GROWTH, **INNOVATION** AND PARTNERSHIPS

The impact of projects funded by ECSEL on the Austrian business landscape

Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

ECSEL
Austria

ECSEL-Austria

KDT JU is the public-private partnership for electronic components and systems in Europe and this function is assumed by ECSEL-Austria on a national level. This industry-led funding program was initiated in 2007/2008. Austria was involved intensively in the programs from the beginning and the federal ministry for climate action, environment, energy, mobility, innovation, and technology (BMK) has invested considerable funds in Austria's technological future. **www.kdt-ju.europa.eu**

ECSEL-Austria actively networks interest groups, industrial companies, and national and international institutes of higher education. It is a national research, development, and innovation platform driven by industry that represents the technological fields of micro- and nanoelectronics, embedded systems, and system integration. This enables ECSEL to provide Austrian stakeholders with access to research and knowledge networks with constant focus on driving forward cutting-edge research in Europe and Austria. **www.ecsel-austria.net**

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ECSEL Programs enable entry into the new and important technological fields of the future.
What defines a technological breakthrough? To make something possible that previously appeared to be impossible. The development of forward-looking technologies for a company is often associated with a high risk. The path from an innovative idea to a market-ready product is long and accompanied by high costs and numerous challenges.

ECSEL Programs help overcome obstacles and minimize risks thus strengthening the Austrian business landscape.

Industrial stakeholders profit from

- ✓ An expansion of their product portfolios
- ✓ An increase in competitiveness
- ✓ The creation of value chains and ecosystems
- ✓ The establishment of new manufacturing capacity
- ✓ The facilitation of innovation transfer to production and marketing
- ✓ Lower entry obstacles for small companies

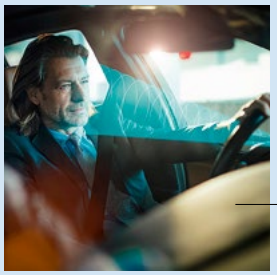
Austria profits by

- ✓ Generating value in Austria
- ✓ Creating and maintaining jobs
- ✓ Follow-on investments in company sites in Austria
- ✓ Strengthening the position in the global market and cementing global leadership
- ✓ Expanding of the domestic innovation ecosystem
- ✓ Devising technologies for future-relevant topics such as climate protection , Tech for Green, etc.

Research Funding Works!

A study carried out in 2020 proves by way of four examples of industrial companies **what advantages and added value** the funding of research and development programs generates for the Austrian economy. How and in what way do ECSEL-funded R&D programs have an impact?

Case Studies



ams OSRAM

On the path to market leadership

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AVL List

Evolving into a global technology leader

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Infineon Technologies Austria

Ready for Mission Future – made in Europe

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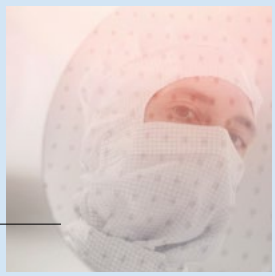

TTTech Group

From a small company to a global player

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Foreword

Over the past 5 years, questions regarding the economic significance of key technologies in general, and of the electronics industry in particular, have emerged at the center of techno-political and above all geo-political discussions in Europe. In the meantime, the significance of these technologies for economic and social processes of transformation, for current and future value creation, for the solution of large social challenges and hence for the prosperity of entire national economies, even continents, has become increasingly visible and understandable. Strategic plans that describe how to reduce dependencies on the further development of these technologies and increase self-determined and sovereign action are therefore gaining traction in political decisions. A new chapter has been opened up with the recently published European Chips Act. All these efforts are becoming more and more urgent in a world in which the fragility of globalization has been proven by multiple shocks such as the pandemic, the first tangible consequences of climate change, and recently by acts of war in the heart of Europe.

Domestic technological sovereignty is difficult to achieve for a small and open economy such as that in Austria, however Austrian developments can make important contributions to the supranational sovereignty of Europe. KDT, ECSEL and its predecessors ARTEMIS and ENIAC have conducted significant pioneering work for this.

The impact of these initiatives has already been proven within the scope of program evaluations in which references were made to the high number of patents and scientific publications, and the high share of SMEs in R&D projects resulting from within the context of the programs.

