

# Fraunhofer

2 / 19 special  
issue magazine

# 70 YEARS OF FRAUNHOFER 70 YEARS OF FUTURE *#WHATSNEXT*

**The story of the Fraunhofer-Gesellschaft**  
From beacon of hope to innovation engine



70 YEARS OF  
FRAUNHOFER  
**70 YEARS  
OF FUTURE**  
*#WHATSNEXT*

# Foreword

Our Basic Law has been in place for 70 years. For those 70 years, it has guaranteed the freedom of science in Germany. And the Fraunhofer-Gesellschaft has known how to put this freedom to good use for 70 years – for the benefit of all society.

From mp3 and LED technology to artificial cartilage, Fraunhofer stands for revolutionary inventions that make our lives easier. The former pioneer of applied research has grown to become Europe's largest organization for applied research. Its impact extends far beyond the direct benefit it brings to customers: The Fraunhofer Institutes' research and development efforts contribute to the competitiveness of the region, Germany and Europe.

With its clear focus on key future-minded technologies, Fraunhofer is a protagonist of the innovation process in Germany and Europe. Fraunhofer has become an engine of innovation for our economy. And it is this great capacity for innovation that makes our economy such a powerhouse, the fourth strongest in the world.

Long may this continue. I hope the Fraunhofer-Gesellschaft will carry on exploring new avenues to ensure that research outcomes and new technologies reach the industry and society, quickly and efficiently. I look forward to many more results from the Fraunhofer-Gesellschaft's research and development efforts; results that will benefit mankind and secure Germany's position as a hub of business.

On this 70th anniversary, I wish Fraunhofer brilliant new ideas, an intrepid spirit of scientific inquiry and a feel for the next breakthrough innovation.



Anja Karliczek  
Member of the German Bundestag  
Federal Minister of Education and Research



# Content



14

1968 - 1974

**Conflicts, the rebuild and the invention of the Fraunhofer model**

The Fraunhofer-Gesellschaft is restructured. It opens and becomes a ray of hope for the German economy.

30

1983 - 1993

**Growth and reunification**

After thoughts of consolidation, the reunification creates unexpected opportunities for expansion.



1968

1989

1949

1974



06

1949 - 1968

**New start and hurdles**

Post-war Germany: While children play in ruins, courageous pioneers found the Fraunhofer-Gesellschaft.



22

1974 - 1983

**Awakening and revival**

The rebuild of the Fraunhofer-Gesellschaft is complete. The alignment to market-oriented research under contract is driven forward. Fraunhofer reacts to the oil crisis and oil price shock.



48

**2002 - 2012**  
**Innovation offensive and research on behalf of the future**  
 Innovation has become synonymous with a company's ability to survive. Fraunhofer identifies perspectives for new future markets.



70

**70 years of Fraunhofer**  
**70 years of future**  
 Fraunhofer looks back at its achievements so far and, above all else, looks forward.

2002

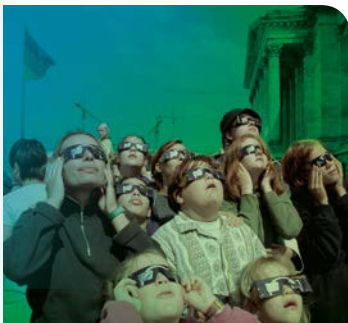
2019

1993

2012

38

**1993 - 2002**  
**Innovation drivers and internationalization**  
 Increasing income in a sustainable manner returns to the agenda. The Fraunhofer-Gesellschaft's profile is honed. The process of becoming more international begins.



58

**2012 - 2019**  
**Scientific excellence and springboard innovations**  
 With the declared intention to continue growing in a controlled and sustainable manner and to identify new areas and markets, Reimund Neugebauer takes office as president of the Fraunhofer-Gesellschaft.



1949 – 1968

# New start and hurdles



The early days were arduous for the fledgling Fraunhofer-Gesellschaft, with established science organizations and government regulations making life difficult for its researchers. In the post-war years, Germany's public funding was earmarked mainly for fundamental research. Applied research started to gain traction in Germany in the early 1950's when the wave of market-centric contract research in the USA spilled over to Europe. The Fraunhofer-Gesellschaft began to look beyond fund-raising to support its research projects. And when it set up institutes of its own, it cemented its foothold in Germany's science community.

On Saturday, March 26, 1949, 210 scientists, businesspeople and politicians gathered in the Bavarian Ministry of Economic Affairs' conference hall at the invitation of State Secretary Hugo Geiger. They were there to witness the founding of the Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V. (Fraunhofer society for the promotion of applied research). This was a matter of urgency for Geiger who felt that "there has been a lack of support for applied research by way of a direct and permanent link between business and science." The Nazis, the war and the ensuing devastation had taken a toll on science. Thousands of scientists and engineers emigrated after the war. Germany had forfeited its lead in many areas of science and technology. This gap had opened up for a lack of qualified scientists, but not only for that. Governmental restrictions also stifled industry-centered research – particularly developments with potential military applications. The vigilant scrutiny of a scientific research monitoring unit at the Bavarian Ministry of Economic Affairs and other watchdog organizations made sure of that.

The expectations of the Fraunhofer-Gesellschaft's founding fathers diverged. While Hugo Geiger hoped it would drive the industrialization of Bavaria, at that time still a bit of a business backwater, others had but one concern – they sought to exploit local mineral resources, particularly uranium. Even at this early stage, still other founding members were already dreaming of a major nationwide research enterprise.

The renowned nuclear physicist and Munich University rector Walther Gerlach was elected president and Hugo Geiger chairman of the senate. The opening ceremony was followed by the laying of a wreath at the Maximilianstrasse memorial to the organization's namesake Joseph von Fraunhofer and a meal at the Spatenhaus, paid for with food stamps. That currency of post-war rationing would remain in use until the spring of 1950 to manage the food shortage.

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“In fact, the financial situation of the Fraunhofer-Gesellschaft was more than precarious in 1954; the executive board and the senate had to address the issue of liquidation.”

August Epp, Secretary General



**Joseph von Fraunhofer**  
1787 – 1826

This Bavarian inventor and successful entrepreneur stands out in the history of technology as one of its towering researchers. Having apprenticed as a glass grinder, he later worked as an optician at the Mathematical-Mechanical Institute at Benediktbeuern in Upper Bavaria. Within a few years, his employers had entrusted him with the responsibility for glassmaking operations and then the entire institute. It was there that he crafted optical instruments of unprecedented quality. His large astronomical telescopes were in demand worldwide. He also achieved recognition as a scientist, investigating the refractivity of glass and the diffraction of light, and discovering dark lines in the solar spectrum that would come to be called Fraunhofer lines.



*Fraunhofer*  
*ausgeführt von Joseph von Fraunhofer am 10<sup>ten</sup> Nov. 1825*  
*zu Berlin*



### Blue-and-white Bavarian exceptionalism

Despite all its efforts, this new society was for a number of years unable to shed its regional skin. For many, it was the odd one out, Bavarian exceptionalism draped in a blue-and-white banner. Other science organizations' attitudes toward it bordered on hostility. The Fraunhofer-Gesellschaft was made to fight hard for its *raison d'être* in the early years. Many scientists scorned applied science, the accusation being that it was not proper research; its reputation left in tatters by the Nazis. Shrinking from the tentacles of political influence and pinning their hopes on the ideal of autonomous science freed from any particular purpose, these scientists retreated into fundamental research. The struggle to find its place in the German research ecosystem culminated in 1951 with President Gerlach's attempt to dissolve the Fraunhofer-Gesellschaft or merge it into the German Research Foundation (DFG). After Gerlach's forced resignation, the influential industrialist Wilhelm Roelen was elected president and the former Weimar Reich Chancellor Hans Luther was elected chairman of the senate. Helmuth Trischler, a historian specializing in technology, believes this is when the organization changed its course: "When a North Rhine-Westphalian manager of heavy industry replaced a fundamental researcher at the helm of Fraunhofer, it was a staff shakeup that would steer the organization towards an industrial application-oriented outlook."

But the scratching for survival continued until 1955. The Stifterverband, a donors' association for the promotion of sciences and humanities in Germany, and the German Research Foundation took a dim view of the young Fraunhofer-Gesellschaft. It was a thorn in the side of the Stifterverband – it dared to compete for grants from the industry. The DFG presumed to be the definitive funding organization for all German research, including Bavarian efforts. Both repeatedly sought to dissolve their upstart rival, or at least see it absorbed into the DFG. The Fraunhofer-Gesellschaft would later receive donations from the Stifterverband only because it refrained from soliciting industry grants.

In the early years, the Fraunhofer-Gesellschaft was mainly concerned with collecting and conveying money to individual researchers and laboratories. It received grants from the Bavarian government, and starting in 1951, funds from the USA's European Recovery Program, the famous Marshall Plan. This was a milestone achievement for Fraunhofer's management. Policymakers had begun to recognize the organization as the face of applied research.

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Only very few even dreamt of a large, nationwide research association.

Pioneering spirit. On June 1, 1954, the institute for applied microscopy, photography and cinematography in Mannheim opens its doors.

1954





Nuclear physicist, rector of LMU Munich – and first President of the Fraunhofer-Gesellschaft in an honorary capacity: Professor Walther Gerlach.

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To assert its credentials as a serious player in the field of applied research, it would have to finally start putting R&D resources of its own to work.

When Battelle, a major US contract research organization, announced in the early 1950's its intentions to set up an institute in Germany, established research organizations feared that the "pillaging of minds" in Germany would continue. They rejected market-centric contract research – a huge success in the USA – decrying it as a sell-out of intellectual achievement. Contract research was held to be one of those American ideas that were incompatible with Germany's legacy in science. The Federal Ministry of Economics disagreed. It saw an opportunity to adopt the American model to modernize applied research, which in Germany was well behind the curve. Battelle was a powerful rival for the Fraunhofer-Gesellschaft, but it grew stronger in face of this stiff competition. To hold its own against this prominent US institution and plant a footprint as a serious player in applied research, it would have to finally start putting R&D resources of its own to work.

## From rag picker to third pillar

The overhaul of the Fraunhofer-Gesellschaft was largely orchestrated by Emil Sörensen, newly elected chairman of the senate in 1954, and vice president Albert Maucher. The newly elected president was Hermann von Siemens, a grandson of Werner von Siemens, the famed inventor and founder of the Siemens Group. That eminent name added luster to the organization's growing reputation.

The first Fraunhofer Institute – the Institute for Applied Microscopy, Photography and Cinematography IMPK – was founded in Mannheim in 1954 with a workforce of seven. One reason why it ended up in Baden-Württemberg was the close collaboration with the state's government. The other was Battelle's decision to set up its German subsidiary in Frankfurt in the state of Hessen rather than in Stuttgart. Baden-Württemberg was determined to fill that vacancy.

This twist of fate soon proved to be a stroke of luck. Management realized that with institutes of its own, the Fraunhofer-Gesellschaft would be firmly planted and not so easily uprooted from the research field. Fraunhofer negotiated with several states to set up further institutes. In a flurry of activity, it founded the Fraunhofer Institutes for Hygiene and Bacteriological Work Procedures (1956 in Munich) and for Xylolite Research (1956 in Bonn), followed by the Institute for Electrical Materials (1957 in Freiburg).

It was around this time that the Fraunhofer-Gesellschaft forged an alliance with the Federal Ministry of Defence, recently established in 1955. It provided support for four defense research institutes. This steady income enabled it to pursue its campaign to establish further civilian institutes.

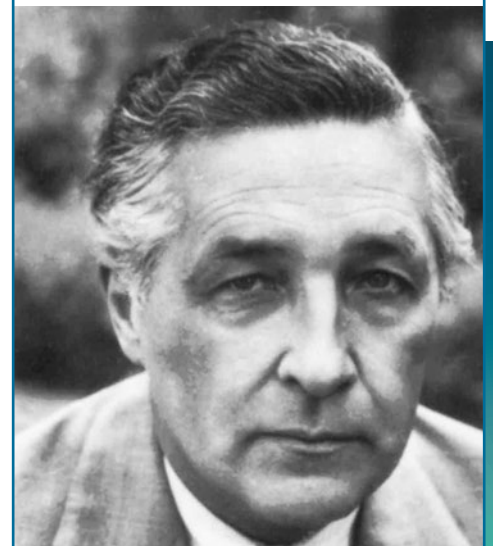
In 1959, ten years after its inception, the Fraunhofer-Gesellschaft already had nine institutes of its own, 135 employees and a budget of 3.6 million German marks. It continued on course for expansion in the ensuing years. In those days, there were many research groups and labs on a shaky financial footing, and Fraunhofer looked to be a rock-solid fortress for their scientific pursuits.

With this forward-looking strategy, the upstart presented the research community with a fait accompli that even the politically influential Science Council could not ignore in its proposals to restructure Germany's research ecosystem. Despite strong reservations, in October 1964 it grudgingly recommended that the Fraunhofer-Gesellschaft be upgraded to the umbrella organization for applied research that the national innovation system had been lacking, but not without demanding fundamental changes. The Fraunhofer-Gesellschaft had sought to be recognized and funded as the third pillar of German research alongside the Max Planck Society and the universities sponsored by the DFG.

1964: Fraunhofer is positioned as the key organization for applied research in the German national innovation system.

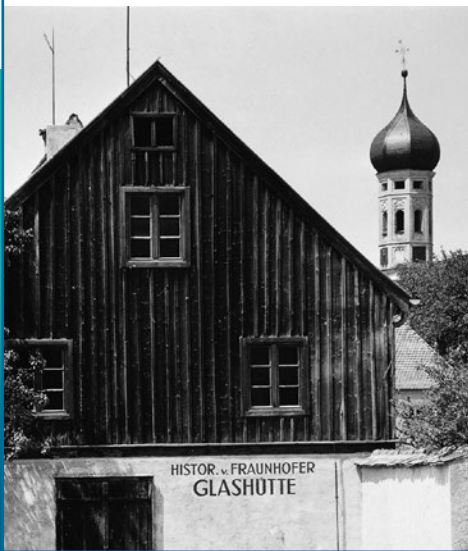
### Hugo Geiger

Geiger, a teacher by training, was employed by the life insurance company Allianz from 1929 to 1946, where he worked his way up to the board. After the war, he entered politics as a member of the CSU, the center-right Christian democrats. Before the year 1945 was out, he had a seat in Bavaria's constituent state assembly. State Secretary in the Bavarian Ministry of Economic Affairs from 1947 to 1950, he also sat in the state parliament from 1950 to 1953 and in the German Bundestag from 1953 to 1961.



### Approximavit sidera – the Fraunhofer-Gesellschaft's motto

The inscription on Joseph von Fraunhofer's tomb reads "Approximavit sidera" (He brought the stars closer). That epitaph would become the organization's motto and long featured on its logo. The Fraunhofer-Gesellschaft honored the memory of its namesake in other ways as well, saving his Benediktbeuern glassworks from ruin and for posterity. Today, it hosts a small museum where visitors can admire two large melting furnaces with agitators for glassmaking, historical tools, optical instruments and other exhibits.



It looked as if that vision would finally materialize. In certain circles, though, the organization's reputation had suffered for its dizzying growth and ties to the Ministry of Defence. Some scientists disparaged the Fraunhofer-Gesellschaft – it was said to be a "rag picker" with a "patchwork" of institutes, not all of which were accomplishing their industry-related research mission.

Disproving all the naysayers, Fraunhofer began to regularly draw budgetary funding from the government in 1968. Applied research was on the upswing. The economic recession of 1967 marked the end of the Wirtschaftswunder – Germany's post-war economic miracle replete with full employment and constant growth. The fat years were over. With the times turning lean, policymakers turned their attention to innovative technologies that would help revive the country's ailing economy.

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“The German Federal Republic has endorsed defense and the establishment of a German army, so it is self-evident that the Fraunhofer-Gesellschaft has to support defense research as well as non-profit, industry-centered research.”

Emil Sörensen,  
Chairman of the Senate

1949



Cover picture on the founding day: On March 26, the news magazine appears with a cover story about the vote for "Miss Wiesbaden".



1949

Unhindered ride for the economy: From 1948 to 1952, the "Marshall Plan" brings loans, raw materials, food and commodities from the USA to Germany and Western Europe. The Fraunhofer-Gesellschaft also benefits from the American contributions.

The newly established republic: Reconstruction dominates the post-war years. How the new knowledge landscape is to be organized is slow to emerge. Since the mid 1950's, the economic miracle has improved the market situation for Fraunhofer too.

