conditions at Bremen Airport in the northwest of Germany. Thanks to the positive experience made there, we will soon be able to put another such facility into operation at Frankfurt Airport, Germany’s largest airport.

When it comes to innovative procedures, DFS has also been successful. We were, for example, able to significantly expand the number of direct routes on offer. Such progress can only come about when financial investments are made. For this reason, economic regulation resulting from the Single European Sky (SES) legislation poses a significant challenge because it means that financial pressure will remain at current levels or possibly even increase. However, because of the importance of this legislation, we believe that European economic regulation needs to be given a new foundation if it is to achieve the goals it has set out to reach. You’ll find my perspective on this matter in one of the articles in this magazine.

The top priority of DFS is, of course, safety. We can justifiably claim to have a very high level of safety at DFS. Since 2009, our air traffic controllers have not been a contributing factor in the two most serious categories of proximities between aircraft in the air (immediate risk, safety not assured). Our safety standard on the ground is very favourable as well. In the year 2012, DFS was only involved in 2.5 percent of all runway incursions. Although the data for 2013 were not available yet at the time of publication, we can say that last year our air traffic controllers did a fantastic job and we expect the statistics for last year to be at least as good as the year before.

Thus, we are prepared to face whatever tasks come our way. We have highly motivated and well-trained staff, our technology is state-of-the-art and we employ modern procedures. We are not just a strong local player, we have become a global player and offer experience, products and services on the international market. We are active in different regions of the globe, helping other air navigation service providers to achieve their objectives.

We hope you enjoy reading our magazine!

Prof. Klaus-Dieter Scheurle
Chairman and CEO
DFS Deutsche Flugsicherung GmbH
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More passengers, less traffic

Competitive pressures are compelling airlines to operate larger aircraft and utilise their existing capacities to a greater extent. This explains how it is possible that passenger and freight tonne kilometres can continue to grow while the number of aircraft movements stagnates. The total traffic volume in Europe continued to decrease in 2013.
Last year was not an especially good year for air navigation service providers (ANSP) in Europe. According to EUROCONTROL reports, there were 1.1 percent fewer aircraft movements in European airspace in 2013 than in 2012. If one considers just the 28 Member States of the European Union, the decline was 1.7 percent; a total of 8.6 million aircraft movements were recorded in 2013. This development is the result of a drop in the number of intra-European flights. While the number of entries and exits increased, the number of intra-European flights dropped by 2.2 percent; in the 28 EU States even by 3.7 percent.

In four of the five countries with the most traffic – Germany, France, Italy and Spain – air traffic experienced a downswing in 2013. Only the United Kingdom saw a slight upswing of 0.6 percent. This is a doubly difficult situation for air navigation service providers in the European Union. On the one hand, the decline in traffic means that their income is diminished while they are not in a position to reduce their expenditures to the same extent that their income has dropped. On the other hand, EU regulation has made ANSPs take on the major part of the risk associated with declines in air traffic. Charges for air navigation services were fixed on the basis of a 2011 forecast which had assumed significant growth.

No growth can be seen in central Europe. If growth can be seen anywhere, it is at the remote edges of Europe. Air traffic in Turkey, for example, grew by 7.1 percent in 2013. Eastern Europe experienced growth as well, even if it was not as considerable. Romania reported 5.3 percent more flights and Ukraine growth of 6.0 percent. This regionally inconsistent growth in Europe was felt at the airports as well. According to EUROCONTROL, the three busiest airports in Europe – Paris-Charles de Gaulle, Frankfurt and London-Heathrow – saw traffic declines between 0.4 and 3.6 percent. By contrast, both of Istanbul’s airports experienced two-figure growth. At Atatürk Airport, the number of aircraft movements increased by 12.5 percent; at Sabiha Gökçen, it was a whopping 19.3 percent.

While the number of aircraft movements in Europe is declining, passenger numbers continue to grow. According to the International Air Transport Association (IATA), the number of passenger kilometres flown in Europe between January and December of 2013 was up by 0.7 to 5.5 percent as compared to the same months of the previous year. Passenger kilometres worldwide are also increasing. According to IATA, the increase fluctuated

### Major European airports

<table>
<thead>
<tr>
<th>Airport</th>
<th>Country</th>
<th>2013</th>
<th>Change in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paris-Charles de Gaulle</td>
<td>France</td>
<td>655</td>
<td>-3.6</td>
</tr>
<tr>
<td>Frankfurt</td>
<td>Germany</td>
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<tr>
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<td>Germany</td>
<td>520</td>
<td>-3.8</td>
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<td>Denmark</td>
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<tr>
<td>Warsaw-Okecie</td>
<td>Poland</td>
<td>195</td>
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Source: EUROCONTROL

Paris-Charles de Gaulle Airport handles the most traffic of all the European airports: In 2013, it recorded a daily average of 655 take-offs and landings, closely followed by Frankfurt Airport and London-Heathrow. Most countries reported either a drop in the number of take-offs and landings in 2013 or just marginal growth. Turkey is the exception: Both airports in Istanbul, Atatürk and Sabiha Gökçen, saw traffic increases in the double digits.
Traffic figures from 2013

While the number of passengers keeps increasing, freight tonne kilometres are stagnating. In the previous two years, the amount of freight transported worldwide by air fell. The year 2013, however, saw a change in this trend. In February and March, the number of freight tonne kilometres was below the same two months of the previous year, but beginning in the second quarter, there was growth. The apex was reached in November with a high of 6.1 percent. In the future, IATA expects the volume of freight transported by air to continue to increase – but at a significantly lower rate than that of passenger kilometres.

Development varies extremely depending on the region of the world. The largest growth rates were recorded in the Middle East in both passenger and freight transport. A monthly growth rate of up to 23.8 percent was recorded in this region. The Asia Pacific region also saw significant growth in passenger numbers (up to 10.4 percent), while the demand for air freight transport stagnated. Europe showed slight growth in both passenger and freight figures, while, in North America, only the number of passengers grew. The air freight sector there showed losses.

Thus, in total, traffic development for the airlines was positive – even if more demand does not necessarily translate to higher profits. The reasons cited by IATA for the airlines’

| Flights under instrument flight rules (IFR) |
|-----------------|---------|
| Germany*        | 2,990,069 |
| France          | 2,931,787 |
| United Kingdom  | 2,225,104 |
| Italy           | 1,648,035 |
| Spain           | 1,528,010 |
| Turkey          | 1,141,522 |
| Austria         | 1,113,926 |
| Netherlands     | 1,108,972 |
| Belgium and Luxembourg | 1,100,599 |
| Switzerland     | 1,019,188 |
| Sweden          | 730,181   |
| Poland          | 691,817   |
| Czech Republic  | 679,567   |
| Greece          | 623,122   |
| Denmark         | 618,246   |
| Norway          | 610,163   |
| Hungary         | 600,202   |
| Bulgaria        | 550,540   |
| Ireland         | 522,398   |
| Serbia and Montenegro | 518,201 |
| Romania         | 512,887   |
| Ukraine         | 494,165   |
| Croatia         | 492,382   |
| Portugal        | 449,394   |
| Slovakia        | 397,506   |
| Slovenia        | 329,004   |
| Cyprus          | 277,394   |
| Bosnia and Herzegovina | 262,467 |
| Belarus         | 249,003   |
| Finland         | 243,018   |
| Lithuania       | 241,749   |
| Latvia          | 235,927   |
| Albania         | 200,578   |
| Estonia         | 183,019   |
| Iceland         | 130,937   |
| Azerbaijan      | 128,591   |
| FYROM           | 112,718   |
| Georgia         | 110,245   |
| Malta           | 109,212   |
| Moldova         | 74,211    |
| Armenia         | 52,302    |

* Due to different calculation methods, the figures published by EUROCONTROL are not identical with DFS figures.