The four case studies presented here look beyond this. They result from a more detailed study* whose goal was to follow the impact of these programs on the technological paths over a longer timescale on an individual company level, and to also consider other national and international affiliated programs, historical developments, and external factors. This 360° view shows that these European industrial research programs are far more than a framework for the awarding of R&D projects and in actuality can have huge significance for the competitiveness of individual companies. They play a key role in helping to build a broad spectrum of expertise and development networks, to establish new fields of business, to access new customers, to enter into new markets, or to accelerate the development of competences for clear market differentiation. In these eventful times, we must do everything we can to ensure that this path can continue to be followed.

"KDT, ECSEL and the predecessor programs ARTEMIS and ENIAC have conducted important pioneering work for European sovereignty."

Mag. Michael Wiesmüller
Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology (BMK)

* The comprehensive study "ECSEL-funded projects and their impact: Case studies of Austrian companies", published in 2020, is available at www.ecsel-austria.net/impactreport.

„Tech for Green". The Corona pandemic triggered a digitalization push and created broad social awareness for technological innovations in everyday life. At the same time, the increasingly urgent discussion about climate change has shown that technology is also an essential lever for achieving climate goals and making a major contribution to the energy transition. In this respect, crises are also times to tackle big issues like climate change with courage.

The course for this has been set: At European level, the Recovery Plan and the Green Deal have created excellent opportunities to implement real climate innovations. As an important instrument, KDT also pays into a green future and promotes sustainable business, creates new forward-looking jobs and improves the ecological footprint in Austria and in Europe.

As a semiconductor company, Infineon is making a significant contribution from Austria with "Tech for Green" solutions: The energy-saving chips produced in Villach in the 2021 financial year will save around 7 million tonnes of CO_2 emissions over their lifetime. This corresponds to about half of Austria's car emissions. With solutions based on new semiconductor materials, we are already in the middle of the next innovative leap. These switch electricity even more efficiently and are already in use in solar plants, electric cars, data centres or charging stations.

Global challenges like the climate crisis cannot be solved on our own. What is needed is the courage to change for a sustainable future. Research, innovation and cooperation along the valuechain play a key role in this.

DI Stefan Rohringer, MSc
Chairman ECSEL-Austria,
Deputy CTO, Infineon Technologies Austria AG

"How can we further strengthen the European technological landscape in order to remain globally competitive?"

ECSEL and the predecessor programs ARTEMIS and ENIAC have contributed for over 15 years to the development of ground-breaking technology in Europe. Clever and, above all, long-term considerations form the foundation of the ECSEL program: Facts that are supported by the survey published in 2020 and the four case studies covered in this brochure. They show how research funding serves as a multiplier and how high the added value can be if a common goal is followed on a European level.

ECSEL creates the structures and rules necessary for strong collaboration on national and European levels: Technological developments are accelerated, knowledge networks are established, and the creation and expansion of value chains are enabled. The amount of funding released is not necessarily in the foreground, but rather on sustainable and targeted strategies on the political and entrepreneurial side. In this way, ECSEL makes a significant contribution to European sovereignty in the field of electronic based systems. A necessary dependency since a large part of the European economy is reliant on EBS solutions and products.

For the sake of our economy, we will have to answer many questions in the future, for example, "What does industry need in order to further expand domestic high-tech expertise?", "How can we secure long-term manufacturing in European locations?", and "How can we further strengthen the European technological landscape in order to remain globally competitive?". The ECSEL survey shows that ambitious goals are achievable with the right strategic and political focus on a European level, and that there is still a lot of unused potential out there.

DI Dr. Klaus Bernhardt, MBA
Core Division Management Research & Development
FEEI – Trade Association of the Electrical and Electronics Industry

Key Technologies for Europe

The name of the program describes precisely the content: **KDT JU*** – Key Digital Technologies Joint Undertaking. Research, development, and innovation projects are funded that strengthen and secure the strategic autonomy of the EU in key electronic technologies.