1955



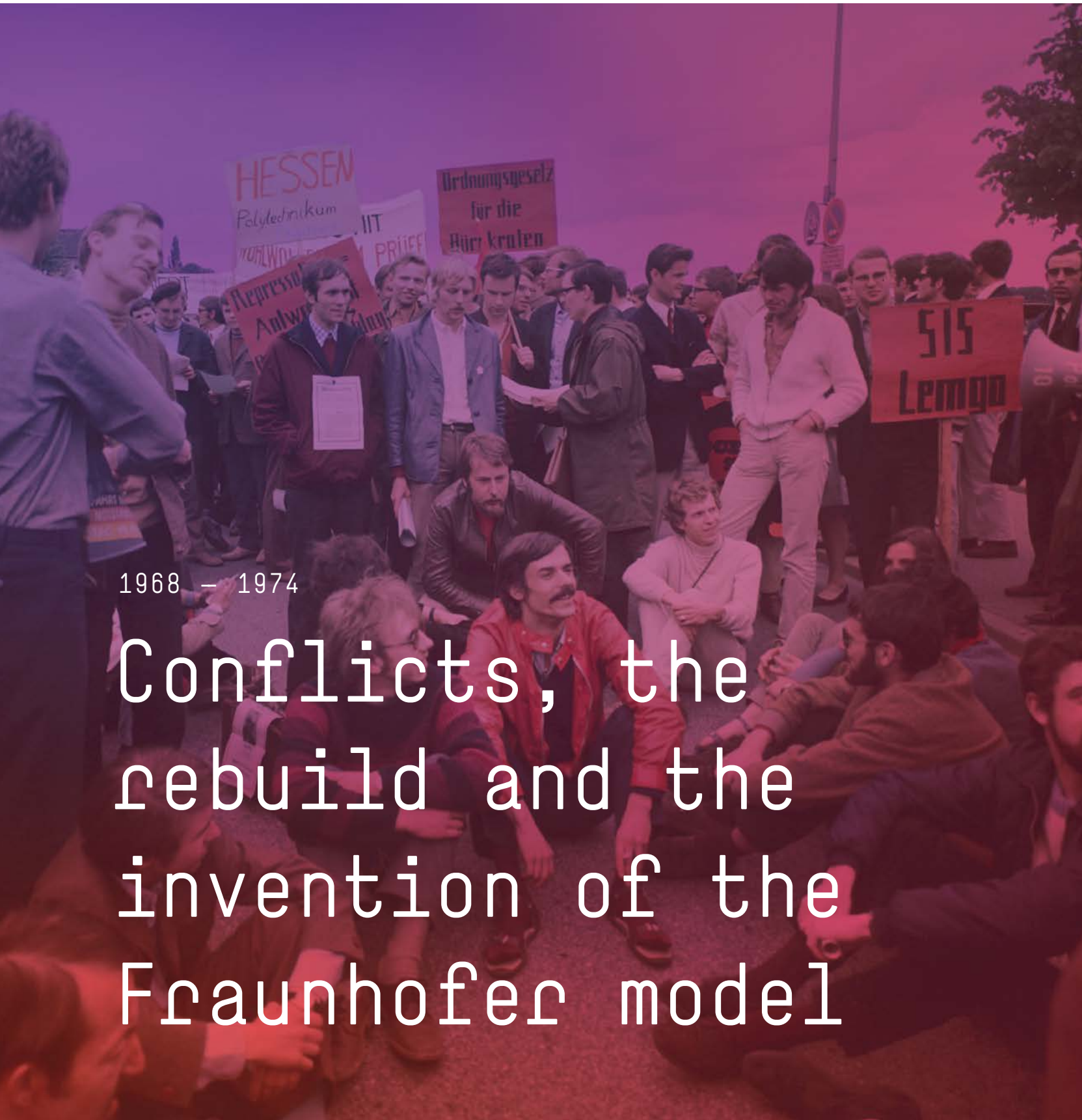
A question of security: On May 6, 1955, the Federal Republic joins the western military alliance NATO. The purpose of the defense alliance is to protect western democracy from a Soviet attack. The Fraunhofer-Gesellschaft enters into close cooperation with the Federal Defence Ministry, which drives forward defense research in the newly established republic.

1961



Scene from the cold war: Between 1961 and 1990, Checkpoint Charlie, probably Berlin's most famous border crossing, connects the Soviet and American sectors.





1968 – 1974

# Conflicts, the rebuild and the invention of the Fraunhofer model

In 1970, the commission to further the expansion of the Fraunhofer-Gesellschaft tabled various recommendations, including the creation of new institutes along with a reorganization of its structure and reformulation of its scientific purpose. That very same year, a “joint commission” was created. Its brief was to formulate a wide-ranging program of restructuring and expansion at the Fraunhofer-Gesellschaft. This resulted in the so-called Fraunhofer model, which, among other things, placed base funding on a performance-related footing. This model was the key to a period of unprecedented growth at the Fraunhofer-Gesellschaft – so much so, in fact, that Fraunhofer became a beacon for the whole of the German economy.

In late 1968, Federal Research Minister Gerhard Stoltenberg set up a commission to further the expansion of the Fraunhofer-Gesellschaft. It comprised 15 members from science and politics, including five Fraunhofer representatives. Its sole purpose was to examine which of the existing institutes should be incorporated in the new structure and which new ones should be created. Ultimately, however, it ended up drafting a completely new concept regarding Fraunhofer’s future structure and scientific mission. The question then was how best to implement the commission’s wide-ranging recommendations.

Although Stoltenberg and his ministry had already assumed responsibility for the Fraunhofer-Gesellschaft, the newly appointed science minister, Hans Leussink, craved even more influence. On November 11, 1970, in what can only be described as a coup, Leussink called for the establishment of a joint commission involving the Federal Ministry of Science and the Fraunhofer-Gesellschaft. Chaired by Max Scheidwimmer, a senior civil servant, the commission was to be charged with developing a wide-ranging program of restructuring. At the same time, Scheidwimmer was to be appointed to the Fraunhofer board, where he would represent the interests of the science ministry. Leussink had chaired the German Council of Science and Humanities from 1965 to 1969 and was known to have serious misgivings regarding Fraunhofer. This attack upon the autonomy of the Fraunhofer-Gesellschaft was met with protest from many sides – not only in Fraunhofer’s Munich headquarters. There was widespread outrage in the scientific community. And the state governments of Bavaria and Baden-Württemberg, who had both contributed substantial funds to help Fraunhofer through various financial crises, felt they were being edged out of “their” Fraunhofer-Gesellschaft.

Given the strength of reaction, the agreement was watered down. At the end of that year, and following a hefty debate, the Fraunhofer senate gave its approval. The joint commission had eight members: four representatives from Fraunhofer and four from the government ministries. They faced an immense task that was scheduled for completion by the end of 1972: to draw up new plans covering research, expansion, finance and reorganization; to draw up a new constitution as well as general rules and regulations for the institutes; and to produce reports on employee codetermination, on the expansion, on the reorganization of headquarters and on the employee remuneration system.

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In 1968, students demonstrated for reforms, better studying conditions and a democratization of academic life.

Although initially perceived as paternalistic, the joint commission proved an excellent solution, not least because it plowed through its substantial workload with ease. The person chiefly responsible for this was Scheidwimmer, who chaired the commission. "Even the harshest critics soon conceded that the commission was doing good work," writes the historian Helmuth Trischler.

The new constitution was a particular bone of contention, since it awarded greater powers and responsibilities to the executive board, thereby giving it a key political role within the organization. In place of an honorary board with its numerous members came a full-time executive board comprising three members with clearly defined areas of responsibility and a substantially reinforced leadership role for the president. The Fraunhofer headquarters – perceived by many as an impediment to change – was to be substantially enlarged. And the role of the senate, as the ultimate decision-making and supervisory body, was reinforced.

In order to facilitate codetermination, a Scientific and Technical Council (STC) was established, with equal representation of institute management and scientific and technical staff. This parity of membership was forced through by the government representatives on the joint commission, despite strong resistance on the part of the institute directors. However, it also coincided with a general demand for greater democracy within the science community. Indeed, this had already led to criticism of the lack of codetermination at the Fraunhofer-Gesellschaft. Under the leadership of Rudolf Zapp, who would later sit on the central works council, it was primarily researchers from the then Fraunhofer Institute for the Chemistry of Propellants and Explosives ICT who called for greater employee participation. The central works council was established in February 1972; by that date, six institutes already had their own works councils.

At the institute level, a management committee was established as a counterpart to the STC. This was made up of management, functionaries and elected representatives of the scientific and technical staff.

Working out the powers and responsibilities of all the various bodies and committees was an exhausting though instructive process. When it came to appointments, there were fierce battles over every seat and every vote. The aim was to find the right balance between Fraunhofer and government ministries, on the one hand, and Fraunhofer headquarters and the institutes, on the other. And the effort paid off, not least when it later became apparent that the institutional mechanisms for settling disputes did indeed function as intended.

All in all, the years spent developing a new structure for Fraunhofer were also accompanied by growing uncertainty. There was conflict at the level of the executive board, institute management and the STC. Yet these grueling debates also spawned a raft of creative proposals that opened up new horizons for the Fraunhofer-Gesellschaft.



General Meeting of the Fraunhofer-Gesellschaft in 1969 with Federal Minister for Scientific Research Gerhard Stoltenberg (1st row, 2nd from right).



Contemporary participation: Fraunhofer Institute for Chemical Technology ICT.

### The Fraunhofer model

The joint commission had established a planning committee for research and expansion. Max Syrbe, who after many years in industry was now director of the Institute for Information Processing in Technology and Biology IITB, had acquired some experience of research planning during his time as a member of the Fraunhofer senate. Syrbe was therefore able to produce a rough draft, more or less unassisted, which then served as a basis for further consultation. In February 1972, he was joined by Helmar Krupp, who had played a key role at Fraunhofer's major rival and role model, Battelle. Krupp was now in charge of setting up the pioneering Fraunhofer Institute for Systems and Innovation Research ISI, which was to serve as a kind of think tank for Fraunhofer's new innovation strategy. Finally, the two were assisted in their efforts by Klaus Schroeter, the newly appointed planning consultant.

In mid-1972, the team presented its draft plan for research, organization, expansion and finance. At almost 100 pages in length, its concept departed substantially from the core idea of the expansion commission, which advocated a guaranteed budget as a means of strengthening applied research. According to Trischler, the draft plan landed "like a bombshell."

The reverberations were immense. After all, the new concept marked a complete departure from standard thinking among institute management. It proposed dividing an institute's research activities into in-house, framework and contract research, with framework and contract research making up two-thirds of an institute's total activities. In other words, an institute would be forced to earn two-thirds of its own budget. Equally revolutionary was the proposal regarding the allocation of funding, since it departed entirely from customary procedure: the idea was that base funding should increase in direct proportion to growth in income from contract and framework research. Indeed, the very idea that institutes should focus on market-oriented, contract research prompted protest from many institute directors, not least those working in areas hitherto far removed from any commercial interest.

Without further ado, six institute directors drafted an alternative plan based closely on the recommendations of the expansion commission. They advocated greater diversity in research focus among the various institutes. This in turn prompted the chair of the STC to resign in protest at a lack of consultation.

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"There is no better illustration of Fraunhofer-Gesellschaft's increasing adoption of corporate-like structures than its shift from a largely honorary board with numerous members to a full-time executive board comprising three members with clearly defined areas of responsibility."

Prof. Dr. Helmut Trischler



Helmar Krupp set up the unprecedented Institute for Systems and Innovation Research ISI, a sort of *think tank* tasked with supporting efforts to restructure the innovation system.

#### Prof. Dr. Helmar Krupp

In 1971, the Doctor of Physics Helmar Krupp left the American Battelle Institute to join the Fraunhofer-Gesellschaft. He established the Fraunhofer Institute for Systems and Innovation Research ISI in Karlsruhe, heading the organization until 1989. Together with Max Syrbe, he developed the Fraunhofer model for performance-related basic funding.



#### “The hard-earned money of contract research”

The dispute about the right balance between in-house and contract research revealed a basic problem at the heart of applied research. There was no doubt that contract research also required in-house research, since that was what encouraged industry to award attractive research contracts. Yet how much in-house research did this actually take? Was it really only one-third, as Krupp and Syrbe maintained? Many institute directors disagreed. Understandably, they were keen to attract as much funding for free research as possible. Ultimately, in fact, the Syrbe and Krupp model proved unenforceable. Therefore, in order to restore the peace, Syrbe was commissioned to produce a watered-down summary in consultation with the STC.

Entitled “Basic outline of the further development of the Fraunhofer-Gesellschaft,” this compromise was presented in early October 1972 and then approved by the senate. Many of the proposals in this paper were very general and purposely vague. Nor did it attempt to lay down the relationship between in-house and contract research. Yet the idea of performance-related funding for in-house research had taken root. And so the idea of base funding being dependent upon performance – later known as the Fraunhofer model – became a legitimate subject of debate.

For many years, institute management had fought for a fixed level of base funding. Yet now they were supposed to agree to an insecure system of variable grants. There would be enormous pressure to secure new research contracts, and few felt they would be up to it. There was even greater opposition from the finance ministry. Officials there were appalled at what the science ministry had cooked up, since the new model diverged radically from the cast-iron principles of state finance. For the finance ministry, performance-related base funding meant committing to future expenditure without knowing how much this would entail.

It was only after months of wrangling that a compromise was reached. On this basis, following years of discussion and conflict, the cabinet committee for education, research and technology was finally able to pass a resolution on the future of the Fraunhofer-Gesellschaft on October 3, 1973. There was now a firm political will to transform the Fraunhofer-Gesellschaft into a powerful and effective organization for applied research – and, at the same time, to explore new forms of research funding with a view to strengthening the role of contract research. From this moment on, the Fraunhofer-Gesellschaft would assume a double role – as a partner serving, in equal measure, industry and the state.

Historian Helmuth Trischler describes the cabinet resolution as “the basic law of the new Fraunhofer-Gesellschaft.” The introduction of this model of performance-related base funding had enormous consequences. It liberated huge energy within the Fraunhofer-Gesellschaft and triggered a once unimaginable level of growth. The new model also broke the vicious circle whereby any money earned by Fraunhofer automatically resulted in a reduction in state funding. Performance was now rewarded by an increase in direct grants. Instead of each institute having a fixed budget and



staff, the successful ones would now grow, while the less successful had to tighten their belts. To this day, the model remains a supremely effective planning instrument that enforces continuous adjustment to emerging markets, thereby encouraging institutes to remain efficient.

Ultimately, it was a blessing that the relation between base funding and contract research was never fixed in detail. As things stand, it can be adjusted to accommodate changed circumstances in science, industry or government. The original proposal was to test the model over a period of five years and then to scrutinize it again every five years. The ability to adjust both the structure and the purpose of each institute became a fundamental part of Fraunhofer's new identity.

### Growth and the new constitution

It would be another two years before agreement was achieved on all the details of the Fraunhofer model. In their enthusiasm for market-oriented research, government ministries harbored completely unrealistic expectations regarding contract research. Inspired by the example of Battelle, they thought that contract research would enable Fraunhofer to cover not only a large part of its budget but also any new investment and the costs of its headquarters. It took a lot of hard lobbying before Fraunhofer was able to persuade the ministries to adopt a more realistic approach. In 1974, the institutes were able to cover, on average, 54 percent of their own budgetary requirements. The idea of increasing this beyond 60 percent was therefore extremely ambitious. These arguments fed into the framework agreement on research funding that was adopted at the end of 1975.

Given the uncertain outlook at the time of reorganization, Fraunhofer had been hesitant about pushing ahead with the planned expansion. Its caution proved well founded. At that time, a whole succession of scientific bodies were proposed as potential Fraunhofer Institutes. Yet not all them were of the requisite quality or active in a relevant field of research. In fact, in response to the recommendations of the expansion commission, the Fraunhofer-Gesellschaft added a mere ten institutes between 1969 and 1974, thereby increasing the total number of institutes to 27.

The new constitution of 1972 mandated an executive board comprising three members with clearly defined areas of responsibility: a president with responsibility for research policy, a board member for legal affairs, and another board member for commercial affairs. In September 1971, Otto Mohr, at the time honorary president, was made executive president. This was during the period of reorganization, and Mohr was regarded as an interim appointment. The following year, the senate therefore began the search for a new president. The inaugural board member for legal affairs was Max Scheidwimmer, who had established a solid reputation as chair of the joint commission and was regarded as an ideal candidate. However, he soon announced his intention to return to state politics in Saarbrücken, so the search began for a replacement. Once again, the Federal Ministry of Research and Technology (BMFT) prevailed, and its preferred candidate, Eberhard Schlephorst, became the new board member for legal affairs and human resources. Former secretary general August Epp, who had acted as manager director under the honorary president, was appointed executive board member for commercial affairs. The only person missing was a new president.

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“My time at Fraunhofer began in 1966 as a member of the senate; back then, the Fraunhofer-Gesellschaft was very much the grubby urchin of the science community.”

Prof. Dr. Max Sybke

Many of the big questions from back then are still relevant to the Fraunhofer-Gesellschaft of today. These include the proper relation between base funding and contract research, and the use of performance related remuneration. "It was – and is to this day – impossible, without conflict, to make market-oriented research fit into the tight framework that regulates the state funding of science, as circumscribed by the official pay scale for civil servants (Bundesangestelltentarifvertrag, BAT) and by the imperial budget regulations," Trischler writes. "And it proved impossible simply to adopt the model of contract research as it was practiced in the USA. Instead, it had to be reinvented and adapted to the established German culture of innovation".

This difficult process of reorganization and reorientation took ten years to complete. At the end of it, the foundations for the Fraunhofer-Gesellschaft in its modern incarnation had been laid: a market-oriented approach to research based on the innovative Fraunhofer model and its principle of performance-related base funding.

### August Epp

August Epp initially joined the Fraunhofer-Gesellschaft as a commercial employee. In 1962, he became Managing Director, in 1965 Secretary General, and from 1971 to 1978 he was the Senior Vice President of the Commercial Division. Up until the time of basic financing, his skilled and prudent budget management safeguarded the survival of the Fraunhofer-Gesellschaft. In recognition of his outstanding services, he was later appointed Honorary Senator.