Source: EUROCONTROL/STATFOR

While the number of passengers in Europe is increasing, the number of flights is decreasing: In total, there were 1.1 percent fewer take-offs, landings and overflights in 2013 than in 2012. Four of the five countries with the most traffic, Germany, France, Italy and Spain, experienced a decrease. Only the United Kingdom saw a slight increase. By contrast, Turkey reported a marked increase. Traffic in this country at the border between Europe and Asia grew by 7.1 percent.

between 2.7 percent in January and 6.8 percent in August as compared to the same months in 2012. This is in line with the positive trend of the past years. IATA expects demand to continue to grow in the upcoming years. The forecast for 2014 is an expected increase of six percent, reaching 3.3 billion passengers worldwide.
small profit margins are: a significant decline in the share of business and first class seats sold, a decrease in air freight and continued high fuel prices. Financial pressure resulted in underused connections being cut altogether, smaller airplanes being replaced with larger more cost-efficient ones and seat factors being raised. According to IATA, the seat factor – the relation of seats sold to the total number of seats available – has increased steadily since 2009. In August 2013, a new worldwide record was set with a seat factor of 83.4 percent.

Growth was seen in the number of overflights in German airspace but at the same time the number of take-offs and landings at German airports fell in 2013. The decline came to a total of 3.4 percent at the 16 international airports in Germany. Only two German airports reported increases: Erfurt and Berlin-Tegel. Delays in the opening of the new Berlin Airport benefitted Berlin-Tegel.
It was a step into the future of air traffic technology that DFS took together with Air Berlin in 2012. On its flight from Majorca, via Nürnberg, to Bremen on 9 February 2012, the Air Berlin Boeing 737-800 with the flight number AB 6573 was the first aircraft worldwide to land with the help of a certified GBAS system under CAT I conditions. Prior to this, the German Federal Supervisory Authority for Air Navigation Services had granted the GBAS station SLS-4000 – manufactured by Honeywell and used by DFS – the necessary certification as a primary landing system under CAT I conditions in Germany. Since then, it has been possible to conduct approaches to Bremen Airport in instrument meteorological conditions independent of the conventional ILS system. DFS was the first air navigation service provider (ANSP) in the world to create the technical and operational conditions necessary for the new GBAS precision approach procedure to be used by the airlines’ regular scheduled air services. “That is an important step on the way towards replacing conventional ILS with a new

The Ground Based Augmentation System – also known as GBAS – makes it possible for airplanes to fly precision approaches with the aid of data from the Global Positioning System (GPS). In the past, precision approaches were only possible with the aid of the instrument landing system (ILS). For airlines and airports, GBAS has a lot of advantages over ILS. In February 2012, DFS received the first certification worldwide for satellite-based approach procedures under CAT I conditions at Bremen Airport in the northwest of Germany.
generation of precision landing systems,” says Stefan Naerlich, head of Navigation Services at DFS.

In Germany, GPS has been permitted as a primary means of navigation for en-route flights and non-precision approach and landing operations since the late 1990s. To use the GPS signal for a precision approach, a ground station needs to send corrections of the satellite signals to the aircraft to achieve the level of accuracy and reliability necessary for this phase of flight. The reference antennas of the GBAS ground station receive the GPS satellite signals as does the approaching aircraft. Because the position of the ground station is known exactly, the system can produce correction signals for each satellite by calculating the true slant range to the satellite. These correction data and the corresponding approach path data are transmitted from the ground station to the airplane via a digital VHF data link. On board the aircraft, a multi-mode receiver (MMR) processes these transmissions and calculates the current position of the aircraft in relation to its prescribed approach.

DFS involvement in the development of a satellite-based alternative to ILS for precision approaches extends back almost 20 years. As early as the mid-1990s, DFS specialists were intensely involved in technical tests for integrating satellite navigation.

In Munich in 1995, DFS conducted tests that compared three different types of precision approaches under CAT I conditions: approaches with ILS, MLS (Microwave Landing System) and DGPS (Differential GPS). “It was then that we found out that approaches using Differential GPS, which is based on the same principle as GBAS, allowed for a greater level of flexibility and offered much more potential than MLS,” says Stefan Naerlich. “But, back then there were no ICAO standards establishing a uniform method of data transmission from a ground-based system to one on board the aircraft.”

DFS also operated a GBAS ground station at Frankfurt Airport to carry out further tests. “There we had a prototype that was not officially approved for regular operations,” explains Dr Winfried Dunkel, specialist for satellite navigation at DFS. The station was also used for test flights on behalf of EUROCONTROL with a specially equipped Dornier 128-6. This research aircraft belongs to the Technical University of Braunschweig and the tests were carried out at Egelsbach Airport, a busy general aviation airport southeast of Frankfurt Airport. “These flights were used to check whether the ground station and the on-board receiver interacted correctly,” says Dr Dunkel.

In 2005, DFS launched its GBAS project in Bremen together with the airline TUIfly as its testing partner. “For this venture into the technological unknown, we chose Bremen because there were no additional hurdles as neither the infrastructure on the ground nor the airspace at the airport posed any problems,” says Stefan Naerlich. “We were able to develop and test the system in peace.”

As part of the project, the GBAS SLS-3000+ ground station produced by Honeywell was installed at Bremen Airport in 2007. It was a prototype and had not been certified at that time. So, it was only possible to use it for approaches under visual meteorological conditions while using additional ILS support. An important milestone was reached on 5 September 2007, the day that the first scheduled flight in Europe used the GBAS system in the cockpit of a Boeing B737-800 operated by TUIfly. The crew monitored the ILS signal in parallel.

The project experienced a small hiccup when TUIfly eliminated Bremen Airport from its schedule in the spring of 2008. “All of a sudden we didn’t have an airplane that could fly GBAS
approaches anymore,” recalls project manager Gabriele Zaki. In the end, DFS was able to convince Air Berlin to come on board as a new partner as they had just ordered a number of Boeings with GBAS equipage and they were very interested in trying out these capabilities. Marc Altenscheidt, the head of Air Berlin’s fleet of Boeings, was eager to work on the project when DFS contacted him. “After their initial flights, the Air Berlin pilots were enthusiastic and praised the fact that GBAS provided them with more exact and stable approaches than ILS did,” reports DFS project manager Zaki.

In November 2008, the navigation specialists at DFS under the leadership of Dr Winfried Dunkel and Olaf Weber installed an SLS-4000 ground station at Bremen Airport and switched off the prototype. A year later, this model was updated to the configuration that had been approved by the FAA. In addition, the manufacturer Honeywell needed the German type certification, which was granted by the German Federal Supervisory Authority for Air Navigation Services in November 2011. “At the moment, Honeywell is the only manufacturer that has type certification in the USA and Germany,” says Naerlich. The GBAS CAT I implementation in Bremen was approved for general use on 9 February 2012. This cleared the way for the first GBAS-supported landing of an aircraft providing regular scheduled air services without ILS support.

