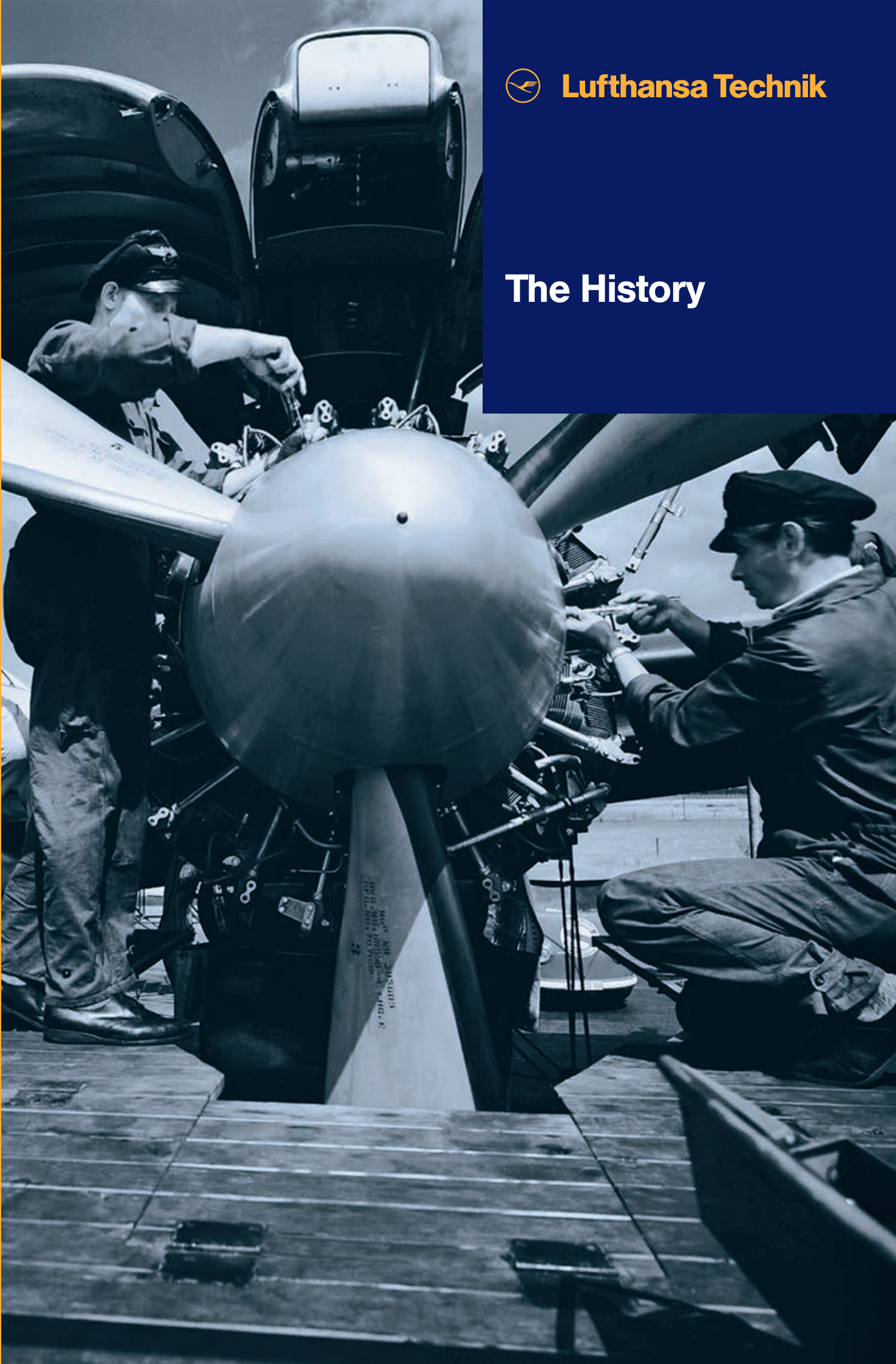
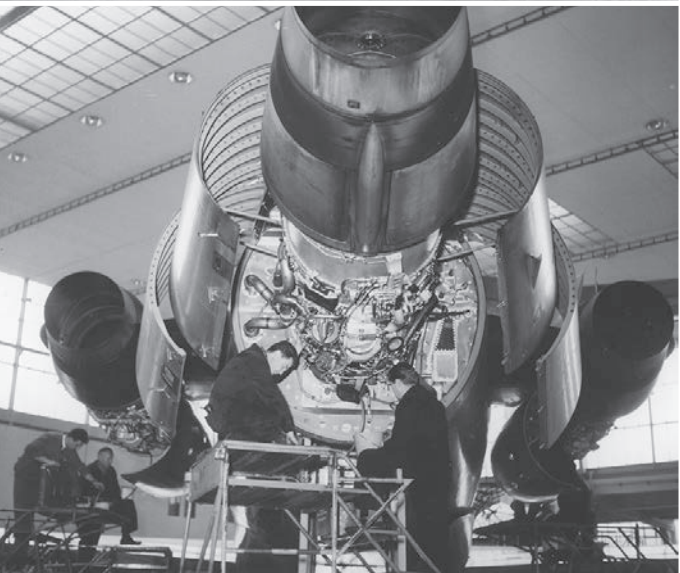
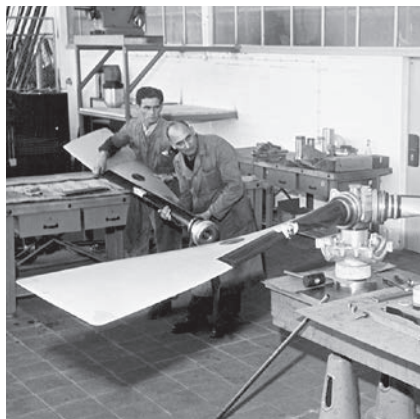


## The History







**04** Events 1951 to 1955  
**Warm-up**

Before the re-establishment of Deutsche Lufthansa, work commenced on the construction of a maintenance base for the new airline. When the first aircraft arrived, the maintenance and repair installations were ready for use.

**12** Events 1955 to 1964  
**Take off**

The new Lufthansa company began flight operations on 1 April 1955. During those first years Hamburg was not only the chief maintenance base, but also the main hub for the company's international services. The jet age arrived for Lufthansa in 1960 with the Boeing 707.

**20** Events 1965 to 1974  
**Full Thrust**

In the 1960s jet aircraft changed the world of civil aviation. They carried twice as many passengers as propeller aircraft and reached their destinations in half the time. At first, jets dominated long-range services, and then quickly conquered medium- and short-range routes as well.

**28** Events 1975 to 1984  
**Steep Climb**

During the third decade of Lufthansa's maintenance, repair and overhaul activities there was a significant increase in business from other international customers. On the European aircraft market, Airbus Industrie emerged as a serious competitor to the Boeing and Douglas monopoly, with technical support from Lufthansa.

**38** Events 1985 to 1994  
**Maintain Flight Level**

Over the years Lufthansa's engineers and technicians introduced significant improvements to the design and maintenance procedures for commercial aircraft. In the early 1990s the company made large investments in a major expansion program of its Hamburg facilities.

**50** Events 1995 to 2004  
**The Technik Group**

Separating Lufthansa Technik as an independently operated company took place at a time when the market was becoming increasingly difficult. But the new company's response was rapid and effective – new products and the development of a global network. This strategy proved to be correct: Ten years later Lufthansa Technik is a world-leading provider of technical services for commercial aircraft.

**64** Events 2005 to 2014  
**Global Expansion**

The 50th anniversary of the foundation of the Lufthansa Group and the tenth birthday of Lufthansa Technik AG in 2005 marked the beginning of a decade of global expansion. Important milestones were the opening of new sites in the growth markets of Asia and America along with a stronger focus on the establishment of partnerships with the original equipment manufacturers (OEMs) of engines and components. Furthermore, the funding of innovation projects, such as new products, services, and technologies, set the course for a profitable future for the world's leading provider of technical aviation services.

## 1951

### 29 May

German Minister of Transport Hans-Christoph Seebohm appoints pre-war Lufthansa executive Hans M. Bongers to advise the Federal German Government on the future commercial aspects of German civil aviation. Another founding member of the 'Bureau Bongers' was Dipl.- Ing. Gerhard Höltje who took on responsibility for the technical side of the future airline.



## 1952

### 16 January

The Bureau Bongers presents its first report, 'The technical basis for a German airline'. Written by Gerhard Höltje, the report describes the technical requirements for a maintenance base, plus systems for maintenance and overhaul.

### 28 August

The Hamburg State Government – the Senate – gives the Bureau Bongers its support for the construction of a maintenance base. The letter was signed by a young official named Helmut Schmidt. He later became Federal German Chancellor.

### 26 September

The German Cabinet decides on a company to plan and prepare the resumption of civil air transport.

### 30 October

Another report from the Bureau Bongers recommends Hamburg as the location for a maintenance base.

## 1953

### 6 January

A new company – the Luftag Corporation for air transport requirements – is set up in Cologne. Bongers runs the commercial and Höltje the engineering side of the business.



### 26 June

Luftag places their first order for long-range aircraft, four Lockheed Super Constellations.



### 21 July

Construction machinery starts work preparing the land for a maintenance base on the southwest corner of Hamburg's Fuhlsbüttel Airport, on the site of a former horserace track.

### 28 September

An order is placed for four short-range Convair 340 airliners.



### 2 December

Luftag signs a lease with the Hamburg Senate for the workshops and storage facilities already under construction and those to follow.

## 1954

### 24 May

Topping-out ceremony for the first office building.

### 6 August

Luftag is renamed 'Deutsche Lufthansa Aktiengesellschaft'.

### 30 August

The first workshop and storage building has been completed.

### 4 October

Construction is completed of the first half of a two-part aircraft hangar. Maintenance technicians begin 'dry training' in preparation for the arrival of aircraft on order.



### 1 November

The Lufthansa Hamburg staff roll lists 36 salaried and 86 weekly-paid employees – with an upward trend.

### 29 November

Lufthansa's first two Convair 340 aircraft arrive in Hamburg.

## 1955

### 1 March

Lufthansa begins route-proving trial flights to prepare for domestic services.

### 31 March

Official entry into service of the first section of the maintenance hangar at Lufthansa's Hamburg base. Each section is designed to accommodate six aircraft.



# 1951-55

## Warm-up

Before the re-establishment of Deutsche Lufthansa, work commenced on the **construction of a maintenance base** for the new airline. When the first aircraft arrived, the maintenance and repair installations were ready for use.

## The History

### Warm-up

**T**he early days of Lufthansa's operations in Hamburg were not exactly spectacular: The Hamburg Senate (State Government) advised Lufthansa in understated tones, that "it would be possible to meet your requests in reasonable measure".

### A Letter from Helmut Schmidt

The letter was signed by one Helmut Schmidt, aged 33 and the official in charge of the State's transport office. Schmidt was on the threshold of a high-flying career; 22 years later he was elected Federal Chancellor of Germany.

The letter was addressed to the Bureau Bongers in Cologne, where a small group of pre-war Lufthansa executives were quietly planning the establishment of a new German airline. At that time the young Federal Republic of Germany had not regained sovereignty of its own airspace, and the work was undertaken away from the glare of publicity.

On behalf of the Hamburg State, Helmut Schmidt's letter also answered Bureau Bongers' question: 'What costs were likely to be faced by a new airline if renting buildings and equipment to set up a new maintenance center in Hamburg?' Another important question was whether suitable accommodation could be made available quickly for essential personnel, but without liability to pay rental surcharges for private residential property which was common in post-war Germany.

After receipt of the basic green light

from the Hamburg State, Lufthansa went ahead with setting up the new maintenance organization.

This followed an extended period of preparation. Although large parts of Germany still remained severely damaged or destroyed by wartime bombing, shortly after the Federal Republic of Germany was constituted in September 1949 there were the first signs of a rapid economic recovery. One of the essential prerequisites for this recovery process – later called the 'German economic miracle' or 'Wirtschaftswunder' – was the establishment of links to potential foreign markets. For this reason, in the same year the then Federal Minister of Transport Hans-Christoph Seebohm asked the occupying allied powers that Germany should henceforth recover 'full decision-taking powers with respect to all issues affecting transport'. This included recovery of full sovereignty of the air and operation of a national airline.

### Recovery of sovereignty of the air

The Federal German Government soon found it was knocking on the Western Allies' open door. Consequently, the Bonn Government made budget provisions for a new beginning. And on 29 May 1951, Minister Seebohm wrote to the Bureau Bongers that it 'should advise the Federal Government on issues relating to the future of air transport and act as a consultant in these matters'. In plain language, The Bongers team was to plan and prepare the establishment of a new German airline.

This letter effectively triggered the fu-



**With enterprise and initiative**  
by Helmut Schmidt

My first visit to Hamburg airport was about 1931 or 1932 when I was 12 or 13 years old. You had to hang about for hours until an aircraft landed – a major sensation. Delighted, I walked back to the underground railway and then traveled home, happy that I had been given a small Lufthansa badge with the crane bird logo.

My second visit to the airport was 20 years later when I was in charge of Hamburg's transport management office. The airport and aviation fell under my responsibility.

I remember Hans Bongers and Gerhard Höltje very well, and the problems we had to overcome at the time. It wasn't until 1955 that the Allies gave us the green light. Hereafter, the new operation was set up with much enterprise and initiative. What an example for today!

At that time all the major cities in Germany were vying to become the main location for the expected new Lufthansa. I was very proud of the fact that I managed to get the decision made in favor of Hamburg-Fuhlsbüttel for the new maintenance base. It was plain to me then, that as time went on, it would bring thousands of new jobs to Hamburg. And so it did.

*Extract from a speech given by the former Federal Chancellor of Germany, Helmut Schmidt on 31 March 2005, at Lufthansa Technik's Hamburg Base.*



ture division of labor within the Bongers team, which was then located in the sparsely furnished first floor of a house in Cologne's city center. Bongers (53) was a businessman and he therefore looked after the commercial aspects, while Höltje (44) was an engineer and as such responsible for technical matters.

As early as January 1952 Höltje presented Transport Minister Seehofer with a 37-page study entitled: 'The technical basis for a German airline'. His far-sighted report set out the maintenance and repair systems requirements for a new German airline. He defined the necessary buildings and equipment and itemized the likely costs. In addition Höltje set out in careful and diplomatic language his first thoughts as to which airports might be suitable for this purpose.

At that time the operational situation indicated that a location close to the German border would be most suitable as a main base, both for flight and maintenance operations. On the flight operations side, long-range flights could make an intermediate stop elsewhere to pick up more passengers. This consideration reduced the suitable locations to Hamburg and Munich. Behind the scenes there ensued a heated argument between the two cities as to which one would have the maintenance base and the jobs that would follow.

In October 1952 the Cologne planning team presented a list of detailed arguments that clearly favored Hamburg. Firstly, maintenance should be concentrated at an airfield where aircraft were usually concentrated for an overnight stop. It was further argued that an operation based in Munich (1712 ft above mean sea level) would cost 2 million DM more than Hamburg (53 ft MSL). In addition, temperatures at Munich Riem Airport were often very high; therefore aircraft would not always be able to take off with a full payload. ►



Steel scaffolding denotes the new construction site in Hamburg; the old trees are still there today.



The first building of the technical base was a hangar, still in operation today.



Luftag's founding fathers shake hands on the company's first day: Chairman Hans M. Bongers, Federal German Minister of Transport Hans-Christoph Seehofer, Technical Director Gerhard Höltje, and Chairman of the Supervisory Board Dr. Kurt Weigelt (l. to. r.).

## The History

### Warm-up



#### The Bureau Bongers

Hans Max Bongers was an airline man to the core who had developed his passion while working for the Junkers aircraft company in Dessau. Prior to the end of WW2 he had become head of operations for the original Lufthansa company. He acquired the nickname 'Beko' (Betriebskosten = operating costs) Bongers because of his constant focus on efficient operations. After Lufthansa ceased operations in 1945, he found himself in Bavaria thinking about resurrection of German civil air transport. His initial approach to the American Military Government was met with a point blank refusal. But

#### Büro Bongers 1. Stock

at least his name had become known to those who mattered. He subsequently worked as an economics consultant at Bitburg in the Eifel mountains, before moving to Cologne a few miles north of the provisional new German capital, Bonn. The 'Bureau Bongers' became – more or less officially – the meeting place for those who were planning a new German airline. First to join was graduate engineer Gerhard Höltje, another from pre-war Lufthansa. After the war he had first worked on the maintenance of American aircraft at Berlin's Tempelhof Airport, so he was well up to speed with current technology.

In May 1951 Minister of Transport Hans Christoph Seebohm engaged the Bureau Bongers to 'provide advice on the economic and technical aspects of future German civil air transport.'

### Decision for Hamburg

The team concluded: 'Hamburg airport meets practically all the requirements in terms of efficient airline timetable planning and a maintenance base.' This conclusion was supported in all aspects by Cologne University's Faculty of Transport.

The Hamburg Senate remained keen for Lufthansa to be based in their city, as confirmed in the letter mentioned above from Helmut Schmidt, with whom Höltje had held preliminary discussions. When Schmidt had signed the letter, he flew to the Farnborough Air Show in England to hold talks with the Bongers team about specific next steps.

Hamburg offered to construct the necessary buildings and let them to the new airline at an attractively priced rent. At that time the initial estimate was for capital investment of nearly 12 million DM. The city offered additional support for the first years in the form of a stepped reduction in rent and local payroll tax.

At the beginning of 1953 the semi-official Bureau Bongers was absorbed into the Government-owned 'Luftag'. Bongers was appointed Commercial Director, Höltje was named Technical Director. This was followed by initial employee appointments, and orders were placed for the first aircraft: four long-range Lockheed Super Constellations and four short-range Convair 340s. The Luftag supervisory board then decided that the company's main base would be in Hamburg.

This decision was taken in May 1953 and the State of Hamburg reacted quickly. Two months later construction machinery was at work clearing a former horse racetrack next to the City's Fuhlsbüttel airport as a building site for the first maintenance hangars, workshops and office building.

### Unusual working conditions

The first 20 Luftag staff members were cramped inside an airport workshop; the conditions under which they worked were most unusual, even for those early post-war years. Although the first aircraft were on order and the maintenance buildings were under construction, the whole business was barely legal since Germany had not regained full sovereignty.

From time to time there were spot checks by a British officer dressed in 'civvies'. On one occasion he saw technical drawings and suspected he had tumbled upon plans to build new war-planes, of course absolutely forbidden. One of those present said later: „We had great difficulty in convincing him that he was looking at American-supplied drawings for the Convair 340s on order.“

At this time Gerhard Höltje assembled a team of senior managers who left their marks on Lufthansa's maintenance operations for many years.

For example, Joachim Alpheis had studied with Höltje and worked in the Bureau Bongers; he became the main driving force in the subsequent development of the Hamburg maintenance operation. His tall figure and broad shoulders were always highly visible, both in the workshops and at official functions.

The team was soon joined by Kurt Ihssen who had been Lufthansa's maintenance base manager at Rio de Janeiro until 1942. After WW2 he was responsible for the development and expansion of the maintenance and repair facilities for Brazilian national airline Varig. He was rapidly promoted and placed in charge of aircraft maintenance and repair. ►

On 29 November 1954: Lufthansa's small work force and a lot of curious guests admire the company's first two brand new Convair CV-340.



Topping-out ceremony for Hangar 1/2: first visible sign of the new home base for the Lufthansa fleet, with the Crane bird logo on the fin.



As yet not much is happening in the new air craft hangar – just two Convair airliners at the back.



## The History

### Warm-up



Left: A big welcome in Hamburg for Lufthansa's first two Conquairs on 29 November 1954.

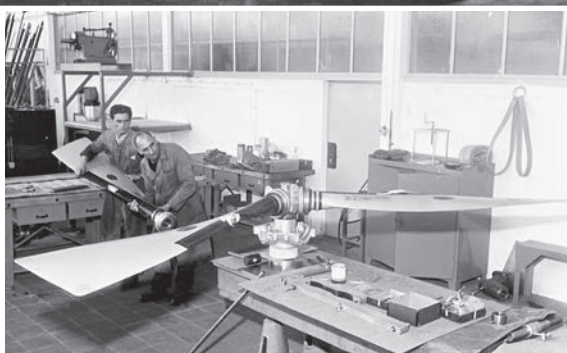
Right: Engine maintenance is one of the first jobs required at the Hamburg maintenance base.



Hamburg Senator Professor Karl Schiller, Airport Director Max Wachtel and Luftag Board Member Gerhard Hölte (seated, l. to r.) sign the rental agreement for the Hamburg base.



A Conquair CV-340 parked in front of the Hamburg hangar.



Left: Pilot training: First training course in Hamburg, relocated to Bremen in 1956.

Right: Propeller overhaul requires a combination of physical strength and great care.

Whilst the construction machines were shifting earth at the former racetrack, the lawyers were drawing up official documents. The rental agreement for the Hamburg base was finally signed on 2 December 1953. However, all the movable inventory, machines and tools were the property of the new company.

The first buildings consisted of workshops and a double aircraft hangar, both of which were ready for use during the course of the following year. The first office building was deliberately set apart from the maintenance and repair facilities.

Even today, there remains a small copse of oak trees between the two oldest buildings. It was Höltje who called for their preservation: "The trees give protection from wind, give shade in summer, and pleasure to our work force."

In the summer of 1954 the new Deutsche Lufthansa Aktiengesellschaft emerged from the plans forged by Luftag, employing just over 100 people in Hamburg. For most of them, civil aviation was an entirely new career.

The airline had entered into an agreement with the State of Hamburg that it would only recruit senior salaried employees and master craftsmen from the ranks of the old Lufthansa. All others were to be hired and trained in Hamburg for their new jobs; so it was that blacksmiths, precision mechanics, welders and turners sat side-by-side on three-month intensive training courses.

Even long-time employees from the old Lufthansa had to attend training courses run by airlines in the UK and USA. Germany's isolation after WW2 had cut them off from much of the technical development. By this time the British and Americans were in the technical lead, and Lufthansa had a gap to make up of more than ten years.

### Initial training in form of dry runs

There was the additional problem of 'over-qualification'. American maintenance handbooks had to be somewhat simplified because German craftsmen were well educated and the English text was excessively detailed.

As far as the practical aspects of the work were concerned, much initial training was in the form of 'dry runs'. The workshops were equipped with many components, motors and other equipment, but not the most important training device of them all – the aircraft.

That all changed on 29 November 1954 when the new Lufthansa's first two aircraft arrived at Hamburg's Fuhlsbüttel Airport, flushed in the drizzle with which the city is so familiar. The Convair 340s, registered D-ACAD and D-ACOH, bore the German flag on their fins.

They were delivered by American pilots, but they were accompanied by two experienced pre-war Lufthansa Flight Captains, Walter Blume and Rudolf Mayr, who was later to become chief pilot. Mayr was from Miesbach in Bavaria; that is why he was known by the nickname 'Miesi'.

The next day the maintenance crews could at last get to work on real aircraft. Then everything rapidly gathered speed, with more recruitment and training.

In March 1955 Lufthansa began route-proving trials, though without paying passengers. On 31 March the first half of the double hangar in Hamburg was ceremonially handed over. The following day came the first real test, when Lufthansa began regular services.



**Gerhard Höltje**

So well was Gerhard Höltje known throughout the world of civil aviation, that his nicknames were an accolade in their own right. He was described as a pacemaker of modern aviation technology, and as the underlying driving force behind the Boeing 737. His Lufthansa colleagues simply called this enthusiastic engineer who was later appointed Professor 'Mr. Boeing', because he laid the foundation for close cooperation with that company. By contrast, in American aviation circles he was known as 'Mr. Lufthansa'.