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The relationship between basic financing and research under contract and the question of performance-related remuneration still occupy the Fraunhofer-Gesellschaft today.

Societal transformation intersected with technology optimism in the 60's and 70's. Suddenly, the impossible seemed probable.

1969



New territory: On July 16, 1969, 500 million people follow Neil Armstrong's first step on the moon. Technical progress appears to be unstoppable.

1970



Convincing political gesture in the spirit of reconciliation: Willy Brandt was later awarded the Nobel Peace Prize for his expression of humility.

1972



Precisely quantified: East Germany's Monika Zehrt (left) is 0.13 seconds faster at the Olympic Games than Rita Wilden from the Federal Republic and takes gold. In the same year, Casio launches the first pocket calculator for consumers.

1974



With her book "Little Difference", Alice Schwarzer makes women's independence the commandment of the hour.





1974 – 1983

# Awakening and revival

By 1974, the phase of reorganization at the Fraunhofer-Gesellschaft was complete. The time had therefore come to concentrate in earnest on attracting commercially oriented contract research. Everything now focused on research strategy: the institutes were trimmed in line with the major state funding programs, and every effort was made to improve how they marketed their research. The result was a period of unprecedented growth.

The sense of a fresh start was already manifest in the way Fraunhofer approached the appointment of a full-time president. Given the new focus on commercially oriented research, it was the senate's view, supported by institute management and the Federal Ministry of Research and Technology (BMFT), that candidates should come with leadership experience in industry. Heinz Keller, board member of Vereinigte Deutsche Metallwerke, appeared the ideal choice. He had experience of research at both university and industry level, he was a senior executive at a major company, and he understood the importance of innovation to business success. He was excited by the challenge of reshaping the Fraunhofer-Gesellschaft. Moreover, he had very good contacts in industry circles and fully intended to use them in order to secure new research contracts.

By the time Keller took over the presidency in July 1974, the Munich headquarters had undergone extensive reorganization. The original headquarters was quite simply not fit for administering a large and efficient organization for contract research. Back in 1972, the decision had therefore been taken to expand and reorganize. Since then, a "plethora of high-quality posts" had been created. In 1973, the board of management staff, which for a while had been scattered across nine buildings in Munich, were reunited in rented premises on the Leonrodstraße. "There was a spirit of optimism, it was an exciting time! Our job was to create a new contract research establishment out of a bunch of disparate institutes," recalls Alexander Imbusch, who arrived from Berlin to bolster the planning department, fresh from having completed his doctorate. Keller quickly got down to work, supported by his fellow board members and a reinvigorated headquarters. From the word go, Keller's top priority was research strategy and planning. As a consequence, the newly created planning department came to play a central role. This led to the creation of so-called research sections, which became a highly effective planning instrument, with the institute liaison officers taking on a key management role. Keller soon increased the number of sections and trimmed Fraunhofer's new research plan in line with the federal government's technology program.

When drawing up the new research plan, Keller was careful to consult with the institutes. To find out what kind of work they were doing, he organized briefings with institute management, grouped according to the newly created sections. The institute liaison officers were responsible for preparing meetings and for any subsequent debriefing. This revived old fears of a new hierarchy level between the executive board and the institute directors. Keller was careful to assuage these fears, however, with the result that the section briefings came to play a key role in research planning. Here, too, dialog proved the best way of improving the trust between headquarters and the institutes.

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The oil price shock causes a global economic crisis, unemployment rises. Fraunhofer takes a lead in the development of alternative energy technologies.



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Keller came up with a three-pronged strategy. Its aim was to link university, Fraunhofer and industrial research with one another.

### Pitching to boardrooms

The new president was equally pragmatic when it came to soliciting new research contracts. For some institute directors, it was beneath their dignity to have to “sell” their work. They therefore had few contacts in industry. Keller cut to the chase and, within a few months, he had brought them together with people from all the major sectors. Calling on his own wide range of contacts to key figures in industry, Keller escorted groups of institute directors to boardrooms around the country, where they could then showcase the research being done at Fraunhofer. This not only delivered new contracts but also built up long-term contacts to companies that relied heavily on research. At the same time, these meetings were an opportunity to discover where companies needed research.

Keller came up with a three-pronged strategy to boost the quality of research and strengthen relations to industry. His idea was to link university, Fraunhofer and industry research so that every project would be guided throughout the entire innovation process to its ultimate industrial application. At the time, however, coordination at this level proved impracticable.

Part of the fresh approach at Fraunhofer was to introduce new faces. The coming elections to the senate were an ideal opportunity for the new president to show his mettle. The new senate, it was thought, should represent a more balanced picture of society. Alongside representatives from science, government and industry, the plan was therefore to have people from other sections of society, such as the labor movement and the media. The electoral college drew up a shortlist of influential figures, whose job it would be to usher in the new era. Keller, for example, also put forward a woman, Marion Gräfin Dönhoff from the “DIE ZEIT” newspaper. In the ensuing election, none of the former senators was reappointed. The new chair was Eduard Pestel, a highly regarded and well-connected university professor with extensive experience of research management. With Pestel at the helm, the new senate, which now comprised a broader section of society, delivered the requisite ratification for the strategic decisions made by the executive board.

Following the battles that had accompanied restructuring, Keller saw the need to forge a new sense of community at Fraunhofer and to demonstrate unity both inside and outside the organization. The joint business and research plan of 1974 contributed toward strengthening this new spirit. Meanwhile, Fraunhofer’s newly created PR department began working on a unified corporate image and placing media relations on a more professional footing. It also started producing Fraunhofer-Gesellschaft publications in order to introduce the organization to the public at large.

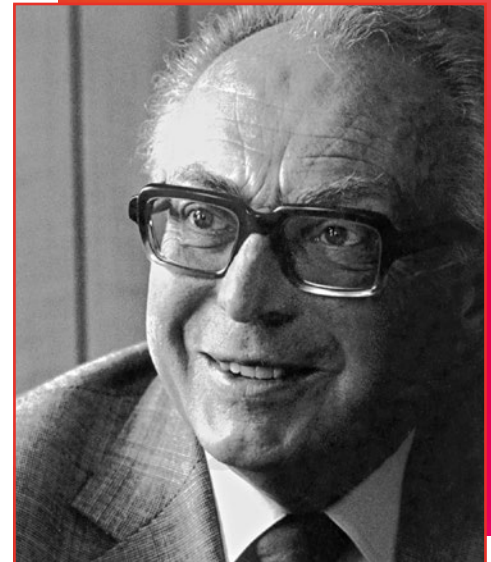
## Unity from diversity

The first task was to try and forge unity out of the diverse mix of old and new institutes. This almost failed at the first hurdle, when renowned establishments such as the Ernst-Mach-Institut or the Wilhelm-Klauditz-Institut insisted on retaining their original name. Yet the biggest problem of all was caused by an institute that didn't even belong to the Fraunhofer-Gesellschaft and still called itself the Fraunhofer Institute for Solar Research. It was only in 1978, when it renamed itself the Kiepenheuer Institute for Solar Physics, that Fraunhofer was finally in a position to endow all of its institutes with the unitary name of "Fraunhofer Institute for..." In order to further strengthen the sense of identification with the organization, Keller inaugurated the annual Joseph von Fraunhofer Prize in 1978, which has rewarded research excellence ever since.

The executive board and institute management soon realized that joint projects were the best way to promote a common identity. The test case for this was the reactor safety program, which involved a total of six Fraunhofer Institutes. Fraunhofer went on to launch a whole raft of programs in which a host of institutions took part.

Perhaps the most important of all these was the one targeted at small and medium-sized enterprises. Keller was among the first to highlight the importance of this sector of industry and its role in generating innovation. In response to the economic crisis of the 1970's and the increasing importance of the so-called technology gap, industrial policy underwent a paradigm shift, with research switching its attention to SMEs. This was in stark contrast to the state-run research programs of the 1960's in atomic energy and aerospace, which were very much tailored to major companies. But this focus ultimately hampered innovation because it led to a neglect of other technologies. The new funding programs in medical technology, optics and measurement techniques were much better suited to the kind of work being done by SMEs. Analyses conducted by the BMFT revealed that in 1973 as much as 93 percent of state funding had gone to just 50 recipients, almost all of them major companies. Keller's proposal to do more for small and medium-sized enterprises was therefore certain of a warm response. However, this strategy encroached upon the territory of the Federal Ministry of Economic Affairs and the closely linked German Federation of Industrial Research Associations (AiF). The BMFT therefore had to undertake delicate negotiations before the Fraunhofer program was finally launched in July 1976.

The path was now free for Fraunhofer Institutes to approach SMEs with attractive offers of contract research, with the state covering between 40 and 60 percent of the project costs. In the process, the Fraunhofer-Gesellschaft acquired a major new customer base. Over half of such projects were with companies that had never worked with Fraunhofer before. Within six months, these contracts gave rise to a host of innovative products and processes. The list of projects in receipt of funding made for impressive reading. It highlighted the great social benefit of contract research and secured considerable prestige for Fraunhofer. During this period, it was thought that the best way of promoting innovation was to enable technology transfer by means of SMEs.



Dr. Heinz Keller

Keller studied chemistry and gained his doctorate in 1950. He served on the board of management of Vereinigte Deutsche Metallwerke AG until 1974 before joining the Fraunhofer-Gesellschaft as executive president, an office he held until 1983. Fraunhofer-Gesellschaft in its modern form was established by him. With great skill and strategic vision, he implemented sweeping reforms that would improve efficiency and bring long-term growth.

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“We had the freedom to be creative. At the time, there was nothing: no internal communication, none at all. Not even all of the institute directors knew one another!”

Dr. Alexander Imbusch,  
research planner

1980



The Fraunhofer-Gesellschaft is taking state-of-the-art technology to the next level: cochlea implants help people with hearing impairments.

“The so-called Fraunhofer model, which made base funding dependent upon performance, put fresh wind beneath Fraunhofer’s wings. By the mid-1970’s, the Fraunhofer-Gesellschaft was ready to fly!”

Prof. Dr. Helmuth Trischler,  
historian

### Growing competition between the federal states

A new framework agreement on research funding was reached in 1975. This meant that federal government was now contributing 90 percent of base funding for big science and applied research. It marked a profound shift in the balance of power in favor of federal government. As a result, the regional states felt increasingly marginalized in matters of research and technology. The ongoing recession in the wake of the oil crisis had increased pressure on the states to undertake measures to revive the economy at a regional level. Economists and political scientists agreed on the key role of research and high-tech companies in generating new sources of economic growth. Following the lead of Silicon Valley, the favored approach was to make innovation the focus of regional economic policy. Realizing that policies to promote innovation were a useful weapon in the battle to persuade high-tech companies to choose their region as a location to set up business, the states now launched their own funding programs. Whereas this type of funding had previously been targeted at major companies, which were expected to deliver the innovations that would fire the economy, politicians now pinned their hopes on small and medium-sized enterprises. In 1976, Chancellor Helmut Schmidt announced the launch of a federal program of research and technology funding for SMEs. Baden-Württemberg was the first of the states to emulate this strategy, with North Rhine-Westphalia, Bavaria, Lower Saxony and Berlin soon following suit. As a result, business incubators and new tech parks sprang up like mushrooms.

With their focus on industry, Fraunhofer Institutes rapidly became the hub of regional innovation networks. The states were keen to exploit this phenomenon in order to accelerate the process of structural change at the regional level. North Rhine-Westphalia, in particular, pursued an expansive policy of research funding at this time.

Yet, compared to other research establishments, Fraunhofer Institutes received an extremely low level of regional investment. On the one hand, the institutes generated a large portion of their budget themselves; on the other, 90 percent of their base funding came from federal government. Meanwhile, Keller set about consolidating the Fraunhofer-Gesellschaft. This meant ensuring that institutes concentrated on contract research and encouraging the less commercially oriented ones to redouble their efforts. In fact, during Keller's period of office, five institutes were disbanded or divested because there was no demand for their research.

Keller's research strategy focused on two goals. Firstly, he wanted to expand contract research with industry; secondly, he wanted to capture a large slice of federal government's major research funding programs. Keller hoped that industry and the state would each provide one-third of Fraunhofer's research budget. In the beginning, however, three-quarters of all projects were funded with government money. He therefore had to ensure that institutes would profit not only from major programs that were already running but also from those that were just being launched. This was the only way, or so he thought, to acquire the volume of projects needed to place Fraunhofer on a stable path of growth. In other words, research planning for Keller was also about identifying and seizing new opportunities. There were two specific areas in which he saw great potential for the less commercially oriented institutes to profit from contract research: medical technology and the humanization of work.

The various strategic measures implemented during Keller's reign were so successful that, by the end of the 1970's, Fraunhofer entered a further phase of powerful expansion. The emergence of new key technologies, such as microelectronics, promised to create new markets for contract research.

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A fresh breeze and new blood were to herald a new start.



70 YEARS  
OF FUTURE  
#WHATSNEXT

## Conversion of sunlight

In energy system scenarios, photovoltaics play a major role as central pillars of the future energy supply, besides wind energy. Thanks to technological progress, the cost of solar power has fallen 75 percent since 2006. In Germany, energy from photovoltaic power stations can be supplied for four to five euro cents per kilowatt hour. The Fraunhofer Institute for Solar Energy Systems (ISE), Europe's largest solar research institute, has been contributing to this for years. The institute has been setting new efficiency records ever since it was founded.

Since 2017, for example, it has held the world efficiency record for multi-crystalline silicon solar cells.

1978



Creating the future: The Fraunhofer Institute for Manufacturing Engineering and Automation IPA in Stuttgart.

During the ten years of Keller's presidency, the image of the Fraunhofer-Gesellschaft had undergone a radical change. Writing for the "DIE ZEITmagazin" in 1979, in an article entitled "Die Forscher-GmbH" (The Researchers Inc.), Marion Gräfin Dönhoff opened with the following line: "Max Planck earns the Nobel prizes, Fraunhofer the money." This shows that Fraunhofer's reputation in the public eye was by now every bit as good as in government and industry circles. Keller's calm and confident approach had left its imprint on the organization as a whole.

"The main reason why the policy pursued by the Fraunhofer-Gesellschaft during the Keller era appeared so credible to society at large is that it engaged with, and was embedded in, the major processes and structures of the period," the historian Helmuth Trischler says, before adding: "Yet by the beginning of the 1980's, the Fraunhofer-Gesellschaft was in danger of becoming a victim of its own success. By the end of the Keller era, the rapid rate of expansion had left some people wondering how much more growth the Fraunhofer-Gesellschaft could take."

Heinz Keller was known to have a liking for the figure three. At the end of his period of office, he left behind an impressive record: the Fraunhofer-Gesellschaft now had three executive board members, 30 institutes, a budget of 300 million D-Mark and 3,000 employees.

1974



In 1974, a new senate is appointed for the Fraunhofer-Gesellschaft. For the first time, renowned personalities from the media, social sciences and the political world are also on board. Marion Gräfin Dönhoff, well-known author and publisher of "DIE ZEIT" is the first woman to be invited to this important committee.



1974



The first oil price crisis in 1973 reverberates like a shock wave: Images of empty highways leave their mark in 1974, the FRG had to pay around 17 billion D-Mark more for imports than it had the year before.

Partners with pioneering spirit: Paul Allen and Bill Gates found Microsoft in 1975.



1975

In the “wild” 1970’s, computer technology develops at a rapid pace. The information era begins; the subject of “Limits of growth” is also high on the agenda.



1979

The first European carrier rocket ARIANE takes off on its maiden flight in French Guiana. In the years that followed, the ARIANE rockets carried numerous satellites into outer space – often on board: Fraunhofer technology.



1983 – 1993

# Growth and reunification



Following the vigorous economic growth at the end of the 1970's, it was time for the new president, Max Syrbe, to consolidate. However, the dynamic success continued and the German reunification opened up unexpected opportunities for further expansion. The Fraunhofer-Gesellschaft seized the opportunity faster and with greater resolution than other research organizations and founded 21 new institutes and facilities in Germany's new federal states.

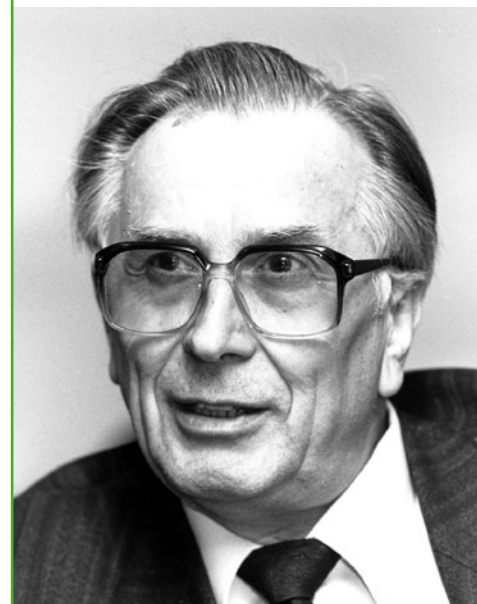
In the wake of the second oil crisis at the beginning of the 1980's, the worst recession in the history of the Federal Republic of Germany began to unfold. The drastic economic crisis and shortage of funding forced policy makers to rethink. In 1982, following elections and the change in coalition partners in government, the appointment of the new Federal Research Minister Heinz Riesenhuber set off a change of strategy in the funding of research covered by the guideline "The state's withdrawal from market and economy." Due to this change in policy, the direct funding of research was further reduced. At the same time, the Federal Ministry of Education and Research withdrew from market-oriented research funding and instead stepped up the funding for basic research. Dark clouds appeared on the horizon of the Fraunhofer-Gesellschaft.