KDT JU in numbers**:

16 calls

92 projects

More than **3 100** participations

4.8 bn€
for research and development

thereof 2.2 bn€
EU and national funding

and 2.6 bn€
Industries' own financing

KDT JU is the public-private partnership for electronic components and systems in Europe. The who's who of Europe develop the cutting-edge technologies of tomorrow under the auspices of KDT JU. The network connects universities, industries, start-ups, etc.

ENIAC | ARTEMIS | EPoSS

previously ECSEL Joint Undertaking, today KDT JU

Together for Europe's Technology
31 countries participate in the KDT JU:
Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Germany, Denmark, Estonia, Greece, Spain, Finland, France, Hungary, Ireland, Israel, Iceland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia and Turkey

*Previously ECSEL Joint Undertaking
** Source: www.kdt-ju.europa.eu, Status November 2021

Electronic Based Systems (EBS)
Electronics drive the future. Cell-phone, car, computer, airplane: the list is infinite. Nowadays, there is not much that does not depend on electronics: Key factors are EBS that, together with innovative materials and integrated software, form the basis of nano- and microelectronic, or cybertronic, systems. The industrial and research elite in Austria develop electronic components and systems under ECSEL that render products more intelligent, more economical, and more capable.

Competitive Advantage for Austria

ECSEL-Austria is driving the development of Electronic Based Systems (EBS) forwards while creating synergy and acting as a multiplier. The funding programs permit Austria's industrial companies to help shape the technological megatrends of the future and to continue to play a leading role amongst global competition.

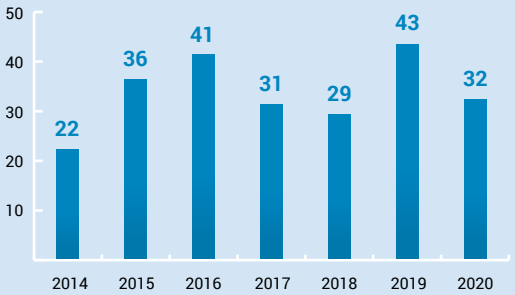
€ 283 million
Project volume
(2014–2020)

€ 63 million
National funding
(2014–2020)

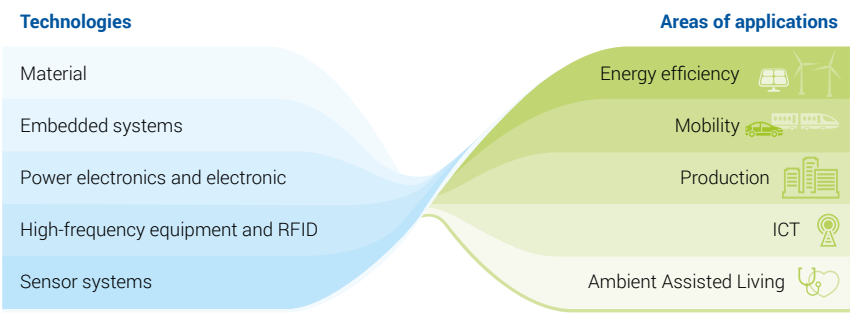
50 funded projects with Austrian participation
(2014–2020)

The targeted funding not only secures and strengthens Austria's business landscape, it also creates new, highly qualified jobs.

Number of Austrian participations in projects in funded ECSEL projects



Electronic Components and Systems
Fundamental key technologies are researched and developed under ECSEL-Austria that are indispensable for numerous industrial sectors in Austria and Europe. They help secure the sites of innovation, promote economic growth, and thus ensure prosperity.



ams OSRAM

Passenger cars are becoming more and more intelligent. ams OSRAM is developing new sensor and communication paths between the vehicle, the driver, other traffic participants, and traffic guidance systems.

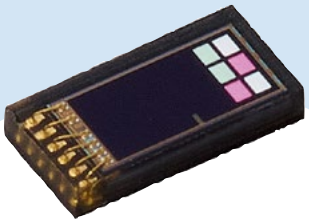
On the Road to Becoming Market Leader

The story of ams OSRAM shows how fundamental ECSEL/ENIAC projects can promote business growth. The company grew from being an Austro-American joint venture to a publicly listed company, ams-OSRAM AG.