Compared to conventional ILS, GBAS has a lot of advantages: lower operating costs, more accuracy and more reliable signals with a lower degree of susceptibility to disruptions. Furthermore, GBAS provides even more safety and creates the conditions needed for new procedures to reduce noise levels. An airport with two runways needs a total of four ILS installations, while one GBAS station can handle up to 49 approaches to different runways with different thresholds and glide slope angles. Interruptions of service due to maintenance on the ground station total less than eight hours per year. It is only necessary to check measurements once a year. Regular flight inspection does not need to take place at all. By contrast, ILS installations are subject to frequent regular time-consuming and costly maintenance servicing that is prescribed by ICAO.

A GBAS station is not yet cheaper than a single ILS installation, but it can be used for several runway thresholds simultaneously and has significantly lower maintenance costs. Both of these are good for the operator.

GBAS is not, of course, free. Airports and the airlines have to be willing to invest. For the airlines, the most significant investments have to be made in equipping their fleets with multi-mode receivers (MMR) that receive signals of the GBAS ground station. “Up until now, fewer than five percent of all operating airplanes have been equipped with MMR,” estimates Naerlich. Increasingly, the aircraft manufacturers Airbus and Boeing are including the receivers for GBAS data in the standard equipment of their new airplanes. Boeing models B737 NG, B747-8 and B787 come with an MMR. Airbus models A380, A320 and the entire A330 family do as well.

“We’ve developed something that is beneficial to everyone involved in air transport,” says Naerlich. “The next step is up to the airports and airlines. We want to enter into dialogue with them and are eager to continue the discussion.”
A system with a bright future

Cross-border technology is the future in air traffic management. As part of the European iTEC programme “interoperability Through European Collaboration”, and in cooperation with the Dutch air navigation service provider LVNL, DFS is developing iCAS – a new standardised air traffic management system for upper and lower airspace. It is scheduled to be introduced in 2016/2017.
Technology

There is an invisible boundary in the sky, the boundary between upper and lower airspace. In Germany, lower airspace is watched over by the control centres in Langen, Munich and Bremen with the system called P1/ATCAS. The vast majority of German upper airspace is controlled from the upper area control centre in Karlsruhe. This centre uses a different system, the P1/VAFORIT, which has been in place since 2010. This system provides new tools to air traffic controllers that support them in the planning of flight routes and in detecting conflicts.

The reason various systems are now used in parallel is because there are different requirements for upper and lower airspace. In lower airspace, traffic consists mostly of airplanes that are climbing after take-off or that are descending to land. By contrast, vertical movement does not play much of a role in upper airspace. The airplanes are at cruising altitude for en-route flights which means that movement is mostly horizontal.

The additional functions that P1/VAFORIT provides to controllers will be used at all DFS control centres in the future. DFS and the Spanish manufacturer Indra are currently developing a new air traffic management system called iCAS which will initially be used for upper airspace. The start of operations is planned for 2017; however, it may be possible to start implementing the system in 2016. At the same time, DFS and LVNL are adapting iCAS to the requirements of lower airspace and then plan to gradually introduce it there. The name iCAS is an amalgamation of iTEC and CAS. CAS stands for “Centre Automation System”, while iTEC stands for “interoperability Through European Collaboration” and refers to the collaboration between DFS and its counterparts in the UK and Spain, NATS and AENA.

The goal of the collaboration is to develop components for a European air traffic management system.

A major impetus for developing iCAS is the harmonisation of the technical infrastructure of air navigation services driven by the Single European Sky initiative. “With iCAS, our hope is to provide an air traffic management system that is also an attractive alternative for our FABEC partners,” says Thomas Schweer, the manager of the iCAS programme at DFS. Having one uniform system at DFS would itself be very beneficial. Maintenance costs would sink and new functions could be made available more quickly.

The iCAS system is based on four-dimensional trajectories just as P1/VAFORIT is. This means that the system displays the position of the aircraft precisely in three-dimensional space and adds the dimension of time.
Thus, it is able to calculate the future traffic situation as well as potential conflicts minutes ahead of time. Air traffic controllers who have this information can plan better and react more flexibly. This means fewer delays and increased capacity. Since P1/VAFORIT was introduced in the Karlsruhe control centre for use in upper airspace, capacity has increased by about eleven percent. However, the head of the iCAS programme expects the potential for increasing capacity in lower airspace to be less significant than in upper airspace. “The greatest potential is in en-route flight, in large sectors of airspace.”

The four-dimensional trajectory makes airspace users less dependent on fixed routes leading to their destination. Free route airspace is the expression generally used for this type of flexibility. It is an important part of future concepts that are currently being developed by FABEC partners. “For this, we need a more precise calculation of the planned route as well as tools that support controllers in recognising planning conflicts and monitoring trajectory conformance,” says Schweer. “The functions that were introduced with P1/VAFORIT that are based on the four-dimensional trajectories are being further developed for use in lower airspace with iCAS.”

There is actually a very mundane reason behind the need to replace the current generation of systems. Namely, the hardware used by the current P1 systems is out of date. Important components are no longer available on the market, making finding spare parts increasingly difficult. This is not only true for P1/ATCAS, but also for the much more recent P1/VAFORIT. The reason for this is that long development times are needed for the highly complex air traffic management systems. The P1 programme was started in 1994 and the first P1/ATCAS system introduced at the end of 1999. Even the recently introduced P1/VAFORIT system, which has been in use in Karlsruhe since the end of 2010, is anything but new in terms of hardware. Construction of the system began in 2004. When iCAS goes into operation in 2017, the hardware will already be 13 years old. In today’s fast-paced IT world, that is half an eternity.

The iCAS system will be introduced in two phases. The first step will be to replace the P1/VAFORIT system in Karlsruhe with iCAS in 2017. The changes for the air traffic controllers will be marginal as the functions of the two systems are identical. The second step will be to adapt iCAS functions to lower airspace and then to introduce the new system at the remaining control centres starting in 2018/2019. This will take advantage of the experience DFS will have gained from developing P1/VAFORIT. “It is very risky to combine a major technical change with a major operational change,” says Schweer. “So, our objective was to separate the technical and the operational changes and thus risks.”

Developers are faced with a special challenge in adapting iCAS to lower airspace. Their first goal is to develop the controller’s tools so that they can be used as effectively in the much smaller sectors in lower airspace as they are in the large sectors of upper airspace. The next goal is to make sure that the switch from P1/ATCAS to iCAS does not present too great a problem for the controllers. The Bremen control centre will be the first to put iCAS into operation. If everything goes according to schedule, this will happen in 2018/2019. “What we learn in Bremen, we will then use at the other control centres,” says Schweer.

However, before iCAS can be put into operation in lower airspace, another step needs to be taken. To extend the lifespan of the current P1 system to the end of this decade, the hardware in Langen and Munich has to be replaced. In Bremen, this will be a bit different. As this centre was the last location scheduled to have its hardware replaced, the decision was subsequently made to introduce iCAS directly, skipping the intermediate step. Afterwards, Munich and Langen control centres will be fitted with iCAS.
A quick look across the Atlantic Ocean shows that speech recognition is a cutting-edge technology for air traffic control simulators. This technology saves costs and creates new opportunities in the world of training.

