



SE²A Magazine December 2024

Dear readers, dear members and friends of the cluster SE²A,

Time flies! As the year already comes to an end, we would like to look back with you on exciting news of the second half of 2024!

Although the proposal and review for SE²A-II has been at the centre of attention in recent months, a lot has been achieved and taken place during this time. This was only possible through the engagement and support of each member of our cluster. This strong commitment allows us to look to the future with great optimism!

Here's to a wonderful festive season and a happy new year! Enjoy reading!

With best regards,

Prof. Dr.-Ing. Jens Friedrichs
(Spokesperson SE²A)

Dr. Doris Pester
(SE²A-Managing-Director)



CLUSTER NEWS

Updates on the SE²A-II Cluster Proposal – a look back on an exciting process

During the last year, we formulated an ambitious and forward-looking work program for the time ahead. For that, we went through a process of collecting ideas, brainstorming and having numerous discussions.

We have thought about SE²A II in many ways, and after extensive conversations, we were able to agree on a challenging concept. The preparation for the DFG review started right after the submission of the full proposal in August. On November 14, a group of 15 of our many experts of the cluster travelled to Bonn to present our program to the 16 reviewers from various disciplines, answer questions, and demonstrate that our project upholds the highest standards in research for a sustainable future of aviation.

This intensive working period, crossing institutional and disciplinary boundaries, was both challenging and productive. Therefore, we would like to thank all Cluster members for their dedicated participation, the valuable exchange of ideas, and the important feedback received from the various projects, research units, and ICAs. Each contribution was carefully considered by us and has led to an outstanding result.

We would like to express our gratitude to the Research Service and the Project House of TU Braunschweig for their support throughout the application process. A very special thanks goes to the members of our writing team, to the researchers and President Angela Ittel for her intensive support and preparing and participating in the review. Further thanks goes to State Secretary Prof. Joachim Schachtner and Dr. Marcus Beiner from the Lower Saxony Ministry for Science and Culture for their political support at the state level.

It's time to keep our fingers crossed: Results will be announced on May 22, 2025.

SE²A Image film launched

This film introduces the mission, vision, and innovative research conducted by the cluster, which is dedicated to transforming the air transport system with its rapidly increasing demands.

With a team of 140 researchers in an innovative, international research consortium, SE²A plays a pioneering role in meeting the changing requirements and expectations with regard to environmental protection and noise pollution. The film emphasizes the cluster's commitment to a revolution of the air transport system, aiming to achieve a significant reduction in emissions and ultimately minimize the climate impact of aviation for the next generation of flying.

“Our cluster of excellence is doing research for nothing less than a full revolution of the air transport system.”

Prof. Dr.-Ing. Jens Friedrichs, Spokesperson of the Cluster of Excellence SE²A

The film paints a picture of how the transition path to a cleaner future in aviation can be managed, taking into account ecological, economic, and social criteria as well as future scenarios.



[Click the picture to watch the Image film](#)

First Full-Scale Model Aircraft takes off successfully

As part of the CLIME project, a full-scale flight model of our SE²A reference medium-haul aircraft was developed and manufactured. CLIME focuses on the study of flight dynamics and engine integration in a novel configuration. The model itself was developed in cooperation with TU Delft and is characterized by a number of distinctive features, including forward-swept wings, an arrangement of the engines above and behind the wing and an additional engine at the rear. Furthermore, the model is designed modular, allowing for change of the wings and engines as needed.



[Click the picture for the CLIME video explained by Prof. Jens Friedrichs](#)

“This is our research vehicle for investigating future technologies for medium-haul aircraft with sustainable propulsion systems and radical energy savings in a real environment – outside the laboratory and wind tunnel” says Prof. Dr. Jens Friedrichs, spokesperson of the Cluster of Excellence SE²A.

The model will provide the basis for a number of new experiments, which are to be conducted in collaboration with several of our scientists. These initial six flights,

executed on 20th and 26th of June, represent only the first in a series of surely many more to come. TU Braunschweig is one of a few European research institutions to have successfully pursued this path.



The SE²A test carrier CLIME right before the initial flight

“The scaled flight test is, so to speak, a game changer” says Prof. Dr. Peter Hecker, Vice-President for Research at TU Braunschweig.