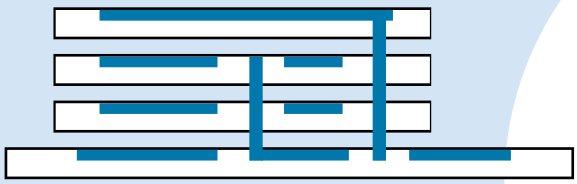
Economic Milestones

The specialist in sensor solutions has performed several economic and technological quantum leaps over the past few years. In 2017, the semiconductor company first passed the hurdle of over 1 billion Euros turnover, and in 2019, boasted another record turnover of over 2 billion USD. The next clever move was the acquisition of the considerably larger German company OSRAM in 2021. The new company was called ams-OSRAM AG, the world's leading supplier of optical solutions. With a combined 110 years of experience, the company defines its core as consisting of the power of vision, deep technical expertise, and the capability to manufacture sensor and light technologies at globally industrial scales.

ams OSRAM was able to bring innovations to market maturity faster, even across multiple projects, via continuous collaboration with academic and industrial partners.



ams OSRAM supplies complete optical high-tech solutions for the consumer, automotive, health, and industry sectors.

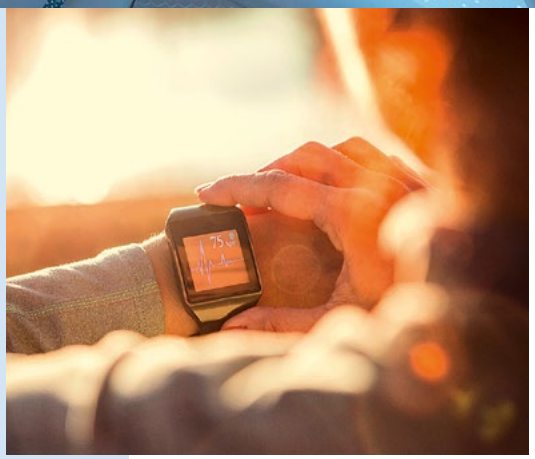


Using 3D integration, electronic components are no longer just vertically but also horizontally arranged. This results in sensor solutions from ams OSRAM being increasingly compact and powerful.

ams OSRAM connects light with intelligence and innovation, thus enriching people's lives. This means sensing is life.

ECSEL as multiplier
Thanks to ECSEL, ams OSRAM is able to not only continuously expand its sensor portfolio but also creates a buzz in the market with trendsetting technological developments. This leads to a higher level of value creation and delivers added value for Austria as a manufacturing location. An outstanding highlight was the development of the process technology for production of the world's smallest 3D integrated environmental light sensor under ECSEL. The application of 3D integrated sensors enables ams OSRAM to design and manufacture increasingly powerful sensor solutions that continue to decrease in size, increase in accuracy, are more economical, and are easier to integrate.

A further focus is on the creation of complete sensor solutions including end-user application software and its integration. These rapidly moving advancements were and continue to be enabled via the collaboration between academic and industrial partners. ECSEL shortens the time between the initial idea and production maturity enormously. The goal is mutual learning along the value chain and the concrete implementation and handover to mass production. ams OSRAM plays a leading role in helping Europe position itself at the forefront of global optical technologies and that manufacturing in Austria is competitive.



Smart Health
ams Osram is developing innovative, biometric, optical sensors and components for fitness tracking, analysis, and health monitoring. This permits the non-invasive measurement of heart frequency, blood temperature, and oxygen saturation level.

Strategic and forward-looking
The research and development division is one of ams OSRAMS's pivotal points of success. Thanks to the strategic and forward-looking efforts, the company on the cutting-edge of technology can look upon countless trendsetting and groundbreaking successes. Over 15,000 patents granted and applied for are testimony to this.

The company, whose main headquarters are in Premstätten/Graz (Austria) with a co-headquarter in Munich (Germany), employs around 24,000 people worldwide and, in 2021, the ams OSRAM group reported a turnover of over 5 billion Euros and is now listed as ams-OSRAM AG on the SIX Swiss Exchange (ISIN: AT0000A18XM4).

ams OSRAM makes a significant contribution to enabling increasingly sharp photos to be made with smartphones. Color (RGB), proximity and flimmer recognition sensors enable automatic white balance, the recognition of light sources, autofocus, the support of background blurring, and spectral ambient light measurement (ALS).