Dipl.-Ing. Gerhard Höltje was one of the founders of the new Lufthansa and was a member of the Board from 1953 to 1972, where he was responsible for technical issues. Long before Lufthansa ordered its first aircraft, he had drafted a detailed plan describing the technological structure that would be required for an airline. The consequence was the choice of Hamburg for a maintenance base.

Without him, the most successful commercial airliner of all time – the Boeing 737 – would have stayed on the drawing board. He took early decisions in favor of the Boeing 707 and 727 long-range and medium range aircraft for Lufthansa's future fleet. Under his auspices Lufthansa was the first non-American airline to order the Boeing 747 wide-body jet, and the first carrier worldwide to order the 747F freighter.

## 1955

### 1 April

Lufthansa starts domestic flights, with return services between Hamburg and Munich.

### 19 April

Delivery of the first Lockheed L-1049G Super Constellation, fondly remembered as the 'Super Connie', carrying 77 passengers and cruising at up to 530 km/h (330 mph).

### 8 June

First intercontinental flight with a Super Constellation from Hamburg to New York via Düsseldorf and Shannon.



### 1 October

Lufthansa begins its first pilot training course in Hamburg.

## 1956

### 11 February

Letter of intent signed for the purchase of four Boeing 707s.

### 3 April

The first group of Lufthansa technical apprentices begin their training.

### 2 May

Lufthansa opens its commercial pilot training school in Bremen.

### 15 June

Contract placed for seven Vickers Viscounts. These four-engine turboprop aircraft remained in service with Lufthansa from late 1958 to March 1971.

### 5 November

Lufthansa starts 'Paper Jet' study to simulate jet aircraft flights over the North Atlantic.

## 1957

### 5 September

A Super Constellation flight deck simulator starts operation in Hamburg. Further simulators follow for the Vickers Viscount and Boeing 707.

### 16 December

The first batch of co-pilots trained by Lufthansa commence regular flight operations.

## 1958

### 2 March

Lufthansa establishes a local technical liaison office with the Boeing works in Seattle to monitor production and handover of the 707.

### 17 March

Lufthansa begins transatlantic flights with the Lockheed L-1649A 'Super Star', which was at that time the most advanced civil air transport type in service.



## 1959

### 11 January

Lufthansa Super Constellation D-ALAK accident in Rio de Janeiro, killing 29 passengers and seven of the ten crew members.

## 1960

### 2 March

Lufthansa enters the jet age: the first Boeing 707 lands in Hamburg

### 17 March

The Boeing 707 starts service on the North Atlantic route.



## 1961

### 23 January

Lufthansa begins operating Boeing 707 routes to the Far East (Bangkok - Hong Kong - Tokyo).

### 20 May

The Boeing 720B begins service, a smaller long-range version of the 707.

## 1962

### 1 February

In Hamburg Lufthansa starts operation of the first engine noise reduction test hangar in Germany.

### 5 November

A major success and international recognition for Lufthansa's maintenance and overhaul services: the American Federal Aviation Administration (FAA) gives formal permission for Lufthansa to perform maintenance and overhaul on US-registered airliners and their engines.

## 1963



### 1 April

Inauguration of a low-cost 'Airbus' walk-on shuttle air service between Hamburg and Frankfurt. The Super Constellations fly at regular times; tickets are sold on board; there is no on-board catering or reserved seats. The shuttle service continues until 1966.

## 1964

### 21 March

The first Boeing 727 arrives in Hamburg. Named the 'Europa Jet' by Lufthansa's marketing department, it is easily identified by its high tailplane and three jet engines in the rear fuselage.



### 16 April

The Boeing 727 enters regular service.

### 31 December

Hans M. Bongers retires.

# 1955 - 64

## Take off

The new Lufthansa company began flight operations on 1 April 1955. During those first years Hamburg was not only the chief maintenance base, but also the **main hub for the company's international services**. The jet age arrived for Lufthansa in 1960 with the Boeing 707.



## The History

### Take off

**O**n 1 April 1955 the Lufthansa flag was fluttering over the airports at Hamburg and Munich. Almost simultaneously, Convair 340s bearing the company's Crane bird logo on the fin, took off from each airport – Lufthansa's regular services started with flight numbers 101 and 102.

Further domestic and foreign destinations followed at short intervals. The first intercontinental service was flown by a Super Constellation on 8 June from Hamburg to New York via Düsseldorf and Shannon. The flight time was 17 hours.

### Super Connie: A 'diva'

The Lockheed Super Constellation was fondly known by its fans as the 'Super Connie' and admired as the most beautiful aircraft of all time. The Super Connie had a three-fin tailplane and long-range wingtip tanks; she was without doubt the most modern aircraft of the era. For the flight and maintenance crews, however, this was no protection from her 'diva' foibles.

This was particularly true of the four Curtiss-Wright 18 cylinder twin-banked radial engines, each weighing more than two tons. At that time, large aircraft variable-pitch propeller technology was well developed, right down to the last detail. Each engine consisted of no less than 14,000 individual components.

For example, there were exhaust gas turbines, more correctly known as 'power recovery units'. Engine mechanics soon began referring to them sarcastically as 'parts recovery units'. Any tiny screw or metal fixture that became detached from somewhere within the engine, fell with the exhaust gases into the turbine, which then self-destructed.

It was not at all unusual for a Super Connie to arrive home with a feathered

propeller, earning her the nickname of 'the world's best tri-motor'. This phenomenon was by no means exclusive to Lufthansa; other airlines had exactly the same problem.

The engine manufacturer specified a time between overhauls of 1100 hours, but in reality the interval was closer to 800 hours. For comparison, a record-setting General Electric CF6-50 powering a Lufthansa Boeing 747-200 remained on the wing for more than 26,000 hours.

### Early diagnostic methods

Even during the early years Lufthansa maintenance crews were resourceful in their choice of diagnostic methods. The engine condition monitoring now in use has a simple precursor.

A sample of engine oil was drained through a coffee filter paper, leaving a variety of metal grains. If inspection revealed high aluminum content, the finger of suspicion was directed at a particular bolt which was promptly replaced before engine damage ensued.

In the first years of the new Lufthansa, Hamburg Airport was not only the main maintenance base but also the main hub for intercontinental flight operations. With the growth of the international route network and frequency of services, the maintenance facilities grew very quickly.

When the first aircraft arrived to begin service there were 124 employees in Hamburg. By the end of 1955 this number had grown to 651. By 1960, Lufthansa's technical department employed 2,460 engineers, technicians, white collar workers and secretaries in Hamburg. The terms of employment were set down by an agreement in 1955; hourly wages ranged from 1.48 DM to 2.15 DM in the highest-paid group. ►



### „As if inside a wild animal“

The simultaneous first Lufthansa flights between Hamburg and Munich made intermediate stops; the flight from Hamburg landed at Düsseldorf and Frankfurt, while that from Munich also landed at Frankfurt and Cologne.

The head of public affairs for the Bavarian State Government was one of 17 passengers on the first flight from Munich to Hamburg. He was ecstatic and wrote in a newspaper article:

“Before take-off, the pilot runs up both engines for a final test at full power. Barely restrained, the aircraft vibrates. It feels as if one were sitting inside a wild animal about to leap.

There is a brief jerk, then the aircraft hurtles down the runway. As the Convair rotates, the passenger is pressed gently into the foam rubber seat cushions and barely notices he has left the ground.”

The same day, Pan American World Airways took display ads in German newspapers welcoming the arrival of its new competitor: “Blocks Away!”



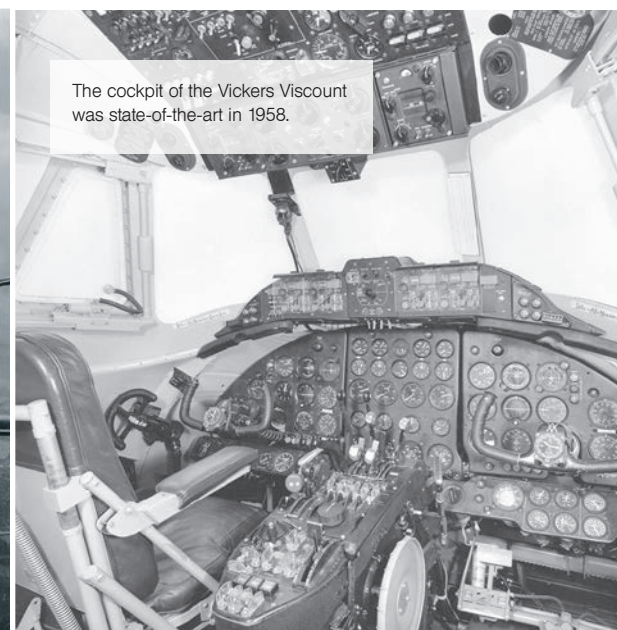
James C. Fitzmaurice, Dr. Hans-Christoph Seeböhm und Hans M. Bongers (r. to l.) in New York, on the occasion of the first intercontinental scheduled flight between Hamburg and New York.



The first cabin crew members were ready for flight operations in February 1955; they started work with route proving flights in March.



The Vickers V-814 Viscount flew with Lufthansa until 1971.



The cockpit of the Vickers Viscount was state-of-the-art in 1958.



From 1958 the Vickers Viscount turboprop airliner was a regular visitor to the Hamburg maintenance shop.

## The History

### Take off

#### Construction

##### 1955 - 1964

After the first aircraft hangar was officially handed over in March 1955; there followed a period of rapid construction of Lufthansa maintenance facilities.

#### Hamburg

**1955** Test cells for piston and turboprop engines

**1957** Simulator Building

**1958** Engine shop with apprentice training facilities; additional offices.

**1959** Hydraulics workshop with test stand; extension of the existing powerplant shop to accommodate jet engines.

**1960** Second double hangar building, further workshops.

**1962** Noise-protection hangar, canteen, equipment repair workshop.

**1963** Jet engine test stand.

**1964** Materials warehouse with administration building.

#### Frankfurt

**1960** Official handover of the 'Butterfly Hangar', at that time the biggest aircraft maintenance building in the world.



Even then, there were some unusual non-wage benefits: On 15 April 1955 employees were provided with a load of tasty apples free of charge. Fresh fruit in April was a sensation in Germany at that time. The secret was that on its delivery flight from Burbank in California, the company's first Super Constellation had brought cases of fresh apples.

In the first few years Lufthansa's Hamburg operation looked more like a building site than a maintenance base. In a very short time the company had to erect new buildings and essential equipment – docks for airframe access, machines, test gear and tools.

#### Advent of the jet age

But even though the world was still buying propeller-driven aircraft, all eyes were on the horizon and the advent of the jet age. In 1959 the powerplant maintenance and repair workshops were extended to make provision for jet engines.

It was self-evident that Lufthansa would order jet-powered aircraft as soon as these became available. After careful consideration of all the pros and cons, Lufthansa decided against the Douglas DC-8 and in favor of the Boeing 707.

The famous Dash 80 prototype of the Boeing 707 had made its successful first flight in the summer of 1954. Eighteen months later Lufthansa signed a letter of intent for the purchase of its first Boeing 707s. The arrival of jet-powered passenger airliners represented a quantum leap in civil air transport. Not only did they fly twice as fast and high as their propeller-powered predecessors; they carried double the number of passengers over much greater distances.

Now Lufthansa would not be Lufthansa, if its engineers had pur-

chased aircraft so to speak 'off the peg'. For instance, the company's choice of jet engines differed from that made by most other companies, but was important and correct.

The standard powerplant for the 707 was the American-made Pratt & Whitney JT4A. Lufthansa, however, held back the decision until the British company Rolls-Royce had finished development of the Conway engine. It was both lighter and quieter than the JT4A, was less expensive and consumed less fuel. With the same amount of fuel, the Conway powered 707 could either carry a bigger payload or fly further. Thus, Lufthansa became the first airline to fly a full payload Frankfurt- Chicago non-stop.

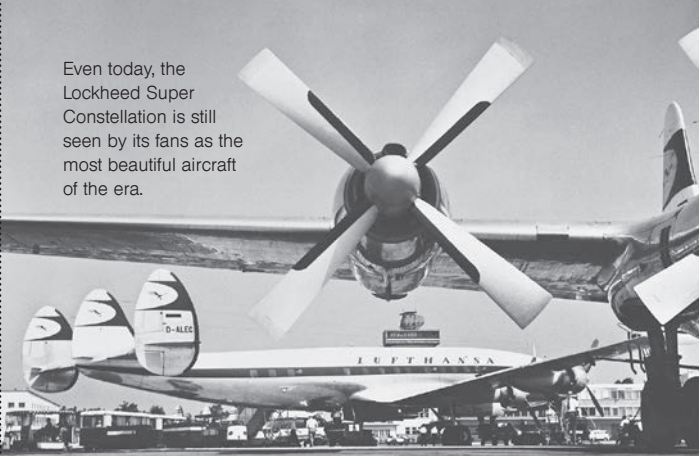
In order to prepare for all aspects of operating the next generation of aircraft, in November 1956 Lufthansa started a 'Paper Jet' study to simulate flight operations between Frankfurt and New York using performance figures for the Boeing prototype.

These were combined with meteorological data such as wind speed and direction, flight visibility and air traffic density at the destination. The study produced data which subsequently proved to be quite realistic on such vital matters as take-off weight, cruise altitude, flight duration and fuel consumption.

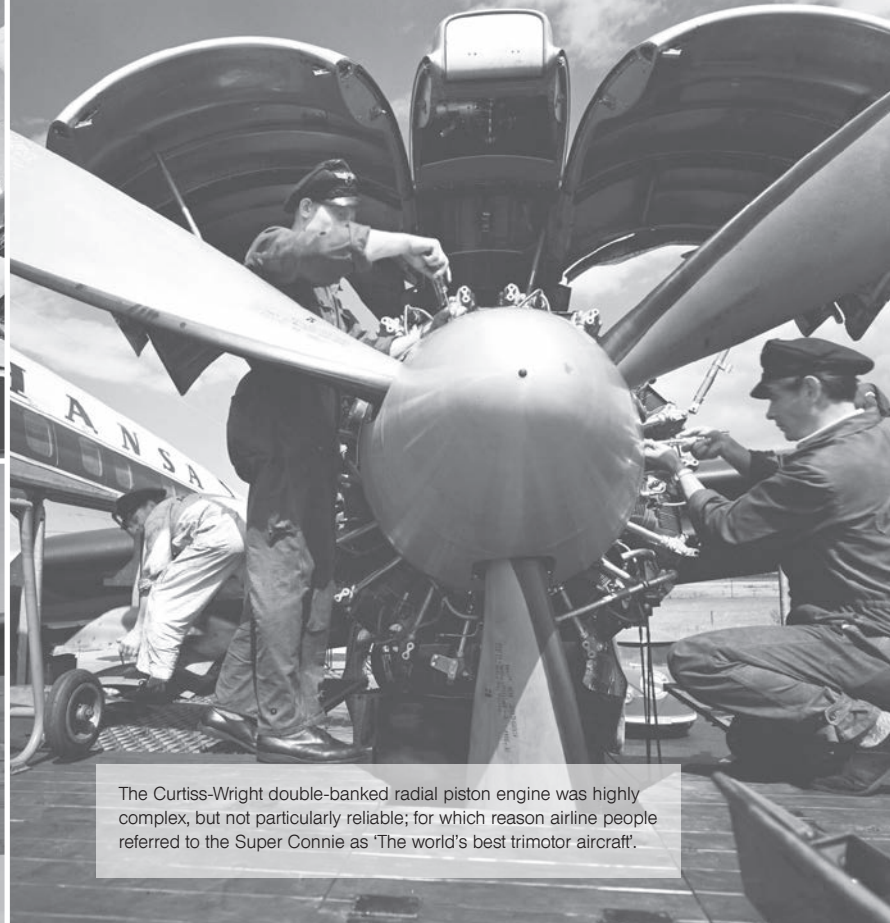
#### Maintenance base Frankfurt

The introduction of jet aircraft was accompanied by far-reaching changes because Frankfurt was chosen as Lufthansa's main base for the jets' line maintenance and flight operations. The jets offered much more range than piston-engined aircraft. Therefore, the factors which, years before, had resulted in the original choice of Hamburg as the main operational base no longer held good. ►

Even today, the Lockheed Super Constellation is still seen by its fans as the most beautiful aircraft of the era.



Not only good-looking, the Super- Connie's long-range tip tanks.



The Curtiss-Wright double-banked radial piston engine was highly complex, but not particularly reliable; for which reason airline people referred to the Super Connie as 'The world's best trimotor aircraft'.



Four 'Super Connies' are prepared in Hamburg for their next long-range flight.

## The History

### Take off

The advent of jets meant that Lufthansa technicians had to take in an enormous amount of new information and training, for at that time very few people in Germany had experience of jet aero engines. After the war the victorious allies had put a full stop to German involvement in jet engines. During their studies, young engineers might have gained some experience of simple steam turbines, but no more.

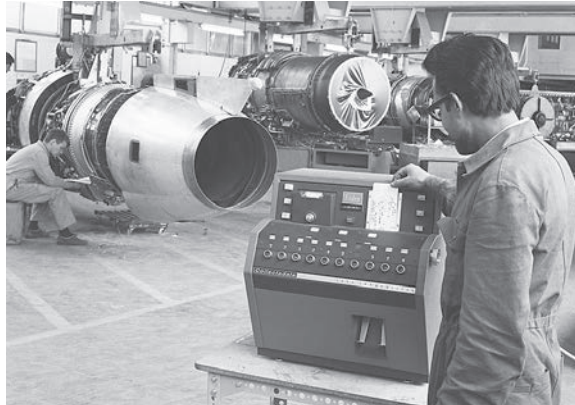
Then there were new technologies of airframe construction and pressurized cabins. Jet engines made a lot more noise than piston engines; so the company built a noise-insulated engine test cell and even a noise-insulated hangar for ground testing of aircraft engines in order to minimize the impact on the neighboring community.

### International links

As in the early years of operation, international links between technicians helped the company through this challenging period. Other airlines such as Air France, Sabena, Swissair and KLM shared their technical knowledge with Lufthansa on such matters as tooling and equipment, laying the foundation for subsequent technical cooperation between members of the European ATLAS Group of airlines.

This technical assistance fell upon fertile ground. Very soon the Hamburg maintenance base had such a good command of the new technology, that in 1962 the US Federal Aviation Administration gave Lufthansa the formal authority to maintain and overhaul US-registered commercial airliners and engines. This recognized the very high standards achieved by the company's technical division.

On 2 March 1960 the sirens screamed over Lufthansa's Hamburg base, but were soon drowned by the high-pitched whine of four turbine engines when the first Boeing 707, finished



ADELE (automatic data-logging by punch card entry) was the precursor of modern computer systems.

The centerline engine in the Boeing 727 rear fuselage under maintenance.





The jet age arrived for Lufthansa with the Boeing 707, seen here shortly after landing in Hamburg.

in Lufthansa's blue-yellow-white house livery, landed at Fuhlsbüttel Airport.

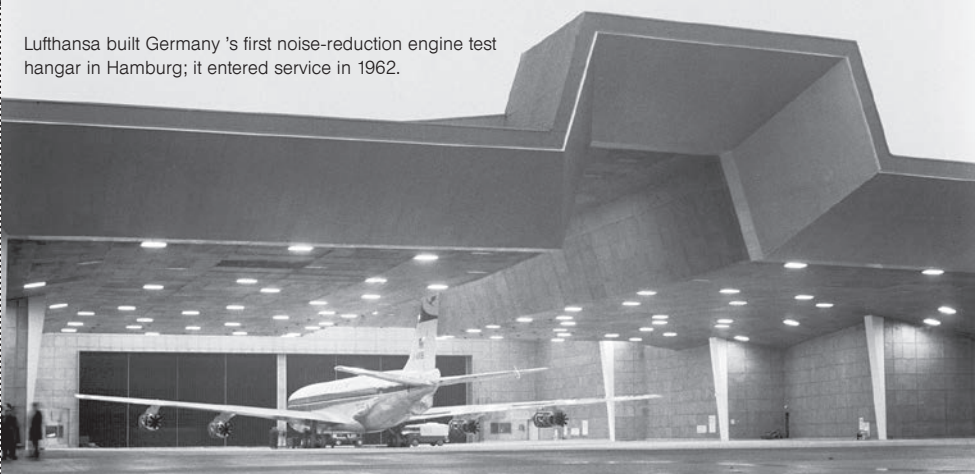
At the controls of this 25 million DM aircraft registered D-ABOB were Chief Pilot Rudolf Mayr and Captain Werner Utter, who later joined the executive board and was in charge of flight operations.

The Boeing 707 and (from 1961) the slightly smaller 720B variant took Lufthansa's medium and long-range routes by storm. But just around the corner was the next in line: the Boeing 727.

### **Boeing 727: Unique appearance**

The 727 presented a unique appearance in the sky, with its high T-tail and three jets in the rear fuselage. Very early on, Lufthansa recognized the great potential of this short- and medium-range jet and was the first European airline to place an order, for a batch of twelve. The Boeing 727 entered scheduled service in April 1964 and was an instant success. Now Lufthansa was able to offer its passengers the same degree of speed and comfort on their European and Middle East routes that they already enjoyed on long-range flights. The 727 flew just as fast as the big 707, had the same cabin cross-sectional area, and hence exactly the same seating comfort. Even better, passengers liked the fact that the rear-mounted engines minimized cabin noise and stress.

Lufthansa success was also reflected in its financial results; for the first time since its foundation the company made a profit of DM37 million in 1963.



Lufthansa built Germany's first noise-reduction engine test hangar in Hamburg; it entered service in 1962.

## 1965



### 19 February

Lufthansa becomes the launch customer for the Boeing 737, whose technical concept has been significantly influenced by the company's engineering team.

### 10 November

Delivery of Lufthansa's first jet-powered cargo aircraft, a Boeing 707, named 'America'.

### December

First fleet rollover: the four Boeing 720B aircraft are retired in favor of the larger and improved Boeing 707.

## 1966

### 25 January

A Convair Metropolitan operated by Lufthansa stalls during an aborted landing at Bremen, killing all 46 persons on board. The cause of the accident is never fully established..

### 27 June

The era of wide-body jets begins for Lufthansa with an order placed for three Boeing 747-100s.



## 1967

### 1 May

The Lufthansa flight training school transfers most of its non-academic operations to San Diego in California, subsequently (1970) to Phoenix, Arizona.

### 6 October

The Super Constellation makes its last scheduled flight for Lufthansa.



## 1968

### 10 February

World Premiere: The Boeing 737 commences scheduled services with Lufthansa. Dubbed the 'City Jet', it rapidly establishes short-haul services. establishes shorthaul services.



## 1969

### 14 March

The ATLAS agreement is signed by Lufthansa, Air France, Alitalia and Sabena, under which these airlines agree joint maintenance arrangements for the Boeing 747. Iberia joins in 1972.

## 1970

### 9 March

Lufthansa's first Boeing 747-100 lands in Frankfurt.

### 14 April

The Lufthansa Board determines that all jet engines in the company's Boeing 727 and 737 will be retrofitted with environmentally friendly combustion chambers.

### 26 April

The Boeing 747-100 begins scheduled services. It is the first Lufthansa aircraft to be fitted with an in-flight entertainment system for passengers.

## 1971

### 31 March

The era of propeller-powered aircraft comes to an end for Lufthansa; the last Vickers Viscount is retired.

### 19 April

Lufthansa becomes the first airline to operate the cargo version of the Boeing 747.