Concurrently, there was a change in personnel at Fraunhofer. The term of office for President Keller, at age 65, expired at the end of 1982. Max Syrbe, who had already distinguished himself as the inventor of the Fraunhofer model, was considered the best candidate and was duly elected president on October 1, 1983. At the same time, the two board members Eberhard Schlephorst and Hans-Ulrich Wiese were confirmed in office for a further five years.

Max Syrbe took office with the precept of consolidating the organization. Following the vigorous expansion of the prior years, the focus was now placed on qualitative growth. In order to reduce competition and interdisciplinary overlap, the institutes were tasked with clearly defining their core areas of work. With the founding of the "Fraunhofer Group for Microelectronics" in April 1984, the Fraunhofer-Gesellschaft responded to the wishes of both industry and the government to avoid thematic overlaps and double investments. At first, however, it remained a loose association because the institute management insisted on its "statutory freedom." Moreover, Max Syrbe's wish for further alliances was not immediately fulfilled.

### Prof. Dr. Max Syrbe

After completing his secondary education in Leipzig, he studied physics in Frankfurt and received his doctorate in control engineering in 1953. After 15 years of work experience in the industry as director at BBC Mannheim, he became head of the Institute for Vibration Research – later Fraunhofer Institute for Information Technology and Data Processing IITB – in 1968. He was elected to the Senate in 1966, from 1971 he was Deputy Chairman of the Scientific Technical Council, and together with Helmar Krupp he invented the Fraunhofer model, which became the basis of the modern Fraunhofer-Gesellschaft. He was elected president of the Fraunhofer-Gesellschaft in 1983 and remained so until 1993. He was extraordinarily committed to the founding of the Fraunhofer Institutes in the former East Germany.





The award-winning Production Technology Center Berlin was inaugurated in 1985. Executive vice president of finances Hans-Ulrich Wiese began to equip the institutes with modern buildings and laboratories.

### Qualitative instead of quantitative growth

With his initiatives, Syrbe was able to make good progress in increasing the quality of work. As an experienced institute director, he knew that professional project management could reduce costs considerably. He was also very well aware of the fact that this could not be mandated from above, rather the staff had to be enabled to work more efficiently and competently through training. Initially, Syrbe's training strategy focused on the institutes' managerial levels. With great commitment, he himself took part in the "leadership seminars," which soon became an important permanent institution for management training. In order to increase the potential of all employees, a department for human resources development was set up in the headquarters.

As an information engineer, Syrbe immediately recognized, the potential of computerization for accelerated information retrieval, networking and support in standardized work processes. Using the term "WAP Scientist Workplace," the working conditions in the institutes as well as in the headquarters were updated with the latest information technology. Syrbe optimistically called it "research enterprise." Through rationalisation and the delimitation of competences, the course was set for quality improvement.

### Economic revenues – the key objective

Syrbe was under great pressure to increase revenues. Between 1984 and 1989, contract research at Fraunhofer grew by 107 percent, economic revenues even rose by 136 percent, although basic financing increased by only 59 percent. The Fraunhofer model – where increases in basic financing were on a par with increases in contract research – no longer worked. As late as 1986, the Fraunhofer committee's sponsors considered revenues of 26 percent to be sufficient. In 1987, the Fraunhofer-Gesellschaft was able to agree a 10 percent increase for basic financing with Germany's Minister of Scientific Research Heinz Riesenhuber, who, however, had demanded a significant consolidation from 1988/89 onward. Nevertheless, Syrbe would only be able to achieve higher growth rates than the two to three percent envisaged by the federal government's medium-term finance planning if the Fraunhofer-Gesellschaft was able to significantly increase revenues. Syrbe accepted this challenge and confronted the heads of the institutes with the new key objective of increasing economic yields to 40 percent. This meant he modified the Fraunhofer model with the new premise of 20 percent basic financing and 40 percent economic and project revenues respectively. But soon afterwards, the goal of returning to the original model emerged as an option again.

"I was fascinated by our growth because we had to create structures for it: The organization had to grow with them."

Dr. Hans-Ulrich Wiese



“During Max Syrbe’s era, the name Fraunhofer finally established itself as a seal of quality for competence, excellence and high quality. Syrbe made research more efficient: He made sure that the Fraunhofer Institutes were managed like real companies.”

Prof. Dr. Gerhardt Zeidler,  
Chairman of the Senate

efficiency and quality could only be achieved with ideal working conditions. This also included new buildings with modern equipment and laboratories. Soon construction was carried out at all locations, especially in the regional centers of Stuttgart, Karlsruhe and Freiburg. The first institute center was established in Stuttgart, which was to combine up to six Fraunhofer Institutes in the immediate vicinity of the university campus.

At the same time, however, the Fraunhofer-Gesellschaft had to live up to its claim of expanding into high-growth future technologies. Thus, Fraunhofer established new institutes for laser technology in Aachen, for graphic data processing in Darmstadt and for surface technology in Braunschweig. The key technology of microelectronics was further expanded in Erlangen and Berlin as well as in Itzehoe.

In order to effectively accommodate new institutes, the Executive Board founded a Fraunhofer-Management-Gesellschaft in 1988 as a private-sector subsidiary. It should support institutes and establishments in research planning, project management and administration, and ultimately also sound out whether an institute was suitable for admission to the Fraunhofer-Gesellschaft.

But before the various concepts could unfold their full effect, the fall of the wall between East and West Germany created obligations that no one had foreseen.

Fraunhofer executive vice president for finances Hans-Ulrich Wiese succeeded in gaining support for a significant increase in investments for construction and equipment. He, too, had recognised that the required increase in

#### Dr. Hans-Ulrich Wiese

After studying and earning his doctorate, Hans-Ulrich Wiese joined the management of a medium-sized clothing manufacturer. In 1974, he moved to the computer giant Nixdorf. From 1978 to 2002, he was Executive Vice President finances of the Fraunhofer-Gesellschaft. His activities included business management, controlling, purchasing, building and administrative IT systems.



### Pioneer in the new German states

As early as 1990, the Fraunhofer-Gesellschaft dared to redesign the research landscape in the dissolving GDR with courage, speed and commitment like no other research organization. As a native of Leipzig, Max Syrbe was particularly moved by the prospect of actively participating in the restructuring of the East German research landscape. He succeeded in inspiring the Fraunhofer executive board and the institute directors for the project.

By spring 1990, a concept for cooperation was developed with the intention of "helping people to help themselves." But the situation was changing faster than the projects were able to get off the ground. With the first free elections of the People's Chamber (Volkskammer) in March 1990, the German Democratic Republic rapidly began to dissolve. The Fraunhofer-Gesellschaft was forced to act quickly. The aim was to identify, capture and stabilize fragments of the decaying research landscape worthy of preservation. Thousands of researchers from the institutes of the Academy of Sciences and universities faced an uncertain future. They were urgently looking for a sustainable perspective and experienced partners who could help them find their way under new parameters. On the spur of the moment, Mr. Syrbe made the decision to travel to East Germany with Fraunhofer executives and institute directors in order to seek out potential candidates for the Fraunhofer-Gesellschaft, especially among the former academy institutions, and to hold talks with them – an extremely elaborate but fast-track procedure.

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“It was a great challenge to combine the quantitative growth of the Fraunhofer-Gesellschaft with qualitative growth.”

Prof. Dr. Max Syrbe

1992



Flourishing landscapes: Back in the 1990's, the Fraunhofer-Gesellschaft decided to build a new institute center in Dresden.

1984



New cutting and machining technologies: Fraunhofer strengthens Germany as an industrial location with technical innovations.

When the German Science Council accepted the mandate to assess non-university research in the GDR in July 1990, the Fraunhofer-Gesellschaft had already completed its evaluation in a first step and developed a concept. The study also progressed faster because the Fraunhofer-Gesellschaft, with its fields of research in natural sciences and engineering, was active in areas that were less burdened ideologically. In order to compensate for the necessarily preliminary examination of quality and market opportunities, the planned facilities were to be limited in time to three years and set up on a permanent basis only after a detailed evaluation.

Syrbe was impressed by the strong commitment of those affected. "As our approach was very personal, the motivation in both East and West Germany was enormous. Some of those involved wanted to learn new things, others wanted to help," he recalled. This leap of faith triggered a high level of motivation and initiative, which helped overcome the adversities. The willingness to help met a willingness to take personal responsibility. "The Fraunhofer-Gesellschaft has been received with great respect, goodwill and trust," recalls Reimund Neugebauer, now president of the Fraunhofer-Gesellschaft and at the time instrumental in founding the Fraunhofer IWU in Chemnitz. "The reasons lay firstly in the fact that they had no reservations whatsoever, and secondly in the fact that they valued the high standards of technical training of the people on site."

1993



Since its establishment in 1993, the Fraunhofer Institute for Reliability and Microintegration IZM in Berlin can look back on a successful track record. Over 200 employees now carry out research and development work at the institute.

### Dr. Alexander Imbusch

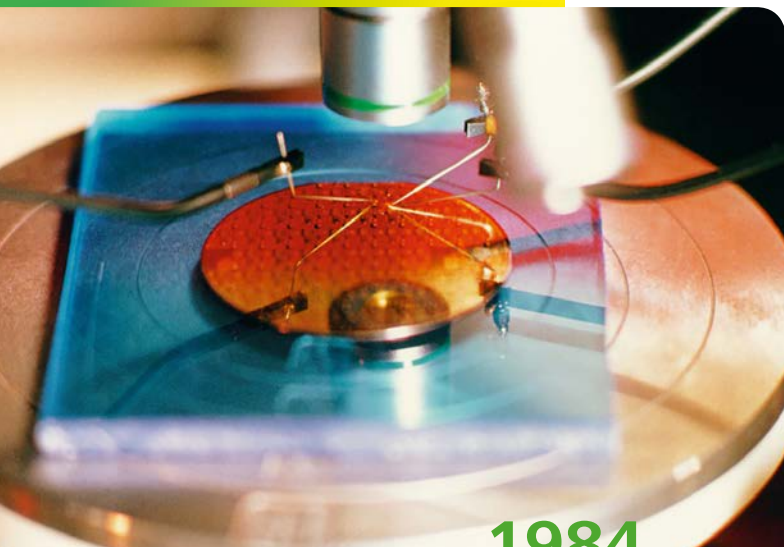
After his studies and obtaining his doctorate in Berlin, he joined the planning department in 1973, became its head and then head of the research and communications department where he remained until 2006. For 33 years, he ensured a high degree of continuity in strategic research planning. His influence extended far beyond this function. He played a decisive role in the repositioning of the Fraunhofer-Gesellschaft from the very beginning and was responsible for the constant adaptation to the fast-growing future markets.



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In an auspicious moment,  
the willingness to  
help coincided with  
the readiness to take  
responsibility.

Future technology – microelectronics:  
Fraunhofer stands up to the emerging  
competition.



In the spring of 1991, the Fraunhofer Senate approved the concept. Then, on July 5 of that year, the Science Council presented its recommendations and approved the Fraunhofer concept. According to this plan, eight institutes, one branch of an institute and twelve branch offices of existing institutes were to be established. Most of the institutes and research units – often in temporary emergency quarters – immediately commenced work. Nevertheless, it was a tremendous feat for all those involved in both East and West Germany until a total of 21 institutes and branch offices were officially opened on January 1, 1992.

Heinz Riesenhuber, Minister of Research, praised the Fraunhofer-Gesellschaft and Syrbe in the highest possible terms, in particular “for his impressive personal commitment” to this hands-on approach. However, this did not prevent him from further reducing funds for the Fraunhofer-Gesellschaft. Due to the financial burdens of reconstruction in East Germany, he was forced to make drastic cuts in project funding.

#### Determined shaper and tireless driving force

Max Syrbe worked as the tireless “driving force” for the modernization of the Fraunhofer-Gesellschaft. Keller and Syrbe “were united in the goal of helping the Fraunhofer-Gesellschaft gain luster and prestige,” Alexander Imbusch, who accompanied him, describes the two presidents with whom he shared his passion for Fraunhofer.

Despite contemporary efforts aimed primarily at consolidation, Syrbe’s presidential term goes down in the history of the Fraunhofer-Gesellschaft as a period of considerable growth. As a result of the expansion, the share of defense research fell below ten percent during this period. Market demands and competition from the federal states led to strong expansion, no matter how much the Research Ministry slowed it down. And, as a result, the budget of the Fraunhofer-Gesellschaft grew in that decade from 300 million D-Mark to over 1 billion D-Mark, and the number of institutes increased from 30 to 47.



To learn more about our institutes in the newly-formed German states, read “25 Jahre Fraunhofer,” a special edition of the Fraunhofer magazine available on our website at:

[www.fraunhofer.de/en/  
media-center/publications/  
fraunhofer-magazine.html](http://www.fraunhofer.de/en/media-center/publications/fraunhofer-magazine.html)

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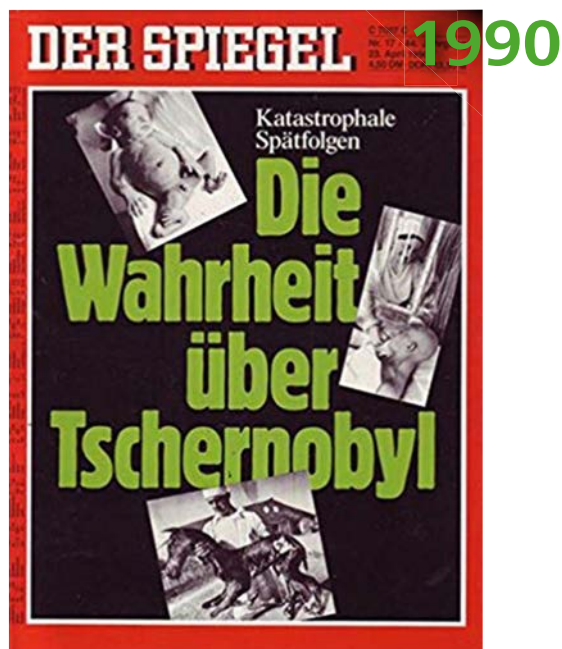


The first portable cellphones still weigh an imposing 800 grams. In 1983, some 300,000 were sold for 4,000 US dollars each.

The 1980's and 1990's are dominated by an ambivalent relationship with euphoria over technology from the past.



Go Trabi Go: The first Trabants from East Berlin were enthusiastically welcomed in the city's western part. Reunification is around the corner; Fraunhofer takes up residence in the new federal states at an early stage.



Tschernobyl and its consequences: The reactor disaster ignited new discussion about nuclear energy.

Under the Maastricht Treaty, the European Union is founded as a high-order association for the European communities. Initially, there were 12 states, today there are 27. The Fraunhofer-Gesellschaft's commitment in Europe is diverse and constantly expanding.





1993 - 2002

# Innovation drivers and international- ization



Consolidation and a sustained increase in economic earnings were once again on the agenda as Hans-Jürgen Warnecke took office as president of the Fraunhofer-Gesellschaft. Under his leadership, the profile of the organization was refined and the industrial revenues elevated to become the measurable performance indicator. The “Leitbild 2000” – the guiding principles for the year 2000 – described the Fraunhofer-Gesellschaft as a powerful group of networked institutes with a consistent orientation to the market. And the foundation of Fraunhofer USA marked the beginning of the internationalization of the organization.

In October 1993, Hans-Jürgen Warnecke took over as the new president. With the end of Max Syrbe’s term, Minister of Research Heinz Riesenhuber called upon Hans-Jürgen Warnecke to fulfill the goal that Syrbe had no longer been able to fully realize – namely to increase industrial revenues to 33 percent in the short term. Warnecke, who had developed the Fraunhofer Institute for Manufacturing Engineering IPA in Stuttgart into the largest and economically strongest institute of the Fraunhofer-Gesellschaft, was confident that he could do it. He set the target of increasing industrial revenues to 34 percent by 1995 and those of the business-related institutes to as much as 40 percent. The ongoing debate with the Federal Minister of Scientific Research had, for one thing, finally come to an end while, in a consistent continuation of the Fraunhofer history, industrial revenues were also chosen as the all-decisive evaluation criterion – because this performance indicator was precisely measurable. From then on, the quota of industrial revenues in comparison to the overall budget became the dominant control element inside and outside of the organization. But Heinz Riesenhuber was no longer able to claim all this as his success; he had, in the meantime, been replaced as Federal Research Minister.

However, his successors continued to maintain the drastic austerity measures. Between 1995 and 1997, the Fraunhofer-Gesellschaft’s basic funding grew by a mere two percent, and by only three percent in 1998; in contrast, contract research showed annual growth rates of up to 9 percent. The funding gap kept getting larger. It is important to note here that sufficient preliminary research was, and is, essential for the Fraunhofer-Gesellschaft. It has always provided the organization with a great amount of freedom for scientific creativity and, with newly developed technologies and processes, it has also enhanced Fraunhofer’s attractiveness in the business world. Nevertheless, the strong lag in basic financing threatened to whittle away the company’s future viability.