AVL List

Optimization of efficiency and performance: AVL offers a portfolio of tools and processes with which every component and system, up to an entire vehicle, can be investigated.

Evolving to the Global Leader in Technology

AVL has transformed itself, with the support of ECSEL projects, from a development partner for powertrains to a technology leader in mobility. A holistic approach in the fields of development, simulation, and testing helps the company to make significant contributions to a sustainable, networked, and intelligent mobility of the future.

Holistic Technology
AVL pursues an interdisciplinary approach In the development of vehicles with a consistent focus on the overall product. Individual components do not determine the market success of a vehicle, but it is rather the overall performance that the vehicle provides to the end customer in daily use.

Reimagining Motion
Since 1992, AVL List GmbH has participated in over 150 R&D projects that were funded with public European grants.

AVL develops cost-efficient and innovative systems for the effective reduction of CO_2 and achieves this through the application of a multiple energy carrier strategy in all areas, from hybrid to battery-electric and fuel cell technologies. The company supports its customers throughout the entire development process from the concept phase to series production. AVL has comprehensive expertise in the fields of ADAS, autonomous driving, and digitalization, enabling it to make the vision of an intelligent and networked mobility reality.

The joint projects with ECSEL enable AVL to drive innovation within the company forwards.

Future topics in the automotive industry
Participation in national funding programs and international ECSEL projects in the fields of embedded software and electronics help support the entry into future fields of interest such as electrification and automated driving. Digitalization poses challenges across the entire sector since it is based on complex software technologies with a large share of electronics.

Leading European technological companies worked together under ECSEL in order to face these challenges resulting in an innovation ecosystem. AVL played a leading role in this development. The narrow and continuing interdisciplinary collaboration with international partners enabled AVL to develop and commercialize new solutions. These innovative technologies not only strengthen AVL's position in the global market but also contribute significantly to the further development and acquisition of new fields of business.

Measurable success
AVL continuously optimizes the vehicle development process. Technological and market trends shape AVL's strategically aligned R&D activities. The international network of experts spans 26 countries and bundles AVL's expertise in 45 competence and development centers over the entire globe. The share of internally financed research is 12 % of turnover, which in 2020 amounted to 1.7 billion Euros.

Over 11,000 employees, 4,000 in Graz, are working today on the mobility solutions for tomorrow. The business area Automated Driving in particular promises enormous growth potential. ECSEL projects promoted the entry into new and promising business areas thus creating new jobs and generating considerable value in Austria.

ECSEL and ARTEMIS levelled the way for AVL into the increasingly important domain of digitalization in vehicle development.

Efficiency through simulation
Simulation solutions developed by AVL can be used in early stages of the vehicle development process enabling essential decisions to be made regarding concept and design. This results in customers saving time and money.

Research for greener mobility
One of the decisive elements for low emission and emission-free mobility is the powertrain. The term powertrain covers all vehicle components that generate power for motion and transfer it to the ground. This area offers potential for enormous savings in CO_2, whether it is powered by combustion engines, electrically or as a hybrid. During the development of all types of powertrain, AVL places particular focus on the reduction of the CO_2 footprint in all stages of the vehicle's life cycle while taking consumer affordability into account.

Infineon Technologies Austria

Ready for Mission Future – Made in Europe

These chips are not sourced from Asia but from Villach. Based on Infineon's ground-breaking 300-mm thin wafer technology, one of the most modern high-tech chip factories was opened in Villach in 2021. ECSEL projects played a major role in making this step into the future possible.

ECSEL projects as the driving force

Since 2012, Infineon Austria has participated in 12 ENIAC/ECSEL projects, the majority as project coordinator. The development of the 300-mm thin wafer technology was one of the outstanding milestones in this context and has become the foundation of an impressive success story. Villach is the competence center for power semiconductors in the company and has been an important site of innovation in Infineon's manufacturing network for a long time.

Energy-saving chips minimize the CO_2 footprint both where they are used and also in their production.

The funded ENIAC/ECSEL projects were the key enablers and drivers of investment into the research of such core future topics.