### 1 July

Dipl.-Ing. Reinhardt Abraham is appointed to Technical Director on the Lufthansa Executive Board, succeeding Prof. Gerhard Höltje.

### 1 November

The company's Chief Pilot Werner Utter joins the Lufthansa Board, the first Flight Captain so appointed.

## 1973

### 16 February

Lufthansa accepts its 100th Boeing jet, a 727. During the delivery flight the aircraft transports a cargo of 5,000 juicy steaks as a gift from Boeing for the personnel at the Hamburg maintenance base.



### November

The first global oil crisis. Lufthansa has to cancel or merge flights. The oil crisis urges manufacturers to develop more fuel-efficient jet engines.

## 1974



### 14 January

The first McDonnell-Douglas DC-10-30 enters service with Lufthansa. It is used on long range routes for which the Boeing 747 would be uneconomic.

### 20 November

Lufthansa Boeing 747 accident on takeoff at Nairobi Airport. The aircraft's leading edge slats were not deployed. 58 occupants die, 97 are injured.

# 1965-74

## Full Thrust

In the 1960s jet aircraft changed the world of civil aviation. **They carried twice as many passengers as propeller aircraft and reached their destinations in half the time.**

At first, jets dominated long-range services, and then quickly conquered medium- and short-range routes as well.



## The History

### Full Thrust

**D**uring the 1960s the pace of aviation technology advanced at an enormous rate. Propeller-powered aircraft were rapidly left behind; fast jets ruled the skies. But then came a major new departure: wide-body jets, dubbed 'Jumbo Jets' by the popular press.

But Lufthansa's first job was to try and persuade Boeing to build a new short and medium-range aircraft, the 737.

In the mid-1960s Lufthansa was well equipped with medium and long-range aircraft in the shape of the Boeing 707 and 727. But the company's technical and commercial teams wanted a jet to replace propeller-powered short-range aircraft.

In theory that should not have been a problem. The French-built Caravelle had been in service for several years, the British had the BAC 1-11, and Douglas in the USA had started series production of the DC-9. All three types had common features: five seats in each row (3 + 2) and two jet engines in the rear fuselage.

### Demand on Boeing

However, Höltje and his team were not happy with this arrangement. They wanted an aircraft with the engines installed in pods under the wings because this gave more space in the cabin for passengers, six seats per row, and a cabin with the same cross-sectional area as the Boeing 707 and 727. In addition, they wanted a two-man cockpit with as much commonality as possible with the 727. This design would make for great synergies in maintenance and pilot training.

The negotiations with Boeing were long and difficult. Both sides had known each other well since 1954, when the first emissaries from Seattle had made their attendance upon the Bureau Bongers in Cologne. In addition, Lufthansa had become an important customer.

But were these reasons enough to design and build a totally new aircraft, especially when Boeing itself was not totally convinced?

Back in Germany, criticisms were voiced in the media: a leading news magazine said that the 737 development was out of line with market requirements and was destined to be a flop. But Lufthansa was convinced it was right and ignored the criticisms. However, even the wildest optimists would not have dared to predict that the initially un-loved Boeing 737 would become the most successful commercial jet aircraft of all time – about 13,000 had been built so far.

### Grinding of teeth in Seattle

It was not until Lufthansa let it be known it might switch to Douglas that Boeing gave in and began to design the 737, as one observer put it: "grinding their teeth and without enthusiasm". The first 737 seated 86 passengers

and met all requirements of the Höltje team. In February 1965 the Lufthansa Supervisory Board gave permission to order 22 Boeing 737-100 at a price of exactly \$ 2,983,936 each.

The Lufthansa launch order quickly triggered follow-on bookings



### The Saga of the Rear Stairs

by Ernst Simon

For about 40 years the rumour has been doing the rounds that I had designed the rear door and air stairs for the Boeing 737-100. This is a nice story, and flatters me greatly. Unfortunately, it is also incorrect. The truth is :

For reasons of passenger convenience, our sales people wanted the 737 to have side access doors with integral air stairs at both the front and rear. In those days there were few airports with the jetways now in general use.

In response to Lufthansa's wishes, Boeing designed an electric-powered mechanical marvel. The door opened inwards, while the stairs naturally deployed outwards. Both the door and stairs were fairly heavy. On top of that, there was the need for battery back-up. We found all this additional weight unacceptable.

At the time I happened to be in Seattle and suggested to our American friends how they could do the job more easily and lighter: with a door that opened outwards and a hand-deployed staircase. That's what they finally built.

*Prof. Ernst Simon who was head of Technical Project Engineering for many years, sadly died in March 2014 at the age of 92. Although he had been retired for quite some time, his vast knowledge was still in demand by many. With him the international aviation business lost a highly reputed insider.*

from others such as United, a leading American airline. Subsequently, Boeing produced many further variants.

Lufthansa replaced its 737 twin-jets several times in a series of 'rollover' programs and purchased a total of 140 Boeing 737s of various types over the years.

From 1968 Lufthansa marketed the Boeing 737 as the 'City Jet'. Even now,

flight crews still fondly refer to the 737 as 'Bobby' – the name was borrowed from a children's story book now long since out of print, 'Bobby Boeing Earns His Wings'. This entertaining book tells the story of Bobby's construction and his adventures in flight operations.

Like any new aircraft, the Boeing 737 had teething troubles. There were problems with aerodynamic details

and the thrust reverser on the Pratt & Whitney jet engines. Lufthansa postponed acceptance of several 737s until these problems were solved. At one time there was a line of 737-200 aircraft bearing the crane logo on their fins and parked outside the Boeing factory. There they remained until the autopilots had been modified to the satisfaction of the Lufthansa's engineers. ►



The Boeing 727 cockpit as seen by the crew.



Two generations side-by-side; the Boeing 727 (l.) rapidly displaced the older Vickers Viscount.

## The History

### Full Thrust



#### More construction 1965 to 1973

##### Hamburg

**1965** Seating and upholstery workshop

**1966** New engine shop

**1967** Energy Supply Center

**1968** Office Building C, heating central

**1969** School of technical training

**1972** Electro-plating building, central workshop

**1973** High-rack warehouse

##### Frankfurt

**1970** Widebody jet maintenance hangar. Like the 'Butterfly Hangar' built in the early 1960s, at that time it was the biggest in the world.



Boeing did not see Lufthansa as being the easiest customer to please. In 1958 the company had set up a liaison office with Boeing in Seattle. It was staffed by experienced and highly qualified technicians whose job was to monitor in detail the construction, assembly and testing of each aircraft destined for Lufthansa.

Their objective was to ensure that an aircraft destined for Lufthansa service not only was technically perfect but also that the manufacturer adhered to the company's quality guidelines during the entire construction phase. This cooperation within the Boeing factory was highly beneficial to both sides; the local German team made many suggestions for improvements that were gladly incorporated into wider series production.

But even before the first flight of the Boeing 737, a new shape was on the drawing board – the Boeing 747 captured the imagination of engineers and the media alike. It was the first commercial wide-body jet.

#### Boeing 747 at the start

The origins of the 747 were simple and logical. The American Department of Defense had wanted a long-range heavy transport aircraft. The Boeing design was rejected, but the company decided to use its expertise gained at the C-5 project as the basis for the construction of a completely new civil aircraft which they named 747. Initially, few international air carriers showed interest; only the US flag carrier PanAm soon placed an initial order for 25.

Otherwise, sales of the 747 were slow in its early years. Although Höltje's team was convinced that the wide-body jet had a good future, Lufthansa initially hung back but later became the first non-American carrier to order the Jumbo – three 747-100s. The next Lufthansa orders for the 747 followed



nearly three years later, followed by numerous bookings as long-range traffic became stronger. In March 1969 Lufthansa was the launch customer for the 747 freighter. By 2005, the German carrier had purchased a total of 61 Boeing Jumbo Jets.

Following the introduction of the first generation of civil jet aircraft, the Boeing 747 represented the second major revolution in air transport within hardly more than a decade. The 70-metre fuselage accommodated between 350 and 380 passengers, depending upon the seat plan. The gross takeoff weight was 300 tons and the range was 9,000 km.



Lufthansa's first Boeing 747-100 arrives in Frankfurt on 9 March 1970; it entered scheduled service a few weeks later.

Behind the cockpit and reached by a spiral staircase, there was a short top-deck in which Lufthansa and other airlines initially installed a lounge with a small bar for First-Class passengers. This arrangement was soon changed when it was realized that more seats would earn more profit. The bar was removed. However, there were some long-range routes for which the 747 was too large and the 707 too small. After long deliberations, Lufthansa's commercial and technical teams decided to buy, for the first time, a jet aircraft not built by Boeing. The tri-jet McDonnell-Douglas DC-10-30 was a 250-seat twin-aisled wide-body aircraft.

From 1974 it was operated on routes where Lufthansa could not fill the 350 seats in the 747.

Lufthansa had long since determined that servicing its jet fleet – that is all the technical maintenance which can be performed without taking an aircraft out of circulation – should be located as close as possible to an operational base. For this reason all regular maintenance up to the annual C-Check takes place in Frankfurt. In 1960 the company therefore built a new maintenance hangar, which at that time was the biggest hangar in the world, on the edge of Frankfurt's Rhein-Main Airport ►



#### **My First Day...** by Wolfgang Mayrhuber

At half past seven in the morning of 2 February 1970 I stood in the

office of Wolfgang Hergesell, then in charge of Hamburg's engine maintenance. He was known world-wide by the nickname of 'Mr. Engine'. Within the company he had the reputation as an energy-charged full-blooded Lufthansa man to the core. He was a charismatic leader, respected and feared alike.

There were jobs to be allocated but there was no time to spare for pleasantries. While Hergesell was outlining the responsibilities of a planning engineer I raised my hand with a question and he took it that I wanted this job. So there was I, the new boy, thrown right in the deep end.

The cold water was refreshing, and the responsibility great. My first task was to prepare the job sheets for retrofitting thrust-reversers and heat exchangers to the JT9 engines powering the Boeing 747-200.

I shared an office with a dozen colleagues. There were four telephones and one typewriter. Nevertheless, with maximum concentration on the essential things and a tab of Tipp-Ex correction paper, it worked well. We were kept very busy and thoroughly enjoyed our work.

*From 1995 to 2000, Wolfgang Mayrhuber was Chairman of the Executive Board of Lufthansa Technik AG. From June 2003 until December 2010 Chairman of the Executive Board and CEO of Deutsche Lufthansa AG. In May 2013 Mayrhuber was elected to join the Lufthansa Supervisory Board of which he is chairman to this day.*



### Supersonic? No Thanks!

Lufthansa gave but brief serious consideration to the possibility of supersonic air traffic. In-line with the times, the company took options on three Concorde. However, given the rising cost of kerosene and massive protests from the environmental lobby about supersonic bangs, they let the options lapse.

In the 1960s there were two possible choices, the Anglo-French Concorde, or the US Supersonic Transport project initiated by President John F. Kennedy. Both Lockheed and Boeing drew up plans for a 250-seat aircraft. The Lockheed design had a double delta planform, while Boeing went for a variable-geometry swing-wing design, the 2707.

Prof. Ernst Simon was at that time responsible for aircraft evaluation in Lufthansa's engineering division. He remembers: "All that was much too complicated. As far as we were concerned the operating costs of the American designs were much too high, while the Concorde could only transport 100 First-Class passengers. None of these designs could have been operated by Lufthansa at a profit."



Its unusual architecture earned the name 'Butterfly Hangar'; it was joined in 1970 by the 'Jumbo Hangar'. Frankfurt is also the work station for the company's technical pilot, who acts as an interface between flight operations and the maintenance organization. Hamburg became the main technical base and concentrates on overhaul.

This work embraces checks and repairs to airframes, components, cabin refurbishment, equipment, instruments and engines, for which a separate workshop complex had been built.

### New principles in maintenance

The victory march of the jets and the relatively rapid demise of propeller powered aircraft brought commensurate changes to the company's maintenance operations.

There was a progressive change from 'life cycle' and 'fixed-interval' maintenance to 'on-condition maintenance'. This means that components are no longer removed according to a strict schedule but when their condition calls for action. Under the on-condition philosophy, a repair is made whenever a defect is to be expected or is at an early stage. This may sound a little risky, but in reality poses no threat to safety. Every aircraft has a duplicate set of all vital systems; redundancy is a fundamental principle of airliner construction.

Secondly, Lufthansa engineers have developed effective monitoring and diagnostic procedures which provide reliable information on the point at which problems may occur in the life cycle of an engine or other component, whether this be mechanical wear or failure, and their possible consequences.

It is no exaggeration to say that Lufthansa's maintenance engineers have been pioneers in developing on-condition maintenance, in which they retain a world-leading role.

### End of an era

In Hamburg and Frankfurt the era of Lufthansa's founding fathers came to an end in 1972. Reinhardt Abraham, an aviation and business engineer who had been with the company since 1956, joined the Board as Technical Director in succession to Prof. Gerhard Höltje.

Joachim Alpheis retired; under his leadership the Hamburg Lufthansa maintenance base had become an internationally recognized technology center in less than two decades. He was succeeded by Dr. Alban Rupp, who until then had been in charge of the Frankfurt line maintenance operations.

Abraham and Rupp took on their new tasks at a difficult time. The first world oil crisis had stalled the German economic miracle and in 1974 there was a more than six percent decline in Lufthansa passengers. In addition, profits suffered from the progressive increase in international value of the DM.

The de-facto progressive revaluation of the DM against the US dollar hit the company's maintenance operations hard. In Hamburg, a new business sector had just begun a period of rapid growth: providing technical services for airlines not belonging to the Lufthansa group, and private operators of civil airliners.

Because of the international strength of the German currency, labor costs increased disproportionately in relation to the international standard method of invoicing in US dollars.



Lufthansa was the first airline to order the Boeing 747 cargo version with the upward-hinged nose loading hatch.



A big reception from Hamburg aviation enthusiasts at Easter 1970 for the Jumbo Jet.



Reinhardt Abraham (l.) succeeded Prof. Gerhard Hölzle as Technical Director.



As of 1974 DC 10's replace Boeing 707 on routes with little traffic.

## 1975

**25 June**

Lufthansa places its first order with Airbus Industrie: three A300Bs and an option for a further nine.



## 1976

**9 February**

Official handover of the first A300B2 to Lufthansa at Airbus Industrie's Hamburg Factory.



**1 April**

The A300 starts flying scheduled services within Germany and Europe.

## 1977

**3 April**

First non-stop flight from Frankfurt to Los Angeles with a Boeing 747-200 SL equipped with special long-range tanks.



**14 July**

The company's Supervisory Board gives the green light to a major program of fleet modernization: the purchase of five Boeing 747, six 727 and options for four further 747. Total value: over one billion DM.

**3 November**

Dramatic decrease in booking numbers when RAF terrorists threaten to detonate explosive devices on board Lufthansa aircraft following the suicide of imprisoned followers.

## 1978



**31 January**

Lufthansa takes a share in regional carrier DLT (later renamed Lufthansa CityLine).

## 1979

**22 March**

Further fleet modernization: orders placed for 32 Boeing 737-200 advanced and options for a further 25.

**2 April**

Lufthansa places an order for 25 Airbus A310, and takes options for another 25 aircraft of this type.



## 1980

**21 December**

Delivery of the first Boeing 737-200 adv., with the total orders for this aircraft increased to 36.

## 1981

**23 June**

Hans M. Bongers dies, aged 82.

## 1982

**30 June**

Heinz Ruhnau is appointed Chairman of the Lufthansa Executive Board in succession to Dr. Herbert Culmann (photo).



## 1983

**29 March**

Airbus hands over the first A310 aircraft in Toulouse to launch customers Lufthansa and Swissair.

## 1984

**6 December**

A Lufthansa subsidiary providing software for the aviation industry is founded: LIS (Lufthansa Information Technology and Software)



**31 December**

Last flight of a Lufthansa operated Boeing 707.

## Steep Climb

During the third decade of Lufthansa's maintenance, **repair and overhaul activities there was a significant increase in business from other international customers.**

On the European aircraft market, Airbus Industrie emerged as a serious competitor to the Boeing and Douglas duopoly, with technical support from Lufthansa.



**N**ecessity is the mother of invention; this was true, too, of Lufthansa's overhaul and repair operations for other airlines. The starting point was the sharp seasonal rise and fall in the use of the heavy maintenance plant and equipment. In winter the aircraft docks were booked solid, while in summer there was little to do. In the opinion of the Hamburg base chief Joachim Alpheis, not nearly enough.

At the same time, one of the company's engineers, Günter Siebel, was following evening classes of economics study. His final examination thesis was an analysis of Lufthansa's use of dock capacity, and was coupled with an estimate of the additional income that might be earned by the use of docks for the overhaul of non-Lufthansa aircraft.

His conclusions were convincing. In summary he argued that external contracts would not only make better use of operational facilities and labor; they would also make good money. In late 1970 Siebel was put in charge of the Technical Services and Sales department, with the task of new customer acquisition and managing non-Lufthansa maintenance contracts.

### **Start of the 'fill-in' operation**

During the early days there were skeptics within the company who saw work for 'external' customers as a 'fill-in' operation. Certainly, by no means everyone was in favor of the new branch of business. For a long time the Board policy was quite straightforward: 'Okay to work for external customers, but just so long as not a single additional employee is required'. This policy changed as it became clear that work for third parties was growing fast and very profitably.

The origins of third-party business were in Hamburg, where the engine

shop had for a long time accepted work from other airlines. And it was only a short walk from the powerplant facilities to the airframe docks. So Lufthansa's external customers quickly came to appreciate the idea of a one-stop shop: a service provider who could provide everything from a single source; technical services for airframe structures and cabins, engines, instruments and other components, plus world-wide support from an internationally respected team of technicians and engineers.

The list of customers grew slowly, but surely. One of the earliest in the mid-1960s was the German Government's Special Air Mission Wing with their Douglas C-47, a variant of the world-famous DC-3. They were soon joined by Finnair, Lan Chile, Iran Air, Saudi Arabian Airlines, Egypt Air, Tarom of Rumania, and Lufthansa's subsidiary Condor.

In the early phase of developing engineering services for external customers, there was an incident in which a cloud had a silver lining. Although the Boeing 707 was still relatively young (first flight with Lufthansa in 1960), a number of aircraft developed wing cracks. Boeing therefore designed a Wing Life Extension Program (WLE) and provided a strengthening kit for the wing's upper skin.

So far so good – but a number of airlines found to their cost that the integral wing fuel tanks had developed leaks during the repair. These leaks were extremely difficult to seal, if at all.

Not so Lufthansa, whose engineers had developed their own repair process. Before the wing skins were removed, the aircraft were supported by hydraulic jacks which de-stressed the wings while work proceeded. That solved the leak problem and resulted in a renewed surge of customers such as the Pakistan airline PIA, Qantas from Australia and VARIG from Brazil. ►



### **ATLAS**

Wide-body jets presented the maintenance managers of airlines with a new set of problems. The amount of maintenance work per aircraft was relatively large, but at first the wide-bodies were few in number.

In this situation cooperation between airlines again paid dividends: Lufthansa, Air France, Alitalia and Sabena set up the ATLAS cooperative network in 1969, joined by Iberia in 1972.

These airlines shared the overhaul and spare parts holdings for wide-body jets and achieved considerable savings. The work share arrangements were such that none of the partners made a profit or loss.

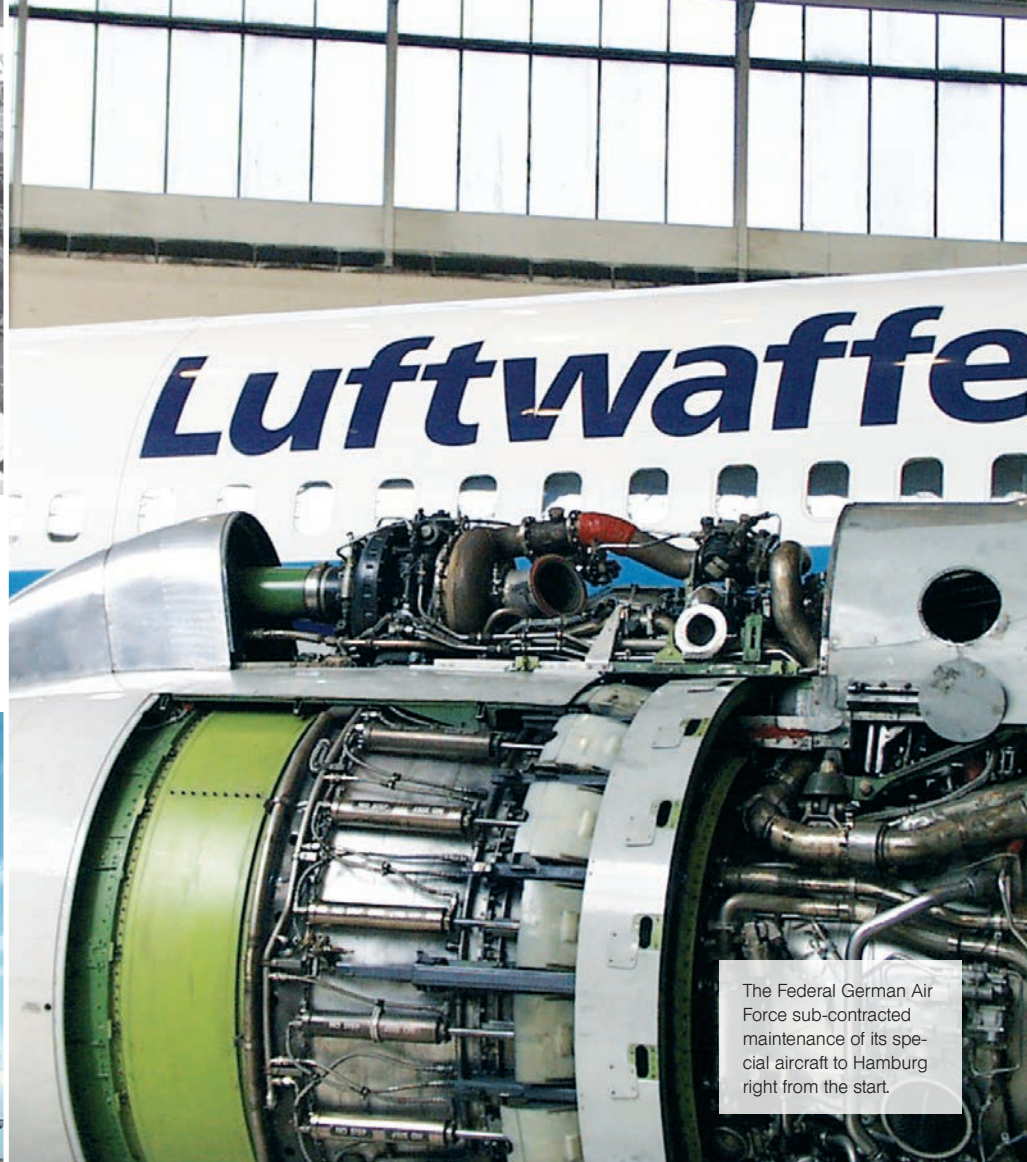
Initially, Lufthansa was responsible for Pratt & Whitney jet engines and in addition repaired the General Electric CF6-50. Later the company also took on the Airbus A300 airframe. The Boeing 747 airframes were overhauled by Air France and Iberia, and the DC-10s by Alitalia.

As the wide-body fleets grew, the underlying reason for the ATLAS partnership gradually lost its economic relevance, for which reason the partnership was officially terminated in 1994.



The Boeing 707 Wing Life Extension program triggered a breakthrough in developing the business of providing technical services for other airlines.

Lufthansa technicians' long experience with the Boeing 707 formed the basis of the company's successful new business providing maintenance services for other airlines.