Following the exceptional boom as a result of German reunification, the global economic crisis began to have a more severe effect on Germany. In this rapidly changing economic environment, the Fraunhofer-Gesellschaft began reorienting itself and, through intensive discourse with the institutes, began developing a new guiding principle under the name “Leitbild 2000.” In this vision for the new millennium, the Fraunhofer-Gesellschaft defined itself as a high-performance group of networked institutes that work in a market and customer-oriented manner for national and international research and development markets. All this internal communication regarding the organization’s common goals led to a sense of common meaning and identity, the honing of the organization’s profile, and the creation of a new self-image. Since all decision-makers, right

“Forschung für den Markt. Geschichte der Fraunhofer-Gesellschaft.” by Helmuth Trischler and Rüdiger vom Bruch.

The two historians published this book on the history of the Fraunhofer-Gesellschaft in 1999. It is “a critical review of the Fraunhofer-Gesellschaft from a historical perspective” rather than a commemorative publication. The historians spent three years researching the archives of ministries and the Fraunhofer-Gesellschaft. “This gave us an unparalleled density of tradition,” they wrote in the foreword.



“A company must be a living organism, capable of learning, adapting and, above all, reacting immediately when a new problem arises. In this respect, I also had the Fraunhofer-Gesellschaft in mind.”

Prof. Dr. Hans-Jürgen Warnecke

up to the works council, were involved in the process and shared a common responsibility, Warnecke was able to tackle the organization’s strategic re-positioning without any major resistance.

This also called for a uniform corporate design to support the new corporate identity. For the first time, all institutes appeared under the same corporate look. The old company abbreviation, FhG, was dispensed with making way for a distinctive green which still defines the brand. The corporate identity also included its own corporate typeface and a clear nomenclature for the institutes and research institutions. The new corporate design not only reinforced the brand and image, but also increased Fraunhofer’s overall level of recognition far beyond the borders of the national research landscape.

### Joint research – greater efficiency through networking

One of the main results of discussing the new guiding principles was that competence and efficiency could best be increased through networking and the creation of focal points. Deeper cross-institutional cooperation was to open up synergies and offer customers interdisciplinary solutions. Traditionally, the strength of the Fraunhofer-Gesellschaft had been based on the independence and entrepreneurial autonomy of its institutes, despite the fact that they often acted as competitors, which sometimes made cooperation more difficult. An external impetus helped to further modernize the existing structures.

The Ministry of Research, which had been under increased financial pressure since the reunification, called for tighter coordination of microelectronics activities, as did the German Electrical and Electronic Manufacturers’ Association (ZVEI), which assessed the industrial relevance of government-funded information technology research institutions in 1993. The ZVEI recommended that “the Fraunhofer-Gesellschaft’s microelectronics domain should be brought together much more effectively than before under a single leadership.” This took effect in 1996 with the programmatic and organizational reorientation of the microelectronics group, which in the meantime had grown to seven institutes. Instead of

setting up a separate board division for microelectronics, the executive board decided to strengthen the self-organization forces and transferred decision-making authority to the group’s steering committee. This enabled the advisory board to fulfill its coordinating role. At the same time, the group, which had previously been strongly oriented towards large-scale industry, was now consistently focusing on the applications industry. The main objective was the development of customer-specific solutions. This stronger market orientation very quickly had an effect – the group’s industrial revenues soon reached the “magical” barrier of 40 percent.



70 YEARS OF FUTURE  
#WHATSNEXT

## mp3 compresses music data

Revolutionary: The first prototype of an mp3 player is the size of a cigarette box and is equipped with one megabyte of memory. From today’s perspective, mp3 is the first generation of a series of audio coding methods that were developed at the Fraunhofer Institute for Integrated Circuits IIS.

The keys to the long success story are the scientific excellence of the Fraunhofer IIS which, over the last 30 years, has won all technical audio standardization competitions against large-scale international players, and also the fruitful marketing of the development results with well over ten billion licensed devices.



In May 1997, six Fraunhofer Institutes joined forces to form the new Fraunhofer Group for Materials and Components. In the same year, the Fraunhofer Group for Production was founded. Joint marketing concepts and coordination of research strategies were at the forefront of their activities. In 2001, four Fraunhofer Institutes formed the Fraunhofer Group for Life Sciences. In addition, the central administration set up a wealth of internal funding programs to stimulate cooperation between the institutes: "Joint Studies", "Economic Strategic Alliances" and "Demonstration Centers" were established.

### Cooperation with industry

A study revealed that some 30,000 companies in Germany were themselves involved in research and development (R&D). "We have therefore only reached 10 percent of the market in terms of the number of customers, and still see considerable untapped potential," stressed Warnecke, who wanted to position the Fraunhofer-Gesellschaft as the central R&D department of the Federal Republic of Germany. "The aim is to achieve this potential through even more professional marketing and intensive acquisition as well as the constant adaptation of our competencies."

Under the motto of "customer orientation," the Fraunhofer-Gesellschaft sought new opportunities for collaboration with the industry. The model of "research bridgeheads" was to bring industry directly to the institute. The steel company Thyssen, for example, wanted to make the key laser technology available to the entire group. For this purpose, the subsidiary Thyssen Lasertechnik set up its base at the Fraunhofer Institute for Laser Technology ILT in Aachen. The advantage of being able to share large-scale equipment and infrastructures played an important role in microelectronics, where complex and expensive clean rooms are an issue. In Duisburg, for example, the Fraunhofer Institute for Microelectronic Circuits and Systems IMS started a collaboration with Elmos, and in Iztehoe the Fraunhofer Institute for Silicon Technology ISIT set up its collaboration with the company TEMIC.

In order to accelerate the transfer of knowledge to industry, special application centers were set up at universities of applied sciences in 1997. These branch labs of Fraunhofer Institutes were to open up new markets in the regional economy.

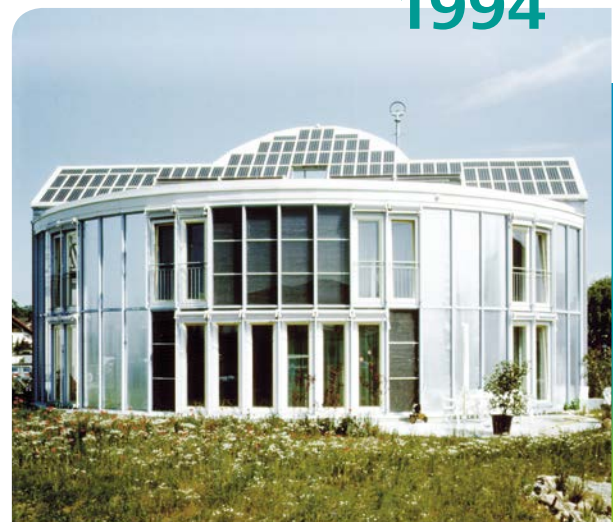
Innovation research at the time pointed to a decisive gap in the transfer and innovation process. Many technical innovations failed to take the leap from research laboratory to market. Some laboratory prototypes were still too far short of the complex demands of serial production. The Fraunhofer-Gesellschaft recognized that this gap could be bridged by producing prototypes and small series and started to establish "innovation centers" as a pilot project.

A dream comes true:  
The first energy self-sufficient solar house goes into operation. Thanks to solar technology and excellent insulation, the building engineered by the Fraunhofer Institute for Solar Energy Systems ISE manages without an external energy supply.

"We must behave like a commercial enterprise and comply with the rules of a government agency under state supervision."

Prof. Dr. Hans-Jürgen Warnecke

1994



“Never find a  
culprit, find  
a solution.”

Prof. Dr. Hans-Jürgen Warnecke

Prof. Dr.  
Hans-Jürgen Warnecke

Hans-Jürgen Warnecke studied mechanical engineering at the Technische Universität Braunschweig and received his doctorate in 1963. After gaining industrial experience at the production facility at Rollei, he became full professor and Chairperson for Industrial Manufacturing and Factory Operation at the University of Stuttgart and head of the Fraunhofer Institute for Manufacturing Engineering and Automation IPA, which he developed into the largest and most economically powerful institute of the Fraunhofer-Gesellschaft in 1971. In 1992, Warnecke published the book “The Fractal Factory,” which summarized his experiences and thoughts on corporate management and organization and focused on people and their abilities. The publication earned him international recognition. From 1993 to 2002 he was president of the Fraunhofer-Gesellschaft, and, from 1995 to 1997, also president of the Association of German Engineers (VDI) in Dusseldorf.



This enabled Fraunhofer to expand its line of business to the production of commercially usable prototypes and small series. Their commercially organized innovation centers, therefore, corresponded to the federal government’s “Guidelines for the Strategic Orientation of the German Research Landscape”.

As a result, many institutes began hiring marketing specialists. The Fraunhofer-wide marketing network provided training and competence exchange. Research bridgeheads, demonstration, application and innovation centers, and the professionalization of marketing all served the goal of shortening the path to the customer and accelerating technology transfer. This made the Fraunhofer-Gesellschaft’s offering to commerce even more diverse, transparent and attractive.

Another important contribution to strengthening Germany’s innovation system was the establishment of technology-oriented companies. Fraunhofer’s central administration therefore established its “Fraunhofer Venture.” Since then, the task of this group has been to support spin-offs and to prepare investments. In the year 2000, 48 companies were spun off from the Fraunhofer-Gesellschaft, more than half of them supervised by Fraunhofer Venture.

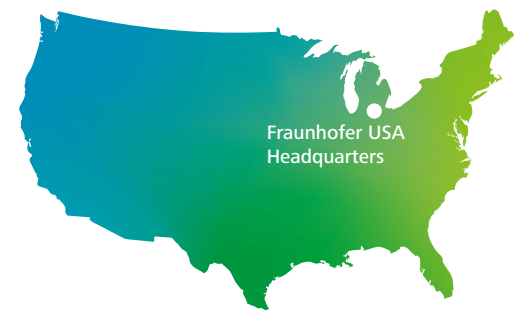
### Internationalization for the globalized economy

The guiding principle had already stated: “The Fraunhofer-Gesellschaft conducts research on the national and international R&D market in a demand-oriented and market-oriented manner”. Many international projects carried out by the Fraunhofer Institutes in the 1970’s and 1980’s typically featured government development aid. The focus was on development aid through technology transfer. Some institutes, however, had already followed the companies in their globalization process and supported them in setting up new plants – for example, the Fraunhofer IPA was already working on a contract with VW in Brazil. After the shock resulting from an MIT study at the time, which found that the German automotive industry was lagging behind Japanese and US production methods, the focus shifted to the leading industrial nations.

Now it was a matter of connecting with the world’s most important centers of knowledge creation. “International networking is a essential in order to increase our value as a partner for business and society in Germany,” as Warnecke described the situation in which knowledge was created worldwide and it depended on who was the first to implement it. Above all, the United States was regarded as an outstanding location for integration into top-class science.

This led to the foundation of Fraunhofer USA with a number of centers in 1994. In addition, representative offices were founded in Asia, such as the ones in Malaysia, Singapore and China. The aim was to establish and maintain contacts in the world’s important economic regions.

1994



Fraunhofer USA was founded in 1994 in order to carry out research and development for customers from the industrial sector, the federal state governments and the federal government in the USA. The headquarters in Plymouth, Michigan, coordinates and supports broadscale activities.

At the same time, to set up the leap across the Atlantic, a liaison office was created in Brussels to provide the institutes with greater support in the competition for European research funding. This was also intended to demonstrate the orientation of the Fraunhofer-Gesellschaft toward being a European research institution.

In the beginning, internationalization was viewed critically, because the Fraunhofer-Gesellschaft was first and foremost intended to make the German economy more competitive. Under the pressure of accelerated globalization, however, policy makers as well as the industry soon recognized the advantages of an international presence and intensively supported the Fraunhofer-Gesellschaft.

### Flexible adjustment of capacities

The strict orientation of the Fraunhofer Institutes towards the market for contract research necessitated an adjustment of the institutes far removed from the market. In his statement, Warnecke clearly described the tightrope walked by the Fraunhofer-Gesellschaft between its focus on future technologies and market ties: "On the one hand, it has to conduct future-oriented research, on the other hand, however, it is tied to the orders of industry and can only go as far ahead as the current research market permits." Due to the interests and sensitivities of the federal states, closures were hardly feasible, so the Fraunhofer-Gesellschaft increasingly relied on the technical reorientation of its institutes. In contrast to the large research units, it demonstrated a high degree of flexibility and consistent adjustment of its capacities to technological developments. The Fraunhofer Institute for Atmospheric Environmental Research IFU, which carried out outstanding basic research but was unable to create demand on the industry side, was finally handed over to a more suitable body. The Fraunhofer model stimulated competition and forced constant evolutionary adaptation to the market, which Warnecke intensively promoted. An especially effective incentive system proved to be one that particularly rewarded those institutions that achieved between 25 and 50 percent economic returns.

It was with this dynamism that the institutes and research institutions established in the German federal states in the east following reunification were launched into the nationwide competition. After only a few years, all of them were made permanent; and it took only eight years for Fraunhofer to end the formal distinction between institutes in the east and west because they had achieved the same financial structures with a high share of revenues. They had thus achieved what the economy in general was not able to do for a long time: bringing the new German federal states up to the level of the states in Western Germany and being able to assert themselves nationally and internationally. Consequently, fragments of a decaying research landscape in the east became efficient and competitive research institutions.

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"My goal was to generate around 40 percent of turnover from orders with industry. And that's what the institutes have achieved."

Prof. Dr. Hans-Jürgen Warnecke

## Fraunhofer USA

Fraunhofer Institutes had already begun to establish Branch Labs in the USA at the beginning of the 1990's. Warnecke took up these initiatives and in 1994 supported the founding of Fraunhofer USA on Rhode Island as an independent foreign subsidiary of the Fraunhofer-Gesellschaft. The Fraunhofer Center for Research in Computer Graphics had already established itself in Providence, and thereafter a Fraunhofer Resource Center was founded in Hartford – later it moved to Boston – in cooperation with the Fraunhofer Institute for Production Technology IPT and another one in cooperation with the Fraunhofer Institute for Laser Technology ILT. In the following year, the presence in the United States was further expanded.

1994



Globalization does good: Fraunhofer establishes its first locations in the USA. Relationships with the coveted center of knowledge become more intense.

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Now it was a matter of connecting with the major centers of knowledge around the world.



## New focus on information and communication technologies

During the internal system evaluation in 1998, one of the recommendations was to become more involved in information and communication technologies. Nevertheless, it came as a surprise to the general public, the research community, but also to the employees of the Fraunhofer-Gesellschaft and the GMD Information Technology Research Center, when Federal Minister for Education and Research, Edelgard Bulmahn, announced the merger of the two institutions in September 1999. It was “the biggest, but also the most controversial coup in the history of German science policy,” says historian Helmuth Trischler, assessing the integration of a large research institution into the Fraunhofer-Gesellschaft, which had been prepared by a few initiates. For many years, the Federal Ministry of Education and Research (BMBF) had been looking to modify the orientation of the Gesellschaft für Mathematik und Datenverarbeitung GMD (Group for Mathematics and Data Processing), which as founded in 1968. However, various restructuring measures had not achieved the desired success. The BMBF therefore believed that an association with the Fraunhofer-Gesellschaft would release the synergies it had hoped for. The model for the merger, which was agreed between the BMBF State Secretary Uwe Thomas, the president of the Fraunhofer-Gesellschaft Hans-Jürgen Warnecke, the chairman of the Senate Horst Nasko and the chairman of the board of GMD Dennis Tschritzis, provided for the organizational restructuring of the Fraunhofer-Gesellschaft and its split into corporate divisions. Dennis Tschritzis was to become vice president and head the new Information/Communication Division. In addition, the GMD institutes were not subject to the Fraunhofer model, but should receive up to 70 percent basic funding.

Yet the agreements that had been negotiated informally by only a very small select group triggered an outcry and they were met with great resistance from those affected. The Fraunhofer-Gesellschaft fought to preserve their proven Fraunhofer model as a fundamental principle of fair resource allocation, the GMD for the further financing of its basic research. Only after two years and fierce debates was it possible to legally implement the “integration,” as Warnecke now called the result, which had initially been announced as a merger. The Fraunhofer-Gesellschaft neither changed the organizational structures nor the Fraunhofer model. The newly-formed Fraunhofer Information and Communication Technology Group, which comprised eight GMD institutes and six Fraunhofer Institutes, was the largest European research association in this field, but differed only slightly from the other institute groups. The research program known as “Living and Working in a Networked World” was primarily intended to support the former GMD institutes for a period of five years in order to enable the gradual creation of a contract research portfolio. Dennis Tschritzis was accepted as a further member of the executive board of the Fraunhofer-Gesellschaft. In the end, Fraunhofer had succeeded in not diluting its profile, which had been laboriously fought for and was so successful, with a clear orientation towards the market.

### Dr. Dirk-Meints Polter

Polter, who holds a doctorate in law, held various positions in the German Federal Ministry of Research, then served on the board of directors of Deutsches Elektronen-Synchrotron (DESY). In 1989, he took over the position of Executive Director for Human Resources and Legal Affairs from his predecessor Eberhard Schlephorst where he stayed until 2008. He initiated the employee survey and dealt with the ongoing issue of performance-related remuneration and recruiting measures. He brought in his international experience and bundled the foreign activities in his board division.



The European automotive industry faces difficulties in terms of competitiveness. Warnecke, Fraunhofer President, develops the concept of the “Fractal Factory”: The idea is for organizations to be faster and more flexible in their reactions.

