



Dear readers, dear members and friends of the cluster SE<sup>2</sup>A,

With this issue, we are looking back on many events and exciting news of the first half of 2024.

Over the past few months, we have been working intensively to translate the valuable results of our previous cluster work into a programme for a second SE<sup>2</sup>A funding period. In doing so, we have summarised and rethought the SE<sup>2</sup>A Cluster of Excellence and thus established a work programme that can only emerge through our unique collaboration across disciplines and research institutions beyond national borders. We look back on a productive, exciting phase and would like to thank everyone involved for the intensive dialogue, ongoing participation and feedback!

But while the foundations for further research have been laid, many other interesting events have also taken place in recent months. Please have a look and enjoy reading.

With best regards,

**Prof. Dr.-Ing. Jens Friedrichs**  
(Spokesperson SE<sup>2</sup>A)

**Dr. Doris Pester**  
(SE<sup>2</sup>A-Managing-Director)

## SE<sup>2</sup>A EVENT

### Science & Art! Fly High – Short film night with panel discussion



"Film is not me seeing, film is me flying", writes philosopher Paul Virilio, alluding to the relationship between seeing film and flying machines. Inspired by this, the Cluster of Excellence SE<sup>2</sup>A together with the Science & Art Lab at TU Braunschweig, invites you to the Fly High short film night.

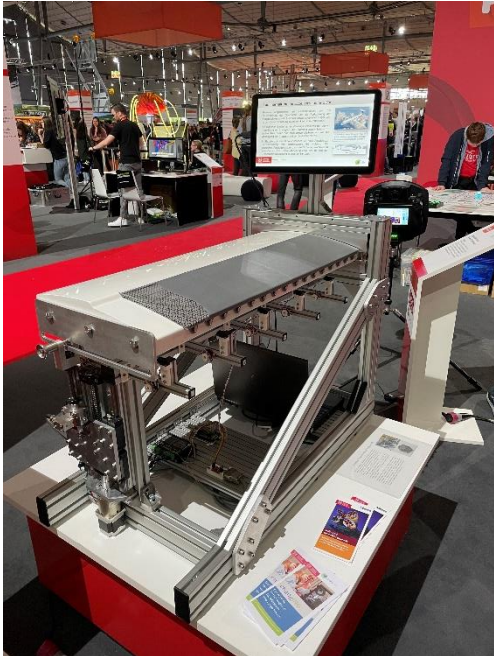
In addition to a panel discussion and insights into current research findings, a short film programme curated in cooperation with the Braunschweig International Film Festival will be shown.

After a short welcome, we will proudly present our SE<sup>2</sup>A image film for the first time. You can look forward to a panel discussion with our experts, institute tours and more short films!

You can find [more information about the agenda](#) on our website!

June 2024

## IdeenExpo 2024: SE<sup>2</sup>A Research for pupils



Active laminar flow control (3D print): structural design of a suction panel and its integration into the wing

Inspiring young people for technology and the natural sciences - a goal that is being pursued by many institutions, including the SE<sup>2</sup>A Cluster of Excellence. The IdeenExpo offers everyone the opportunity to get a glimpse of research and development, of technology and natural sciences, and to take something home. The hands-on and experience activities at the IdeenExpo attracted several hundred thousand visitors every two years since 2007. This year, the SE<sup>2</sup>A research institutes at TU Braunschweig presented themselves for the first time with topics relating to the aviation of the future.

Between the 8<sup>th</sup> and 16<sup>th</sup> of June, pupils had the opportunity to be inspired by experimental stations, workshops and a variety of stage performances: In the IdeenExpo 2024 production arena, pupils were able to visualise sound with an acoustic camera and explore the inside of a battery, for example. To make airplanes more environmentally friendly, not only does the technology need to be revised, but the design also needs to be adapted.



Dr. Doris Pester (CEO) presenting the "Blended Wing Body" to representatives from politics and the economy

The "Blended Wing Body" was used to show pupils how environmentally friendly technologies change the appearance of an aircraft. Furthermore, a 3D printed model visualised a promising approach to reduce aircraft drag in the context of active laminar flow control.



Set up of the Ozobot Smartie transport competition

A hands-on highlight was the Ozobot Smartie transport competition: the aim was to transport Smarties placed in the centre to the pupils' own storage facility and thus familiarise them with the importance and challenges of coordinating different means of transport in logistics. SE<sup>2</sup>A looks back on exciting and successful days:

We are pleased to have inspired young people for the topic of 'Aviation of the Future' and to have introduced them to our research. We are also pleased that our various exhibits were visited by numerous representatives from politics and science and we thank all participating institutes.

[Click here](#) for more insights of the IdeenExpo 2024. See you next time!