Click the picture to find out how a scaled aircraft model works

You can read the full article [here](#).

RESEARCH

The Integrated Cluster Areas

The Cluster of Excellence "Sustainable and Energy-Efficient Aviation" is an interdisciplinary research center with the purpose of investigating technologies for a sustainable and eco-friendly air transport system.

Scientists from aerospace, electrical, energy and chemical engineering are working on the reduction of emissions and noise, as well as recycling and life-cycle concepts for airframes and improvements in air traffic management. Technische Universität Braunschweig, the German Aerospace Center (DLR), Leibniz University Hannover (LUH), the Braunschweig University of Art (HBK) and the National Metrology Institute of Germany (PTB) have joined forces in this extraordinary scientific undertaking.

The Cluster organisation is structured in three **Integrated Cluster Areas (ICA)** reflecting the mission-critical research demands and following a coherent and coordinated roadmap. The three ICAs resulting from our assessment of critical research demand are:

ICA A - "Assessment of the Air Transport System"

The goal of this cluster area is the development of comprehensive criteria and metrics for sustainable air transport that can serve as a basis for decision-making and future scenarios. [More information](#)

ICA B - "Flight Physics and Vehicle Systems"

This cluster area takes an in-depth look at technologies that have the potential to significantly reduce the power required from the propulsion system. [More information](#)

ICA C - "Energy Storage and Conversion"

Even with major advances in aircraft drag and propulsion efficiency, carbon emissions can only be reduced, while carbon-free aviation requires new concepts for the energy supply. The cluster looks at advanced lithium-sulfur chemistry for solid-state batteries as well as load bearing batteries.

[More information](#)

Fuel Cells in Sustainable Flying: SE²A Doctoral Researcher Patrick Meyer on their Impact as Key Technology for the Future

A key element is the optimisation of the air management system, which has a direct influence on the weight of the aircraft and therefore the feasibility of the undertaking.

[Patrick Meyer](#) and his team from the SE²A project "[DEFCA: Design-space evaluation of the air, heat and power management of fuel cells for aviation](#)" look at the entire system: they analyse various architectures and models from their project partners, combine them into an overall system view and compare what works best for the system as a whole. The results are then used by the project partners to make improvements to future components.

However, current challenges, such as the development of a hydrogen infrastructure and the fulfilment of approval regulations, must be overcome. Meyer explains that the first fuel cell aircraft will probably be based on existing designs, but will require major changes to the aircraft design to meet the specific requirements.

While the vision of environmentally friendly flying with fuel cells remains a complex endeavor, ongoing research and developments show promising approaches for the aviation of the future. Read the full interview [here](#).



SE²A doctoral researcher Patrick Meyer giving an interview about his research at the Institute of Aircraft Propulsion and Turbomachinery

Aeronautics Research Centre Niedersachsen awards science prizes

This year, SE²A was again represented at the Research Day of the Aeronautics Research Centre Niedersachsen ([NFL](#)) on 28th of November 2024.

Former SE²A doctoral researcher [Dr. Alexander Barke](#) has won one of two Hermann Blenk Prizes for best dissertation with his thesis on the ecological and socio-economic impact of innovative aircraft propulsion concepts and the energy sources required throughout their entire life cycle. The focus is on identifying suitable combinations of propulsion concepts and energy source variants that will improve the environmental compatibility of the aviation sector in terms of reducing emissions, while at the same time being economically advantageous.



Winner of the Hermann Blenk prize for best dissertation Dr. Alexander Barke

Dr. Barke's research combines methods of life cycle assessments and operations research. This makes it possible to identify potentially suitable propulsion concepts at an early stage and provide recommendations for further research and development.

Dr. Barke conducted his research at the [Institute of Automotive Management and Industrial Production \(AIP\)](#) at TU Braunschweig and is involved in the project [SUMAFly II - Sustainability Modeling and Analysis of Future aircraft systems II](#) in the SE²A Cluster of Excellence

that deals with the development and design of propulsion concepts

and can also identify transformation paths with regard to the fleet development of airlines with innovative aircraft propulsion concepts.

We congratulate Dr. Barke and all winners for their extraordinary work!

Find the full article [here](#).

Fly High movie night – a great success!