The system evaluation, which was completed in 1998, had certified that the Fraunhofer-Gesellschaft conducts “research of an international level and considerable economic benefit, primarily oriented to the needs of the economy”. With its clear mission, the Fraunhofer-Gesellschaft was an “indispensable element of the German research landscape.” On the occasion of its 50th anniversary in 1999, Federal Research Minister Edelgard Bulmahn named the Fraunhofer-Gesellschaft as the outstanding “model of success in applied research, for excellent research” bar none. Fraunhofer had repeatedly been held up as a role model for large-scale research that had been able to show how successful contract research can be. It couldn’t just throw its tried-and-tested principles overboard. Exceptions would be a violation of the principle of equal treatment of all institutes and blur the “clarity” of their mission.

Warnecke was aware of the tightrope walk: “My dream is to be a research company that operates in the private sector, is free from the restrictions that publicly funded organizations are normally subject to, and can still operate internally toward its employees and externally toward its clients as an international organization. At present, an almost unsolvable dilemma.”

The controversies regarding the GMD integration overshadowed Warnecke’s last years in office. In 1999, the year of Fraunhofer’s 50th anniversary, the organization clearly exceeded its target of 37 percent economic earnings. In 2001, it reached its highest level at 39 percent. Then the new integration reduced industrial revenues down to 30 percent.

Reimund Neugebauer, current president of the Fraunhofer-Gesellschaft, summed up Warnecke’s achievements in his speech on the occasion of his 80th birthday: “As president of the Fraunhofer-Gesellschaft, Hans-Jürgen Warnecke has developed the Fraunhofer-Gesellschaft into a high-performance research organization as an innovation driver for industry and opened up completely new possibilities for the creation of synergies and strategic action by profiling it into specialist groups and demand-oriented alliances. We should also thank him for internationalizing the organization and for enforcing performance fairness.”

70 YEARS  
OF FUTURE  
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## White LED

Back in 1995, the late Professor Jürgen Schneider from the Fraunhofer Institute for Applied Solid State Physics IAF and his team succeeded in generating white light from just one light diode chip. Before then, this was possible only by combining three monochrome light diodes with an elaborate control system. The Fraunhofer IAF continues to research efficient and reliable LED lighting and develops LED modules that can adapt, for example, to human biorhythms.

1991



Tim Berners-Lee develops the fundamentals of the World Wide Web at CERN. On August 6, 1991, the British physicist and computer scientist rolls out his Hypertext service project worldwide: The Internet, as we know it today, is born.

The winds of change swept the 90's, but few people could have predicted the profound transformation that the World Wide Web would bring.

Dolly the cloned sheep: Dolly, the first sheep created through cloning, astonishes mankind and puts the global scientific community in turmoil. The animal, which died in 2003, can be seen today in the Royal Museum in Edinburgh.



1996

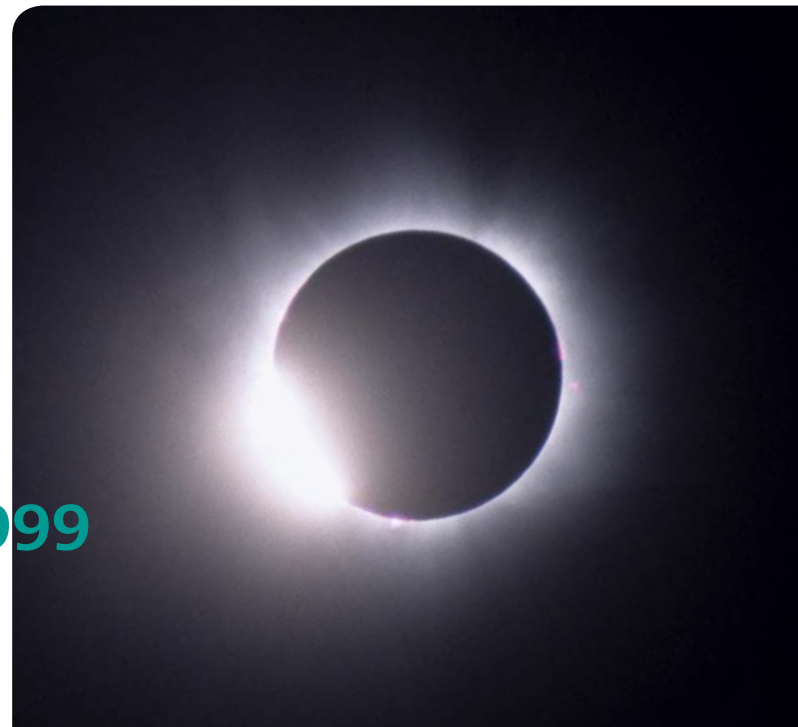
1998



New Labour: Just like Bill Clinton's New Democrats in 1992 and Tony Blair's New Labour in 1997, Gerhard Schröder's "New Center" champions personal responsibility, pragmatism and pro-business policies.

1999

Total eclipse: The last solar eclipse of the century had some people storming opticians' shops in the search for protective glasses. Others were happy to enjoy the rare astronomical event.



A man is standing on a wooden ladder, reaching up to adjust a small screw on a white wall. Above him, large, dark blue 3D letters spell out 'GIGABIT'. The scene is lit with a cool blue and purple light, creating a futuristic atmosphere. The man is wearing a dark long-sleeved shirt and glasses.

GIGABIT

2002 – 2012

Innovation  
offensive and  
research on behalf  
of the future



At the beginning of the new millennium, innovation became synonymous with the viability and future orientation of companies and industrialized countries. This is when the Fraunhofer-Gesellschaft seized the opportunity to continue presenting itself as a driver of innovation. Hans-Jörg Bullinger, the new Fraunhofer President, supported the “innovation offensive” of the German Chancellor Gerhard Schröder with a communication campaign. Key innovations and prospects for future markets showed where new opportunities of growth lay. Chancellor Merkel set a clear course with the “High-Tech Strategy for Germany”.

“Professor Bullinger, let us get this innovation offensive going,” was how Chancellor Gerhard Schröder ended his presentation at the Fraunhofer Annual Conference in October 2003. Hans-Jörg Bullinger had thus achieved what he had demanded since taking office a year earlier: an innovation offensive to help the faltering German economy become more competitive again. “An exporting nation like Germany can only secure employment and prosperity if its products are competitive on world markets. It is not possible to win a price competition against countries such as Korea, Taiwan or Hungary,” he warned the guests from politics and industry. “And how should we justify our higher standard of living when we manufacture products that can be produced anywhere? There is only one alternative to this: constantly introducing new, better products to the market.” Already during the change of presidency in October 2002, the focus of the presentations was on the fascination of the new. Together, Warnecke and Bullinger presented their book “Kunststück Innovation” (The Feat of Innovation). After more than twenty years as director of the Fraunhofer Institute for Industrial Engineering IAO in Stuttgart, which he had spun off from Warnecke’s IPA in 1981, Bullinger was appointed president.

In December 2003, Bullinger presented twelve lead innovations in cooperation with the journal “bild der wissenschaft” in order to give the topic of innovation new momentum. The lead innovations, which had been developed in a Fraunhofer-wide ideas contest, were to use concrete examples in order to show where promising future potential for the German economy lay. This was the prelude to the Year of Technology in 2004, which was proclaimed by the German Federal Ministry of Education and Research (BMBF). The Fraunhofer-Gesellschaft assumed special responsibility and prepared a large event in Stuttgart.

Gerhard Schröder kept his word and, already in January 2004, called together the leading representatives from science and industry – including Bullinger – to found the initiative “Partners for Innovation” in Berlin. It was the most comprehensive innovation initiative in the history of the Federal Republic of Germany to date and was intended to create a more innovative climate in Germany. Bullinger was the driving force behind the concept developed by Fraunhofer on behalf of the Federal Chancellery. In addition to the federal government, 17 top managers of large companies and research institutions became partners in the initiative. Fraunhofer played an active role from the very beginning and supported the establishment of the “Innovation Office” in Berlin.

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Turbulent times  
need creative  
minds.

### Prof. Dr. Hans-Jörg Bullinger

After attending technical high school, the trained factory mechanic began studying mechanical engineering at Stuttgart University, where he received his doctorate in 1974 and his habilitation qualification in 1978. From 1971, he worked at the university as a scientific assistant and, from 1975, he was also head of the Corporate Planning Department at Fraunhofer IPA. In 1980, he was appointed full professor of ergonomics at the Fernuniversität in Hagen, a distance education university. In 1981, he founded the Fraunhofer Institute for Industrial Engineering IAO and headed it for more than 20 years. Between 2002 and 2012, he was president of the Fraunhofer-Gesellschaft, and from 2006 to 2012, together with Dr. Arend Oetker, he was chairman of the Federal Ministry of Education and Research's Industry Research Union. Manager Magazin voted him Manager of the Year 2009. From 2013 to 2018, he was Senator of the Fraunhofer-Gesellschaft.



"Germany's decline in technological performance is a long-term consequence of the weak economic growth that has persisted since the 1990's. We're living on our reserves. It is particularly alarming that we haven't been able to keep pace with the future technologies that are growing dynamically," said Bullinger, giving the reason for the innovation offensive. Hence the initiative's slogan "making ideas successful" generated a spirit of optimism. Between early 2004 and the end of 2006, more than 400 experts cooperated on 15 specialist and working groups of the initiative. Lighthouse projects such as the "Energy-efficient School" and the "Digital Hospital of the Future" were jointly developed, and recommended actions for policy makers were drawn up. Many still remember the campaign "Du bist Deutschland" (You are Germany). It was the largest social marketing campaign in the history of the Federal Republic of Germany, and through it the large German media companies supported the "Partner for Innovation" initiative in television commercials and large advertisements.

Angela Merkel, who was elected Federal Chancellor in November 2005, continued the initiative in an adapted form and appointed the "Council for Innovation and Growth" as an advisory body to the new federal government. For the first time, the federal government had drawn up an interdisciplinary "high-tech strategy for Germany" to define the central tasks and objectives of the innovation policy.

At the same time, Bullinger launched his presidential projects at Fraunhofer to increase innovation capability on a sustainable basis and permanently accelerate the pace of innovation. The study examined crucial questions of technology and innovation management: How can innovations be developed more quickly? How can new technologies be identified at an early stage and adapted? How can new technologies be successfully introduced to the market and what will successful business models look like in the future? Numerous Fraunhofer Institutes provided their expertise to answer these questions. These studies resulted in systematic methods that provided valuable instruments for the institutes as well as for the economy.

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"You don't get a head start by just running behind, you get a head start by overtaking in new ways: through innovation."

Prof. Dr. Hans-Jörg Bullinger

2003



New technologies are established on the markets of the future. The Fraunhofer Institute for Reliability and Microintegration IZM plays a pioneering role in the Wearable Computing sector.

### Internal and external networking – the next level

Studies on the technological performance of the leading industrial countries showed that a country like the Federal Republic of Germany cannot comprehensively and simultaneously overcome all challenges in order to achieve leadership in all areas. “If we succeed in pooling our strengths and networking our competencies, we will be able to achieve the critical mass and clout necessary to keep up with international competition,” Bullinger had recognized. “However, we also need the declared will to stay ahead.” The right strategy was to “strengthen the strengths” – and this could best be achieved by networking existing capacities. With this goal in mind, Fraunhofer developed the concept of innovation clusters. The task of these clusters was to bundle the regional research and development resources of science and industry in order to drive innovation dynamics through concrete projects. The concept of the Fraunhofer innovation clusters proved to be extremely successful. The Joint Science Conference of the federal government and the federal states wrote: “Currently, the 16 Fraunhofer Innovation Clusters are a model for success for forward-looking collaborations with industry and are the inspiration for the Leading-Edge Cluster Competition of the Federal Ministry of Education and Research”. Well prepared due to their own innovation clusters, the Fraunhofer Institutes succeeded in taking a leading role in five out of ten top clusters.

It should be noted that internal networking had already reached a new level by the time Bullinger took office. And, nevertheless, the Fraunhofer Groups were further upgraded. The Articles of Association were amended and a new presidential council was introduced to support the executive board in the implementation of corporate policy. The presidential council consists of the members of the executive board and the group chairmen. The chair of the group are elected by the heads of the institutes of the respective group. At the moment, there are seven thematically oriented research groups: Materials and Components – MATERIALS; Microelectronics; ICT; Production; Life Sciences; Light & Surfaces; Defense and Security VVS.

“Flexibility and responsiveness are the characteristics that are required in times of crisis,” Bullinger stressed, driving networking forward. While closely related institutes were organized within the groups, institutes with a variety of competencies were working together for a limited period of time as Fraunhofer Alliances, to develop or market a specific business area. Very quickly, a variety of alliances emerged, for example on traffic and transport, energy, lightweight design, adaptronics or ambient assisted living. This meant the urgent need of the industry to obtain system solutions from a single source could be fulfilled.

“The secret of success at Fraunhofer is, was and will continue to be its employees. They must find a corporate culture, a canon of values and career opportunities with us so that they can develop their full potential here.”

Prof. Dr. Hans-Jörg Bullinger

Cryo-preservation technology: With its laboratory technology, theranostics and bio-medical technology business areas, the Fraunhofer IBMT perceives itself as a technology and device developer in the service of its customers.

2005



Responsibility for research at the Germany location: "The future needs research" is the motto of the 2008 annual conference.




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"With the lead innovations, we initiated a strategy process for the entire Fraunhofer-Gesellschaft. This enables the institutes and groups to align their development goals with those of society as a whole."

Prof. Dr. Hans-Jörg Bullinger

### Creative minds – more added value

"Turbulent times need creative minds," is how Hans-Jörg Bullinger titled one of his programmatic presentations. According to Bullinger, Germany had to face up to the global "competition for talent." In continuation of Warnecke's ideas on the fractal factory, Bullinger focused on the human being; for only man is creative, not the computer. "It is important," he said, "that we create a climate of trust, openness and error tolerance not only at Fraunhofer but also in the companies, so that our employees can develop their ideas." In his opinion, the purpose of leadership is to value and promote creative minds and to give them freedom. In difficult times, values have to be conveyed: "Those who demand greater performance must offer more meaning."

In order to revitalize the Fraunhofer-Gesellschaft with new topics and more creative minds, the executive board launched the Attract funding program. "The message – also for our institutes – is that we want to retain the best young minds in the world," said executive vice president for research Ulrich Buller, explaining the initiative. Attract offers young external researchers the opportunity to develop their ideas to market maturity at Fraunhofer. For five years, the selected scientists can set up a group at a Fraunhofer Institute to efficiently advance their technology project. The competition brought promising applications and enriched the technology portfolio of the institutes with new research areas.

At the same time, the collaboration with universities was intensified in order to expand access to the scientific networks, attract young scientists and intensify preliminary research. "It is important to me that Fraunhofer seizes every opportunity to maintain its proximity to research and our young scientists through collaboration with universities, higher education institutions or with Max Planck," says Ulrich Buller, describing the growing integration with the tertiary education establishments. "In recent years, we have succeeded in significantly increasing the number of joint appointments with universities and colleges at the second-tier level as well."

In order to strengthen scientific excellence, a cooperation program with the Max Planck Society was launched in 2005. The two research organizations provided up to four million euros annually for joint projects. A panel of experts consisting of members from both organizations recommended projects for funding for three to four years. The projects are characterized by the fact that the challenges were set at the highest scientific level, which at the same time offered the best possible solutions for exploitation. The complex issues can only be solved by linking the core competencies of both organizations – knowledge-driven basic research with industry-related technology development.



In order to exploit the intellectual property of creative minds, it has to be protected. The Fraunhofer-Gesellschaft began patenting ideas and inventions at an early stage and for years has been one of the largest patent applicants in Germany. The term intellectual property (IP) – as in inventions, property rights and know-how – has meanwhile become a decisive competitive factor. Patents are not only exchanged and licensed, claims are also being made more frequently. The Fraunhofer-Gesellschaft has also had to review its IP strategy. So far, patents had mainly been used to attract industry. In the meantime, the aim was to build up a portfolio of intellectual property rights and to make the best possible use of the Fraunhofer-Gesellschaft's own intellectual property. In several cases, the marketing of licenses also generated substantial revenues – for example, in the well-known case of mp3 technology. Its outstanding economic success enabled Fraunhofer to establish a future foundation with strong capital resources. Preliminary research was used to create new valuable patent clusters, the exploitation of which can generate new income. This opened the way to sustainable IP construction.

Further training is one way of qualifying top talent. In the past, some Fraunhofer Institutes were already involved in the training of skilled workers. With the founding of the Fraunhofer Academy in 2006, the continuing education offerings were bundled and expanded under one roof. The offering is based on the research activities of the Fraunhofer Institutes in cooperation with selected and renowned partner universities. The aim is to provide specialists and executives from business with the latest findings in science and research. This is because companies can only enter into new technologies if they receive freshly trained specialists who bring new skills with them and can use them. The advanced training courses offered by the Fraunhofer Academy accelerated the transfer of technology to industry and, at the same time, laid the foundation for the participants' careers.

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The advanced training offered by the Fraunhofer Academy accelerates the transfer of technology to the industry and provides a firm foothold for stepping up the career ladder.

Meanwhile, the Fraunhofer-Gesellschaft was voted as one of the most popular employers in several surveys. Nevertheless, due to declining student numbers, it became necessary to introduce special recruiting measures. In addition to its own events and campaigns, the campaigns by the Federal Ministry of Education and Research were supported to encourage more young people to study the MINT subjects of mathematics, information technology, natural sciences and technology. The Fraunhofer Talent School succeeded in attracting young people to the institutes and awaking their enthusiasm for research and technology.