Research and Development
Infineon Austria is one of Austria's strongest companies regarding research. In 2021 alone, 516 million Euros was poured into research resulting in the registering of 217 patents.

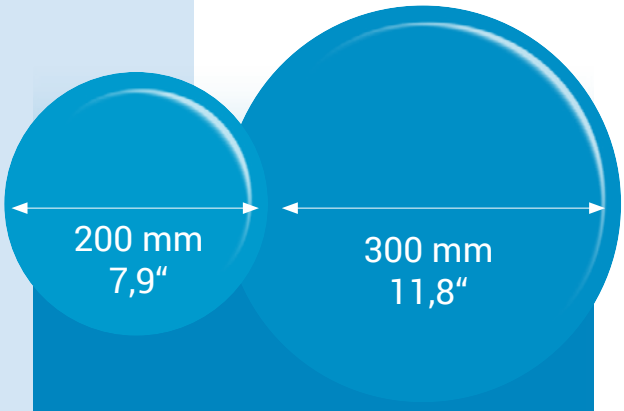
Wafer-thin, powerful, and energy-efficient
The silicon wafers manufactured at Infineon in Villach are down to 0.04 mm thin: not even half as thin as a sheet of paper. This technology enables Infineon and thus Austria's industry to score in global competition.

Ready for Mission Future
Thanks to further ECSEL projects, the materials were optimized, and the production process was translated into mass production; keyword Industry 4.0. The required suppliers and cooperation partners were also found and integrated within the scope of these projects. The result was one of the world's most up-to-date power semiconductor factories opening in Villach in 2021. This unparalleled investment of 1.6 billion Euros promises the Infineon group a potential additional turnover of around 2 billion Euros per year. Infineon has proved with this investment that successful manufacturing can be both competitive and sustainable, even in Europe. The two factories in Villach and Dresden mean that Infineon now has two large power semiconductor production plants for 300-mm thin wafers forming a virtual Megafactory.

Tech for Green
The rapid progression of digitalization and electrification has meant that global demand for power semiconductors has shot up. The focus is on the low-cost production of energy-saving chips that minimize the CO_2 footprint and fulfil the highest quality requirements. Whether consumer electronics, domestic appliances, e-mobility, or industrial plant, no sector can survive without these impressive technological achievements. The focus in Villach on power electronics provides concrete solutions to reach climate targets. Infineon's intelligent technologies thus make a huge contribution to the energy transition. The energy-saving chips manufactured in Villach during the business year 2021 alone will save around 7 million tons of CO_2 emissions over the course of their lifetime. This corresponds to almost 50 % of passenger car emissions in Austria.

Infineon Austria
Infineon Austria bundles together research and development (R&D), production, and global business responsibility, while being responsible for 13 product lines in the business divisions Automotive, Power & Sensor Systems, and Industrial Power Control. In the business year 2021, the subsidiary company of Infineon Technologies AG achieved a turnover of 3.9 billion Euros. The headquarters are located in Villach with further affiliates in Graz, Klagenfurt, Linz, and Vienna.

The R&D area employs 2,100 people in Austria. A total of 4,820 people from 73 nations work on future technologies at Infineon Austria. Just building the high-tech factory in Villach created an additional 400 jobs in production in addition to the around 350 in R&D.



100 mm larger - a gamechanger
From the point of view of the micro-electronics sector, there is a world of difference between wafer sizes of 200- and 300-mm. Wafers are slices of silicon upon which semiconductors, or chips, can be produced. Infineon's ability to produce 40 micrometer (0.04 mm) thin wafers with a diameter of 300 mm is unique across the globe. The particularly thin energy-saving chips enable the even more efficient conversion of energy in electronic systems. More than double the number of chips can be produced in a production run using 300 mm wafers than using 200 mm wafers. This makes mass production significantly more productive, uses less resources, and reduces capital investment.

TTTech Group

From Small Enterprise to Global Player

Founded in 1998, the TTTech Group now is among the big players. On the path from start-up to medium-sized company and on to large enterprise with global reach, ECSEL projects acted as valuable door-openers.