In the last week of September, the Science & Art Lab at TU Braunschweig, together with the SE²A Cluster of Excellence and in cooperation with the Braunschweig International Film Festival, invited guests to a short-film evening. The [Institute of Aircraft Design and Lightweight Structures \(IFL\)](#) opened its otherwise closed doors for this unique event. In this exceptional location, guests were welcomed with some introductory words from Prof. Peter Hecker, Vice President of TU Braunschweig for Research and Academic Career Paths and from Dr. Jule Hillgärtner & Henrike Wenzel from the Science & Art Lab at TU Braunschweig.

Prof. Jens Friedrichs, spokesperson for the Cluster of Excellence, then invited the participants to watch the SE²A image film, which was presented for the first time.

The following panel discussion on the future of aviation and the interplay between art and science, moderated by Meggy Jackstadt, provided many interesting insights. Dr. André Bauknecht, independent junior research group leader in the SE²A Cluster of Excellence (TU Braunschweig), Prof. Gerhard Glatzel, Institute for Design Research (HBK Braunschweig) and Dr. Katja Naie, Managing Director of the Ernst Schering Foundation (Berlin), took part in this discussion.



(from left) Meggy Jackstadt, Dr. Katja Naie, Prof. Gerhard Glatzel and Dr. André Bauknecht



A highlight was the venue of the evening: the IFL opened their doors for the public

The evening was accompanied by guided tours of various SE2A facilities, with topics ranging from flow to lightweight construction. We would like to thank [Lennart Lobitz](#) (IFL), [Nick Gottschalk](#) (IFAS), [Renato Lumia](#) and colleagues (IFF) and [Dr.](#)

[André Bauknecht](#) (ISM) for providing insights into their work and the corresponding facilities. The high level of interest in our work in the Cluster of Excellence was demonstrated by the numerous questions from the participants. The event not only offered the citizens of Braunschweig the opportunity to gain insights into the topics of the Cluster, but also to emphasize the relevance and interdisciplinarity of aviation research. With all available seats booked, this pilot event was a great success and inspires us to reach even greater heights in the future.



No film night without popcorn!

Summer School for Advanced Sustainable Aviation Technologies 2024

The Summer School once again offered a unique opportunity for national and international students to expand their knowledge and exchange ideas on sustainable aviation with leading experts from science and industry. This year's participants came from Germany, Iran, India and France and seized the opportunity from 2 to 13 September 2024.



Getting to know the Campus Research Airport and the TU Braunschweig research aircraft

After a week of online input in the form of almost 20 lectures with experts from TU Braunschweig, Leibniz Universität Hannover, DLR, Lufthansa and Airbus, the participants met in Braunschweig to get to know each other personally.

The programme also included a tour of [Aerodata AG](#) with a visit to the hangars, as well as guided tours of the SE2A [Institute of Jet Propulsion and Turbomachinery \(IFAS\)](#), the [Institute of Fluid Mechanics \(ISM\)](#) and the [Institute of Aircraft Design](#)

[and Lightweight Structures \(IFL\)](#) at the research airport campus. Another highlight was the guided tour of [Hanover Airport](#) and a discussion with CEO Prof. Dr. Martin Roll, who took extra time for the participants and answered their many questions with great insight.



Exploring historical Braunschweig on a guided city tour

Participants had the chance to discover more about Braunschweig and gain unusual views of the city during a guided tour. The ascent of the town hall tower was the ideal opportunity to

do this. On their last day, the students presented the results of their group work to Prof. Dr. Ulrich Römer, the expert consultants Marcel Seidler, Daniel Kessler and Patrick Brunow (IFAS), and further scientists. The future of aviation looks bright with so many great, new ideas.

We would like to thank everyone involved for their support of the Summer School and we look forward to next year!

The International Aviation Summer School is a project of the SE²A Cluster of Excellence and TU Braunschweig, which took place for the first time in summer 2023. One of its aims is to get young students interested in SE²A and to encourage them to pursue a scientific career in our unique Cluster of Excellence. Read more [here](#).

A new cohort of changING has started their journey

Prof. Dr. Jens Friedrichs, spokesperson for the Cluster of Excellence, welcomed nearly 50 participants to this year's kick-off event, which was held at the Haus der Wissenschaft, on November 5th.