Apple advertises Siri by saying that it understands what you say, knows what you mean and even talks back. Siri is not a friendly employee at the Apple service centre but a speech recognition system for their smartphones. Siri is often mentioned when you hear the R&D experts at DFS talk about speech recognition. They see it as proof that this technology has already arrived in people’s everyday lives. “Especially younger people are quite used to it,” says Dr Karl-Heinz Steffens, Head of the ATM Simulator Centre.

Speech recognition has become part of the training infrastructure at DFS. The DFS unit in Munich has been using this technology in its air traffic control simulator since August 2011. By the end of 2014, a Voice Recognition and Response (VRR) system will have been introduced at all DFS control centres and at the DFS Academy. The VRR system takes over the role of the simulation pilots. It talks back to the air traffic controllers and navigates the aircraft according to the controller’s instructions. Speech recognition only works in standard situations,” reports Andreas Türk, Head of Product Management for Tower Simulators. An additional appeal is the relatively low cost for the system itself. The hardware is already a component of DFS air traffic control simulators. The software is provided by a US company called UFA. UFA developed the speech recognition component for its simulators in cooperation with the Canadian air navigation service provider NAV CANADA and US universities. “DFS only has to pay the costs of the licences and the DFS-specific adaptations,” says Dr Steffens.

The new technology also provides greater flexibility: Without the need for simulation pilots, trainees are free to plan their own training times. “They can practise at the simulators at the weekend or late in the evening if they want – completely independent of the shift roster for simulation pilots,” explains Michael Slotty, Head of Product Management for Centre Simulators and Project Manager for the project ‘Introduction of speech recognition at all control centres’. At NAV CANADA, this is already common practice in air traffic control training. They and other organisations, such as the FAA and the US Air Force, have been using speech recognition for quite a while. “NAV CANADA places a high priority on independent learning and training. They do not rely as much on classroom-teaching as we do,” says Dr Steffens.

Once speech recognition is in place everywhere at DFS, DFS may well develop in this direction, too. The trainees will then be able to work on certain areas on their own, without simulation pilots being necessary. Simulations with simulation pilots could be scheduled for later training phases or for situations where communication is not restricted to aviation phraseology, such as for the training of emergency situations.

“We probably will not be in a position to completely do without simulation pilots as currently the speech recognition program only works with standard phraseology,” says Andreas Türk. The technology cannot yet cope with plain language. But this limitation actually has advantages for training. The new technology forces air traffic controllers to keep exactly to the phraseology. The speech recognition program only responds if the trainee uses the correct phrases. In many cases, human beings are not as strict and react even if they only roughly understand what is meant, according to Slotty.

DFS is pressing ahead with the expansion of the phraseology in use. The goal is to have the system sound as human and realistic as possible.
That is why the readback is made by various voices. The appeal of this technology is not only obvious for training, it also has tremendous potential for research and development. When performing test runs for example, simulation pilots often have to wait around for hours because the set-up has to be modified before the next test run can be made. Such downtime would be eliminated if speech recognition were employed. As a next step, speech recognition is to be used for the training of air traffic controllers at the tower simulators of the DFS Academy.

The technology will first be introduced for the start-up and clearance delivery position. DFS experts have added an innovation in the form of a mixed mode, where both speech recognition and simulation pilots are used simultaneously within a control sector. This mixed mode makes sense for centre as well as tower simulators.

Andreas Türk thinks that speech recognition can also support real operations one day. Research is being conducted in this direction to reduce head-down time in control towers. This is the time that tower controllers spend making entries into the system.

Simulation pilots
Simulation pilots are staff who take on the role of pilots when trainee air traffic controllers learn their trade at air traffic control simulators. Simulation pilots are not only used in initial training. They are also to be found in the proficiency training of already fully fledged air traffic controllers and in research and development, such as the development of new procedures. Simulation pilots sound like real pilots. They need good English language skills and special knowledge about airspaces and procedures, for example. This knowledge is learnt during a six-month training course.
Reducing runway waiting time

Airport Collaborative Decision-Making (Airport CDM) brings many benefits for all involved, not least by avoiding unnecessary engine run times and congestion at the runway. This not only makes the planning of operational processes more reliable, it also reduces noise and fuel consumption.

Before Airport Collaborative Decision-Making was introduced, pilots had to learn to shout loudly. The principle then was “first come, first served”. “In those days, it worked like this: The pilot who shouted first got the approval to start his engines, whether he was actually ready to go or not,” says Erik Sinz, senior expert for hub capacity at the DFS business unit Tower and a member of the DFS project team for the first Airport CDM procedure in Germany. “For our air traffic controllers, there was always an element of surprise.”

A pilot would often receive start-up approval at his parking position but start his engines 15 minutes later. Due to this, air traffic controllers would issue several start-up approvals at a time so that they always had an aircraft ready to go. This allowed them to optimally use the scarce resources on the runway and ensured that they always had an aircraft lined up to take off.

But this often led to bottlenecks and long waiting times at the runway if too many aircraft taxied to the take-off position at the same time. The consequence? Unnecessary engine run times, causing more noise and higher fuel consumption. All of which represented an additional burden on the environment.

This all belongs to the past for the airports that have implemented Airport Collaborative Decision-Making (Airport CDM). Munich Airport was the first European airport to introduce Airport CDM as a standard procedure. In June 2007, it was transferred from the trial phase into regular operations.

Since then, many others have joined the CDM family: In Germany, Frankfurt Airport joined in February 2011 and Düsseldorf Airport in April 2013. Projects to introduce it are currently up and running at Berlin, Stuttgart and Hamburg airports.

The goal of Airport CDM is to expedite the aircraft turn-round process on the ground and to make the interaction between all parties concerned more transparent. The core idea is to have a target off-block time (TOBT) for each flight. The TOBT is the target time at which the individual aircraft will have completed ground handling, all doors will have been closed and boarding bridges removed.

Each airline sets the target time for its aircraft and transmits it to the CDM system. The system calculates the latest possible time for engine start-up. This is called the target start-up approval time (TSAT) and this time is made available to all parties concerned – airlines, airport operators, air navigation services, handling agents, ground handling agencies as well as the Network Manager, the flow management unit at EUROCONTROL, the European Organisation for the Safety of Air Navigation.

Prior to Airport CDM, air traffic controllers decided when to issue the approval to which aircraft on an ad hoc basis. Now – with the TOBT – this is defined 40 minutes prior to the planned end of ground handling. If a pilot has not started the engines within five minutes of the calculated time, the aircraft is deleted from the system and has to re-join the back of the queue. Every change and deviation from the plan is made available to all parties by means of a tool of the system. This makes everything transparent, which is a major difference to the prior system.

“We were able to reduce the waiting time at the runway from an average of 4:39 minutes to 3:41 minutes.”

In the summer of 2008, a year after the start of regular operations at Munich Airport, Erik Sinz looked back positively: “We were able to reduce the waiting time at the runway from...”
an average of 4:39 minutes to 3:41 minutes,” explained the hub specialist to the DFS magazine. The positive CDM trend in Munich has continued since then as the analysis of the data for the subsequent years has shown. In the latest annual report for 2011, the majority of measurements showed that the values had improved over the prior year.

DFS specialist Sinz is particularly happy that, thanks to Airport CDM, the waiting times at the runway have continued to experience a significant decrease and the ATFM slot adherence an increase. “These values are two of the most important metrics in Airport CDM,” said Erik Sinz. The 95-percent value for slot adherence seen in May 2011 represents the highest value ever achieved.