Prof. (Univ. Stellenbosch)  
Dr. Alfred Gossner

Alfred Gossner studied economics, econometrics and politics at the Ludwig-Maximilians-Universität in Munich and the University of Lancaster in UK. He also studied philosophy at the Munich School of Philosophy. In 1983, he received his doctorate in economics at the LMU. In 2002, after almost two decades of leadership activity in international management, of which he spent more than 16 years with the Allianz insurance group, he was appointed Chief Financial Officer of the Fraunhofer-Gesellschaft. In 2010, he was promoted to Professor Extraordinary at the South African University of Stellenbosch Business School. After 15 years as Chief Financial Officer, he retired at the end of 2017 to become president of the Munich Business School.



### Dr. Ulrich Buller

Ulrich Buller, who holds a doctorate in chemistry, has been working for the Fraunhofer-Gesellschaft since 1984. Between 1991 and 1992, he established a contact office at the European Union in Brussels. In 1994, he became head of the Research Planning Department. Three years later he went to the Fraunhofer Institute for Applied Polymer Research IAP in Golm, first as provisional director, and from 1999, he was appointed institute director. In 2005, Buller also assumed the chairmanship of the Fraunhofer Group for Materials and Components.

Between June 2006 and September 2013, Buller was a member of the executive board of the Fraunhofer-Gesellschaft. He headed the research planning department. During this time, he initiated the Attract program and advocated networking with industry, universities, colleges and the Max Planck Society. He set up the Fraunhofer Forum in Berlin in order to better network Fraunhofer with the federal political establishment.



### Responsibility for Germany as a business location – people need a future

Responsibility for Germany as a business location became a particular challenge for the Fraunhofer-Gesellschaft in the global financial and economic crisis of 2007/2008. “Innovations are the best answer to the crisis because they promote new growth,” Bullinger stressed at the BMBF conference on innovation policy. “We will not come out of the crisis with the same products that we went in with. We have to set the course now. Because if Germany is ahead and focuses on the expansion of new technologies, it can emerge stronger from the crisis.” Thanks to the high-tech strategy developed by the German government in 2006, Germany was well prepared. The “Research Union Economy – Science”, an advisory body consisting of leading scientists and entrepreneurs – jointly headed by Arend Oetker, president of the Stifterverband, a donors’ association, and Hans-Jörg Bullinger – was convened to formulate research tasks and give concrete recommendations for action to politicians. On the initiative of the Research Union, a total of nine innovation alliances were formed between science and industry with a financial volume of 3.8 billion euros. Industry alone accounted for 3.2 billion euros, or almost 84 percent, of these investments. The Research Union presented its findings in the report “Where the new growth is coming from – innovation policy impulses for a strong Germany in the world.”

Bullinger thus initiated a change of perspective – away from the technology offered by research towards the needs of people. Providing answers to global challenges became the guiding principle of strategy development at Fraunhofer. Based on the question “What do people need?”, Fraunhofer consistently aligned strategic planning to the six areas of social need: health, safety, energy, communication, the environment and mobility.

The high-tech strategy and the European Commission in their framework research programs were also oriented towards these areas of need. As a member of the High Level Group, Hans-Jörg Bullinger shared responsibility for the evaluation of the 6th Research Framework Program of the EU. This gave him the opportunity to help shape the strategic development of European research policy. The 7th Research Framework Program provided more than 50 billion euros in funding for the funding period 2007–2013.

The 75 percent increase in the budget was also necessary if the EU was to achieve its goal of becoming “the most dynamic and competitive knowledge-based economy in the world.” As Fraunhofer’s presence grew in Brussels, so did their Europeanization efforts. For the first time, further representative offices were established across Europe – in Austria, Portugal and Italy.

During the crisis years, the German government continuously increased its expenditure on education and research despite financial shortages. In 2012, Germany finally achieved its ambitious three-percent target. With the economic stimulus packages I and II, the German government tried to mitigate the financial crisis and overcome the recession. In Program I, the Fraunhofer-Gesellschaft was granted funds of 65 million euros for numerous investments with which the German economy could be supported quickly and sustainably.

Every three years, the Fraunhofer-Gesellschaft continued a discussion to identify significant key topics that are of particular importance for securing the future of Germany as a business location. “We measure ourselves by market success, and that’s why we need to know what our customers expect from us tomorrow. We are used to identifying signals at an early stage, analyzing how they relate and developing strategies,” explained Bullinger. The “12 Frontline Themes” were followed by the “Perspectives for Future Markets”, then the “Fraunhofer Future Topics” and finally the “Markets Beyond Tomorrow”. Also, the large-scale Fraunhofer “Morgenstadt” initiative – the vision of a modern, environmentally and climate-friendly urban world – was born. Many Fraunhofer Institutes were able to bundle their competencies under this mission statement.

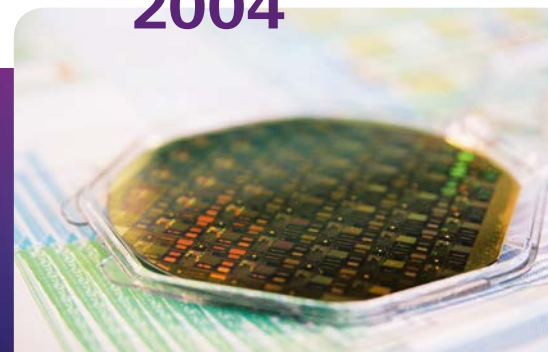
With the Pact for Research and Innovation, the Federal Ministry of Education and Research (BMBF) had promised Fraunhofer an annual increase in basic funding of three percent. This provided planning security, but – as in the past – could not keep pace with the growth of contract research. Finally, the Fraunhofer-Gesellschaft had to implement the integration of another research organization in 2009. This FGAN Research Society for Applied Sciences was a community of three institutes for defense and security research. In contrast to the previous integration of the GMD, this integration went surprisingly well. The research institutes that were formerly purely defense related were pleased to offer their expertise to the civil contract research market as well. They also hoped to become connected to the extended research community through their links to universities.

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“In the future, the institutes will need to operate more strongly under the Fraunhofer umbrella brand. We need to recognize that the Fraunhofer network is of great value and that the institutes are even stronger when they operate as a network.”

Prof. Dr. Hans-Jörg Bullinger

2004



Fraunhofer Institute for Silicon Technology ISIT: Automated proof of carcinogens or toxins.



2008

The Care-O-bot of the Fraunhofer Institute for Manufacturing Engineering and Automation IPA is the product vision of a mobile robot assistant for actively supporting people in a domestic environment.

### A strong brand – a strong network for the globalized economy

The Fraunhofer-Gesellschaft had already moved into the “Fraunhofer House” in Munich’s Hansastrasse back in 2003. So the headquarters finally had its own modern building and became a visible presence in Bavaria’s capital, given the 17-floor high-rise’s eye-catching appearance.

In Berlin, too, the Fraunhofer-Gesellschaft strengthened its presence with an office in the capital city in order to optimize cooperation with the federal government. Executive vice president of research Ullrich Buller found the ideal location for the Fraunhofer Forum Berlin, which opened in 2007, in the SpreePalais am Dom.

During Mr. Bullinger’s term of office, the Fraunhofer Gesellschaft was able to significantly increase its responsiveness through an extensive strategy process and the bundling of competencies. It was necessary to further strengthen the sense of belonging to the “Fraunhofer family” and to convey a clear message to “the customer.” A new brand design supported this development visually. Fraunhofer’s new, optimized logo formed the basis for providing individual divisions with their own logo, making the multitude of competencies visible. In 2009, the anniversary year, a Fraunhofer truck drove through Germany bringing the fascination of technology with Fraunhofer solutions closer to the people.

Hans-Jörg Bullinger had consistently pushed two things forward during his presidency, VW Board Member Michael Macht summarized at his farewell: “Firstly, strategy development; secondly, internal and external networking. This enabled Fraunhofer to establish itself as a strong network for innovation at home and abroad. First and foremost, however, has always been the responsibility for Germany as a business location – securing the future through innovation.”

2009



Hop in and experience the future:  
In March 2009, the Fraunhofer truck takes a tour through Germany.



2002



The euro is introduced as the common currency in 2002. In the same year, it receives the International Charlemagne Prize of Aachen in recognition of it "promoting identification with Europe like no other integration step before".

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The noughties were a hopeful decade, the zeitgeist imbued with a new currency, new media habits and a new president in the USA.



2007

On January 9, 2007, Steve Jobs presents the iPhone. Within just a few years, it revolutionizes our use of media. Mobile television is then also made possible – thanks to High Efficiency Video Coding, developed at the Fraunhofer Institute for Telecommunications, Heinrich-Hertz Institut, HHI.



2008

On November 4, 2008: Barack Obama, Democratic Party candidate, becomes the 44th President of the United States under the auspicious election slogan "Yes We Can."

A young child with light-colored hair and eyes is shown in profile, looking intently at a small, light-colored gecko. The gecko is clinging to a clear glass surface, possibly a petri dish or a beaker. The background is a soft, out-of-focus green, suggesting a natural or laboratory setting. The overall lighting is cool and blue-toned, creating a sense of scientific inquiry and discovery.

2012 – 2019

Scientific  
excellence and  
springboard  
innovations

With the declared will to continue growth in a controlled and sustainable manner, Reimund Neugebauer took office as President of the Fraunhofer-Gesellschaft. New collaboration concepts for high performance centers and systems research allowed him to increase both economic efficiency and scientific excellence. Neugebauer honed the profile of Fraunhofer as an innovation driver for strategic initiatives to solve future challenges.

Like his predecessors, Reimund Neugebauer thought less about consolidation when he was elected Fraunhofer President. From a detailed analysis of all contracts at the Fraunhofer-Gesellschaft, he found out where new growth needed to be generated: "85 percent of our clients account for only a quarter of our total contract value. We have too many small contracts." That is why he saw "great development potential where we not only supply relatively small detailed solutions but also offer system solutions together with several Fraunhofer Institutes and with research and industry partners".

With Reimund Neugebauer, the Fraunhofer Senate had once again elected a long-standing and very successful institute director as president. Neugebauer co-founded the Fraunhofer Institute for Machine Tools and Forming Technology IWU in Chemnitz in 1991 and developed it into a leading international partner for the automotive and mechanical engineering industries. When he took office as the tenth Fraunhofer President on October 1, 2012, he relied on successfully established principles, but also saw a need to further develop the Fraunhofer model. He recognized how to make better use of existing potentials in order to more frequently assume technological leadership. To this end, Fraunhofer was to strengthen business development above institute level and establish a professional exploitation strategy. Not only was Neugebauer interested in greater efficiency through strategic focus, he was also interested in scientific excellence. His goal was to create a consistent strategy for sustainable growth.

September 16, 2015 saw the "Virtual topping out ceremony" for the autartec®-FreiLichtHaus (floating house) at the premises of the Fraunhofer Institute for Transportation and Infrastructure Systems IVI.

2015



A global economy and global scientific community face daunting challenges. Fraunhofer employees rise to the occasion with qualifications steeped in internationally oriented research.

**Prof. Dr.  
Reimund Neugebauer**

After studying mechanical engineering at the Technische Universität Dresden, Neugebauer worked there as an assistant and senior assistant, earning his doctorate in 1984. From 1990 onward, he headed the Institute for Machine Tools at TU Dresden. In 1991, he moved to Chemnitz as head of a newly founded Fraunhofer Institute, which he later renamed the Fraunhofer Institute for Machine Tools and Forming Technology IWU. In 1993, he became Professor of Machine Tools at the Chemnitz University of Technology. And, in 2000, he was founding president, later honorary president and member of the advisory board of the Saxony Industrial Association 1828 e.V. Since 2000, he has also been director of the Institute for Machine Tools and Production Processes IWP at Chemnitz University of Technology. In 2012, Reimund Neugebauer took over as president of the Fraunhofer-Gesellschaft.



Over the years, Fraunhofer had also become a sought-after cooperation partner in the international business world. “Our motto: scientific added value for Fraunhofer and positive effects for Germany, Europe and the respective partner countries. This has resulted in a complex network of collaborative projects, strategic cooperations and international projects,” explained Neugebauer. If nothing else, the international dimension of Fraunhofer’s research contributes significantly to the qualification for demanding tasks in globalized economy and science. The high level of foreign revenue reflects this. In 2017, revenue from collaborations with international clients and partners amounted to 311 million euros.

### Powerful groups and alliances

As members of the presidential council, the group chairmen were already involved in the strategic decisions of the Fraunhofer Executive Board. Now, the role of the groups was further strengthened and the responsibility of the group chairmen extended. In order to increase internal efficiency, the executive board introduced a portfolio and consolidation management system in which the group chairmen occupy key positions. It aims to strengthen the synergies between the institutes and reduce redundancies. With the newly developed “stability indicator,” critical developments in institutes can be recognized at an early stage and portfolios of institutes can be quickly and consistently adapted to changing market situations. Experience over the past few years has shown that all Fraunhofer Institutes are prepared to assume responsibility for each other. For this reason, the competencies of the entire network of institutes will be used to provide assistance to individual institutes and to develop a strategy for the future. With the new responsibility of the group chairmen, the presidential council has been allocated its own development funds for consolidation procedures and for entering new business areas.

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“Every innovation begins with an original idea. The Fraunhofer-Gesellschaft brings these ideas into industrial application, thus making a decisive contribution to the innovative ability and success of the German economy.”

Prof. Dr. Reimund Neugebauer



In times of accelerated change, foresight through socio-economic research is becoming ever more important. The future can only be shaped if it is possible to identify even vague signals at an early stage. The eighth Fraunhofer Group was founded in 2017: With the Fraunhofer Group for Innovation Research, in which five Fraunhofer Institutes coordinate their work, all institutes are now organized in group networks. The institutes of the Group for Innovation Research are to become even more involved in policy consulting in the future.

President Neugebauer set himself the goal of making consistent use of the advantages of the Fraunhofer-Gesellschaft – many competencies brought together under one roof. He therefore pushed the expansion of the Fraunhofer Alliances into industry-oriented and regionally-oriented acquisition platforms: “This can bring us large contracts and collaborations and make us systemically relevant for entire industries.”

#### Professional exploitation – valuable patent portfolios

The resignation of executive vice president of research Ulrich Buller was used as a chance to realign the executive board members’ areas of responsibility. Research planning was assigned to the president. This opened up the opportunity to focus the fourth area of the executive board on the new spheres of Technology Marketing and Business Models.

The new executive board area is now responsible for customer measures across the institutes. On the one hand, this entails the development of strategic partnerships with important companies; it also entails the development of systemically-relevant solutions for entire industries, which can only be mastered by involving several institutes. Depending on requirements, the companies are supported with innovation consulting, feasibility studies, product and process development or training formats. As an important measure, a team of industry experts was put together. Its task is to determine the companies’ need for research and development services, initiate cross-institute projects and implement them together with the groups and alliances.

70 YEARS  
OF FUTURE  
#WHATSNEXT

## Taraxagum™ – Tires from dandelion

The “Taraxagum™” project is all about the Russian dandelion. What’s so special about this plant? Its chyle contains large amounts of natural rubber. In just a few years, Prof. Dirk Prüfer, Professor at the University of Münster in North-Rhine Westphalia and departmental head at the Fraunhofer Institute for Molecular Biology and Applied Ecology IME, and his team developed the Russian dandelion in collaboration with the plant cultivation company ESKUSA, Continental Reifen Deutschland GmbH and the Julius Kühn Institute, transforming a wild plant into a useful plant. Its use as an alternative source of natural rubber has been trialed.



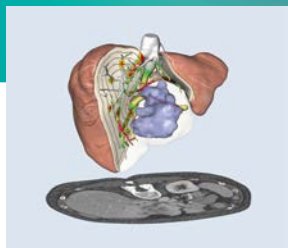
Another way to increase efficiency is to make better use of intellectual property. In order to tap further potential in the licensing of Fraunhofer patents, central IP commercialization was expanded in 2015. Its task is to design patent portfolios that are open to exploitation across institutes and to offer them to companies. In addition, existing patent portfolios are to be used to define and implement licensing programs and to prosecute patent infringements. This increases IP exploitation opportunities for the institutes while reducing costs.

Prerequisite for this exploitation however is the creation of new valuable IP. This is realized in the pre-competitive research of the institutes. Only if they have funded the development themselves can they claim the property rights on their own. For many modern technological developments, a patent is often not sufficient and, therefore, a whole patent portfolio is required. With the Fraunhofer Future Foundation, the Fraunhofer-Gesellschaft has an excellent instrument at its disposal for building up such cross-institute patent portfolios. In this way, projects that create valuable IP can be promoted in order to generate future licensing income. This also opens up the opportunity for cognitive innovations that make real breakthroughs possible.

70 YEARS  
OF FUTURE  
#WHATSNEXT

## Algorithms for liver surgery

Liver cancer is the world's second most common cause of cancer-related deaths and continues to increase at a faster rate than other types of cancer. The surgical removal of cancer foci presents a difficult task for medics due to the liver's complex vascular system and the position of the individual tumors. The Fraunhofer Institute for Digital Medicine MEVIS has developed a piece of software that analyses radiological data. The technology has been available in hospitals as a medical product from an industrial partner since 2014. And thus a standard known for MEVIS analysis in liver surgery, which received the Joseph von Fraunhofer Prize for MEVIS scientists in 2018, was created in clinics all over the world.