The team around Dr. Dina Al-Kharabsheh organized a get together to give the pupils the chance to get to know each other better. They were also invited by Prof. Friedrichs to visit the Cluster's laboratories and institutes. As in previous years, participants were presented with a challenge, this time in the form of a paper plane competition.

The changING research club of the Cluster of Excellence SE²A deals with showing and transferring knowledge of current scientific questions and research to mainly female pupils from 10th class and upwards. ChangING provides a diverse programme that offers the chance to work together with the TU Braunschweig researchers and conduct their own projects in an authentic academic surrounding with its facilities. With almost 200 students who have already participated in the programme, it can be considered a notable success.

We are delighted to welcome so many new faces and look forward to an enjoyable and productive time with you. Click [here](#) for more info about changING.



The new cohort of changING having a paper plane competition

FURTHER EVENTS

SE²A at the DLRK Congress Hamburg

The congress opened on September 30th with the SE²A Image Film. The German Aerospace Congress (DLRK) is Germany's largest aerospace congress, with almost 1,000 participants. This year, the event was hosted by the University of Hamburg.



The opening of the DLRK Congress with the SE²A Imagefilm

SE²A presented a number of cluster project results at the event, and also provided a valuable networking opportunity at the stand in collaboration with the [Aeronautics Research Centre Niedersachsen \(NFL\)](#) and [Braunschweig Research Airport](#). Our DISPROP exhibition model, which is based on the cluster's fundamental research and has been further developed in EU projects into a wind tunnel demonstrator with a height of nearly 3 metres, attracted the attention of

experts and prompted some in-depth discussions. Similarly, the Institute of Flight Guidance from TU Braunschweig presented an aircraft model for meteorological measurements. While many technical solutions for short- and medium-haul flights are nearing feasibility, further fundamental research is required, particularly in the area of sustainability for long-haul flights.



A part of the SE²A stand at the DLRK Congress

We would like to thank all those who participated in the discussions and networking opportunities at our SE²A-NFL-Braunschweig Research Airport stand.

Find the whole article [here](#).

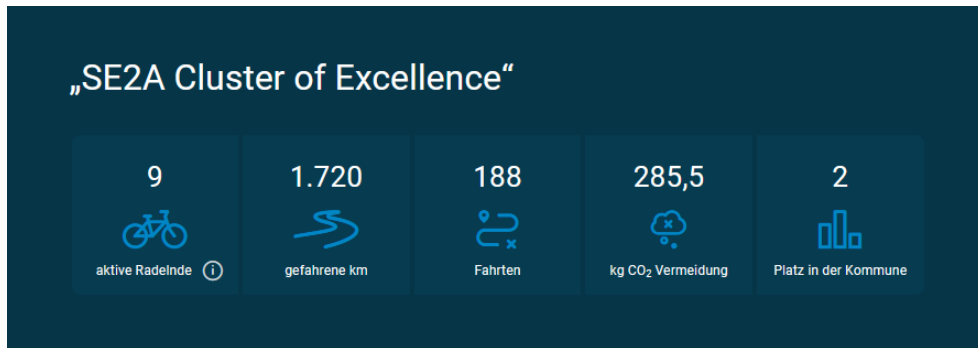
SE²A on Bike: The Team took part again in the Stadtradeln Event

September marked an exciting month for cycling enthusiasts across the region, as the annual Stadtradeln event took place. The event lasted three weeks, during which participants were encouraged to cycle instead of driving by car, in order to save as much CO₂ as possible.

With 9 members, the SE²A team cycled a total of 1720 kilometers. With that, 285 kilogramm CO₂ were avoided. The winner of this year is Nofiyanti Heradita Seifert with an incredible amount of 621 km cycled! Congratulations! The second and third winners are Richard von Soldenhoff with 409 km and Dr. Doris Pester with 193 km.

The event aims to increase awareness of the impact of cycling. It encourages individuals to complete their everyday journeys by bicycle instead of by car and to assess the potential for CO₂ savings, thereby contributing to climate protection. The data collected will also be made available to local authorities to assist in the development of more cycle-friendly cities.

Find the Stadtradeln website [here](#).