The Federal German Air Force sub-contracted maintenance of its special aircraft to Hamburg right from the start.



The building program continued; by the mid-70s the company's Hamburg facilities had grown to many times their original size.



**Reinhardt Abraham**

There are many parts of the Lufthansa corporation that bear the imprint of Reinhardt Abraham; for example the development of Frankfurt as a maintenance base, the anti-cyclical aircraft purchasing policy, his unswerving support for the Airbus A320 family, but also the restoration of an almost scrap Ju 52 to flying conditions that has since been operating as a Lufthansa historic aircraft. He enjoyed a tremendous reputation as an expert in civil air transport that extended well beyond Germany.

Born in the eastern German province of Silesia in 1929, he studied aircraft engineering, physics and industrial engineering at the Charlottenburg Technical University in Berlin.

After his final examinations as a Diplom-Ingenieur he started work for Lufthansa in 1956. In 1960 he was put in charge of line maintenance in Frankfurt. In 1972 he joined the Executive Board with responsibility for the entire technical and engineering division and became deputy chairman in 1982. During this period he reflected and propagated the image of Lufthansa as an airline operating the best equipped and maintained aircraft, combining safety with reliable service.

Reinhardt Abraham retired from the Board in 1989 and then devoted himself to many honorary posts. He died in 1995 aged 66. He is remembered also through the work of the Reinhardt Abraham Memorial Foundation, which was set up by Boeing and Lufthansa to assist the education of the next generation of young aircraft engineers.

Kurt Ihssen, at that time manager of external customer business, grasped the opportunity and mailed a promotional letter to 707 operators around the world, describing the Lufthansa repair procedure together with photos. This marked the beginning of systematic efforts to market Lufthansa's technical expertise to external customers. Over the course of the next 20 years, this business took off and climbed to a point where it enjoyed equal importance with work performed for the parent company.

### **‘Section 41’ and ‘Strut mod’**

One of the main drivers behind this business was the company's ability to correct fundamental design flaws, or complete tasks requiring deep penetration into an aircraft's systems such as the Boeing 707 Wing Life Extension Program. Another typical example occurred in the late 1970s when cracks developed in Section 41 of the Boeing 747 at the oval transition between the upper deck and the rest of the fuselage.

Both Boeing and the airworthiness authorities required rapid rectification before the cracks could spread. Another ‘bestseller’ was the engine pylon modification for the Boeing 747, colloquially referred to as ‘strut mod’. There had been two accidents in which the massive main support bolts had fractured.

Lufthansa engineers were also actively engaged in leading functions of international work groups in various life-extension programs for ageing aircraft. These programs ran for many years.

The company's technical expertise was and remains based on twin foundations: the training and experience of its skilled workers and master craftsmen, plus the knowledge and inven-

tiveness of its engineers. Lufthansa engineers have always been sought out for advice and information not only by customer airlines, but also by manufacturers of airframes, engines and components.

Other airlines tap into the wealth of knowledge in the company's maintenance, engineering and flight operations organization through long-term consulting contracts.

Inventiveness was called for in particular when dealing with one customer sector which has since proved to be highly profitable, and in which Lufthansa now enjoys a unique position: modification and cabin furnishing of VIP aircraft. The first customer of this business branch, which today is a division of its own, was from the United Arab Emirates.

The public and media imagination about VIP aircraft owned by royal households, governments and corporations knows virtually no bounds. Some media even alleged that a VIP aircraft was fitted with a swimming pool – a technical impossibility.

### **Flying palaces**

Lufthansa's technical sales have always been discreet about orders placed for furnishing VIP aircraft. Not surprisingly, VIP customers would not be particularly pleased to find a detailed description of their ‘flying palace’ in the tabloid press. Discretion remains an important factor in the success of the company's VIP business.

Starting as a small seedling, Lufthansa's third-party business grew rapidly. Between 1970 and 1972 the profit from this type of business increased from 30 million to 90 million DM, of which more than half was for companies such as Condor which belonged to the Lufthansa group and were considered as internal customers. ►



The Hamburg engine shop is the biggest outside the USA.



In 1986 the Lufthansa Technik maintenance team celebrated completion of the full overhaul of the company's historic Ju 52.



In the 1970s Middle East governments and royal households became the first customers for VIP luxury cabin furnishings and fittings, individually designed and installed.

In the following years this ratio was reversed. By 1982 the former 'fill-in' work had grown to an annual value of 275 million DM, of which two-thirds was for customers outside the Lufthansa corporation. By 1994, when the technical division became an independent corporation trading as Lufthansa Technik, annual turnover of third-party work had reached a billion DM.

More importantly, this business remained profitable in spite of the rising international value of the DM. It helped Lufthansa to keep a grip on its own engineering and maintenance costs within a high-wage economy. In 1992 Dr. Alban Rupp, head of repair, maintenance and overhaul (MRO) services and mentor for third-party business, did the arithmetic. In the 20 years since 1972, Lufthansa's engineering costs per ton kilometer – an important efficiency indicator in the airline business – had declined from 9.3 to 9.1 pfennigs. That was virtually no change. However, if one takes monetary inflation into account, this represents an improvement in productivity of about 60 per cent.

The strength of the DM and the associated devaluation of the dollar has always forced Lufthansa to quote very competitive prices; its services were provided in a high-wage country in which it had to pay its employees in DM. However, in the aerospace industry the international unit of currency was the weak US dollar. This undermined the company's competitive status and made it difficult if not sometimes impossible to charge customers by the hour.

A way out of this dilemma was found which also brought a major advantage to the customer, who was henceforth charged flat rates. In the engine sector this charging system is known as 'power by the hour'. Lufthansa contracts the maintenance of a customer's engine for a flat rate fee per operating hour.

A similar approach was also offered under the trade name Total Technical Support TTS® for individual aircraft or an entire fleet. The charges include engineering services and the provision of spare parts.

In the context of fixed prices, the Hamburg engineering services have two key advantages. First, high-quality work results in fewer subsequent repairs. Secondly, short repair times increase workshop throughput. The customer can work within fixed financial engineering parameters, saves on the cost of buildings, plants and machinery, spares inventory and storage facilities, and he can concentrate on the main business of flying aircraft.

### **A new manufacturer: Airbus**

The mid-1970s saw the arrival of a new member in the exclusive ranks of aircraft manufacturers: the European Airbus company was set up in direct competition to the effective duopoly presented by Boeing and Douglas. Airbus was not only backed by the French and German governments, but also by the airline industry. In particular, Lufthansa put much time and know-how into the first Airbus, the twin-jet A300. This intellectual investment related not just to the fundamental design, but subsequently to the maintenance system as well.

Nevertheless, the airline industry regarded the advent of a new aircraft manufacturer with some skepticism; sales were initially disappointing. It was not until 1975 that Lufthansa placed an order for three A300, after considerable hesitation. These aircraft entered scheduled service in 1976. One of the major advantages of the A300 was that it offered wide-body comfort to short- and medium-range passengers.

Airbus quickly spotted another market chance: The 727 had come of

age, but Boeing had not developed a replacement model early enough. Under pressure from launch customers Lufthansa and Swissair, who also called for a further reduction in operating costs in comparison with the A300, Airbus conceived what was by far the most up-to-date aircraft of its generation, the 220-seat A310.

The cockpit layout was greatly influenced by Lufthansa's engineers and its Technical Pilot, and became a model of good design for the entire industry. It was the first time that an aircraft of this size had been designed and built for a two-man flight crew, with no flight engineer. This called for computerized screen presentation of data required for the current flight situation, but eliminating the flood of information presented by previous systems. The flight deck instrument displays were much clearer and pilots were able to concentrate upon the essentials.

In addition, the A310 boasted numerous technical improvements. These included a new transsonic high-lift low-drag wing section, lightweight composite materials; improved General Electric CF6-80 engines with reduced fuel consumption and improved operating economics. For the first time flight controls such as spoilers and flaps were electrically operated – a precursor of the fly-by-wire systems now in general use.

Lufthansa engineers worked about 30,000 hours on the A310 and made some 1,100 suggestions for technical improvements. The result was that Airbus produced an aircraft that was tailor-made to Lufthansa requirements. At that time Boeing put much pressure on Lufthansa to order the 767. But as far as technical director Reinhardt Abraham and his engineers were concerned, the technical and operational advantages tipped the scales in favor of the A310. ►



Final assembly of the first Airbus A300 aircraft for Lufthansa in Toulouse.



The Hamburg overhaul docks for A300 and A310 were mounted on air cushion lifting and moving pads.



Cockpit of a Lufthansa Airbus A300 B2.

The handover ceremony on 9 February 1976 for Lufthansa's first A300 at the Hamburg- Finkenwerder Airbus factory.



## The History

### Steep Climb

The Lufthansa team turns out to welcome the arrival of the first A310-200 at Frankfurt on 29 March 1983.



The larger fuselage width accommodated eight passengers per row in lieu of seven. The CF6-80 engines consumed less fuel per passenger seat kilometer; and in contrast to the 767, the A310 cargo compartment could accommodate standard-sized cargo pallets. Given Lufthansa's high cargo volume, this was an important consideration.

### A roll-over fleet replacement

In 1979 Lufthansa ordered no fewer than 25 A310 aircraft. These entered

scheduled service four years later.

There were important changes in other areas of Lufthansa flight operations and fleet maintenance. In 1977 the company ordered modernized versions of the Boeing 747 and 727, valued at a billion DM. Two years later the company completely replaced its original Boeing 737 fleet by the follow-on model, the 737-200 adv.

As usual, in this period Lufthansa followed a roll-over fleet replacement policy which kept the average age of the company's aircraft young in

international comparison. The fleet was replaced as soon as more up-to-date and generally more economic variants became available. Lufthansa benefited from the fact that its aircraft were maintained to the highest standard and therefore always netted top prices when sold on the international market.

In addition, orders for new aircraft were placed when the general demand was low and manufacturers made price concessions. This paid off in the early 1990s when Lufthansa was struggling to survive.

In 1985 Lufthansa took delivery of both McDonnell Douglas and Airbus aircraft, in addition to Boeing. Lufthansa has since purchased no more McDonnell Douglas aircraft, but the Airbus fleet has grown steadily.



The Airbus A310 cockpit is designed for a crew of two pilots and no flight engineer, the first time on an aircraft of this size. The use of cathode ray screens for flight instrumentation is a further novelty.

## 1985

### 24 June

Signing of a Memorandum of Understanding with the Chinese airline CAAC on technical cooperation. One week later, Lufthansa sets up a liaison office in Beijing.

### 17 July

Order placed for 33 aircraft and 38 options: Airbus A320 and A300-600, also Boeing 737-300 and 747-200.

## 1986

### 6 April

Lufthansa's Hamburg maintenance base completes restoration and modernization of a Ju 52, which is named Berlin-Tempelhof. As a historic aircraft, the Ju 52 performs pleasure flights on behalf of the Lufthansa Berlin Foundation.



### 23 June

Six Boeing 747-400 ordered, plus options for nine further aircraft.

### September

The Lufthansa corporation starts the biggest internal reorganization in its history. Technical operations are split into key account management units to work more effectively and with enhanced focus on third-party customers.

### 21 November

In Frankfurt, Boeing President T. Wilson hands over the 200th Boeing aircraft bought by Lufthansa, a 737-300.

## 1987

### 15 January

Green light for the Airbus A340: the Lufthansa supervisory board decides to order 15 A340 and to sign options for 15 additional aircraft.

## 1988

### 3 March

Orders placed for more aircraft: 20 Boeing 737-300 and -500, plus options for 20 more.

### 18 May

Lufthansa's Supervisory Board decides on the extension of the Hamburg base with a Widebody Overhaul Center to be built.

### 24 June

Lufthansa takes on maintenance and overhaul of the Airbus A310-300s operated by the East German airline Interflug.

### 30 November

Board decision to build a line maintenance base at the new Munich airport.

## 1989

### 1 April

Chief Technical Operating Officer Jürgen Weber is appointed as a deputy member of the Lufthansa Board.

### 25 May

The first Boeing 747-400 arrives in Frankfurt.



### 1 August

Ameco Beijing starts work as a technical joint venture of Lufthansa and Air China.

### 22 September

22 stretched-fuselage Airbus A321 ordered, plus 20 options.



### 29 October

The first Airbus A320 enters scheduled service.

## 1990

### 1 January

In succession to Reinhardt Abraham, Jürgen Weber takes over Board responsibility for Lufthansa's technical activities.

### 16 January

More orders placed to enlarge and modernize the aircraft fleet: Boeing 747-400, 737-500, and Airbus A310 and A320.

## 1991

### 1 March

The GDR Interflug maintenance base in Berlin-Schönefeld is integrated into Lufthansa's Technical Division.

### 14 May

Jürgen Weber succeeds Heinz Ruhnau as chairman of the Lufthansa Executive Board. Responsibility for the Technical Division passes to Dr. Klaus Nittinger, previously head of aircraft evaluation and fleet development in Hamburg.

### 4 October

Airbus presents the long-range A340, whose design has been greatly influenced by Lufthansa as the launch customer.

## 1992

### 11 June

A new aircraft paint shop is opened at the Hamburg Widebody Overhaul Center.

### 19 August

Official opening of the Widebody Overhaul Hangar in Hamburg.



### 23 August

Dr. Alban Rupp, Chief Technical Operating Officer, retires. He is succeeded by Wolfgang Mayrhuber.

**19 September**

Operations begin at Shannon Aerospace, in which Lufthansa initially has a 35 percent share, later increased to 100 percent.

**4 October**

Last scheduled service flown by a Lufthansa Boeing 727.

**1993**

**1 March**

The Airbus A340 enters scheduled service.



**21 October**

The US Environmental Protection Agency presents Lufthansa with the 'Ozone Layer Protection Award'. Lufthansa's Technical Division is the world's first maintenance and overhaul organization to ban the use of ozone-harmful chemicals.

**1994**

**27 January**

Lufthansa takes delivery of the first Airbus A321.

**31 January**

The Supervisory Board decides that Lufthansa's technical operations and other business sectors will be spun off and become independent companies.

**5 July**

Prof. Gerhard Höltje dies, shortly before reaching the age of 87.

**17 October**

Lufthansa Technik Aktiengesellschaft (LHT) is formally established as a company registered in Hamburg.

**1 December**

A McDonnell-Douglas DC 10 makes its last scheduled flight for Lufthansa.



# 1985-94

## Maintain Flight Level

Over the years Lufthansa's engineers and technicians introduced significant improvements to the design and maintenance procedures for commercial aircraft. In the early 1990s the company made **large investments in a major expansion program of its Hamburg facilities.**

## The History

### Maintain Flight Level

**T**he work of Lufthansa's technicians and engineers goes far beyond the maintenance of aircraft and powerplants; in their workshops and engineering offices they constantly seek to develop new and improve existing maintenance and repair methods. They are also busy working on improvements and modifications to the aircraft themselves. Every modern civil jet now flying incorporates ideas generated by engineers and technicians in Hamburg and Frankfurt.

For Lufthansa Technik is much more than a mere maintenance, repair and overhaul shop. For many years the Luftfahrt-Bundesamt (Federal German Civil Aviation Authority) has recognized the company as an aircraft design agency and manufacturer. This gives the company almost equal technical status with aircraft manufacturers such as Boeing and Airbus.

This approval status gives Lufthansa Technik the legal authority to make far-reaching modifications to particular aircraft designs. A recent example was the conversion of older Airbus A300B freighters from three- to two-man cockpits. The original flight decks were designed for two pilots plus a flight engineer. In addition, even Airbus as an aircraft manufacturer placed a contract with Lufthansa to modify and standardize the flight decks on pre-used A310 aircraft.

### Lufthansa as pioneer

The Boeing 737 was not the only aircraft for which Lufthansa was the launch customer. The company recognized the increase in air cargo and was the first airline to operate a Boeing 747F freighter. The same holds true for the Airbus A310 and A340, and the improved Boeing 747-400. Even though the company was not first to order the Airbus A320, Lufthansa clearly left its mark on this family of short- and medi-

um-range aircraft.

After the success of the A300 and A310, Airbus systematically introduced more modern and lighter materials and further computerized flight controls. The next step was the 150-seat class A320. This was the first civil aircraft with a side-stick control column and full electronic fly-by-wire. The side-stick is linked via a computer to electric motors operating ailerons, flaps, elevator, rudder and spoilers.

With the stretched A321 and the shortened A319, the A320 family provides airlines with a range of carrying capacity spanning the entire operating spectrum of short and medium-range requirements. Lufthansa's technical director, Reinhardt Abraham, was a convinced proponent of the concept of an aircraft family based on a single design.

He insisted in maximum commonality for all systems and components, which brought great savings in maintenance, overhaul, spares holdings and crew training. Abraham was extremely disappointed when the IAE Consortium was unable to produce the modern V2500 engine on time for the A320, and Lufthansa had to switch to the CFM56-5 at short notice.

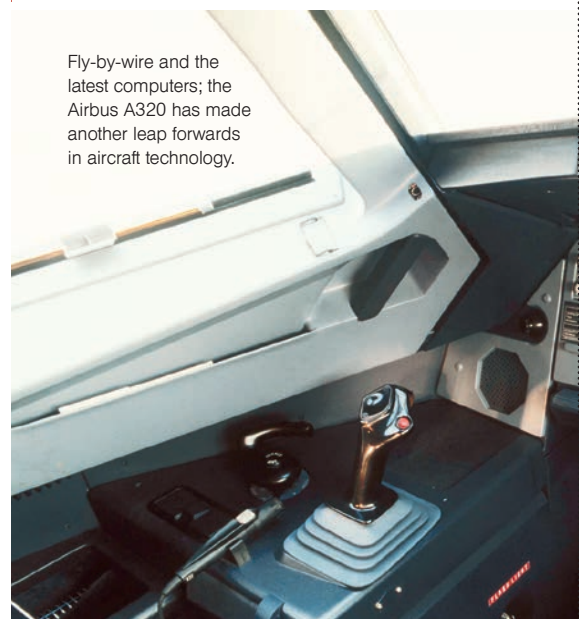
Before the Boeing 747-400 appeared on the market, engineers working for various international airlines had decided to pool their ideas. At that time the usual practice was for an aircraft manufacturer to introduce product improvements into series production as they became available, with a commensurate price increase. The Boeing 747-300 e.g. differed from the 747-200 mainly in terms of its extended top deck.

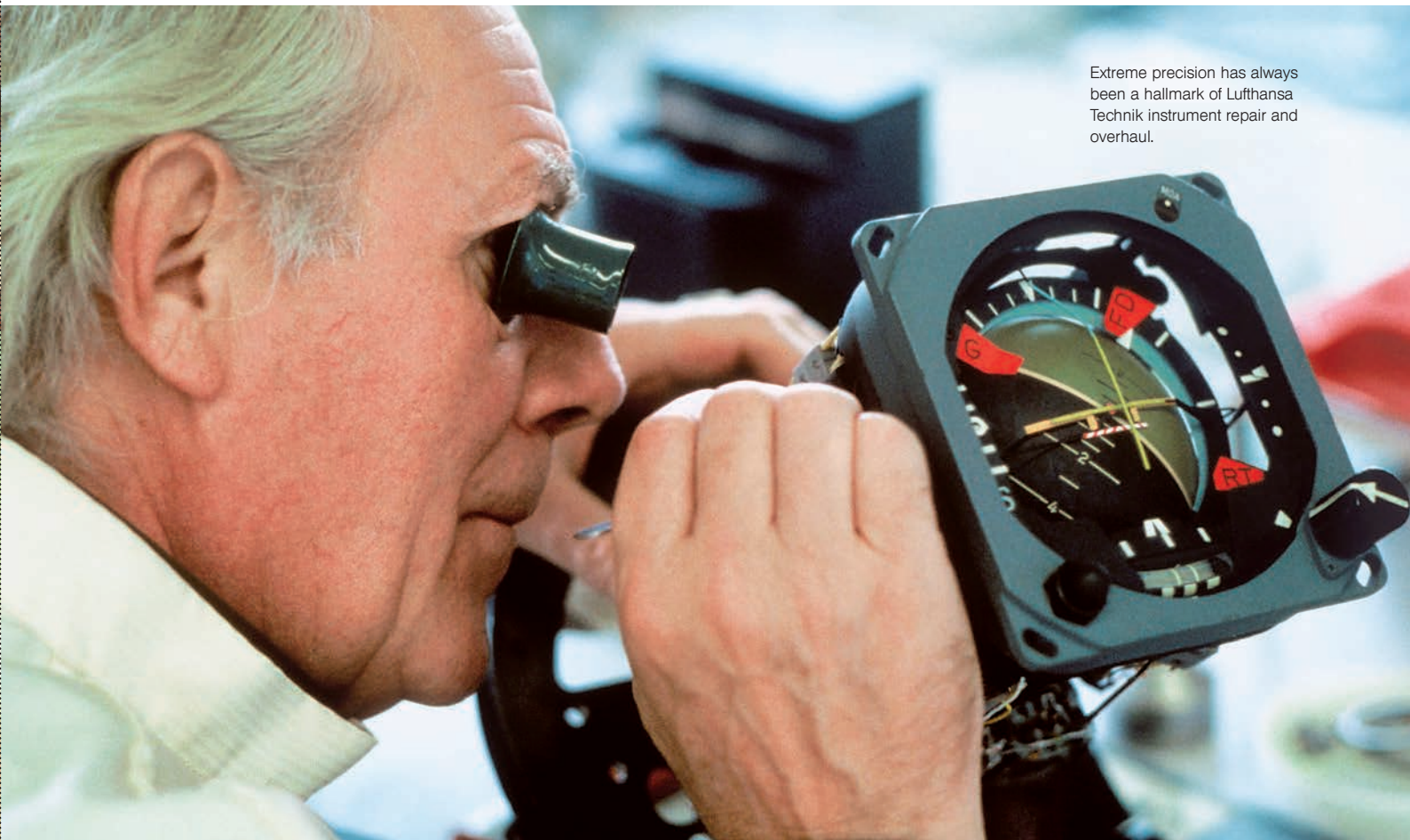
### 'Block Change' for Boeing 747-400

The airlines did not like this policy because of the knock-on effects for maintenance and flight operations; ►



Fly-by-wire and the latest computers; the Airbus A320 has made another leap forwards in aircraft technology.





Extreme precision has always been a hallmark of Lufthansa Technik instrument repair and overhaul.



Its enormous experience in maintenance and overhaul has made Lufthansa Technik an important partner for aircraft manufacturers.

## The History

### Maintain Flight Level



Winglets on the wing tips reduce drag and save fuel (here on a Boeing 747-400).



Two cockpits – and two epochs in aircraft technology. Above, the flight deck in the Boeing 747-200 with the third seat for the flight engineer, and more than 1,000 instruments, dials and switches.



The 747-400 flight deck is much roomier and simpler, with many of the previous generation of instruments now integrated into a few monitor screens. The number of instruments has been reduced to less than 400.



The completely new long-range Airbus A340 entered service with Lufthansa in 1993.

they would have had to operate small fleets of non-standardized aircraft which cost more to maintain and fly.

Lufthansa engineers led by the future Board members Jürgen Weber and Dr. Klaus Nittinger led the resistance. Eventually, the combined pressure of several airlines caused Boeing to adopt the 'Block Change', i.e. all the available improvements were introduced at the same time.

Improvements included a drag-reducing wing tip which helps to save fuel, weight-saving composite materials, increased flexibility of cabin layout, and a new digitally controlled General Electric CF6-80 powerplant. The two-man flight deck was upgraded with digital technology and computer screens. The result was a reduction in the number of switches and dials from about 1,000 to less than 400.