The DFS specialist sees the reason underlying the success in the optimum exchange of information between the CDM airport and the persons responsible for the network. “In addition, the local partners at the airport can plan better thanks to the transparent data flow,” said Erik Sinz. In this way, the individual conditions for each flight, such as varying taxi times, capacity limitations or aircraft de-icing, can be recorded with a higher degree of accuracy and timeliness.

The automated exchange of data between the CDM airports with EUROCONTROL’s Network Manager in Brussels that allocates slots across Europe also allows a better utilisation of sector capacity. In the past, the European Central Flow Management Unit (CFMU) in Brussels received the flight plan and, following take-off, the departure time — and no other information in between. Now with Airport CDM, the planned take-off time and any changes to it can be transmitted to the Network Manager up to three hours prior to actual take-off.

This allows the traffic in the sectors affected by the flights to be predicted more accurately. In other words: The centre in Brussels now knows ahead of time if a flight in Munich or Frankfurt is departing earlier or later and can consider this information when calculating slots, prior to making any necessary changes. The airports expect that this will help to make the handling of flights that have been allocated slots more efficient. The more airports introduce Airport CDM, the denser the Europe-wide network will become and the easier it will be to avoid inefficient and unplanned flight profiles.

“The Airport CDM procedure has proved its worth in practice,” concludes Carl Seifert, Head of Munich Tower, six years after the start of the CDM procedure in Munich. “Data exchange at a local level and in the Europe-wide air navigation services network is technically stable and generates a high-quality basis for planning.” Instead of “first come, first served” as in the past, the slogan under Airport CDM is “best planned, best served”. All those involved benefit from this. Not least the environment.
Direct routes preferred

In March 2013, DFS expanded the number of direct routes it offered. In the meantime, several hundred of these short routes are on offer. Airlines have been able to shorten their routes by millions of air miles and DFS has numerous ideas about further improving the situation.

DFS has a success story to report: In June 2011, 35 direct routes were introduced in the airspace handled by the Karlsruhe upper area control centre, offering direct connections, and therefore shorter routes, from A to B. The first step was made with the programme Free Route Airspace Karlsruhe (FRAK). This was set up with the goal of improving the environmental record of the company. Two years later in June 2013, airlines could choose from 250 routes.

The opportunity to fly direct routes is no longer limited to the Karlsruhe control area. The FRAMaK project unites the directs from Maastricht and Karlsruhe, meeting the requirements of customers, air navigation service providers and the environment as well as providing airlines with 700 direct routes overall.

In a highly complex airspace, re-routing is inevitable to alleviate congested areas. Sometimes, flight routes can be shortened, however. Via radiotelephony, pilots ask air traffic controllers for a direct, and if they are lucky, clearance for a direct routing will be issued over a longer distance regardless of the originally planned route. These tactical directs are mostly possible at night and at the weekend, but there is a drawback: The fuel planned for the original, longer route is still on board the airplane and represents, in the truest sense of the word, excess baggage.

The potential behind plannable direct routes was revealed in a forecast drawn up for 2011: Potential annual savings of approximately four million air miles were estimated, even before FRAMaK was put in place. That corresponds to a saving of 40,000 tonnes of CO2 not released into the atmosphere – per year. Results obtained so far show that this goal was not set too high: The direct routings are used frequently and the airlines normally find something from the broad range available that suits their needs.

DFS is helping the airlines to reduce their costs and make a contribution to environmental protection.

Other issues are considered in flight planning, not just the route length. Wind conditions, timing, en-route charges and the altitudes offered also play an important role. Many of the direct routes help to make a flight more cost-efficient. Thanks to the wide range of alternatives available, congested airspaces can be avoided and thus delays reduced. The shorter routes also benefit the environment. In many cases, however, longer routes can be just as attractive: When lower air navigation charges offset the higher fuel costs, airlines are frequently willing to accept longer routes.

DFS has reacted to this complex requirements profile. “We have based the development of direct routes on more than just statistics. We deliberately entered into a dialogue with airlines,” says Jürgen Regner, a senior expert responsible for procedures at the Karlsruhe control centre. “This is how we developed route profiles which were accepted from the first day of their introduction.” In this way, DFS is helping the airlines to reduce their costs and make a contribution to environmental protection.

Meanwhile, this approach is not only used in the area of responsibility of the Karlsruhe control centre as the longer an aircraft can stay on a direct routing, the more customers and the environment benefit. That is why DFS, EUROCONTROL and Lufthansa German Airlines started work on the project Free Route Airspace Maastricht and Karlsruhe (FRAMaK) in June 2012. A central point is the cross-border directs in the Maastricht and Karlsruhe control areas, which enable direct route segments that span even longer distances. The next step is the expansion of FRAMaK to the Functional Airspace Block Europe Central (FABEC). The FABEC partners France and Switzerland are currently starting with the implementation of direct routes, which will then be connected with the direct routes created under FRAMaK.
The concept of cross-border directs has not gone unnoticed outside FABEC. The air navigation service providers in the neighbouring countries are also trying to make their own routes more attractive and are investing in the development of direct routes in their airspaces. The goal of raising the cost-effectiveness and environmental sustainability of aviation in FABEC airspace is extending beyond its borders.

“Attractive direct routes keep traffic in our airspace,” says Jürgen Regner, explaining one of the advantages for DFS. “And our customers are satisfied as the routes they are offered are tailored to their needs.” DFS started a field study together with Lufthansa German Airlines. From the summer of 2013, user-preferred routes have been trialled on six city pairs. User-preferred routes allow the airline to plan the flight route with almost no restrictions. In an extremely complex airspace such as the one over Germany, this trial is pushing up hard against the limits of what is feasible. The goal is to gather experience and judge the potential of such user-preferred routes. Not every customer wish can be fulfilled, however. “The conventional route network is indispensable for the safe and expeditious handling of the prevailing traffic volume,” says Regner. “Customer requests for short cuts of individual flight routes come second to this objective.”

Customer satisfaction can also be achieved with more service: The Maastricht control centre provides the airlines with monthly user reports on what savings were achieved and which direct routes could have been used. The Karlsruhe control centre wants to offer such analyses in the future, too.

DFS has further options available in upper airspace. In December 2012, the area of responsibility of the Karlsruhe control centre was expanded to include sectors over southern Germany and Austria. These sectors had previously been controlled from the DFS control centre in Munich. This led to 25 direct routes being introduced in March 2013 and another 25 in May 2013. In the future, new direct routes will continue to be introduced twice a year. Of course, safety will remain the top priority. New direct routes will always be introduced step by step to give the system time to adjust.

A large European airline experienced a pleasant but unexpected side effect. Thanks to a direct route, the flight time decreased so much that it allowed the airline to switch from a three-person cockpit crew to a two-person crew.

For the environment, the amount of fuel burnt is the prime concern and thanks to the efforts of DFS and its partners this could already be significantly reduced in the last few years.
A complex balancing act

There are many laws which need to be obeyed. Local rules and regulations. Aircraft noise provisions. All these aspects need to be balanced simultaneously and given equal treatment. How much room to manoeuvre is left? What sounds like an irresolvable situation is part and parcel of daily work life for the procedures planners at DFS and the foundation of their work. Despite all the challenges, they still manage to change, redraft and introduce up to 60 flight procedures each year.
The planning of flight procedures is just as much part of the core duties of DFS as the professional control of the more than 9,000 flights per day in the skies above Germany. Nowhere can this be seen more clearly than when new runways or airports are being planned.