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“In the long term, we need a strategy that will enable Fraunhofer to sustainably preserve excellence and originality in research. It is not enough just to manage the result well; we must also nurture the substance of research so that cognitive innovation can continue to take place.”

Prof. Dr. Reimund Neugebauer

## High performance centers – the locations are distinguishing themselves

Positive experiences with the numerous regional innovation clusters led Neugebauer to develop a sustainable location model as a central structural element of technology transfer: regionally anchored, national high-performance centers. They are intended to organize the close cooperation of university and non-university research with business and industry and to contribute to the profile building of the locations. Their task is to expand established cooperation with industry and to develop new, agile forms of collaboration which can then be used by all actors in the research and innovation system.

For the pilot phase, five high-performance centers were founded with selected universities, for example, in Freiburg, on the subject of sustainability. Their financing is carried out in partnership between the German federal states, the industrial partners and Fraunhofer. The model of regional cooperation proved so successful that such high-performance centers now exist at 17 locations in eleven federal states. Neugebauer sees this as the basis for a Germany-wide transfer system.

With these high-performance centers, Fraunhofer once again provided an exemplary model of regional profiling. The Hightech Forum, the advisory body of the federal government, recommended that “particularly powerful innovation regions should be expanded into international centers of excellence modeled on the excellence cluster competition”.

## Lighthouse projects for technological breakthroughs

The analysis of the innovation process revealed that the emergence of innovation is becoming increasingly cooperative and integrative. In particular, consortia with numerous players are often involved in disruptive innovations that have revolutionized entire industries. As a result, networking is becoming an even more important success factor than before. For this reason, Reimund Neugebauer began to elevate the collaboration between the institutes to a new level: “If we can use our entire portfolio as a synergetic feature in large constellations with global corporations, quantum leaps in key technologies relevant to the future would also be possible.” This ambitious goal was explicitly stated as a vision in the Fraunhofer-Gesellschaft’s renewed mission statement: “As an innovation driver, we lead strategic initiatives to master future challenges and thus achieve technological breakthroughs.”

In 2015, Fraunhofer initiated the “Industrial Data Space” initiative – now known as International Data Spaces – with the aim of creating a digital infrastructure based on European legal, security and data protection standards. A secure data space is a prerequisite for smart services, innovative service offerings and automated business processes.

### Prof. Dr. Alexander Kurz

After studying law at the Universities of Regensburg and Tübingen in 1980, he received his doctorate in administrative sciences in 1993. Following his work at the Karlsruhe Research Center (FzK), CERN, the Society for Heavy Ion Research, he became a member of the board of directors at the Karlsruhe Institute of Technology (KIT) in 2009 and executive vice president responsible for human resources, law and exploitation of the Fraunhofer-Gesellschaft in 2011.





The Fraunhofer house, standing 65 meters and 16 storeys high, was completed in 2003 in the design of architect Günter Henn. The future of the Fraunhofer-Gesellschaft in Bavaria remains secure.

Only by safeguarding the sovereignty of data of both companies and citizens can the exchange of digital data develop further. Another topic strategically advanced by Fraunhofer since 2015 is battery cell production for electric cars.

In order to set further strategic priorities, the executive board decided to promote lighthouse projects. The aim was to develop system-relevant solutions for the current challenges of German industry and to quickly convert scientifically original ideas into marketable products. The first three lighthouse projects for E<sup>3</sup> production, electric mobility and cell-free biotechnology have already been completed. For example, in our current lighthouse project, Go-Beyond 4.0, new manufacturing processes for small series and one-off items are being developed. Here, digital printing and laser processes are being combined with traditional manufacturing processes. In the Fraunhofer lighthouse project Quantum Methods for Advanced Imaging Solutions (QUILT), six institutes are developing new applications for quantum optics. The project "Critical Rare Earths" is to assure the supply of critical raw materials, especially rare earths, to German industry. These raw materials are used for strong magnets in wind turbines or electric motors for example. The main goal of the lighthouse project "eHarsh," is the development of sensor systems for use in extremely harsh environments. In the Fraunhofer lighthouse project "Electricity as a Raw Material," ten Fraunhofer Institutes are developing processes in which power can be used to synthesize important basic chemicals. And in the lighthouse project "Theranostatic Implants," intelligent implants are created that combine diagnostics and therapy in a single medical device.

### Impulses for research policy

The Fraunhofer-Gesellschaft's applied research is a motor for the innovative strength of companies as well as many sectors of Germany's economy. Several studies have shown that the various contributions of the Fraunhofer-Gesellschaft demonstrably increase the business success of cooperating companies and also contribute to enhancing Germany as a location for business and innovation in monetary terms. "The industry speaks well about Fraunhofer and knows what we stand for. Moreover, in the future we will be more decisively and more systematically involved in shaping the public parameters for research and innovation," said Neugebauer, explaining the ten recommendations through which Fraunhofer is setting the tone with authorities in the debate on science policy challenges.





70 YEARS  
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#WHATSNEXT

## E<sup>3</sup> – industrial product rethought

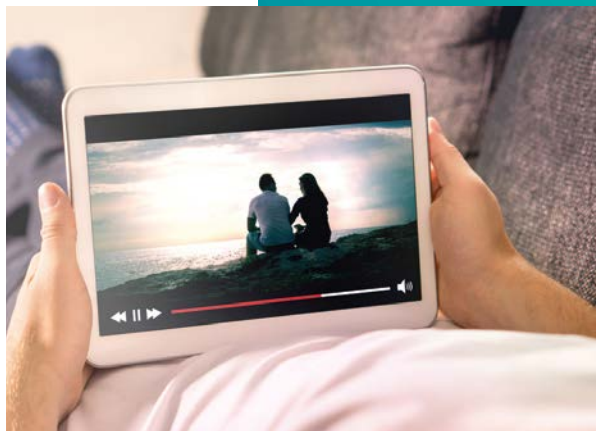
How is it possible to sustainably achieve maximum added value from minimum use of resources? 13 Fraunhofer Institutes have answered this question with an integrated E<sup>3</sup> production concept. The three Es stand for efficient process and products, efficient factories and efficient working environments. Between 2013 and 2016, scientists developed integrated solutions for the widespread use of renewable energies in production, intelligent assistance systems, and also material-efficient and energy-efficient manufacturing processes. Many insights from the E<sup>3</sup> lead project have been incorporated into follow-up projects, such as the SynErgie Kopernikus project, for example.

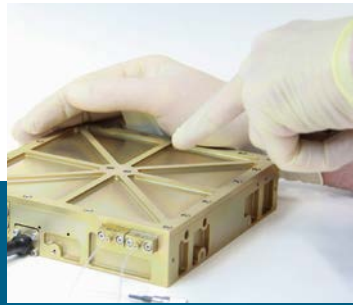
Neugebauer was therefore able to introduce the proposals immediately in Berlin. At the beginning of 2015, the High-tech Forum was established as the central advisory body for implementing the German government's new high-tech strategy. The body was chaired by Reimund Neugebauer and Andreas Barner, President of the Stifterverband für die Deutsche Wissenschaft (Donors' association for the promotion of humanities and sciences in Germany). The body, with 18 further representatives from science, economy, politics and society, worked out strategic guidelines and priority areas of action for Germany in eight expert forums. In close partnership with the Stifterverband and other members, Fraunhofer was able to make a decisive contribution to innovation policy consulting in Germany in terms of topics and methods.

The Chancellor, Angela Merkel, and other representatives of the federal government met twice a year on the subject of innovation with high-ranking representatives from science, industry and society to discuss effective framework conditions for research and innovation. The Fraunhofer President's membership on the steering committee of the Innovation Dialog made it possible to participate in shaping the topics and content of the dialog and to utilize the direct exchange with political decision-makers.

## High Efficiency Video Coding (HEVC)

Compressed video data are growing faster than ever before. They already make up by far the greatest proportion of bits on the Internet and in mobile data traffic. Moreover, the latest ultra-high resolution televisions use the fourfold full HD resolution 4K. This trend towards higher quality and higher resolution images and videos, however, is creating an ever-growing amount of data. Efficient transmission calls for increasingly better compression. The H.265/High Efficiency Video Coding (HEVC) standard offers a highly efficient compression solution. The standard was jointly developed by the Fraunhofer Institute for Telecommunications, Heinrich-Hertz Institut, HHI, and renowned manufacturers from the mobile radio and entertainment electronics sector and has been recognized by a Primetime Engineering Emmy Award.





70 YEARS  
OF FUTURE  
#WHATSNEXT

## Powerful fiber lasers

Fiber lasers are powerful radiation sources for scientific and industrial applications. One key area for the development of fiber lasers is laser material processing in production.

Powerful, efficient and robust lasers that offer a high-quality radiation source are also in high demand in other sectors such as aerospace and medicine. Researchers at the Fraunhofer Institute for Optics and Precision Engineering IOF in Jena have therefore developed a new generation of laser systems with improved parameters. These fiber laser systems achieve performance values of several kilowatts with almost diffraction limited radiation quality.

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The digital transformation runs deepest and is the most pervasive of all recent technology trends.

The close dialog with policy makers was also important for the Fraunhofer-Gesellschaft in order to raise awareness of the issue of basic funding, which, in the past, didn't keep up with the rapid growth of the organization. This caused increasing concern on the executive board. In 2006, the basic funding amounted to 38 percent of the total budget, by 2013 it had fallen to 28 percent. In addition, there was the Pact for Research and Innovation III, which came into force in 2016: It specified that non-university research organization would receive only three-percent annual growth in institutional funding by 2020. Compared to the previous increase of five percent annually, this represented a cut for the Fraunhofer-Gesellschaft that could limit future growth. On top of that, the reimbursement modalities in the EU Framework Programme Horizon 2020 had also changed considerably since 2014. For this reason, basic funding had to be increasingly used to cover the costs of EU-funded projects.

After lengthy negotiations with the German government, Neugebauer succeeded in closing the growing gap in basic funding. Thus, the German Bundestag passed, for the first time, an increase in basic funding of 60 million euros from federal funds with effect from 2017. The federal states of Germany supported the increase and added a further seven million euros to the funding project. As a result, basic funding could be increased again to almost one third in accordance with the Fraunhofer model. In order to guarantee sustainability, sufficient investment must continue to be made in pre-competitive research. Fraunhofer must permanently strengthen itself in strategically important areas through new core competencies. Of all technological trends, digitalization is the most fundamental and most pervasive. The digital transformation is changing economic structures, knowledge

production formats, and ways of working and living. Complementing the digital transformation, which is above all a networking and efficiency strategy, the biological transformation also identified by Neugebauer aims at the increasing use of materials, structures and principles of living nature in technology. The “biological transformation” of technology closely links processes in the life sciences with materials science, engineering and information technology.

### Agenda 2022 – achieving more impact through excellence and synergy

To meet the new challenges of digital transformation and globally networked value chains in the best possible way, the Fraunhofer executive board developed the “Agenda Fraunhofer 2022” as a comprehensive roadmap. It adopts the vision of Fraunhofer’s new guiding principles to consistently implement system-relevant initiatives for Germany as a business location and focuses on the fields of research, transfer, good corporate management and digitalization. “As a networked innovator with efficient research and transfer structures, we want to expand our unique selling points and thus increase our attractiveness for customers,” pointed out Neugebauer, explaining the reasons for the forward strategy. “We have greatly increasing complexity in the innovation process in order to achieve genuine disruptive innovations. And we face increasing competition in the German and European science systems. We are expected to provide solutions for entire industries and have an impact on society”.

At the top of the agenda are the key strategic initiatives. They have the ambition to assume a strategic leadership role in important subject areas: battery cell production, biological transformation, cognitive systems/data sovereignty, public safety, programmable materials, quantum technology and translational medicine.

These system-relevant topics, which can only be dealt with on a cross-institute basis, are funded in the new Fraunhofer Clusters of Excellence on the one hand and in the lighthouse projects on the other. In particular, the Fraunhofer Clusters of Excellence are designed to be permanent. Organizationally, these research clusters correspond to a “virtual institute” that is spread over several locations. The aim is to play a leading role in important research topics such as advanced photon sources, programmable materials, immune-mediated diseases and the cognitive Internet. In contrast, the lighthouse projects are limited to two to three years. Each year, the executive board promotes three new lighthouse projects.

In addition to this scientific profiling, regional profiling is at the heart of Agenda 2022. This has led to the creation of new project centers in which several institutes work together: in Wolfsburg for automobile production, in Erfurt for microelectronics, in Braunschweig for energy storage and in Würzburg for stem cell process technology. The 17 High-Performance Centers are to be developed into a transfer system for Germany in order to stimulate an innovation push.

With Agenda 2022, Neugebauer aims to further increase Fraunhofer’s excellence and efficiency and make it more “athletic” with new structures. A decisive factor in this is the ever-increasing networking of the distributed Fraunhofer competencies. “In recent years, we have moved into a completely new culture.

#### Andreas Meuer

Executive Vice President for Controlling and Digital Business Models, Andreas Meuer joined the Fraunhofer-Gesellschaft in 1992 and has since held various senior roles. Most recently, he was Director of Finances, Accounting and Economic Planning. Among other things, he was responsible for the Fraunhofer-Gesellschaft’s financial volume of more than two billion euros, he further developed the annual financial statements and built up asset management. Andreas Meuer has been involved in internal digitalization projects from the very beginning, e.g. document management or the planning of corporate resources.



We used to have strong internal competition, but now we are demonstrating strong solidarity to the outside world." In order to make maximum use of the synergy potential across the institutes, it is necessary to adapt the research and transfer structures of Fraunhofer as well as the internal topic and project management. In addition, the "Fraunhofer Digital" project aims to create the most efficient digital administration among the research organizations. Andreas Meuer, the new Executive Vice President responsible for Controlling and Digital Business Models, has set himself this task.

Neugebauer has therefore convened a Future Commission to set the course for sustained growth. In the 2019 anniversary year, he will thus be able to consistently advance his great vision of an efficient, excellent, high-performance and highly networked Fraunhofer-Gesellschaft: "Going from a German innovation partner to a European innovation driver, from a contribution provider to a creative navigator in the European scientific system, from an operative innovator to a strategic value-added partner."

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With Agenda 2022,  
Neugebauer is pursuing  
the aspiration to further  
increase the efficiency  
and effectiveness of the  
Fraunhofer-Gesellschaft,  
optimize internal pro-  
cesses and make the  
organization as a whole  
more athletic.





Developed originally for aerospace and automotive technology, 3D printers are conquering the mass market at an increasing pace.

2013

Europe is evolving as new technologies make day-to-day life easier. As the recent past and present go to show, it harbors great potential. The future belongs to the bold.



2014

Our man in space: Geophysicist and astronaut Alexander Gerst takes off into space as the flight engineer on ISS Expeditions 40 and 41.



2015

Policies with prospects: German Chancellor Angela Merkel and US President Barack Obama at the G7 Summit in Elmau Castle.



2018

In November 2018, Brexit opponents protest against Prime Minister Theresa May's policy.

# 70 years of Fraunhofer 70 years of future

Founded in Munich in spring of 1949, the Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. was born to help rebuild Germany's de-industrialized post-war economy. Today it is Europe's largest applied research organization.

On March 26, 1949, State Secretary Hugo Geiger invited 210 government representatives and members of the scientific and business communities to the Bavarian Ministry of Economic Affairs. He had lofty aims for this fledgling organization – it was to help revive Bavaria's economy. While children played amid the rubble, and the Wirtschaftswunder – Germany's postwar economic miracle – was yet a distant prospect, the Munich office's staff of just three people took up the challenge of advancing applied research in Germany.

The Fraunhofer-Gesellschaft elected Hermann von Siemens as its president in late 1954 and founded the first of its institutes, taking a major step toward its goal of becoming the third pillar of research in Germany alongside the Max Planck Society and the nation's universities. The organization flourished – by 1969 it had grown to 19 institutes and research institutions with 1,200 employees and 33 million D-Mark in annual revenue. Restructuring and a redoubled focus on contract research in the early 1970's set off another surge of growth. The Fraunhofer model of performance-based funding sparked the dynamic success that shows no signs of slowing. Fraunhofer had become a recognized brand by 1979. "ZEIT" editor Marion Countess Dönhoff commemorated the organization's 30th anniversary with a high-profile editorial entitled, "Die Forscher-GmbH," or the researchers' corporation. Her bottom line: "Max Planck earns the Nobel prizes, Fraunhofer the money."

More than two-thirds of the Fraunhofer-Gesellschaft's budget is covered by contract research revenue. Base funding provided by the federal and state governments accounts for only around one third of its financing needs. With this business model and its laser-like focus on new technologies and markets, the Fraunhofer-Gesellschaft has become the German economy's innovation engine, a synonym for German engineering, and an example for others around the world to follow. Its inventions range from airbags, white LEDs and dandelion rubber to mp3 technology.

Asked to describe his vision, Prof. Reimund Neugebauer, the current President of the Fraunhofer-Gesellschaft, says, "It is essential to not only conduct research with excellence and efficiency, but also to identify new topics at an early stage and set things in motion for the future. This enables us to respond that much faster to market demands. Our employees are the bedrock of our success. They strike the right balance between research and entrepreneurship, take responsibility for the future, develop solutions for tomorrow's challenges, and keep asking: **What's next?**"

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