Ever since the early 1980s Lufthansa had urged manufacturers to produce a 250-seat aircraft to complement the Boeing 747. The decision was eventually made in favor of the Airbus A340, and thus against the McDonnell-Douglas MD 11 which was a comparatively conservative further development of the older DC-10.

### **A340: 40,000 working hours**

By contrast Airbus went for new technology in the A340: a two-man cockpit with fly-by-wire controls, increased use of composite materials, improved aerodynamics with a transsonic wing and winglets, with enough structural reserves for the development of larger versions, and fuel-efficient CFM56-5C2 powerplants.

Lufthansa engineers invested some 40,000 working hours in the A340 before it entered service in March 1993. At that time a number of worried observers asked whether that effort was justified.

It was. And not just because of the considerable reduction in purchase price that is accorded by a manufacturer to a launch customer, which was never an end in itself for Lufthansa. Rather, the first airline to order a new aircraft type is able to exercise a strong influence on its specification, thereby obtaining a product that is optimized to individual requirements such as range, payload, ease of maintenance and cabin layout.

### On-condition maintenance

A specialty for Lufthansa engineers is the development and improvement of maintenance and overhaul procedures. In particular, they had an important influence on the switch from fixed-interval to on-condition maintenance.

Back in the days of propeller-driven aircraft virtually every component including the engines had to be removed and checked, exchanged or overhauled after a given number of flying hours or flight cycles. However, with the arrival of jets it became clear there was a better way that would both increase safety and cut costs.

Systematic collection of maintenance and inspection records revealed that maintenance intervals could be extended without any detriment to safety or reliability. This was the precursor to the now general use of on-condition maintenance.

Very early on Lufthansa engineers developed an information system known as ROD – Reliability On Demand. With the ROD system, data were collected on aircraft defects or snags reported by crews and the respective remedies or repairs.

Information ranged from defective brakes to blown warning lights and engine damage. From the mid-1970s onwards, these data were processed

and evaluated in Frankfurt with special computer software.

### Technical CV for components

Based on this information, the computer generated a technical curriculum vitae (CV) for every single type of component; the information could be accessed from anywhere in the world via a data network and gave valuable indications of a possible diagnosis or repair.

In addition, ROD pointed a finger directly when a particular type of component developed repeated defects. This represented a considerable advance, but still fell short of the information requirements for on-condition maintenance of jet engines. This objective called for a separate tool that could make a prediction as to when an engine should be overhauled. The answer was Engine Condition Monitoring (ECM), a system developed by Lufthansa engineers to provide continual engine monitoring of selected parameters. In the event of a deviation from the norm, ECM provides a forecast such as the likelihood of a particular type of failure within a certain time frame.

ECM forecasts enable maintenance engineers to take early steps to repair or rectify a problem. This helps to avoid costly secondary damage within the engine, or to reduce costs arising from increased fuel consumption.

Not only does the ECM system increase the safety and reliability of flight operations; rather, it saves money by eliminating expensive disruption arising from technical failure. Most of the necessary repairs can be performed at the Frankfurt maintenance base. In addition, ECM greatly reduces the frequency of engine ground-runs required for inspection and adjustments, and the associated local environmental impact. ►



### Progress made by Lufthansa Technik – Part 1

The team of engineers at Lufthansa Technik has developed a large number of solutions to complex problems, sometimes in cooperation with manufacturers and other partners. Many of their improvements have now become generally accepted industrial standards. Examples are:

#### ADH (Activated Diffusion Healing).

A high-temperature repair soldering process for engine guide vanes; the repair cost is a fraction of replacement.

#### Repair of composite components.

It was necessary for the company to develop its own repair processes because the manufacturers of expensive fiber-reinforced composite parts had not come up with standardized repair methods.

#### HSG (High Speed Grinder). A

computer-controlled precision grinding and balancing machine for heavy turbine rotors, accurate to within two hundredths of a millimeter.

**Plasma Spray.** A high-tech method to apply a surface coating on highly stressed engine parts such as rotor blades and combustion chambers.

**Window Panel Recycling.** A new process to polish and restore the dull or scratched surfaces of aircraft windows.



**Environmental  
Responsibility**  
*by Klaus Nittinger*

There is an environmental burden arising from every flight in the form of noise and exhaust gases. Lufthansa has always done its best to minimize the side effects arising from flight and technical operations. At the beginning of the '90s one trade journal described us as the 'industry leader' in environmental responsibility. The company was subsequently the recipient of several environmental awards, as published in its environmental report Balance.

We have always operated a relatively young fleet. Modern aircraft and their engines generate less noise, consume less fuel and release fewer harmful substances than older generations of jets.

The company's engineers found many new ways to combine the ecologically desirable with the economically feasible. Examples include: No further use of ozone-harmful CFC cleaning agents; implementation where possible of the policy 'recycle instead of throw away'; or the 230 million DM paint shop.

Ever since the early 1990s several Lufthansa aircraft have been fitted with scientific instruments to measure the concentration of gases and other particles at cruising altitude for a variety of research projects. This instrumentation first made upper atmosphere research possible, because there are no satellite- or ground-based systems that can monitor air quality or impurities at this altitude.

*Dr. Klaus Nittinger was Technical Director on the Lufthansa Executive Board from January 1992 to December 1994.*

Initially, ECM parameters were limited to such readings as exhaust gas temperature, engine speed, fuel consumption, vibration, oil pressure and temperature.

Today the so-called FADEC system (Full Authority Digital Engine Control) provides many more parameters that are sent by satellite telemetry back to the maintenance base and enable even more accurate forecasts.

### **Modernisation of Hamburg base**

In 1983 the company found that a chemical leak had penetrated concrete into the ground water under the Hamburg maintenance base. Remedial action was one of the reasons to expand the Hamburg facilities.

Environmental protection was given more importance than ever before; of the 900 million DM invested in the expansion, about one third was for health at work and environmental protection.

At that time Dr. Alban Rupp was in charge of the Hamburg MRO operations. He remembers, "We were absolutely dumbfounded when a new trench revealed a mixture of oil, kerosene and solvents floating on the ground water."

The pollutants had leaked from a tank farm which also contained chemical cleaning agents, and from the sewage network. Nobody – not even the building inspectors – had realized that these substances could permeate thick layers of concrete.

The media outperformed one another with reports of doom and gloom, but the subsequent investigation by the environmental police was closed a few weeks later.

Lufthansa had demonstrated that not only had it fully respected the law, it had also gone well beyond these requirements with its internal regulations on the use and effective monitoring of environmentally hazardous substances.

### **Environmental protection**

The cleanup was expensive and took several years. The ground water was cleaned to potable standard and the maintenance base sewage network completely renewed.

Even before Lufthansa appointed a Commissioner for environmental issues in 1989, there were numerous projects under way with a single goal: to harmonize the business with sound ecological principles as much as possible. One such project was to eliminate the use of any chemicals that posed a threat to the Earth's ozone layer.

Before science became aware of the threat, CFCs (chloro-fluorocarbons) and other chemicals such as methyl chloroform were used for a variety of cleaning purposes. As soon as the threat was apparent, the Lufthansa maintenance teams began an immediate search for environmentally acceptable alternatives.

The 'ozone killers' were progressively replaced by non-harmful cleaning agents; by 1993 consumption of hazardous cleaning agents had been cut to zero. This action was recognized by the US Environmental Protection Agency, which gave Lufthansa the highly respected 'Ozone Layer Protection Award'.

Lufthansa's Hamburg engineers also received recognition from the German Industry Association (BDI) for their invention of the Aquastrip paint stripping process. Prior to external repainting, existing layers of paint were peeled from the aircraft skin by a high-pressure water jet. Previously, paint had been removed by aggressive chemical stripping agents.

But the water jets were soon replaced by something even better: Aquastrip gave way to harmless substances based on amino-acids. These dissolve the old paint, which can then be disposed harmlessly as effluent water via the public drains. ►

The aircraft paint shop is equipped with ultra-modern air filter systems to trap aerosol paint particles and evaporated solvents.



The Engine Condition Monitoring system now enables repairs and overhauls to be scheduled when necessary.

## The History

Maintain Flight Level

The Widebody Overhaul Center opens in Hamburg 1992.



A new maintenance base was constructed at Berlin Schönefeld Airport in 1991



## A new base in Berlin

The reunification of Germany led to further improvements for Lufthansa's technical operations; the company built a new maintenance base on Berlin's Schönefeld Airport, which had previously served East Berlin.

In 1991 Lufthansa employed most of the maintenance team which had previously worked for the East German state airline Interflug. Lufthansa had maintained the long-range Airbus A310 for Interflug since 1988.

After the East German airline went into liquidation in 1990, Lufthansa hired almost 1,000 Interflug staff, of which about 450 worked in maintenance and engineering.

The initial period was not easy, e.g. there were no telephones. The technicians were well educated and trained, but they needed to acquire more experience with western aircraft and maintenance principles. Bernhard Conrad was in charge of Lufthansa's Berlin maintenance operations from 1993:

"The work force overcame all the initial difficulties by their enthusiasm and hard work. Everyone was highly motivated and ready to go. This was not just within our own operation, but also with the authorities and other firms with whom we were working."

Experienced Lufthansa technicians from Hamburg and Frankfurt gave a lot of assistance during the build-up. One of the roads in Lufthansa's Schönefeld site is still named after a Hamburg master craftsman.

At first, the new base concentrated on Boeing 737 overhaul. From 1995 onwards it conducted C-checks for numerous customers, followed from 1997 by a joint venture with Bombardier to service business and smaller transport aircraft.

## Expansion in Hamburg

The Hamburg Wide-body Overhaul Center was constructed from 1989 to 1992 on the western edge of Lufthansa's base. It was the biggest expansion project ever undertaken by the airline. The most important structures were an ultra-modern paint shop – constructed solely to meet the modern requirements of health and safety at work, and environmental protection – and an overhaul hangar for wide-body jets.

This hangar can accommodate two Boeing 747s and one more aircraft up to the size of an Airbus A300. Its unsupported arch is 54 meters high and supports the roof, cranes and telescopic platforms. It dominates the skyline of the Hamburg base.

Lufthansa's technical management realized at an early stage that it would not be able to leave wide-body jet overhaul to the ATLAS group partners forever. The company's own 747 fleet was growing, and increasing numbers of external customers were making enquiries for overhaul of their own Boeing wide-body fleets.

Coupled to this, a contract to overhaul a customer airframe almost automatically brought with it the associated business of engine and component overhaul. This situation arose at a time when the competition to supply technical services was increasingly tough; a strong argument in favor of expansion.

## More and more customers worldwide

Not least, it was important to sustain Lufthansa's technical expertise on the world market by demonstrating with its own aircraft that it remained a technical leader in the overhaul of wide-body jets. Maintaining these skills and expertise was absolutely essential for future business. ►



**The Magic Triangle**  
by Dr. Gerwin  
Dienger

Ever since Lufthansa started its operations all maintenance, repair and development activities were shaped by the 'Magic Triangle':



As the years passed, the triangle became a pentagon that, also, included passenger comfort and environmental responsibility.

Safety is the first imperative for an airline's technical activities; everything else is subservient. Thanks to decades of adherence to this principle, the Lufthansa image is one of a particularly safe airline.

High reliability is the natural result of an operation in which few flights are cancelled or late for technical reasons. Airlines whose aircraft are maintained by Lufthansa Technik enjoy a very low flight cancellation rate in comparison with other airlines.

When it comes to high economic efficiency, Lufthansa Technik engineers work closely with aircraft manufacturers in order to develop optimized maintenance systems. Engines that are maintained to an optimum standard save their operators' money, as do short repair down times – an aircraft can only earn money when it is in the air.

*Dr. Gerwin Dienger was Head of Project and Development Engineering with Lufthansa Technik.*

## The History

### Maintain Flight Level



#### **That's why we had to expand**

*by Alban Rupp*

Back in the mid-1980s there were the first signs of a number of changes on the horizon which called for an expansion of our Hamburg facilities:

1. The size of our fleet called the economic efficiency of the ATLAS cooperation group into question. Lufthansa already had 22 Boeing 747 jets; the logical conclusion was that we should overhaul our own wide-bodies.
2. The latest insights into health and safety at work and environmental protection – particularly with respect to aircraft painting – made it necessary to introduce new processes.
3. With respect to external customers, it was essential that we offer wide-body overhaul services if we were to remain competitive in the MRO market. At the same time, we needed to compensate for the decline in our business with the smaller Boeing 707 and 727.

One should not underestimate the effect of modernization on our work force. Expansion enabled them to see themselves as a part of a high-tech business with a secure future and improved working conditions. The high work quality was and remains one of Lufthansa Technik's key competitive advantages.

*Dr. Alban Rupp was Director of Lufthansa's technical bases from 1972 through 1992.*

By 1991 turnover for external customers had already exceeded one billion DM – the same volume as for Lufthansa itself.

Another part of the Wide-body Overhaul Center was assigned to modernizing the engine shops. For reasons of environmental protection, it was also necessary to erect a storage building for hazardous substances. The program was rounded off by new workshops for overhaul of instruments and other components.

The Wide-body Overhaul Center was completed just at the time when the international civil aviation industry, including Lufthansa, was undergoing a painful transition from a period of rapid climb into one of deep crisis. The first Gulf War triggered a severe worldwide recession, which peaked in 1992.

The number of passengers declined dramatically – particularly in the Middle East and North America – as did cargo. At the same time, there was a sharp increase in the cost of fuel. In 1992 IATA airlines lost about five billion dollars.

Jürgen Weber, who rose from the position of technical director to Chairman of the Board in 1991, and his colleagues had to fight for Lufthansa's survival. There was only one way: save money wherever and however possible. The measures were unpopular but unavoidable. The company had to reduce the size of its work force; there was no hiring.

In addition, 23 aircraft surplus to requirements were temporarily parked in the dry desert climate of Arizona. By the end of 1992 the company had reached its intermediate goal by saving more than a billion DM. It was not until 1994 that Lufthansa returned to profit.

Aircraft that are not flying require almost no maintenance. The worldwide crisis in civil aviation hit Lufthansa's technical operations hard. It became necessary to further reduce costs but

without detriment to the recognized standards of quality, safety and reliability.

The internal hierarchy was downsized, structures and procedures simplified to react faster and more flexibly. The company reduced the work force by 1,200 in Hamburg alone, as far as possible by 'soft' means such as early retirement.

#### **On the way to independence**

All of these measures were aimed in support of one of the biggest ever changes in Lufthansa's technical operations – the establishment of Lufthansa Technik as an independently operating business.

At the beginning of 1994 the Supervisory Board decided upon a new corporate structure: from 1995 on, the technical division, cargo, ground services and the passenger airline would operate separately as international and results-orientated businesses.

On 17 October 1994 Lufthansa Technik Aktiengesellschaft was founded in Hamburg. The first Executive Board was formed by Wolfgang Mayrhuber (Chairman) and Dr. Gerald Gallus; Jürgen Weber became Chairman of the Supervisory Board.



### My Tutor

by Jürgen Weber

My career was shaped by Lufthansa engineering and technical operations. Reinhardt Abraham was my mentor; he

taught me how to move things and take pleasure in the results. He gave repeated pragmatic examples of his approach. It was simple and therefore effective:

1. Recognize the task.
2. Analyze the task.
3. Work through the task.
4. Start on the next task.

Such an approach to work is naturally associated with precision and reliability. This thread runs through all Lufthansa's technical operations and has helped me greatly as head of the corporation. Lufthansa people were and have remained a family. The company culture reflects qualities of mutual support, helpfulness to colleagues and solidarity, which I came to appreciate through my work in Lufthansa engineering. I tried never to lose sight of these values, even when we were going through the painful period of savings and restructuring in the early to mid-'90s.

He who wants to be a leader must put his trust in people. My principle was always to let teams have their heads and run with the problem; and only intervene when they exceed certain limits. Our technical operations have a good example for this approach: Engine Condition Monitoring.

*Dipl.-Ing. Dr.-Ing. E.h. Jürgen Weber succeeded Reinhardt Abraham in 1990 when he took over the Board responsibility for Lufthansa's technical activities. In 1991 he was appointed as Chairman of the Lufthansa Executive Board which he led until 2003 when he was nominated as Chairman of the Lufthansa Supervisory Board. Weber held this position until Wolfgang Mayrhuber succeeded him in May 2013.*



On 17 October 1994 Board members Wolfgang Mayrhuber (r.) and Dr. Gerald Gallus sign the Articles of Incorporation for Lufthansa Technik AG.

## 1995

### 2 January

Official start of Lufthansa Technik (LHT).

### January

Lufthansa Technik's strut modification of Boeing 747 is a bestseller.

### January

At a conference in Dubai experts say that aircraft maintained by Lufthansa Technik achieve top resale values.

### May

United Airlines awards a contract to Lufthansa Technik for maintenance of its 100 Type V2500 powerplants.

### 1 November

Death of Reinhardt Abraham, for many years the head of Lufthansa's technical operations and deputy chairman of the Executive Board.

## 1996

### March

The Luftfahrt-Bundesamt (LBA - German Civil Aviation Authority) gives permission for the installation of non-powered luminescent emergency floor markings – Guideline® – on passenger cabin floors. The floor lighting was developed in Hamburg by Lufthansa Technik.



### August

First financial results press conference for Lufthansa Technik AG. In the first year of independent operations the company makes a pre-tax profit of 35 million DM and repays long-term loans of 40 million DM.

## 1997

### January

Lufthansa Technik is certificated by the LBA as a manufacturer of aircraft components.

### February

Lufthansa Technik becomes the first business of its kind to pass an Ecological Audit, in-line with European Union regulations.

### May

The Star Alliance is founded in Frankfurt. As a consequence Lufthansa Technik receives several follow-on orders from partner airlines.



### October

Lufthansa Technik takes a 20 per cent share in HEICO Aerospace in the USA, a manufacturer of high-value powerplant components. The move is a reaction to the high part prices charged by engine manufacturers.

### November

The last Boeing 737-200 is retired from Lufthansa's service.

### December

A new joint subsidiary – Lufthansa Technik Logistik – is set up together with Lufthansa Cargo. The company provides complex logistics services e.g. for the dispatch of urgent spare parts for aircraft.



## 1998

### August

Lufthansa Technik introduces a unique new service; Airline Support Teams are held at readiness to fly and repair customers' engines around the world within a few hours.

### August

The Hamburg Technical Base completes the 1,000th overhaul of a jet aircraft: the A310-300 'Konrad Adenauer' operated by the German Armed Forces Special Air Mission Wing.

### December

Lufthansa Technik is the first MRO company in the world to convert a Boeing 747-400 Combi into a pure passenger-carrying aircraft. A further six aircraft are converted at short intervals.

## 1999

### March

In a joint project with Airbus, the company modifies several German Armed Forces Airbus A310 to Multi-Role Transport (MRT) configuration (freight, troop transporter, medical evacuation). Years later the role was extended to include air-to-air refueling.



### June

First contract received for conversion of a Boeing 777 to VIP configuration for an Arab customer.

### August

After nearly 40 years the era of the Boeing 707 maintenance comes to an end with a B-check for a German Government operated aircraft.

## 2000

### 1 January

Wolfgang Warburg is appointed Director of Personnel on the Executive Board of Lufthansa Technik AG.

### January

For 640 million DM Lufthansa Technik buys the land and buildings of its Hamburg Base, for which it had previously paid rent, from the Hamburg state.



### 1 April

August Wilhelm Henningsen, previously General Manager of Ameco, joins the Executive Board of Lufthansa Technik with responsibility for Products and Services.

### October

Contract signed with Boeing for completion (interior outfitting) of 30 business jets in the period ending 2008.

## 2001

### 1 January

August Wilhelm Henningsen is appointed Chairman of Lufthansa Technik AG Executive Board in succession to Wolfgang Mayrhuber, who is appointed Chairman of the passenger airline. Dr. Peter Jansen, former head of company controlling of Lufthansa, is appointed Chief Executive Finance. Dr. Gerald Gallus takes over responsibility for Product and Services.

### 11 September

Passenger numbers decline worldwide after the terrorist attacks in New York and Washington. Lufthansa freezes investment and new hiring, lays up aircraft and adjusts capacity to the declining demand.

### December

The Lufthansa Supervisory Board approves an order for 15 Airbus A380.



## 2002

### 21 February

The world's biggest and most up-to-date noise protection engine test hangar is opened at the Hamburg Base. It is large enough to accommodate wide-body jets.



### March

Lufthansa becomes the first airline to provide its passengers with a broadband internet connection on board the Boeing 747-400. The technology is developed jointly by Lufthansa Technik and Boeing.

### October

Lufthansa Technik Philippines begins its first overhaul of an A340.



### 29 November

Jubilee: Lufthansa Technik completes its 25,000th engine overhaul – a CF6-80C2 from a Lufthansa Boeing 747-400.

### December

The Lufthansa Supervisory Board appoints Wolfgang Mayrhuber in succession to Jürgen Weber as Chairman of the Lufthansa Group's Executive Board.

### December

Lufthansa Technik takes on the 50 per cent share owned by SR Technics (Swissair) in Shannon Aerospace, thus becoming outright owner of the maintenance center in Western Ireland.

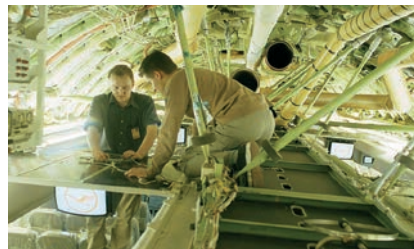
## 2003

### 20 February

Lufthansa Technik and Rolls-Royce link in a joint venture as N3 Engine Overhaul Services to maintain the RR Trent big fan engines in Erfurt, Germany.

### June

Lufthansa Technik is the first company in the world to obtain certification for Wireless LAN on board commercial aircraft.



### 6 October

nice™ (Network Integrated Cabin Equipment) sets new standards in cabin management and in-flight entertainment systems for business and VIP aircraft.

### 9 December

Roll-out of the first German Air Force A310 Multi-Role Transport Tanker (MRTT). The work is conducted together with Airbus.

## 2004

### 3 March

Announcement of AirTrack: a satellite-supported three-dimensional topographical image generation system for in-flight passenger entertainment screens. The technology was jointly developed by Lufthansa Technik and TEAC Aerospace.



### 12 March

Dr. Thomas Stüger, Head of Maintenance in Frankfurt, is appointed to the Lufthansa Technik Executive Board as Director of Products and Services. He succeeds Dr. Gerald Gallus who retires.

### 25 May

The company announces Platinet™, a new worldwide service for large VIP and business jets, provided in conjunction with selected partner firms.

### August

On the 15th anniversary of Ameco Beijing, Lufthansa Technik and Air China agree that their joint venture will continue for a further 25 years. Ameco has become Asia's biggest provider of aviation technical services.

### September

Lufthansa Technik assembles a comprehensive portfolio of services for the Super-Airbus A380 – almost two years before its scheduled entry into regular service.

# 1995-2004

## The Technik Group

The conversion of Lufthansa Technik into an independent company took place at a time when the market was increasingly difficult. But the new company's response was fast, effective and successful – **new products and the creation of a global network with international division of labor.** Ten years later Lufthansa Technik is one of the acknowledged world-wide market leaders in the maintenance, repair and overhaul of commercial aircraft.

**E**xternally, not much had changed except the nameplate at the gate when the company formally opened for business on 2 January 1995. But inside there had been major changes. Not only were there organizational improvements; there was a major switch in focus.

From this day on, there was no difference made between services provided for Lufthansa and those for other customers. The parent company was no longer under any compulsion to have its aircraft maintained in-house, any orders had to be negotiated.