Nothing stays the same forever: Airways have to react to changes in the environment like any transport network. These impulses for change come from many directions. They could result from court decisions or new legislation. Many changes result from the recommendations of stakeholder consultation bodies, such as Noise Abatement Commissions set up for the major international airports in Germany. Often the impulses for change come from technological innovations, such as satellite navigation or new technical equipment on aircraft. This list is by no means exhaustive but it gives an idea of the changes that the airspace design staff at DFS have to react to.

“Actually, there are very rarely ATC-related reasons for changes being necessary,” reports Robert Ertler, a procedures planner at DFS. It is mostly external developments which are the reason to revise a procedure. The former military air traffic controller has been designing the airspace above Germany for over 14 years. Ertler and his 30 colleagues face a difficult balancing act: They have to develop new flight paths which allow the air traffic to be handled safely but at the same time consider their impact on the rest of the route network. They have to take noise abatement aspects into account but at the same time ensure the physical flyability of the procedures. They have to observe legal prerequisites but at the same time consider the economic implications for airports and airlines.

Articles 27c and 29b of the German Aviation Act provide the legal foundation of what they do. The former demands “the safe, orderly and expeditious handling of air traffic”, while the latter requires that the population be protected against unacceptable aircraft noise. Court rulings and legal commentary have confirmed that the safety aspect be accorded the higher priority.

“Our work is restricted to spreading the traffic that has been allowed by others in such a way that our air traffic controllers can handle it.”

When one hears the public and media outcry triggered by new arrival and departure routes it is easy to forget the complex range of issues which are weighed against each other before any decision is made. This outcry can be particularly harsh when a new airport requires new arrival, approach and departure procedures. DFS itself is not involved in decisions about the location of a new airport or a new runway. Nor does it have any influence on the airlines’ fleet mix or flight schedules, or the airport capacity. “Basically, our work is restricted to spreading the traffic that has been allowed by others in such a way that our air traffic controllers can handle it in a safe and orderly manner,” summarises Robert Ertler.

He sees himself in the role of a mediator between the air traffic controllers on the one side and the Noise Abatement Commissions on the other. “In reality, our room to manoeuvre is not as large as the public thinks. It’s extremely limited, almost like a corner. Even if many believe the skies above us to be boundless,” he says. The public have become more and more sensitive to aircraft noise over the last few years which is why his communication skills have become more and more important. “The good thing about my job is that I tell it like it is. This creates a climate of trust even though we can’t satisfy everyone.”

Under German law, DFS only gets involved in the planning process at a later stage. By then, important decisions such as the location of the runways have already been taken. DFS is required to submit a technical expert opinion for a rough flight route concept. “Many mistakenly believe that this rough concept becomes an integral part of the planning approval. But it’s only provisional.” Only much later does it take on concrete form. Until it reaches this stage, many individual steps have to be taken, in particular local conditions need to be given special consideration: “Each procedure has its own special features.”

First of all, the local air traffic control unit draws up a first model for a rough sectorisation and distribution of traffic. Subsequently, the procedures planners at DFS Headquarters take over for the final touches and check: Is the controlled airspace large enough? Is the structure efficient? Have military and VFR flights been considered adequately? The next step is to examine the population density and determine how many people will be impacted by the new arrival and departure routes.
All this provides the basis for numerous variants which have already been examined to see if they would function operationally.

All the variants are then compared with each other in a fast-time simulation. In a relatively short period of time, the busiest day of the prior year is simulated to detect potential conflict situations and provide information on the distribution of traffic. This allows a conclusion to be drawn on the operational capacity implications of each variant. The variants are then evaluated in another simulation program called NIROS, which stands for Noise Impact Reduction and Optimisation System. This program simulates the noise impact. The same noise level will have a greater impact if more people live in the affected area. Afterwards, the individual variants are transferred to a real-time simulation. This is more time-consuming and expensive as much more staff are needed. For about two days, the planned fleet mix flies the new arrival and approach procedures in the real-time simulator. Experienced air traffic controllers test the variants for their real-world feasibility.

A report is written after each step in the process. At the end, a final report is drawn up in which DFS describes the various flight route variants, including their operational impact. This report is then submitted to the local Noise Abatement Commission. These commissions consist of representatives from local councils, airlines and airport operators. DFS provides advice to these commissions, particularly as regards protecting the population from aircraft noise. The local Noise Abatement Commission produces a document and submits it to the German Federal Supervisory Authority for Air Navigation Services. The document is made up of
several components, including a justification for the procedure favoured by DFS as well as a graph showing the different variants, the population density and noise impact on the public. The Federal Supervisory Authority for Air Navigation Services checks the argumentation together with the German Federal Environment Agency. The German Federal Ministry of Justice is also involved to confirm that the formal procedural rules were observed.

This is a time-consuming and complex process which has to unite three things: the public’s desire for mobility, the needs of those impacted by aircraft noise and the needs of the aviation industry. After the authority has finished its deliberations, it lays down the new flight routes by means of a statutory instrument. On average, this happens for 60 procedures each year, although some procedures cover numerous individual measures, up to 160 in the case of Frankfurt Airport, for instance.

The flight route is an ideal path from which an aircraft can depart by several hundred metres horizontally or vertically.

It takes between 9 and 18 months from the first development of a flight procedure to its formal establishment by the national supervisory authority. It can take even longer when a new airport is being built. In one case, it took 12 years from the first rough drafts to the discussions with the Noise Abatement Commission. Even after the authority has published the new routes, there is still scope for misunderstandings. Standardised flight procedures simplify the handling of air traffic but they by no means replace the system of clearances issued by air traffic controllers. An air traffic controller can instruct a pilot to use a flight route that deviates from the standard to gain some flexibility in traffic handling. What is more: We should not assume that pilots keep exactly to the published flight routes. In 2000, the German Federal Administrative Court ruled that flight routes were to be considered more like a tolerance area.

The flight route, therefore, is an ideal path from which an approaching or departing aircraft can depart by several hundred metres horizontally or vertically. This can happen despite modern GPS due, for example, to the inaccuracies of navigation aids, the aircraft mass or aircraft type and the meteorological conditions. It is not as simple as staying between the white lines when driving on a road.
Finding a scientific explanation of human behaviour is an important component of safety management. For this reason, there is close cooperation between the DFS Human Factors department and leading scholars in this field, notably Erik Hollnagel from Denmark. One of his key concepts is the idea he named the Efficiency Thoroughness Trade-Off Principle. The basic idea is that human beings who work in highly complex systems are faced with a constant conflict between their goals, that is to say, there is a trade-off between efficiency on the one hand and conscientious, thorough work on the other. This conflict also exists for an organisation as a whole.

If one assumes this to be the case – that human beings and organisations are constantly deciding between these alternatives – then the questions for safety management are: What influences this trade-off? On which basis are decisions made? Hollnagel wants us to stop just analysing decisions when something unwanted was the result of the decision. His approach is to better understand human behaviour as such. The goal is to then support aspects that contribute to something good happening. He criticises other approaches saying that if you only concentrate on what has gone wrong, then you disregard all other decisions and cannot learn from them.