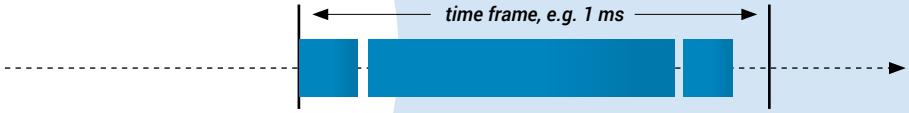
Austria's most influential academic spin-off

TTTech was established as a spin-off of the TU Vienna by Prof. Hermann Kopetz, his son Georg Kopetz, and Dr. Stefan Poledna. The name TTTech stands for "Time-Triggered Technology" and the company has dedicated itself to the highest reliability and security of networked electronic systems in accordance with the company philosophy. The company develops real-time network platforms and security controls that are used in the automotive and aviation industries, as well as for wind turbines and in other sectors.

Successful networking

Within the scope of the ECSEL program and its predecessor ARTEMIS, TTTech conducted research into several promising technologies, brought them to prototype maturity, and converted them into market-ready and competitive products. The initially young and comparatively small company faced high entry barriers, particularly into the aviation and space industries, which posed a huge challenge. However, TTTech was able to use channels such as the networks offered by research programs like ECSEL **to gain access to potential customers and partners**. This helped the company to identify market demands and requirements, to consider them in the development process, and to simultaneously prove the performance of the technology.

TTTech Group's reference list reads like the Who's Who of leading industry (an excerpt): Airbus, Audi, BMW, Boeing, Continental, European Space Agency, General Electrics, Honeywell, Infineon, NASA, Palfinger, Rosenbauer, etc.



A "real-time" system must ensure that a result is guaranteed to be calculated within a defined time interval.

Protect life via real-time data communication

Data communication in cars and airplanes must be reliable and secure. Time-triggered systems work according to fixed time schedules that enable data to be received in the required time interval. In contrast, event-based systems are susceptible to outages or delays.

Risk minimization thanks to ECSEL

TTTech is an industrial company driven by research and development and has always connected entrepreneurial thinking with a strong technological vision. Thanks to ECSEL, daring and yet promising development paths could be followed with a minimized entrepreneurial risk.

The ECSEL network enabled the TTTech Group to build trust and enter long-term relationships within the ecosystem.

Creating synergy

From the very beginning, TTTech aimed to transfer its research and development work to other areas of application and sectors, and to use the resulting synergies and associated leverage. By now, TTTech has achieved technological leadership in many areas and has always had its sights on the future. This is reflected by the broadly diversified field of activity: The solutions developed by TTTech have delivered milestones for autonomous driving, while aviation on-board components and networks can be found in numerous passenger aero planes. Real-time communication and open edge-computing platforms are revolutionizing Industry 4.0 and highly reliable electronic control systems are also used in agricultural machines and snow groomers.

The Group's first unicorn

First established as TTTech Computertechnik GmbH in 1998, the company underwent rapid growth resulting in today's TTTech Group. It consists of the high-tech companies TTTech Computertechnik AG, TTTech Auto AG, TTTech Industrial Automation AG, and TTControl GmbH. The company employs 2,300 people in 14 countries with a focus on central Europe. The headquarters are located in Vienna. One of the most important business divisions is automotive, which successfully continues its impressive course. Thanks to additional capital from Audi and the technology company Aptiv, TTTech Auto advanced to a unicorn at the beginning of 2022, meaning that the young company has already been evaluated at a billion US dollars before the IPO.

TTTech's success contributes not only to Austria's competitiveness but also to the entire European industry.

Reaching for the stars

One of the most spectacular successes achieved by an ECSEL funded project was most definitely the development of TTEthernet® for the Ariane 6, a European carrier rocket. Even though TTTech competed against technology giants, the Viennese company was able to prevail. The high-tech company now collaborates on several projects with NASA and ESA. TTTech Aerospace offers deterministic embedded networking and platform solutions for air and space applications.

The study "ECSEL-funded projects and their impact: Case studies of Austrian companies" from 2020 shows which positive effects can be achieved if mutual targets are strived for on a European level. Four case studies show what added value the funding of research activities can generate.

The comprehensive study can be downloaded from **www.ecsel-austria.net/impactreport**.