The SE²A team results at this year's Stadtradeln event

NEWS FROM THE SE²A RESEARCH TRAINING GROUP

SE²A Doctoral Researchers – Portrait Gallery

Who are the faces behind the valuable research of the SE²A doctoral researchers? Let's create more visibility for you, your work and your projects - both internally and externally and create a comprehensive network on our [website](#)! In order to be able to present you effectively, we kindly ask for your participation. If you would like to take part, please contact [Tatjana Szalkau](#).

ICA C - "Energy Storage and Conversion"



The SE²A Young Researchers Gallery on our Website



Fenja Ahrendt



Project: C3.5 Numerical investigations of synthetic fuel flames in aviation conditions

Institute of Jet Propulsion and Turbomachinery @TU Braunschweig

fenja.ahrendt@tu-braunschweig.de

- Who are you and what is your research topic? ▼

- Which research question are you working on? ▼

- What inspires you about your research? ▼

- Why is your topic relevant to the future of aviation? ▼

- What is special about participating in the interdisciplinary research network SE²A? ▼



We look back: SE²A Research Training Group 2024

SE²A Short Courses, Lectures and Workshops

In the beginning of the year, we continued the successful SE²A Short Course programme, enhancing understanding of various research areas and methodologies of the diverse work conducted within the cluster, while bringing together doctoral researchers from all institutions involved.

Another focus was on the topic of sustainability in research software as well as of publishing. For example, in the workshop "A three-step-guide to develop your paper and to interact with your co-authors in a structured manner" by Prof. Richard Hanke-Rauschenbach, the participants were equipped with essential strategies for effective collaboration, helping them navigate the complexities of co-authoring and project development. In addition to that, Prof. Georg Garnweitner offered practical advice directly from an editor's perspective. The workshop "How to successfully publish your results - Insights from a (former) editor" focused on effective strategies for navigating the review process.



SE²A Doctoral Seminars

Interesting insights were given in many lectures, for example in an introduction by the former SE²A doctoral researcher Lennart Lobitz on "Abaqus Finite Element Analysis", and in a workshop on "Literature Review & Validation" by Tim Wittenborg, a current doctoral researcher in the Cluster of Excellence, which provided valuable input on effective research practices.

In addition to the academic sessions, the doctoral researchers of the Coordination Team organised social events to foster community and collaboration among the group. Highlights included a "Walk and Talk" in the Harz region during the summer, as well as a joint visit to the Christmas market in winter.

Research Training Group - Coordination Team

All activities were planned and discussed within the RTG Coordination Team. We want to say thank you for your contributions and the cross-institutional commitment to the SE²A Research Training Group to this year's team members: Prof. Stefan Helber and Jörn Serrer for ICA A, Dr. Nicolas Fezans and Valerio Mosca for ICA B and Dr. Dajan Mimic and Aditya Kale for ICA C, as well as Prof. Gabriele Raabe and Tatjana Szalkau.

With the many valuable experiences and insights gained from the events in 2024, we are motivated to create a diverse programme for our doctoral researchers in the upcoming year and continue to promote interdisciplinary exchange.

Do you have ideas or wishes for the upcoming year? Please contact one of the members of the Coordination Team!



ANNOUNCEMENTS

SE²A you on LinkedIn

As some of you may be aware already, we left X (formerly Twitter) some time ago and migrated to our new platform of choice: LinkedIn. If you post something about SE²A, please don't forget to tag us, so we can spread the news!

Find us [here](#).



Girls'Day will take place on 3rd April 2025. We hope to welcome many interested pupils at our SE²A facilities! You can find more information about Girls'Day at SE²A [here](#).



The Hannover Messe will take place from 31st of March to 4th of April 2025. SE²A will be part of the world's leading industrial trade fair. Sustainability and climate neutrality are two of the main focuses of this year's Hannover Messe. Read more [here](#).



The congress is the central event of the German speaking aerospace community. As a multidisciplinary event, the DLRK offers all participants a platform to present significant findings, progress and developments in the aerospace industry. More Information [here](#).



The next SE²A Conference will take place in 2025! The exact date and programme are to be announced.



The SE²A-Magazine will be published twice a year. For further information please visit our website: <https://www.tu-braunschweig.de/en/se2a>

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