Hollnagel makes the assumption that individual, social and corporate culture norms influence us when deciding between efficiency and thoroughness. It is important for a safety culture to examine these norms.
closely. An example of a typical peer pressure type rule is: “That’s the way we’ve always done it.” Other typical corporate norms include things such as: “We have to keep to the schedule no matter what.” Another typical social rule is: “If you don’t report me breaking a rule, then I won’t say anything either.” Individual principles that play a role in the violation of the Efficiency Thoroughness Trade-Off Principle are, for example: “The way I do it normally is usually ok, so I don’t have to think it through every single time.” Alternatively: “Someone else will check it later, so I don’t have to be so careful now.”

For Hollnagel, it is clear: Usually there is no difference between decisions that lead to something bad happening and decisions that lead to something good. You can only decide in retrospect if a decision was a mistake. It makes no sense to examine decisions with a positive result separately from decisions which led to a negative result. Dividing human behaviour into faulty and fault-free does not lead to more safety. All decisions have the same origin: namely typical human behaviour. For safety management, this means that we do not only learn from mistakes, but by analysing in a preventive and anticipatory manner. In this way, it will become clear which things are not running as smoothly as they should – before an actual decision is made that leads to a negative result.

“For DFS, this means that we need to pay attention to the prevailing surrounding conditions as well as investigating incidents,” says Jörg Leonhardt, head of the DFS Human Factors department. “Just concentrating on the negative results, such as infringements of separation, reduces what we know about what our organisation does successfully.”

We have to recognise what makes us successful and then invest more time and money in these things.

People who only learn from their mistakes quickly fall victim to a paradox. An organisation with very small failure rates such as DFS will have fewer and fewer indicators for its success. Fewer incidents mean fewer numbers to compare. Fewer numbers mean fewer indicators that can give information about an organisation’s performance. Just because not much is happening, does not mean that everything is the best it could be, at least in a complex environment like air navigation services.

Hollnagel says: To achieve safety in a complex, interdependent and constantly changing environment, employees have to be flexible and adaptive. Additionally, the decision-makers in an organisation and the entire organisation itself must also be flexible and adaptive. Safety is not the absence of accidents or other undesired events but rather the presence of functioning adaptation processes that guarantee a smooth operational process. Decision-makers and management need to have what Hollnagel calls safety intelligence. By this he means, they must possess detailed knowledge of the complexity and the interactivity of the processes of the company. If an organisation is aware of its “success indicators”, this can strengthen the success. And the decision-makers can also have an idea which risks may present themselves in the future. They do not need to wait until something happens and evaluate things after the fact. This approach – strengthening the positive aspects instead of just eliminating the negative ones – is what Hollnagel refers to as Resilience Engineering.

“For DFS, we have to recognise what makes us successful and then invest more time and money in these things to maintain or increase our level of success,” says Leonhardt. It is, however, necessary first to identify more accurately the conditions that contribute to safety. “Because we have limited ourselves until now to the negative results, we only have a rough idea of what our success factors are.” In the future, we should follow the motto of the Austrian-American psychologist Paul Watzlawick who says we should do more of what works.
Whether it is an aircraft proximity or a minor infringement of the separation minima between aircraft, in air traffic control, staff members frequently experience events they may not be able to deal with on their own. To help during these times, DFS established the Critical Incident Stress Management (CISM) programme in 1998. CISM helps with stress management and aims to support people who carry out responsible jobs to come to terms with what they have experienced and to be able to return to work as soon as possible.

Jeffrey T. Mitchell, a US Clinical Professor of Emergency Health Services, originally conceived the programme for rescue workers with the goal of preventing post-traumatic stress disorder after a critical event. This kind of a systematic treatment of stress following a stressful event soon found its way into the world of aviation. “CISM gives staff members the opportunity to become aware of and cope with their reactions to the events. It helps staff members recognise whether they are in a position to deal with their reactions on their own. And it helps them judge whether they are fit to work or not,” says Jörg Leonhardt, who is responsible for the DFS CISM programme. Often, it may actually be a rather insignificant event that becomes a large burden. “When an air traffic controller loses control of an aircraft, this results in stress, even if there is no hazard or just a minimal danger, such as the slightest infringement of the minimum separation,” explains Leonhardt.

Some of the tools of stress management are one-on-one counselling with a peer counsellor as well as the Crisis Management Briefings (CMBs), structured small-group discussions and large-group interventions if an event affects many members of staff or an entire tower or control centre. At the end of 2012, for example, a number of CMBs were held in the control centre in Langen to support staff deeply shocked by the tragic death of a young colleague at the weekend. She was involved in a mid-air collision between two sports airplanes. The counselling ensured that normal operations were maintained in the control centre. “A large number of staff was experiencing distress – but traffic had to be handled nonetheless. The CISM team made sure that any emotional chaos was given a structure so that some form of stability could be achieved,” reports Leonhardt. The CISM programme experienced a baptism by fire in July 2002 when two airplanes collided above the town of Überlingen, located on the northern shore of Lake Constance in the far south of Germany. The DFS peers not only took care of the staff at the Karlsruhe control centre, who had watched the accident on their radar screens without being able to intervene. They also were there for their Swiss colleagues. The Swiss ANSP Skyguide, in whose area of responsibility the accident took place, did not have its own CISM team at the time.

At DFS, all control centres and tower units have CISM peers available. Normally, they are air traffic controllers. They receive special CISM training to become peer counsellors and regularly meet with other peer counsellors to talk about their experiences. Currently, DFS has 85 trained peer counsellors. The DFS Board of Managing Directors has strongly supported the programme from the very beginning. Robert Schickling, Managing Director Operations says: “CISM is an integral part of our safety culture.”

Preventing incidents from becoming traumatic

About 15 years ago, DFS introduced Critical Incident Stress Management, also known as CISM. CISM peers, regular staff trained in CISM counselling, help their colleagues to handle stress-producing events. The programme has proven successful at DFS.
Playing it safe

In an industry whose ups and downs depend on the trust of passengers, safety is everything. It is no coincidence that DFS focuses its activities on its top priority: ensuring the highest possible level of safety in aviation. Thirty staff members are employed on a full-time basis solely to conduct safety assessments. Their job is to make sure that safety, the top corporate goal, is not just paid lip service to, but is actually filled with life. “Better safe than sorry” is the conclusion reached by many a safety assessment – even if significant cost savings make the alternatives seem attractive.

The following example is illustrative. At some point, a cold hard number with considerable appeal was on the table: savings of EUR 7.9 million over the following seven years. That is what the savings would have been if the project to replace the emergency transceiver facilities had been dropped. These emergency facilities were put into operation at the end of the 1980s and comprise 30 radio stations connected to radio units located at the four DFS control centres via modern telephone lines. Their purpose is to ensure radiotelephony communication between air traffic controllers and pilots – but only in the worst-case scenario. The emergency transceivers are neither the main operational system nor the fallback system. They are a separate emergency radio system.

In times where cost-efficiency has become absolutely necessary, the question can easily be raised as to whether threefold redundancy is really necessary and sensible. In May 2012, the DFS Board of Managing Directors took the decision to keep this central safety component of voice communication and thus decided against the cost savings.

Before this decision was made, a careful analysis of the risks was undertaken in a safety assessment. Regardless of what type of task has to be carried out – if a telephone line needs to be reconnected or a new system is introduced – the following statement by Dr Gunther Heidelmeyer, senior expert in Corporate Safety and Security Management in the area of safety assessments, holds true: “Each change that has or could have an impact on the functional ATM system has to be checked to see how much it influences the system and how safe it is.” This also includes possible changes in the life cycle of a system. A functional ATM system includes data, technology, procedures and regulations as well as human beings and processes.