### **Sound commercial reasons for outsourcing**

The prospects of the new company in the world maintenance, repair and overhaul (MRO) market, where increasing numbers of airlines were subcontracting technical tasks to external suppliers, were good. However, the industry then suffered from over-capacity which created a buyer's market, calling for maximum cost flexibility and proximity to the customer.

The technical operations of the Lufthansa Group had grown too large to function well as a simple extension of the main business, as a division or as a cost center.

To maintain efficiency and cost-transparency it proved necessary to make a clear distinction between customer and supplier. And everybody involved was aware of the fact that the new company could only succeed if it had an independent and powerful organization, whose core maintenance business was carefully focused on the market and customers.

### **Actively shape the market**

Under the leadership of Wolfgang Mayrhuber and Dr. Gerald Gallus, Lufthansa Technik defined a set of clear targets and took off with con-

fidence into its future. In particular, the company's service package was distinct from that of the competition.

The top management was able to count on a team of highly skilled and motivated engineers and technicians. These people were backed by the practical experience of 40 years of flight operations, during which time they had accumulated enormous technical know-how.

As an officially certified design agency, Lufthansa Technik provided tailor-made solutions including engineering and logistics services, and guaranteed short production and delivery times. In addition, the company offered numerous other services, e.g. assistance in setting up a new airline or financial advice.

From this position, Mr. Mayrhuber and his management team decided upon three strategic goals for Lufthansa Technik's take-off:

1. Lufthansa Technik must actively shape the market by introducing new products.
2. Lufthansa Technik must be close to its customers, both in terms of speed and geographic position.
3. Lufthansa Technik does not have to provide services that other suppliers can offer at lower cost and the same quality.

This strategy proved to be successful. Lufthansa Technik AG became profitable and rapidly developed into one of the world leaders in the provision of technical and advisory services for airlines and other civil aircraft operators.

Lufthansa Technik acquired or took a share in a number of other companies, which not only reinforced its market position but helped to secure jobs in Germany as well.

### **The way up**

By the end of its first year in business the Lufthansa Technik Board reported a pre-tax profit of 35 million DM; in addition, the company repaid loans of 40 million DM. Biggest customer (65%) was the Lufthansa Aviation Group. In the course of the following years, a steadily increasing share of business was accounted for by other customers around the world.

At the same time, competition in the MRO service industry increased, driven by two underlying trends:

Following Lufthansa's example, more and more airlines converted their in-house maintenance and repair facilities into standalone businesses. This change raised the number of maintenance companies with freely accessible, non-captive capacity which had previously been bound to a single supplier. Their entry into an already narrow market sharpened the competition between MRO companies such as Lufthansa Technik.

Also, there was a continued process of industrial concentration between manufacturers of engines, aircraft and components. Manufacturers extended their own maintenance capacity and offered technical backup services for their products. In particular, the engine business saw an increasing number of companies that linked price concessions for new engines with aggressive offers for maintenance and other services in the after-sales market.

This threat was countered by Lufthansa Technik with a combination of highest quality, short turnaround times and a comprehensive range of services. Unlike manufacturers, Lufthansa Technik had (and still has) access to information derived from many millions of hours of flight operations. The company also took a share in an independent American manufacturer of high-value officially approved engine components, HEICO. ►



### **The Talent Factory**

Right from the first days, Lufthansa's founding managers decided that the best future technicians for the company would be those trained in-house. In Hamburg the company began to select apprentices in the fall of 1955. Just before Christmas, 42 lucky would-be technical apprentices received the good news that they had been awarded one of the much sought-after vacancies. Initial training took place away from the maintenance base; apprentices had to climb seven flights of stairs to reach their classrooms. There were four types of technical training: motors, radio, electrical and precision instruments.

Today, training embraces more than ten specialties. Each year some 150 apprentices graduate from Lufthansa's modern training schools in Hamburg and Frankfurt. In addition, some of the trainees carry on to study at graduate university level. Since 2000, training and further education has been the responsibility of Lufthansa Technik's subsidiary Lufthansa Technical Training.

Basic training is all well and good, but it is not nearly enough for the responsibilities that follow. Lufthansa technicians have to undergo a constant cycle of refreshers and advanced training meet the requirements laid down by the civil aviation authorities and the company's even higher internal standards. Successful training in a multitude of courses is a prerequisite for a career in the highly responsible maintenance work with aircraft, engines and components.

This gave Lufthansa Technik some autonomy from manufacturer price-fixing. By 1997 the proportion of turnover due to engines was 33 per cent, as opposed to 29 per cent for aircraft line maintenance which had occupied the top position in the years before.

In the same year total turnover exceeded three billion DM for the first time, and profit climbed to 94 million. Likewise, Lufthansa Technik became the market leader in the new Eastern European states.

### **Global presence opens new markets**

A company in the MRO business must have a global presence, trans-border division of labor and proximity to the customer if it is to open up new markets and maintain good relations with existing clients.

For this reason Lufthansa Technik has created a worldwide network of subsidiaries, shareholdings and branches now extending to nearly 30 locations. The main geographic focus is in Europe, plus the growth regions of South East Asia/Pacific and North America.

However, there are considerable differences in the nature of demand in these markets. In Europe and Asia Lufthansa Technik operates as a full-service provider, maintaining and overhauling aircraft structures, engines and equipment; while in North America the emphasis is on components and services for business jets. The activities here focus on the aerospace regions of California, Florida, and Tulsa (Oklahoma).

Lufthansa Technik has bases in Hamburg, Frankfurt, Munich and Berlin, with satellites in Brussels, Budapest and Malta, with Ireland developing into a major business center of its own rights.

Most important holdings in Asia are

China's Ameco Beijing and the maintenance and overhaul base in Manila. There are specialized operations in Shenzhen and Kuala Lumpur. The VIP and business jets sector is supported by the main base at Hamburg, plus further service centers in Berlin and Tulsa.

### **20,000 employees worldwide**

There were two opposing trends in subsequent years. Because new aircraft are more reliable and require less maintenance, MRO demand lagged behind world fleet growth. On the other hand, there was also a growing fleet of older aircraft requiring more maintenance.

In this market situation, Lufthansa Technik was able to sell most of its capacity and maintained growth even in its high wage-cost German operations. By the year 2000 turnover had almost doubled in comparison with 1995, while the number of employees around the world had reached 20,000. The biggest driving force were orders from customers not belonging to the Lufthansa Aviation Group.

### **Individually tailored service products**

One of the key reasons that lead to Lufthansa Technik's competitive edge was the introduction of 'Total Support' modular service packages, precisely tailored to each customer's individual requirements. Another competitive advantage was the 'one-stop shop' philosophy: An airline or VIP customer obtains everything he needs from Lufthansa Technik.

The Total Support system spans a range of service products from which the customer selects what he wants: Total Technical Support TTS®, is the most comprehensive of the services. ►

Lufthansa Technik has set up its second maintenance base at Munich, creating 500 jobs.



Electroplating provides corrosion-protective coating for heavily stressed parts.



Very careful checks make for maximum reliability.



**From VIP Jet to Scheduled Service**  
*by Bernhard Conrad*

It is a bit like transferring technology from Formula One to the average family car: many of the new ideas that we first developed for VIP jets later found their way into conventional airliners. The result is that our customers' aircraft are often much better than off-the-peg products owned by competitors.

Two examples are on-board Internet and television. An airline passenger with a wireless LAN laptop can now go on-line in First and Business Class as well as in Coach or Economy. A few years ago that was only possible in VIP aircraft. The seat-mounted power socket was a unique development by Lufthansa Technik and has full technical approval in accordance with the strict conditions laid down by international civil aviation authorities.

Likewise AirTrack; the three-dimensional screen presentation of the flight route was first fitted to VIP aircraft.

Lufthansa Technik is licensed by the international civil aviation authorities to develop and certify products such as these. The company has more than 400 engineers working on new projects.

*Dipl.-Ing. Bernhard Conrad was Head of the Lufthansa Technik Design Organization between 1998 and 2013.*

This package optimizes productivity and incorporates all of Lufthansa Technik's product portfolio – customer-specific aircraft maintenance and overhaul, engines and components, engineering, fault-finding, spare parts supply, rented replacement engines, painting, cabin modification, logistics, training and documentation as prescribed by the civil aviation authorities. The customer can use the entire TTS® product range, or select his own individual service package.

Total Component Support TCS® covers all repairs and the entire provision of spare parts and components; the customer needs no longer maintain his own store of expensive spare parts. Instead, he becomes a member of a pool operated by Lufthansa Technik which when called upon provides everything necessary including logistics, engineering and documentation.

Total Engine Support TES® is a service package which applies the same all-round supply philosophy to engines. Lufthansa is a certified maintenance organization for all common engine types and auxiliary power units. The TES® package embraces repairs, overhaul, engineering, a material and spare parts pool, documentation and the provision of replacement engines. When required, Lufthansa Technik will fly an Airline Support Team (AST®) to the customer and either repair or exchange a defective engine within a few hours.

Total Asset Support TAS®, is designed primarily for aircraft leasing firms to protect their fleets' resale value and to simplify the transfer of aircraft from one leasing customer to another. TAS® covers technical appraisal and maintenance, manufacturer's recommended improvements, repainting, cabin modifications and documentation.

Maintenance Management Services

(MMS) optimizes the maintenance of an entire fleet of aircraft. It ensures that necessary checks are planned well in advance, matched to the operating spectrum, minimizing costs and taking the operator's particular requirements into account.

Such arrangements give the customer the ability to plan his flight schedules with confidence and achieve a significant increase in aircraft utilization. Over a ten-year period, a customer can expect to save up to 15 per cent of maintenance-related costs with MMS.

**Completion and maintenance of VIP aircraft**

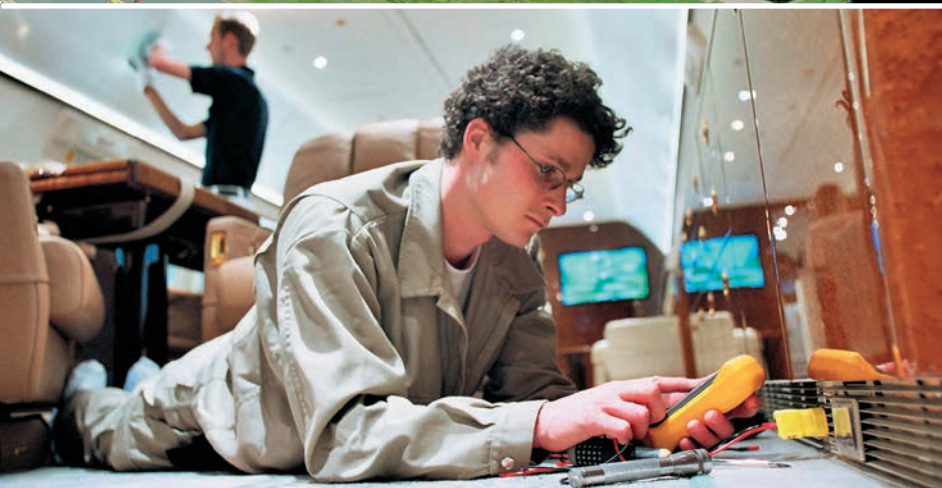
Lufthansa Technik has always been strong in the market for cabin furnishings and fittings, and the maintenance of VIP aircraft. This position was further enhanced by building up a strong position in the completion and maintenance of Boeing Business Jets and Airbus Corporate Jets. The customer can choose between standard or a custom-built designs for his flying office or hotel above the clouds.

**Changes in top management**

In 2001 there were changes in top management. Wolfgang Mayrhofer, the architect of Lufthansa Technik AG, joined the Executive Board of the Lufthansa Aviation Group in Frankfurt. He was replaced in Hamburg by August Wilhelm Henningsen, who had been in charge of Products and Services since April 2000. Previously he had been General Manager at Ameco Beijing.

Turnover and profit continued upwards in the first eight months of 2001. But then the terrorist attacks of 11 September in the USA sent civil aviation into another deep crisis. ►

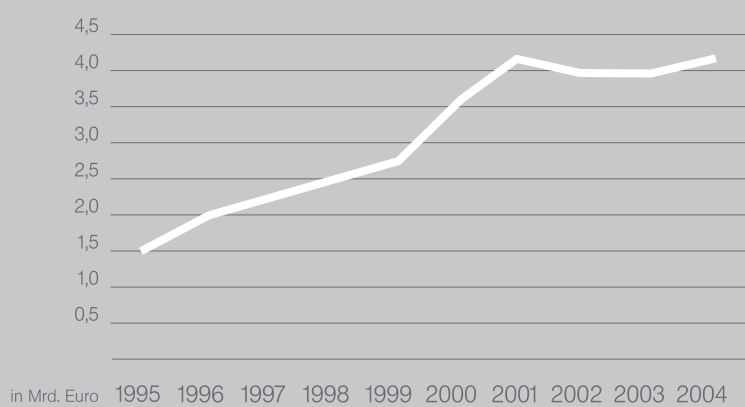
The Widebody Overhaul Center at the Hamburg Lufthansa Base.



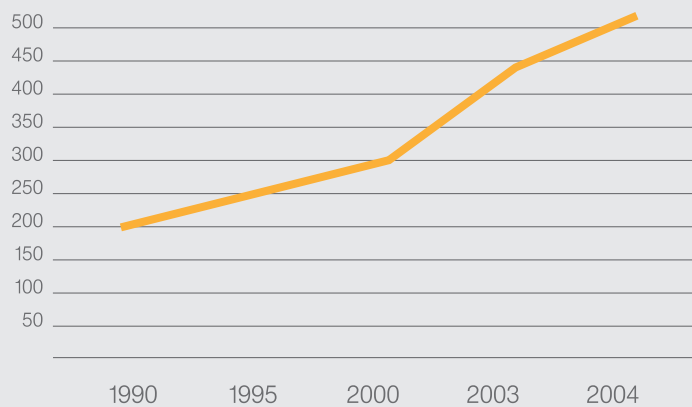
Airbus has selected Lufthansa Technik as preferred completion center – also for an individually designed Airbus A380.



Revenue development LHT Group



Customer worldwide



## The History

The Technik Group

Airlines around the world made severe cuts to their networks and within a few weeks took 900 aircraft out of service. In addition, airlines ceased to invest. Orders for new aircraft were either suspended or cancelled.

### Profit in difficult times

As a consequence, there was a sudden sharp decline in demand for maintenance services, because aircraft that are not flying require no maintenance. This was followed by a further reduction in demand in 2002 when the appearance of the SARS disease brought about a temporary collapse of travel to Asia, forcing airlines to park even more aircraft.

This crisis period revealed the fundamental soundness of Lufthansa Technik's business. While some competitors suffered a fall in turnover of 20 percent and more, Lufthansa Technik reported a decline of only seven percent. Even in this time of recession the company made a profit and increased its customer base.

Immediately after 11 September 2001, Lufthansa Technik implemented a highly-effective cost reduction program, and the system of worldwide production control proved its flexibility. Work which might have been sub-contracted to other suppliers was done in Hamburg and Frankfurt; this kept the shops and workforce employed.

### Cost pressure

There was little improvement in the economic health of the airline industry in 2003. The situation became critical for many airlines, particularly in the USA. This was directly reflected in the MRO market, in which some companies were working at below cost. In the face of low profits and falling ticket prices many airlines demanded cost reductions from their suppliers of up to 20 per cent.

### Numerous new orders

In contrast to the industry trend, Lufthansa Technik finished the year well. Although the average profit per order declined, this was counteracted by numerous orders from new customers.

Throughout 2004 Lufthansa Technik continued a positive trend. This was the first year after the terrorist attacks of 11 September in which the entire MRO business resumed slow growth, though on a lower price level. Lufthansa Technik, however, grew at a faster rate than the overall market and again acquired new customers.

In view of the fact that the North American market is so hotly fought over and virtually ring-fenced against foreign competition, it was remarkable that Lufthansa Technik was able to strengthen its position there.

For the following years, civil aviation – and with it the MRO industry – continued to be under threat from the alarming increase in oil prices, weak economic growth and the risk of terrorist attacks.

Airlines are suffering from pressure on financial yield and the weak dollar, which have a knock-on effect in the MRO industry. Lufthansa Technik is responding with prices in line with the market, further international cooperation and innovative products.

### New generation of aircraft

Technical services for the next generation of long-range aircraft will be one of the biggest challenges and opportunities over the coming years. The Airbus A380, the Boeing 787 and the A350 were introduced into service. ►



#### Progress made by Lufthansa Technik – Part 2

**Flynet.** For the first time passengers on Lufthansa long-distance flights now have high-speed broadband internet access via satellite. There are further add-on modules available for use in VIP and business aircraft.

**Wireless LAN.** This is another first in civil aviation: a wireless network that provides for a wide range of on-board digital applications that do not interfere with the aircraft's navigation systems or flight instruments.

**GuideU.** A non-electrical luminescent floor guide to emergency exits.

**nice™. (Network Integrated Cabin Equipment).** The Nice system is a non-wired network for cabin management and in-flight entertainment systems. It also has interfaces for external communications systems.

**ARP. (Advanced Re-contouring Process).** A unique process in which an industrial robot analyses the defective leading edge of an engine blade before polishing it back to an optimum profile. The process achieves considerable savings in both material and fuel consumption.



An important step into the US market: component support for Spirit Airlines.



Communication and network on board: Tests at Innovation Engineering.



In February 2002, the new noise protection engine test hangar for widebody jets is opened at the Hamburg Base.



After 11 September 2001 hundreds of aircraft worldwide were withdrawn from operations.



### Mastering the total system

Full of enthusiasm for the topic Dipl.-Ing. August Wilhelm Henningsen committed himself even in his younger years to aviation and technical matters. Starting with flying glider planes as a hobby, his professional career path led him to academic engineering studies and consequently up to the top of Lufthansa Technik. His contagious spark of fascination for the industry and its special challenges was easily passed onto long-term employees and apprentices alike.

His credo, "promote and demand" was especially fitting for the young generation of Lufthansa Technik employees. He regarded their optimal education as a corner stone for the development and perspective of the company's future.

As an insider, Henningsen sensed branch trends at an early stage due to his excellent contacts to manufacturers and customers alike. This enabled Lufthansa Technik, being a design organization to create custom-made, unique products.

Always the company's future in mind, he initiated the development of products for the technical support of new aircraft types long before their entry into service. Thanks to this pioneering spirit, Henningsen steered Lufthansa Technik into the globally unique position amongst MRO providers it nowadays holds. Only Lufthansa Technik offers the technical support for the full set of aircraft related systems, resulting in a wide range of innovative and market orientated products.

*Dipl.-Ing. August Wilhelm Henningsen was CEO of Lufthansa Technik AG from January 2001 until March 2015.*

They will incorporate new materials and more highly integrated electronic systems that pose new demands for the maintenance engineers and technicians.

The lessons learned in introducing previous generations of aircraft are now being applied. Even in the development phase, airline customers and MRO organizations have been talking with manufacturers to ensure that their experience from maintenance and operations were incorporated in the new airliners. This know-how will improve the reliability of these aircraft and their systems even further by promoting easy maintenance and low-cost operations.

In 2005, Lufthansa Technik's preparations for the introduction into service of the Airbus A380 are well advanced. From 2001 the company had a group of a dozen engineers working with customer focus groups on the specification and development of the A380. Their experience in everyday flight operations and both line and heavy maintenance has helped to optimize the manufacturer's design. One very important aspect is the reliability of the individual systems.

Because of its comprehensive know-how, Lufthansa Technik chaired the Maintenance Industry Steering Committee in which manufacturers, operators and airworthiness authorities jointly develop the basis for the A380 maintenance schedule. The decisions taken by this group had a strong influence on the cost and complexity of A380 maintenance for many years.

The track record of many years of practical MRO experience is of enormous value for both sides in training maintenance personnel. For this reason Lufthansa Technik's subsidiary Lufthansa Technical Training had a member of staff on site in Toulouse. His job was to contribute to the devel-

opment of the training programs for technical personnel.

Lufthansa Technik has also teamed with Air France Industries in the formation of a jointly owned new subsidiary company, Spairliners.

This company maintains the supply of spare parts for the 25 A380 aircraft ordered by Lufthansa and Air France, and furthermore provides comprehensive maintenance, repair and management service for spare parts with the necessary logistics services for all A380 operators. These services offer airlines considerable cost savings.

A new maintenance hangar was built in Frankfurt to accommodate up to four A380 aircraft under a single roof. In Erfurt, Lufthansa Technik and Rolls-Royce have formed a joint venture company – N3 Engine Overhaul Services – to provide maintenance and overhaul for Rolls-Royce engines powering Airbus long-haul aircraft.

When the A380, the Boeing 787 or the A350 entered commercial service, Lufthansa Technik was ready and waited to provide the necessary technical support for customers around the world.



A380 component services in cooperation with Air France Industries: Spairliners.

In 2003, Lufthansa Technik and Rolls-Royce team up in the joint venture N3 Engine Overhaul Services.



For the maintenance of Lufthansa's A380s, a new hangar is being const ucted in Frankfurt.



October 2005: The Airbus A380 lands for the first time in Frankfurt to perform ground handling tests.

## 2005



### 1 April

Lufthansa marks the 50th anniversary of the “new” Lufthansa commencing operations. For the occasion, Lufthansa Technik personnel create a “Retro Jet”, painting an Airbus A321 in the traditional Lufthansa livery of the early 1960s. More than 15,000 members of the Lufthansa family celebrate the company's 50th anniversary at the Lufthansa Technik base in Hamburg.

### 10 June

Lufthansa Technik and Air France Industries establish the joint venture operation Spairliners in Hamburg. The company will take responsibility for supplying spare parts for the future Lufthansa and Air France A380 fleets and also offer these services to other A380 customers.

## 2006

### 2 May

Federal German Chancellor Angela Merkel lays the foundation stone for N3 Overhaul Services in Thuringia. N3 is a joint venture between Lufthansa Technik and Rolls-Royce, established to carry out overhauls on the Rolls-Royce Trent series of engines.



### 6 December

Lufthansa's supervisory board approves the purchase of 20 Boeing 747-8 long-haul jets. This makes Lufthansa the first customer for the passenger version of the newest variant of the legendary “Jumbo Jet”.

## 2007

### 19 April

US airline Virgin America becomes the first customer for the “Total Material Operations” (TMO) product. The ten-year contract has a total volume of more than 250 million US dollars.

### 28 June

Airfoil Services, a joint venture of Lufthansa Technik and MTU Aero Engines, opens a significantly enlarged new operation in Kuala Lumpur.

### 20 July

Farewell to one of the most symbolic Lufthansa Technik maintenance hangars, constructed by Lufthansa at Frankfurt Airport in 1960 for the beginning of the jet age. Known as the “Butterfly Hangar” because of its distinctive design, the building was the largest maintenance hangar in the world when it opened.

### 14 September

N3 Engine Overhaul Services in Arnstadt, Thuringia, opens its doors after a construction period of just 18 months.

## 2008

### 11 January

The Premier of the state of Hesse, Roland Koch, opens Lufthansa Technik's new A380 maintenance hangar at Frankfurt Airport with the symbolic press of a button.

### 18 March

Ameco's A380 maintenance hangar in Beijing enters operation. Measuring 350 meters in length and 110 meters wide, it is one of the largest hangars in the world, with room for four Airbus A380s at one time.

### 15 December

Formal opening of the new engine overhaul center at the Hamburg base. Annual capacity is planned to increase from 320 to 400 engines.



## 2009

### 31 March

Lufthansa Technik opens the new Research & Development Center for the “Innovation” division at the Hamburg base.