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## step in MINT: Pupils experiment at IFAS and ISM

Step in MINT is a programme offered by the Equal Opportunities Office, in which female pupils in the grade 12 and 13 have a first hands on experience at TU Braunschweig. The aim is to offer them practical insights into STEM degree programs, in which they are statistically underrepresented, and topics of the future: energy, mobility, environment and health.



*Step in MINT participants and Dr. Heiko Schwarz (IFAS)*

In June, the 20 participants visited the Campus Research Airport. They explored the [Institute of Jet Propulsion and Turbomachinery \(IFAS\)](#) and the [Institute of Fluid Mechanics \(ISM\)](#) through experiments in the wind tunnel and investigations of engine blades.

In a practical session, they learnt why the maintenance of aircraft engines is challenging and important. The pupils used a borescope to search for damage to



*Gaining an insight into the structure of an engine*

broken blades on an aircraft engine. The blades were concealed in a box and only visible on a screen via the borescope images - a tricky task.

Further questions addressed: What does the future of flying look like, what needs to be considered? Will we fly with batteries or hydrogen? And why does the wing also have to be modified?

Registration for the upcoming winter semester is open now!

[Click here](#) for more information about the programme and registration details!

**April 2024**

## Science Minister Falko Mohrs visits SE<sup>2</sup>A



*Falko Mohrs gets a demonstration of laminar support in one of the laboratories of the cluster*

Falko Mohrs was our guest at Braunschweig Research Airport Campus on 12 April 2024, to inform himself about the progress of the cluster. He was introduced to current research highlights, such as progress in reducing drag through laminar support, active load reduction and new results on electric



propulsion. Additionally, Minister Mohrs had a tour in the SE<sup>2</sup>A facilities to get a special insight into the research of the cluster and the participating institutes.

“The infrastructure created here and the interdisciplinary cooperation between the research partners have put Braunschweig firmly on the aviation map. We want to emphatically support this path,” says Falko Mohrs and therefore emphasises the relevance of the work within the cluster.

Dr. Doris Pester (CEO) explains the international character of the cluster and the added value it creates. “The cluster benefits from outstanding national and international scientists in the early stages of their careers – something that cannot be taken for granted these days”, says Dr. Pester.



*SE<sup>2</sup>A Spokesperson Prof. Jens Friedrichs explains the structure of the laminar support to Science Minister Falko Mohrs*

[Click here](#) to read more about Falko Mohrs' visit at Campus Research Airport.

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## Girls'Day at the SE<sup>2</sup>A Cluster of Excellence: Tomorrow's female researchers visit Campus Research Airport



*Girls'Day participants on Campus Research Airport*

A total of about 100 female pupils from grade 5 to 10 made their way to Hermann-Blenk-Straße to gain an exciting and practical insight into the topics of aviation and automotive engineering!

Once again, the participating institutions of SE<sup>2</sup>A put together a great programme: For example, the older participants had the opportunity to learn about flight simulators, find out about their practical uses and land an aircraft themselves with a flight simulator for once.



*Pupils testing the flight simulator at the IFF*

Flying an aircraft in the simulator at the [Institute of Flight Guidance \(IFF\)](#) was the absolute highlight!

The pupils also learnt about reducing climate impact in commercial air traffic.



For the younger participants, the topic of ‘crash safety’ was on the programme at the Institute of [Aircraft Design and Lightweight Structures \(IFL\)](#). After being provided with theoretical knowledge, they had to put this know-how into practice.

*Group work: Protecting a raw egg from a crash!*

A small passenger, represented by a raw egg, was to be protected from a crash. Materials such as straws, bags, cardboard and tape were made available to the pupils to find creative solutions for this task.



*Dr. Doris Pester (CEO – SE<sup>2</sup>A) and Girls'Day participants recapping the event in the NFF lecture hall*

Finally, the pupils came together for a breakfast break with frozen yoghurt as a little surprise! We hope all the visitors enjoyed it as much as we did and we would like to say thank you for the great interest in our programmes. Special thanks goes to

the participating SE<sup>2</sup>A researchers and institutes for giving an insight to possible future TU Braunschweig researchers.

**The next Girls'Day will be on April 3<sup>rd</sup> 2025.**

Girls'Day is an annual day of career orientation for female pupils. The aim is to introduce girls to professions in which mostly men are working in and is therefore contributing to increasing the number of female students in STEM topics and boys in typical female professions.

[Click here](#) to learn more about Future Day 2024 at TU Braunschweig. All information about Girls'Day [here](#).

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## SE<sup>2</sup>A goes Hannover Messe



*Julia Sembowski (researcher in the field of propulsion) & Dr. Doris Pester (CEO) in front of the DISPROP model*

This year's Hannover Messe took place between 22<sup>nd</sup> and 26<sup>th</sup> of April. The Cluster of Excellence SE<sup>2</sup>A participated with displaying its DISPROP model. The ability to quickly change propeller thrust, position, flap angle and angle of attack is key to obtaining a meaningful set of measurements. This is exactly what the 2.7 metre wingspan DISPROP model offers.