The legal basis for this is given by the Commission Implementing Regulation (EU) No. 1035 of 17 October 2011. According to it, the principal safety objective of an air navigation service provider’s safety management “is to minimise its contribution to the risk of an aircraft accident as far as reasonably practicable”. The corporate objective of DFS is derived from this, namely that the number of accidents whose cause can be traced to the air navigation service provider must not exceed one accident every 30 years. Systematic evaluations of hazards and risks are meant to assist in identifying and eliminating potential safety-related occurrences in communication and navigation services, air traffic control as well as information, alerting and aeronautical information services.
On improving European regulation

DFS CEO Klaus-Dieter Scheurle calls for an incentive-driven regulation scheme in Europe. This scheme should take the regulated asset-base into account rather than focus on revenues and unreliable traffic forecasts.
European air navigation service providers (ANSPs) are well aware that it makes sense to have a form of performance regulation in place, especially for organisations that are monopolies as are the ANSPs. They are accountable for the efficient use of the funds obtained from the air navigation charges paid by their customers.

European ANSPs are fully committed to the Single European Sky (SES) concept and legislation. It is in their vital interest to deliver safe services in the most efficient way across the whole of Europe. Airspace certainly needs to be defragmented to reduce delays and costs, to further improve air safety and minimise the impact of air transport on the environment.

The overall mission of the ANSPs is to provide safe services for airspace users. They have been quite successful in this until now and the FABEC performance figures support this assertion. FABEC is the largest functional airspace block at the heart of Europe. It handles almost sixty percent of the air traffic in the European Union and operates at an extraordinarily high level of safety. Air traffic controllers guide flights along routings that are nearly direct and ensure that they arrive on time. Furthermore, they are improving in terms of cost-efficiency. During the current reference period, the reduction of the unit rates will result in savings of more than EUR 270 million by 2014 for the airlines.

Nevertheless, it has become clear that the current regulatory approach has failed to achieve what it originally set out to do. Instead it has placed the financial stability of the ANSPs at risk.

**The current approach and its pitfalls**

The current regulatory model is focused on revenues that are in turn based on traffic forecasts. However, these forecasts have proven to be quite unreliable. Traffic has been stagnating for years and yet regulation continues to be based on over-optimistic expectations of the past. In the first reference period (2012-2014), FABEC expects a decline of EUR 226 million in revenues due to the sharp drop in traffic volume. Currently, the level of air traffic in Germany is more than nine percent below the forecast.

Coupling regulation targets to forecasts puts the viability of the ANSPs at grave risk. The fact that the ANSPs employ highly qualified and well-paid staff and also face costly long-term investments means that they need financial predictability. They are bound to adhere to strict labour practices and also experience much longer investment cycles than most other industries. These conditions require that an effective economic regulation be put in place. This is needed so that the ANSPs can react flexibly to volatile conditions in the short-term without endangering the long-term stability of their infrastructure.

Moreover, without a sound financial basis, the ANSPs will not be able to meet the performance targets for capacity, environment and cost-efficiency and, at the same time, maintain the high safety standards.

Equally important is the issue that SES is based on two contradicto- tory approaches. On the one hand, the ANSPs are required to cooperate with each other, for example by establishing FABs, SESAR or the Centralised Services. On the other hand, they must compete with each other at the same time. For example, there are efforts to unbundle services that are not a natural monopoly. What is needed is more clarity about the actual goals of SES. Is it a consolidation or is it competition? The European Commission must be decisive on this issue; otherwise the ANSPs are not in a position to move forward.

**Respect of national diversity**

To improve the regulatory approach, it is crucial that independent and competent regulatory bodies are established in every EU Member State. While the European Commission sets the regulation principles, the EU Member States have to comply. However, this is not all that is needed. Strong national regulatory authorities that have the power to implement the rules in a reliable manner are also needed. This is the only way to take into account the differing conditions in the various countries.

These include such things as the different legal structures of the ANSPs, the vastly different pension schemes, VAT and specific airport requirements.

**A cost-based approach instead of a revenue-driven concept**

Economic regulation needs to focus on the costs that ANSPs can actually influence and manage. This would replace the current revenue-oriented approach which is based on unreliable traffic forecasts. The regulated asset-base should consist of operational costs, capital expenditures, depreciation and adequate cost of capital. While it makes sense to set high targets as an incentive to improve performance, it is perhaps even more important to motivate the
ANSPs by rewarding them when they achieve a target ahead of schedule or better than required by the regulation. The point of regulation is always to encourage monopolies to act as efficiently as possible. Rewarding them when they perform well is also in the best interest of their customers.

Investments made under the EU’s ATM Master Plan, for example, as part of SESAR and services contracted in a competitive manner (such as Centralised Services) or those due to European legal requirements should be excluded from economic regulation. As the overall interest of the SES regulation is to consolidate, it is also important to exclude costs for bi- and multinational restructuring activities from economic regulation.

**Total economic value**

A holistic understanding of the performance concept is necessary. The ultimate goal and purpose of air navigation services is the safety of air traffic. At the same time, improvements in capacity or flight efficiency may impact the other Key Performance Area of cost-efficiency and vice versa.

The total economic cost concept is a tool used to assess interdependencies and trade-offs among the Key Performance Areas with the goal of attaining a fair balance between them. This tool is used to express all Key Performance Indicators in monetary terms. A balance needs to be ensured when defining targets for a reference period, for example, a capacity target should be linked to traffic development. Economic regulation must not make the ANSPs alone bear the costs related to measures to increase safety or flight efficiency while allowing customers to be the only ones to benefit from the savings.

**Intensified dialogue**

In summary, the current regulation approach needs to be reconsidered. Repeating mistakes of the past especially in regard of traffic risk should be avoided. There are already intense discussions with the European Commission, airspace users and regulatory authorities on these proposals. We are convinced that they are in the best interest of aviation as a whole and that they will allow us to deliver truly sustainable performance increases.
New Arrival Manager for Amsterdam

Cooperation between DFS and LVNL

A new arrival management system will support air traffic controllers in organising incoming air traffic at Schiphol Amsterdam Airport. The system is being introduced as part of a cooperation agreement between the German air navigation service provider, DFS Deutsche Flugsicherung, and its Dutch counterpart, Air Traffic Control the Netherlands (LVNL). The new arrival manager will be put into service at the beginning of 2015.

The Advanced Arrival Management System (A-AMAN) from DFS that has been adapted to the LVNL system environment passed its functional acceptance test in December 2013. DFS and LVNL have added new functions to the system. For example, not only does the system suggest the most efficient sequence for arriving aircraft and generate exact landing times, it also gives the controller the recommended optimal speed for a selected aircraft.

“Approach control at Schiphol is very complex as there are six runways. This is why we expanded the display of the planning information,” explained Jan Westland, the project manager at LVNL. If, for example, two additional runways are put in use, the controllers see the calculated arrival sequence for these runways as well as a time line for past planning on their screen. “At any given time, the air traffic controller has a clearly arranged display of the traffic situation and can quickly change flights from one runway to another. This results in an enormous reduction of workload,” says Westland.

The planning information from the arrival manager can also support coordination with upstream control centres such as Maastricht so that the traffic flow can be optimised as early as possible.