### 6 April

Lufthansa Technik Malta opens a new hangar complex. This new facility adds the capability of overhauling wide-bodied Airbus A330 and A340 aircraft.

### 16 April

Lufthansa Technik Sofia launches a second overhaul line for Airbus and Boeing aircraft.

## 2010



### 8 May

Lufthansa and Boeing mark the fiftieth anniversary of their cooperation with a joint celebration at the Hamburg base. Half a century ago, Lufthansa's Boeing 707-430 with the registration D-ABOB entered service. The aircraft was the company's first jet and at the same time its first ever Boeing aircraft.

### 19 May

The A380 epoch begins for Lufthansa with the handover of the company's first mega-Airbus at the Airbus factory in Finkenwerder, Hamburg. Around 700 guests attend the handover ceremony. Lufthansa Technik personnel supported the Airbus team to ensure that the handover happened on schedule. Over a period of six months, more than 24,000 man-hours went into the cabin fitting of the first Lufthansa A380.

## 2011

### 21 June

Groundbreaking ceremony for a new Lufthansa Technik maintenance hangar at the future Berlin Brandenburg International Airport (BBI). The facility will have space for up to five narrow-bodied jets or one wide-bodied aircraft of the size of an Airbus A340.

### 10 July

The children's television series, "Sendung mit der Maus", produced by state broadcaster WDR, celebrates its tenth birthday on the grounds of Lufthansa Technik in Hamburg. Around 25,000 people attend, enjoying a variety-filled show program.

### October

Japan Air Lines is the first 787 "Dreamliner" customer for Lufthansa Technik's TCS Total Component Service.

### December

The handover of the last of four Bombardier Global 5000 aircraft marks Lufthansa Technik's completion of its modernization program for the Federal Ministry of Defence's VIP Squadron. Two Airbus A319 ACJs and two Airbus A340-300s have already been delivered.

## 2012



### 10 February

Lufthansa Technik Philippines opens the third hangar for wide-bodied aircraft in Manila.

### 2 May

Lufthansa is the first airline in the world to take delivery of a Boeing 747-8. The latest generation of the "Jumbo" is substantially quieter and more efficient than its predecessor. Lufthansa Technik engineers made a significant contribution to the design of the 747-8.

### August

Scandinavian Airlines (SAS) transfers responsibility for component supply for its entire fleet of approximately 140 aircraft to Lufthansa Technik. The contract has a period of seven years.

### September

A world first: the VIP & Executive Jet Solutions division in Hamburg commences work on a VIP cabin for a Boeing 747-8.

### 1 December

Open Day at Lufthansa AERO Alzey on the occasion of the company's 25th birthday.

## 2013



### 26 April

An eminent visitor comes to Lufthansa Technik in Hamburg – Germany's Federal President, Joachim Gauck, witnesses a detailed presentation of the overhaul work being performed in Hangar 7 and seats himself in the cockpit of a docked Airbus A330.

### 18 April

The foundation stone is laid for two new hangars at Lufthansa Technik Shenzhen. The new buildings, due for completion at the start of 2014, will double the company's capacity.

### 19 September

Lufthansa announces the largest aircraft order of its history. The Lufthansa Group's long-haul fleet will be rejuvenated from 2016 with 25 Airbus A350-900 and 34 Boeing 777-9x wide-bodied aircraft. Lufthansa Technik is planning to take on the provision of MRO services for the A350-900 and Boeing 777-9X aircraft ordered, including for their next generation engines.

## 2014

### 7 April

Lufthansa announces that 40 new A320neo series aircraft will be fitted with the quiet and highly efficient General Electric "LEAP-1A" engines. Delivery is scheduled for 2021. A further 60 Lufthansa A320neo aircraft will be fitted with the comparable Pratt & Whitney PW1100G engine, beginning in 2016.



### 15 September

The Supervisory Board of Lufthansa Technik appoints Dr. Johannes Bussmann as the new Chairman of the company's Executive Board. He will take over the job with effect from 1 April 2015 when August Wilhelm Henningsen retires.

### 18 September

Lufthansa Technik announces an investment of almost 60 million euros in the expansion of its Frankfurt site. By the start of 2017, a new wheel and brake workshop with 14,500 square meters of gross floor space will be constructed at Osthafen in Frankfurt.

### 27 November

Lufthansa Technik converts a Lufthansa Airbus A340-300 into the evacuation aircraft for the Federal Government. The aircraft, with the name "Robert Koch", is handed over on 27 November. This conversion, carried out in the shortest possible timeframe, provides a globally unique possibility to evacuate highly infectious patients from danger zones.



### 22 November

The biggest product upgrade program in the history of Lufthansa began in October. Lufthansa Technik is commissioned to fit the entire long-haul fleet with the new Lufthansa Premium Economy Class. Already on 22 November, LHT can announce the fitting out of all 747-8 aircraft with the new cabin.

# 2005-2014

## Global Expansion

The 50th anniversary of the foundation of the Lufthansa Group and the tenth birthday of Lufthansa Technik AG **in 2005 marked the beginning of a decade of global expansion.** Important milestones were the opening of new sites in the growth markets of Asia and America along with a stronger focus on the establishment of partnerships with the original equipment manufacturers (OEMs) of engines and components. Furthermore, the funding of innovation projects, such as new products, services, and technologies, set the course for a profitable future for the world's leading provider of technical aviation services.



**O**n 27 April, 2005, just a few days after Lufthansa had looked back on what it had already achieved as it celebrated its 50th anniversary, the eyes of the global aviation industry once again focused on the future of flight.

On this day, the Airbus A380, the largest commercial airliner ever seen, took off from Toulouse in the south of France on its maiden voyage. For Lufthansa Technik, this milestone in the A380 project – which had previously been delayed on several occasions – meant that the ongoing preparations for the new wide-bodied aircraft could now proceed as planned at the company's various sites.

In June, Lufthansa Technik and Air France Industries announced the establishment of their joint venture, Spairliners, to provide component services and maintenance for their own and other A380 fleets.

Another, even more significant milestone along the path to the introduction of the A380 to the Lufthansa fleet was the decision of the Federal Administrative Court on 7 September, 2005, to confirm the planning approval for the Lufthansa Technik A380 hangar at Frankfurt Airport. This cleared the way for the construction of the new technical base for the Lufthansa A380 fleet. The foundation stone was laid a year later at a ceremony attended by leading political figures.

The crowning moment in this A380 year came in October with the debut landing of an Airbus A380 test flight in Frankfurt. With three years to go before the megaliner was planned to enter operation for Lufthansa, this event made it clear to all those involved that a new era of air travel was about to begin. The A380's landing and 24-hour stopover in Frankfurt attracted great attention, and not only from the general public.

Various departments and divisions within the Lufthansa Group, including the experts at Lufthansa Technik, took advantage of this opportunity to carry out important advance tests for future flight operations at what was to become the A380 base.

Fittingly, Lufthansa Technik was chosen by Airbus as "Preferred Partner" for VIP conversions and fittings on both the Airbus A380 megaliner and the then new corporate jet, the Airbus A318 "Elite". Lufthansa Technik was the first service provider worldwide to present VVIP design concepts for both passenger decks of an A380. On the basis of expected orders, the company also invested 2.5 million euros in a so-called hangar extension for Hangar 3 at the Hamburg base, equipping this hangar for work on the A380.

Not long after this, the ground breaking ceremony took place for the engine overhaul center at N3 Overhaul Services in Arnstadt, Thuringia. This joint venture was established by Lufthansa Technik and Rolls-Royce in 2004 for the overhaul of large Rolls-Royce engines. The Federal German Chancellor, Angela Merkel, insisted on personally getting her hands dirty for the laying of the foundation stone for N3 in May 2006. The 100-million euro investment by the two partners was a strong indicator of the future viability of Germany as a business location – and of the performance potential of the former East German states in particular. After a construction project that took just 18 months, operations commenced in September 2007.

And another A380 event reinforced the advance notice that the new megaliner was coming. The same year saw Lufthansa Technik and Air China celebrate the topping-out ceremony for the Ameco A380 hangar in the Chinese capital, Beijing. ►



#### **50 Years of Lufthansa and the Technik Base in Hamburg**

The greatest gift received by the Lufthansa Group for the airline's 50th birthday came from the paintwork experts at Lufthansa Technik in Hamburg. With 150 kilograms of paint and immeasurable craftsmanship, they converted the Airbus A321 D-AIRX into the Lufthansa jubilee "Retro-Jet". Painted in the traditional Lufthansa livery of the late 1950s and early 1960s, "Romeo X-Ray" drew all the looks.

It was formally unveiled on the occasion of the 50th anniversary of the opening of the Technik Base in Hamburg; the ceremony, held at the base on 31 March, was attended by 1,500 high-ranking guests, including the Chairman of the Executive Board of the Lufthansa Group, Wolfgang Mayrhofer, and the retired Federal Chancellor of the Republic of Germany, Helmut Schmidt.

The A321 in its jubilee livery flew the historic route of Lufthansa's first flight on 1 April, 2005, the 50th anniversary of the airline commencing operations. The journey with the special flight number of LH 1955 proceeded from Hamburg via Munich to Düsseldorf, accompanied by celebrations at each airport along the route.

The following day, Lufthansa Technik proved itself once again to be a good host, with 15,000 past and present Lufthansa employees and their family members invited to celebrate the 50th birthday of their airline at the Hamburg base. There were also big jubilee celebrations in the Lufthansa Technik hangars in Berlin-Schoenefeld, Frankfurt, Cologne, and Munich.

The largest maintenance hangar in Asia at the time, with space for up to four A380s at once, opened its doors in March 2008, just two months after the Lufthansa Technik A380 hangar in Frankfurt, designed by Hamburg's star architects, Gerkan, Marg und Partner.

### **Lufthansa's A380 era begins**

The highlight of the year 2010 was the excitedly awaited handover of the first A380-800 to Lufthansa. Lufthansa staff around the globe were looking forward to this event with anticipation. At Lufthansa Technik, the team responsible for the introduction of new aircraft models had prepared diligently for the upcoming Entry into Service. Lufthansa Technik had already received Part 145 Approval from the European Aviation Safety Agency, EASA, for its A380 Line and Base Maintenance programs; then, in April 2010, the maintenance experts conducted a "Docking Fit Check" of the functionality of the new facilities in the Frankfurt A380 hangar with an A380 from the Airbus test fleet. As expected, the tail dock fit perfectly beneath the 24-meter high tail of the huge Airbus. This is just one of many examples of how Lufthansa Technik's experts left nothing to chance in preparing for the introduction of the A380.

The moment finally arrived on 19 May, 2010. The Chairman of the Executive Board of Lufthansa, Wolfgang Mayrhofer, took delivery of the first Lufthansa A380 from Airbus President and CEO Tom Enders at a formal delivery ceremony. The handover could never have taken place on time without the efforts of Lufthansa Technik personnel, who supported the Airbus team over a period of six months with 24,000 man-hours, working on the cabin fittings. Thanks to this dedication, the Lufthansa Technik engineers in the Aircraft Production

Inspection division were able to give the green light for delivery of D-AIMA to Lufthansa for passenger operations when they conducted their final pre-delivery inspection.

The Lufthansa Technik team's dedication and detailed preparation for the introduction of the A380 paid off in the first few weeks after D-AIMA entered service in the form of an extraordinarily high reliability rate. The aircraft shone in the first ten weeks of scheduled operations, commuting between Frankfurt and Tokyo, with a one hundred percent technical dispatch reliability rate. In October 2010, Lufthansa declared the "A380 Entry Into Service" project successfully completed. At this point, A380-related activities within the Group were transferred to the individual divisions within the Group's companies.

### **Facelift for the "Queen of the Skies"**

In June 2012, when Lufthansa launched scheduled services between Frankfurt and Washington D.C. with a Boeing 747-8, it was much more than a conventional maiden flight. Over the decades, the legendary "Jumbo Jet" had been continuously enhanced and improved through close cooperation between the manufacturer and the Lufthansa Technik engineers, with their specialist know-how, on a scale unmatched by any other aircraft in the fleet. Boeing's legendary engineer, Joe Sutter, honored this achievement at the launch of the 747-8. He is considered to be the "father of the jumbo" and was part of Boeing's 747 program from the very beginning in the 1960s.

Sutter reflected on the foresight, dedication, and passion of the leading Lufthansa Technik engineers, Reinhardt Abraham and Juergen Weber, played a significant role in making the 747-400 the best-selling version

of the jumbo. The cooperation and trust continued with the design of the 747-8, which was once again optimized for economical flight operation on the basis of input from the expert departments at Lufthansa's passenger operations and Lufthansa Technik.

The close cooperation between Boeing and Lufthansa began as early as 1960. The long-term partners commemorated this beginning of their partnership in May 2010 in a joint celebration at the Lufthansa Technik base in Hamburg. Beginning with the legendary Boeing 707-430 "Jet Intercontinental", replacing the "Super Constellation" and "Super Star" propliners in Lufthansa's long-haul network starting in the spring of 1960, the German airline ordered many Boeing models and was also directly involved in the development of numerous Boeing aircraft. The most outstanding example is the legendary Boeing 737.

### **Products for the "Dreamliner"**

The maintenance costs for the 747-8 are significantly lower than those for the previous model, thanks to the newest aluminium alloys with improved corrosive properties and weight advantages. But whole new dimensions of efficiency were opened up by Boeing's engineers when they developed the concept for the 787 "Dreamliner". As the first wide-bodied jet with a fuselage structure constructed for the most part of lightweight carbon-fiber composite materials, the newest Boeing model offers not just lower fuel consumption, but also lower maintenance costs in comparison to previous models. The intervals between prescribed checks are longer, and the effort involved in maintenance operations is lower, when compared to conventional aircraft models with aluminium structures. ►



A very special birthday present: an A321 painted in retro design.



The new Lufthansa flagship Boeing 747-8 "Intercontinental".



This aerial view illustrates the huge difference in size between the vintage Junkers Ju 52/3m of Deutsche Lufthansa Berlin Foundation and a brand new Airbus A380 megaliners.



Former German chancellor Helmut Schmidt was always a keen supporter of the aviation cluster in Hamburg – home to LHT.



Offering innovative products, like those for the outfitting of VIP jets with an exclusive ambience is an important part of the LHT service portfolio.

## The History

### Global expansion

#### Lockheed „Super Star“ The Return of a Legend

Throughout its 65-year history, Lufthansa has always deployed the best aircraft available at the time – those aircraft that are most comfortable for the passenger and the most economically viable. But only a very few of these aircraft have gone on to become airborne legends. The Lockheed L-1649A “Super Star” is one of them. At the end of the 1950s, it was the fastest and most comfortable way to travel from Germany to the USA. But it was the luxurious fittings that made it a legendary symbol of the “Golden Age of Flight”. An exclusive Lufthansa First Class cabin with 32 seats, an elegant on-board lounge, and comfortable beds for night flights made the plane unforgettable for those who could afford to make the journey between the Old and New Worlds on a “Super Star”. The aircraft acquired a cult status thanks to its famed luxury and the gracious lines which won admiration wherever it landed.

A total of 44 Lockheed L-1649A aircraft were manufactured in Burbank, California, in 1956 and 1957. The “Super Star” was simultaneously the technological high point and the grand finale of the age of long-haul flight with piston engines. Built immediately before the dawning of the jet age, it was the product of the entirety of technological expertise and know-how in the construction of aircraft. For Lufthansa, the jet age began on 2 April, 1960, with the Boeing 707-430. Where early Constellation series aircraft had already prepared the way for global aviation, the L-1649A, with its extreme range of up to 11,300 km, genuinely opened up new horizons. With this plane, long-haul

routes such as Hamburg-New York could, for the first time, be covered with a full load without refueling stops along the way.

Just four L-1649A aircraft had survived the decades since their commercial demise when Lufthansa got news, in the autumn of 2007, that three examples of the legendary “Super Star” were up for auction. In December 2007, it all came together. The Lufthansa Berlin Foundation (DLBS), entrusted with safeguarding Lufthansa’s airborne legacy, successfully bid for the former Lufthansa flagship with the registration number D-ALAN in Florida along with two former aircraft from the Trans World Airlines (TWA) fleet that had spent the last decades parked at the regional airport of Auburn-Lewiston in the US state of Maine. The expectation was no less than the restoration of one of the three Lockheed L-1649A machines and having it once again licensed as a regular commercial aircraft for the transportation of paying passengers. This was the beginning of an ambitious project, the likes of which the world was yet to see.

#### The technology of today for the Super Star of tomorrow

Immediately after the purchase of the three Lockheed L-1649A aircraft, Lufthansa Technik was commissioned by DLBS to restore one of the three propellers to a point of airworthiness. The choice fell to N7316C, originally built in 1957 for TWA. This aircraft had the most solid technical platform of the three, making it the most suitable for the extensive restoration process. As a maintenance provider and approved development organization active on a global scale, Lufthansa Technik was predestined for the implementation of the compre-

hensive program, which demanded extensive work at the heart of the airframe.

The first step was to put a framework in place that made this work possible, and so Lufthansa Technik rented a maintenance hangar at Auburn-Lewiston Airport. The small regional airport was home to the two best preserved L-1649A aircraft, but neither of them was airworthy at the time, so that one of them would have to be overhauled on site. The opening of the hangar, tailored for the “Super Star”, in November 2008 was effectively the official beginning of the comprehensive maintenance, restoration and conversion program. The corrosion and cracking in many areas of the airframe, in particular the fuselage, was so severe that large sections had to be constructed from scratch.

Whether it was the production of bulkheads, the overhaul of the undercarriage, or spot welding of door elements, time and again, the Group’s specialists and engineers proved their outstanding skills as the “Super Star” project took its course. A prime example of this pool of knowledge within the Lufthansa Technik Group was the team sent to Auburn from Lufthansa Technik Budapest, occupied primarily with the production of fuselage panels. For a long time, the essential production of new, extremely complex components presented an unsolved problem that threatened to delay the entire project. But then an employee of Lufthansa Technik Budapest offered his help and showed himself to be a true virtuoso in his field. Within just a few weeks, he produced the structures that had previously seemed almost impossible, and did so whilst fulfilling all the strict requirements of the project engineering team and of the American FAA.





In 2010, Lufthansa and Boeing celebrated 50 years of collaboration at the Lufthansa Technik base in Hamburg.



N3 Engine Overhaul Services starts as a joint venture between Rolls-Royce and Lufthansa Technik.



Lufthansa Technik built a dedicated hangar at Frankfurt Airport for the technical servicing of not only the Lufthansa A380 fleet.

Lufthansa Technik prepared thoroughly for the market launch of the Boeing 787 in September 2011. In 2012, the company signed ten-year contracts with two customers for TCS Total Component Support for 787 components. Furthermore, since 2013, Lufthansa Technik has been the first MRO provider worldwide to offer airline and VIP customers an "Aircraft Production Inspection Program" for the 787 directly at the manufacturer's site.

### Racing into the markets of the future

The Lufthansa Technik Group has traditionally benefited from a unique

pool of employee competence; the continuous growth of the network at new locations in selected future markets saw this pool extended further. Already in 2005, Lufthansa Technik announced the expansion of its portfolio for existing subsidiaries and holdings in Manila, Shenzhen, Kuala Lumpur, Beijing, and Malta.

The new A380 maintenance hangars for Ameco in Beijing and Lufthansa Technik in Frankfurt, along with the establishment of the N3 Overhaul Services joint venture with Rolls-Royce for the overhaul of Rolls-Royce Trent engines, were further indicators of Lufthansa Technik's global expan-

sion in the field of high-tech products. Brand new locations were established in Hyderabad, India; in Domodedovo, Russia; and in Bulgaria with Lufthansa Technik Sofia.

As Lufthansa Technik began the 2008 financial year, the commercial environment could not have been worse. The global banking and financial crisis, which had begun in the summer of 2007 as a regional real estate crisis in the USA, was threatening to derail the global economy.

The situation became even more dramatic in September 2008 when the major US bank Lehman Brothers collapsed. ►



### Technological Leap

In the field of aviation, the year 2009 was defined by technological change. Symbolically, Lufthansa retired a piece of aviation history on 1 July with the final turnaround for an Airbus A300-600. At an emotional ceremony in Lufthansa Technik's Hangar 5 in Frankfurt, many members of the Lufthansa family, including numerous Lufthansa Technik personnel, bid farewell to this aircraft model, so cherished by the maintenance crews.

Between the introduction of the first Lufthansa A300-600 in March 1997 and this retirement, the fleet covered a distance equivalent to flying around the globe 8,560 times. The retirement of the last A300-600, D-AIAM, also marked the end of the era of the first Airbus generation for Lufthansa, which had begun in 1976 with the commissioning of an A300B2.

With continuous enhancement throughout the lifetime of the series, and equipped with the first generation of innovative glass cockpits, the A300-600 and its "little sister", the A310, prepared the way for the modern, largely automated high-tech cockpits. The Airbus A310 itself was constructed according to specifications provided by, and with the active support of, the engineers at Lufthansa Technik.

The domino effect saw other financial institutions around the world drawn in as a financial maelstrom unfolded. The German banking sector was not immune. A recession was imminent for the coming years in the leading industrial nations, posing great challenges for Lufthansa Technik's management.

Nevertheless, in 2008, thanks to moderate expansion of capacity, a modern product portfolio, economical locations, and numerous cost-saving and efficiency-enhancing programs, the Lufthansa Technik Executive Board, led by August Wilhelm Henningsen, actually managed to achieve an increase in both turnover and profit over the previous year's figures. Operating profit, at 299 million euros, was two percent higher than the year before. Notwithstanding the crisis that was taking shape, Lufthansa Technik managed to sign 500 new contracts, including the renewal of the German Federal Government's long-haul fleet.

With a comprehensive investment program, Lufthansa Technik made its Hamburg site ready for the future in 2008. An overhaul center was built for CFM 56 and V2500 engines, and the new five-storey building for the Innovation Division took shape. The 6,500-square-meter facility includes offices, laboratories, workshops, a special 3D presentation room, and a so-called "Qualification Lab", where the very latest test rigs explore and assess the airworthiness of new products.

The Technology Projects division, established in April 2009, saw Lufthansa Technik bundling all of the company's research & development activities in a single department. In the same year, the newly created division oversaw the intensification of cooperation with universities and SMEs. The importance accorded to this investment in the future by Lufthansa Technik's management can be seen in the provision of an R&D budget in 2010, a first in the history of the company.

### A network on the move

In response to the changes occurring in the aviation industry, Lufthansa Technik Philippines (LTP) marked the 10th anniversary of its establishment with the announcement of a new product tailored for low-cost airlines with special ground times. The product was not only targeted at Asian customers. Thanks to this new product, LTP was able to further expand its position as the most important operation within the Lufthansa Technik Group for the overhaul of long-haul Airbus jets with a new, forward-looking business segment. Another Lufthansa Technik subsidiary, BizJet International, repositioned itself in the market, in this case in North America. Originally specializing in smaller business jets, BizJet became a Completion Center for narrow-bodied aircraft in the Boeing Business Jet (BBJ) and A318 "Elite" ranges. The company, based in Tulsa, Oklahoma, thus became an important element in Lufthansa Technik's global VIP business network.

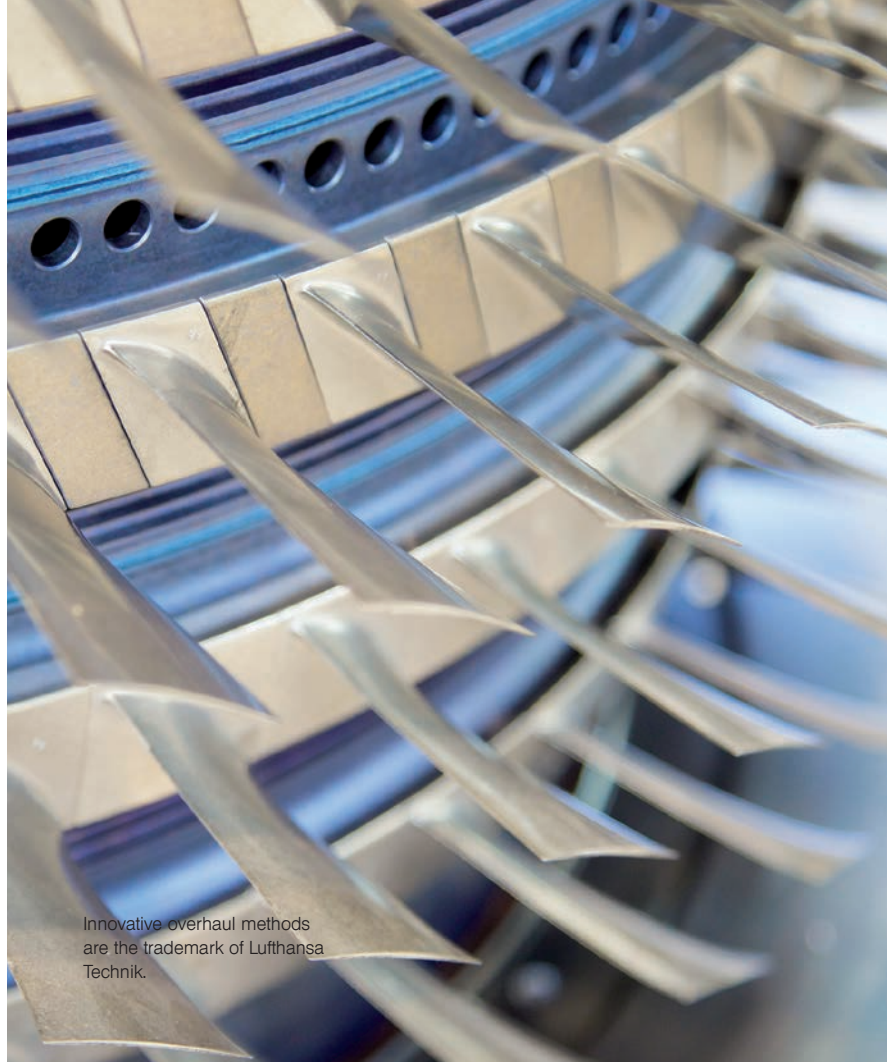
Consolidation was the plan for Shannon Aerospace and Lufthansa Technik Switzerland in 2010. The Irish subsidiary's declared goal was to reduce costs and to secure the future of the company, whilst the Swiss branch aimed to rejuvenate its product palette in the narrow-body VIP and business aircraft sector by means of personnel changes and a restructuring. The component supplier Spairliners saw its order books filling, providing components for 16 Airbus A380 aircraft from its Hamburg operation in 2010. Renewed construction work at the Lufthansa base in Hamburg heralded the preparations for a future of positive expectations. At the workshops for undercarriage, components, and engines, modernization and expansion was underway across the site.

Lufthansa Technik had started the new decade well and was cutting a fine figure with positive news all around the globe. In February 2012, Lufthansa Technik Philippines opened its third hangar for wide-bodied aircraft, facilitating support for Airbus A380 megaliners. The number of workshop positions for aircraft in the hangars at Lufthansa Technik Sofia more than doubled from two to five. The staff of more than 600 was now in the position to carry out more than 60 overhauls per year. And on the other side of the Atlantic, in Tulsa, Oklahoma, Lufthansa Technik Component Services announced a significant expansion of its portfolio of technical services for aircraft components, focussing on the North American aviation market.

Consolidation and expansion were the buzzwords of 2013. The closure of Lufthansa Technik Switzerland and Lufthansa Technik Airmotive Ireland were counterbalanced by expansion of capacity at future-oriented locations. The overhaul capacity was further expanded at Lufthansa Technik Malta, Lufthansa Technik Budapest, Lufthansa Technik Shenzhen, and Lufthansa Bombardier Aviation Services in Berlin.

### **Puerto Rico: Expansion in America**

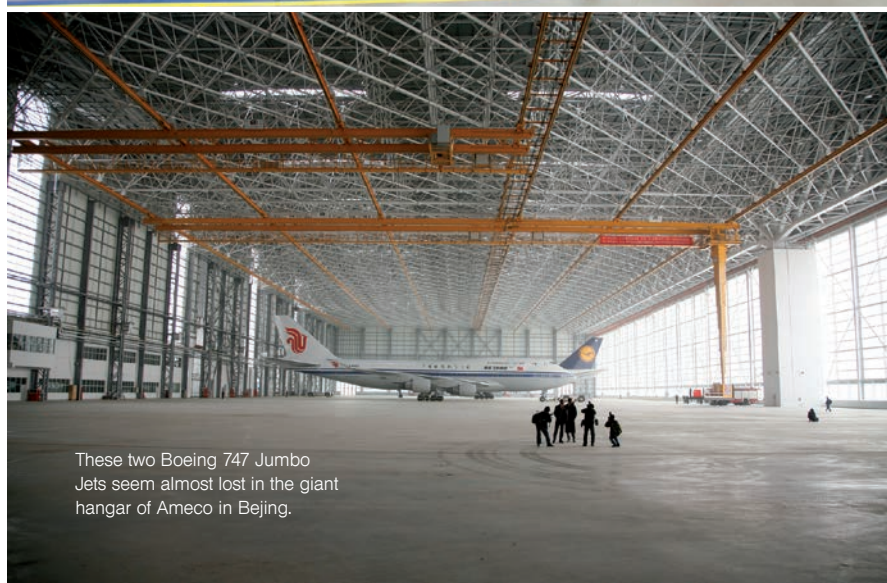
The growth of the Lufthansa Technik Group in 2014 was best characterized by the groundbreaking ceremony for the construction of the new Lufthansa Technik Puerto Rico (LTPR) overhaul site on 13 November. Five overhaul lines will enter operation in 2015 for maintenance operations on the Airbus A320 range of aircraft. Lufthansa Technik could already present two initial customers for LTPR when building work on the hangar complex was just beginning: JetBlue and Spirit Airlines. ►



Innovative overhaul methods are the trademark of Lufthansa Technik.



Ultra-modern: The new engine overhaul center in Hamburg.



These two Boeing 747 Jumbo Jets seem almost lost in the giant hangar of Ameco in Beijing.

## The History

### Global expansion

Lufthansa Technik selected Puerto Rico as a location because it eases access to the world's largest aviation market in many different ways. The Lufthansa Technik Group's many years of experience with the A320 range, quick processing times, high quality, and competitive prices – combined with short distances to customers – make the Caribbean island of Puerto Rico, belonging to the United States, a promising new site for the Lufthansa Technik Group.

### Growing with the market and providing innovative products

The Lufthansa Technik Group is starting 2015, the twentieth year of its history, with a clearly defined goal. The company, Lufthansa Technik AG, was established on 17 October, 1994, and commenced operations on 2 January, 1995. In these twenty years, Lufthansa Technik has continually strived for a leading role in the global market for technical aviation services.

"Grow into the Future" was the name given to the strategy, presented in 2014, with which Lufthansa Technik aims to firmly establish its position as global market leader in the period 2015 – 2019. This – in a market that is characterized by ever more intense competition as original equipment manufacturers join the fray, especially in the engine and component areas – can certainly be called ambitious.

Lufthansa Technik plans to respond to these challenges by leading the industry in terms of products, performance, innovation, and cost. The aim is to increase turnover from the five billion euros of 2014 to eight billion dollars by 2018. This is only possible if the Lufthansa Technik Group can increase its growth beyond the annual average of 4.5 percent for the global MRO market. One pillar of this strategy is to offer innovative products for new aircraft models and high-tech engines.

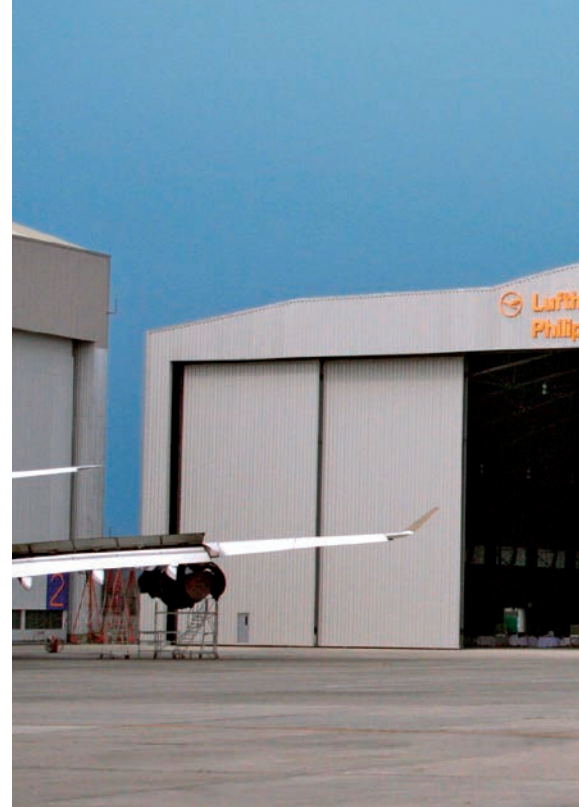
### High-tech jets of the future

In September 2013, the Lufthansa Supervisory Board gave the green light for the largest aircraft order to date in the history of the airline. The package encompassed a total of 34 Boeing 777-9X and 25 Airbus A350-900 aircraft, with delivery planned to commence in 2016. The A350-900 and 777-9X have a fuel consumption of just 2.9 liters of kerosene per passenger per 100 kilometers, so that Lufthansa is calculating for a significant reduction in fuel consumption of 25 percent compared to the aircraft in deployment at the time the order was placed.

The Lufthansa Group also have high expectations of the newly developed A320neo range. With around 15 percent lower fuel consumption than previous models, and noise emissions approximately 10 to 15 dB below the threshold values in place since September 2014, the 'neo' version of the best-selling Airbus A320/321 is intended as the future pillar of inner-European traffic for the Lufthansa Group. At the time of the maiden A320neo flight on 25 September, 2014, there were already 115 examples of the series with the Lufthansa Group's name on them on the Airbus order books.

Within the framework of these new aircraft orders, placed by Lufthansa Group airlines, agreements had been reached between Lufthansa Technik and Rolls-Royce, Pratt & Whitney, and General Electric, giving Lufthansa Technik access to the new engine products.

Although it has not yet been ordered by Lufthansa Group airlines, the latest version of the Boeing 737, an aircraft inspired and initiated by Lufthansa, is very much in the focus of Lufthansa Technik. The first 737 MAX, a direct competitor of the A320neo range, is due to set off on its maiden flight in 2016. By the end of 2014, 55 customers had already placed



Lufthansa Technik Puerto Rico: Setup of a new location in record time.



orders for a total of more than 2,500 of the new aircraft. This is motivation enough for Lufthansa Technik to incorporate the 737 MAX and its high-tech engines in the company's future product and service portfolio.

### The dawn of the A350 era

Lufthansa as an airline will take delivery of its first A350 in November 2016, but for Lufthansa Technik, the A350 era already began in 2014. Right on time for the delivery of the first aircraft to Qatar Airways, Lufthansa Technik was

Lufthansa Technik Puerto Rico started operations in July 2015. The company, wholly owned by Lufthansa Technik is specialized in the overhaul of Airbus A320 family aircraft.



Ground braking for the new facilities in Puerto Rico.



**Dr. Johannes Bußmann**

When I became CEO of Lufthansa Technik in spring 2015, the company presented itself, in a highly competitive environment as the globally leading provider of MRO services. But we will not rest our laurels in this rather comforting starting position. Our “grow into the future” strategy will not only retain, but further strengthen this leading role. By global growth, far above the growth rates of the competition, we will secure our leading role as number one of the industry well into the future.

We are excellently positioned for this task with a highly motivated, extraordinarily well qualified and globally set up team. With innovative, market orientated products that our innovations team developed to a large extent in house. With short turn-around times at strategically positioned sites located in growth markets. And a strict cost management, guaranteeing our attractiveness from a price perspective.

This strategy is the clearly defined path of Lufthansa Technik to be the prime choice of customers and first class employees alike, even in the next decades to come.

*Since March 2015, Dr. Johannes Bußmann has taken over the position of CEO to Lufthansa Technik. He previously held different executive positions within the company.*

ready with a broad range of services for the new aircraft model. The portfolio encompasses production monitoring, support in the commencement of flight operations, material supply, maintenance, maintenance management, and engineering services. IT management represents a particular area of focus, as the aircraft and maintenance systems are even more closely networked than is the case for conventional models.

For Qatar Airways, Lufthansa Technik's first A350 customer, the preparations for A350 Line Maintenance began long before the aircraft entered service

at the start of 2015. Lufthansa Technik personnel prepared themselves for Day X in Germany, at the manufacturer's site in Toulouse, and at the Qatar Airways base in Doha. When, on 15 January, 2015, a Qatar Airways A350 touched down for the first landing in Frankfurt am Main, the Lufthansa Technik Maintenance International team was as ready as could be. Right on time for the Qatar maiden flight to Frankfurt, Lufthansa Technik had received maintenance approval for the Airbus A350 from the European Aviation Safety Agency, EASA. ►

## The History

### Global expansion

The commitment to new aircraft models was accompanied by an expansion and deepening of cooperation with the major original equipment manufacturers (OEMs) of engines, generators, and systems for modern and future aircraft.

Lufthansa Technik has signed cooperation agreements with more than ten important manufacturers of systems for the Airbus A350 and Boeing 787 and 777X aircraft since 2012. These agreements grant the company, amongst other things, long-term access to technical data relevant to MRO services and often subject to restricted availability.

The significance of some major manufacturers is increasing, particularly for the new aircraft models, as they take on the role of systems integrators for Airbus or Boeing. New cooperative models make it possible for Lufthansa Technik to position itself as a technical service provider with a comprehensive portfolio for the very latest aircraft and engine models. The vast technological expertise and global configuration of the Technik network make the MRO provider a recognized and valued partner, able to secure long-term access to the latest technologies and thereby to growth markets.

### Funding innovation projects

Complementing the focus on new aircraft models and on high-tech partnerships with OEMs is the announcement by Lufthansa Technik in 2014 of a four-year investment program for innovation projects, amounting to 200 million euros. The focus of the investment program is on new products, services, and technologies, which will allow Lufthansa Technik to maintain and extend its leading position in the industry.

The coordination of the diverse range of innovation projects was assigned to

the newly established division, Corporate Innovation Management & Product Development. This division funds, coordinates, and guides technology and product development projects across the corporation and has responsibility for the central innovation budget. The creation of standards and processes for innovation management and for the further development of the corporation's Innovation and Technology Roadmap also falls within the remit of the division.

Technology scouts identify relevant trends in the industry, which are then presented to an interdisciplinary innovation committee. The committee assesses the suggested projects in terms of market potential, customer advantage, anticipated commercial feasibility, practicability, and strategic benefit for Lufthansa Technik. Only when a project idea has overcome this hurdle is it then implemented in decentralized innovation teams in the product divisions. In this way, Lufthansa Technik ensures that it always offers its customers the right product, at a saleable price and at the right time. The overwhelming majority of these innovations are directed at new and improved maintenance, repair, and logistics processes for current and future aircraft and engine models and at products in the VIP & Executive Jet Solutions field.

In 2015, Lufthansa Technik is entering its third decade with innovative products and with highly qualified and motivated personnel at its sites around the globe. The early indicators are very positive, pointing to Lufthansa Technik, led by the new Chairman of the Executive Board, Dr. Johannes Bußmann, not just maintaining, but further extending its leading position as a global MRO provider in its third decade



### Progress made by Lufthansa Technik – Part 3

**CAIRE.** The “CAIRE” repair procedure, for mobile deployment on CFRP materials, makes use of a mobile robot with the necessary software to recognize damage and mill the damaged material out. The new part is then manually inserted, glued and cured in the 3D mounting surface created by the robot.

**Laser CWR Coating** The procedure for extending the life of 3D high-pressure compressor blades on aircraft engines results in a long-term increase in engine efficiency. The damaged blades are processed at the periphery using laser welding guided by adaptive CNC; after this, they are refinished with adaptive milling and then a special coating is applied. A single step suffices to restore the original geometry and essential chord length of the blades.

**TCD – Thermographic Crack Detection** MORFI the robot (**M**obile **R**obot for **F**uselage **I**nspection) crawls over metallic aircraft fuselage structures, rapidly inspecting them for cracks. Using vacuum pads, the robot, which is equipped with a thermographic inspection unit, can even navigate vertical and overhanging parts of the fuselage.

**Multifunctional Coating** is researching new aircraft surface coatings with more aerodynamic microstructures patterned on the fine ridging of shark skin (“riblets”). The findings have demonstrated both the stability of the material and the “riblet” structure and their sustainable economic viability. This represents the birth of an innovative painting system to reduce air resistance.



An outstanding example of the extraordinary engineering expertise, creativity, and motivation of Lufthansa Technik personnel was the conversion of a Lufthansa airliner to an evacuation aircraft for highly infectious patients, commissioned by the Federal Government in autumn 2014. Just nine weeks after the order was placed, Lufthansa Technik delivered the Airbus A340-400 to the Federal Foreign Office. In this short time, the VIP & Executive Jet Maintenance division's employees converted the former Lufthansa airliner bearing the name "Villingen-Schwenningen" into the "Robert Koch", an evacuation aircraft for the Federal German Government equipped with three quarantine units. Once the planning work was complete, the modification itself was completed at the Lufthansa Technik base in Hamburg in just ten days!



## The History

The Technik Group

Following is a list of Lufthansa Technik subsidiaries by name and location with their leading products, their relationship to Lufthansa Technik, and the dates when they joined the Lufthansa Technik Group.

### Line and Heavy Maintenance

**Ameco Beijing (China).** Asia's biggest MRO service organization with almost 4,000 employees; overhaul of Airbus and Boeing aircraft up to D-Check of the 747-400. Joint venture with Air China; 40%, founded 1989.

**Lufthansa Technik Shannon (Republic of Ireland).** Europe's leading short-haul aircraft maintenance organization, mainly A320-family and Boeing 737. 100%-owned by Lufthansa Technik.

**Lufthansa Technik Philippines (Manila).** Fast-growing maintenance and overhaul base; specializes in the A330 and A340. Joint Venture with MacroAsia; owned 51% since 2000.

**Lufthansa Technik Brussels (Belgium).** Maintenance to A-Check for Boeing 737 and Airbus A320 family; owned 100% since 1999.

**Lufthansa Technik Budapest (Hungary).** Overhaul to D-Check of the Boeing 737 and Airbus A320 family. Joint venture with Hungarian airline Malev; owned 85% since 2000.

**Lufthansa Technik Malta (Luqa).** Line and Base Maintenance for Boeing 737, Airbus A320 and A330/340 families. Joint venture with Air Malta; Lufthansa Technik owns 92%.

**Lufthansa Technik Sofia.** Founded in the late summer of 2007 and opened in October 2008, Lufthansa Technik Sofia (LTSF) is a joint venture company between Lufthansa Technik (75.1%) and the Bulgarian Aviation Group (24.9%). The Bulgarian company specializes in the maintenance, repair and overhaul of narrowbody aircraft in the Airbus A320 and Boeing 737 families.

**Lufthansa Technik Maintenance International (Frankfurt).** Offers maintenance services and technical support for international airline customers. Wholly-owned by Lufthansa Technik.

**Lufthansa Technik Puerto Rico.** Established in February 2014, Lufthansa Technik Puerto Rico (LTPR) is a wholly-owned subsidiary of Lufthansa Technik. The Puerto Rican company specializes in MRO services for Airbus A320 aircraft. In July 2015 the company inaugurated its approximately 20,000 square meter facility in Aguadilla.

### Engines

**Lufthansa Technik AERO (Alzey, Germany).** Overhaul of engines for smaller commercial aircraft and auxiliary power units; owned 100% since 1995 (founded 1987).

**Lufthansa Technik Turbine Shannon (Republic of Ireland).** Repair of turbine blades and other components for CF6 and CFM56; owned 100% since 1996.

**Airfoil Services (Kuala Lumpur, Malaysia).** Repair of turbine blades. Joint venture with MTU; 50% ownership since 2003

**Lufthansa Technik Intercoat (Kaltenkirchen, Germany).** Repair of high-tech coatings, especially for engines. Joint venture with the Interturbine Group; 51% ownership since 2001.

**N3 Engine Overhaul Services (Erfurt, Germany).** A service center for the Trent engine family, in operation since 2007. Joint venture with Rolls-Royce; 50% share.

**BizJet International (Tulsa/Oklahoma, USA).** Overhaul of Rolls-Royce Spey Mk 511-8 and Tay Mk 611-8 engines powering business jets. 100% owned by Lufthansa Technik.

### Components and Parts

**HEICO Aerospace (Hollywood/Florida, USA).** One of the largest independent manufacturers and developers of engine parts; 20% share since 1997.

**Lufthansa Technik Logistik Services (Hamburg, Germany).** This company was formed by separation from Lufthansa Technik's materials management activities; it has developed rapidly to become one of the world's biggest specialists for fast supplies of airline spare parts; 100%-owned since 1988.

**Hawker Pacific Aerospace (Sun Valley/California, USA).** Leading provider of landing gear services with a branch in London; owned 100% since 2000.

**Lufthansa Technik Component Service (Sun Valley/California, USA).** Full equipment service including repair and logistics for customers in the USA; owned 100% since 1999.

#### **Lufthansa Technik Shenzhen (China).**

Repair of thrust reversers and other compound material components. Joint venture with two Chinese partner companies; 70% share since 2000.

**Spairliners (Hamburg/Paris).** Repair and logistics for Airbus A380 components. Joint venture with Air France, 50% share, established 2005.

**Lufthansa Technik Landing Gear Services UK** is an international MRO service provider based in London, UK. Originally founded as Hawker Pacific Aerospace and renamed by Lufthansa Technik AG in March 2011, the company has specialized in the maintenance of landing gears and related components.

#### **Business Jets**

**Lufthansa Bombardier Aviation Services (Berlin-Schönefeld, Germany).** Maintenance and overhaul of business and smaller transport aircraft. Joint venture with Bombardier and ExecuJet; owned 51% since 1997.

#### **Weitere Service-Unternehmen**

**Lufthansa Technical Training (Hamburg/Frankfurt, Germany).** Training and qualification of service personnel for all types of aircraft operation, especially for many external customers; owned 100% since 1995.

**Lufthansa LEOS (Frankfurt, Germany).** Ground services such as crew transport, aircraft tugs and special tools required for ground services; owned 100% since 1995.

**IDAIR.** Established in April 2011, IDAIR is a joint venture of Lufthansa Technik (50 percent) and Panasonic Avionics Corporation (50 percent). The company specializes in the development, manufacture and sale of in-flight entertainment and communications and cabin management systems.

**Lumics GmbH & Co. KG,** established in autumn 2013 as a 50-50 joint venture of Lufthansa Technik and McKinsey & Company, is specialized in providing consultancy services for industrial manufacturing and production companies.

**INAIRVATION,** established in spring 2014, is a 50-50 joint venture of Lufthansa Technik AG and LIST components & furniture GmbH from Austria. The company bundles the expertise of the world's leading cabin modification and on-board entertainment electronics development providers with the experience of a leading manufacturer of exclusive interior fittings for private and executive jets, luxury yachts, cruise ships, and luxury residences.





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