The aim is to achieve efficient lift, which will allow smaller wings to be built, thereby reducing energy



requirements. Efficient aircraft configurations are necessary for sustainable aviation in the future.

The booth was well attended, for example by Science Minister Falko Mohrs, and great interest was shown in our research. Special thanks to the participating SE<sup>2</sup>A researchers for providing their expertise at the booth!

[Click here](#) for more impressions of the Hannover Messe 2024

**März 2024**

Interview on the Excellence Strategy at TU Braunschweig – an outlook for 2024

TU Braunschweig President Prof. Angela Ittel and Vice President for Research Prof. Peter Hecker were interviewed on the Excellence Strategy of TU Braunschweig. The topics discussed were on possible future clusters, on how to strengthen the existing clusters, while also giving an outlook for the upcoming months of 2024.

President Ittel and Prof. Hecker emphasise the importance to apply for a continuation of the existing Clusters of Excellence at TU Braunschweig, including the cluster SE<sup>2</sup>A and the cluster Quantum Frontiers. A regular exchange of ideas as well as a close cooperation with the entire Executive Board of TU Braunschweig are mentioned as important parts of the process.

“Despite all the efforts that lie behind us and ahead of us, it will be important that we prepare for a marathon”, says President Angela Ittel.

[Click here](#) to read the full interview.



*President Prof. Angela Ittel & Vice President for Research Prof. Peter Hecker*

Honorary Professorship for Dr. Arne Seitz



*President Prof. Angela Ittel & Honorary Professor Dr. Arne Seitz*

We are pleased that Dr. Arne Seitz has been and will continue to be a scientist and expert advisor for the Cluster of Excellence SE<sup>2</sup>A.

Particularly remarkable are his investigations using analytical tools and models in complex large-scale experiments.

For his important work in the context of TU Braunschweig, as well as for the Cluster of Excellence SE<sup>2</sup>A, he was now appointed as an Honorary Professor of the Faculty of Mechanical Engineering. “Our colleagues in aerospace engineering are delighted to be able to bring Arne Seitz, a true expert in his field, even closer to TU Braunschweig”, says SE<sup>2</sup>A spokesperson Prof. Jens Friedrichs. Congratulations!

[Read more](#) about Dr. Arne Seitz and his Honorary Professorship in the TU Braunschweig magazine.

February 2024

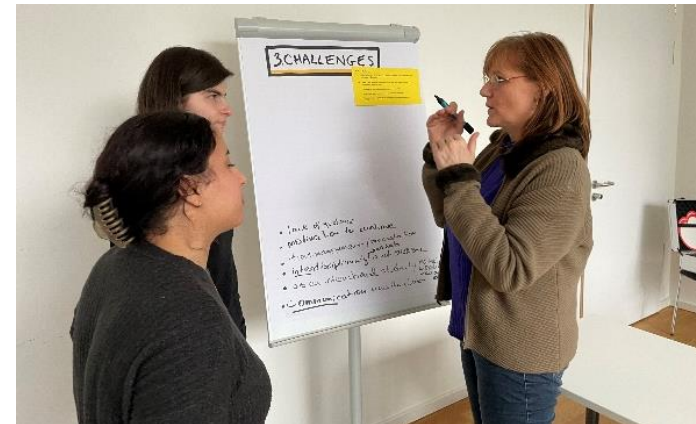
New collaboration brings together female researchers of Clusters of Excellence



Participants & organizers of the collaboration workshop with the kick-off results in the back

On the initiative of SE<sup>2</sup>A, a first exchange meeting has taken place as part of a collaboration between the clusters of excellence PhoenixD (LUH), Quantum Frontiers (LUH), RESIST (Medizinische Hochschule Hannover), and SE<sup>2</sup>A.

With this collaboration, the clusters not only aim to bring together female researchers in the region of Braunschweig and Hannover but also to further strengthen a networking concept and to actively consider the special needs of their female researchers and doctoral candidates. The workshop was organised by Minka Pawlik (TU Braunschweig Equal Opportunity Office) and Tatjana Szalkau (SE<sup>2</sup>A Managing Office) in cooperation with Linda Block (coach) and was advertised to the Clusters of Excellence in the region.



Brainstorming session

After a brief introduction about SE<sup>2</sup>A by Dr. Doris Pester (CEO), the workshop consisted of interactive parts for the participants to get to know each other. In two work phases, the participants developed their ideas about shaping the programme for their respective needs and were offered a protected room to discuss personal challenges in their daily work.

The meeting was the kick-off event for the collaboration beyond cluster boundaries and will be continued, among others, with topics on role management as well as scientific writing.

[Click here](#) for more impressions of the event!





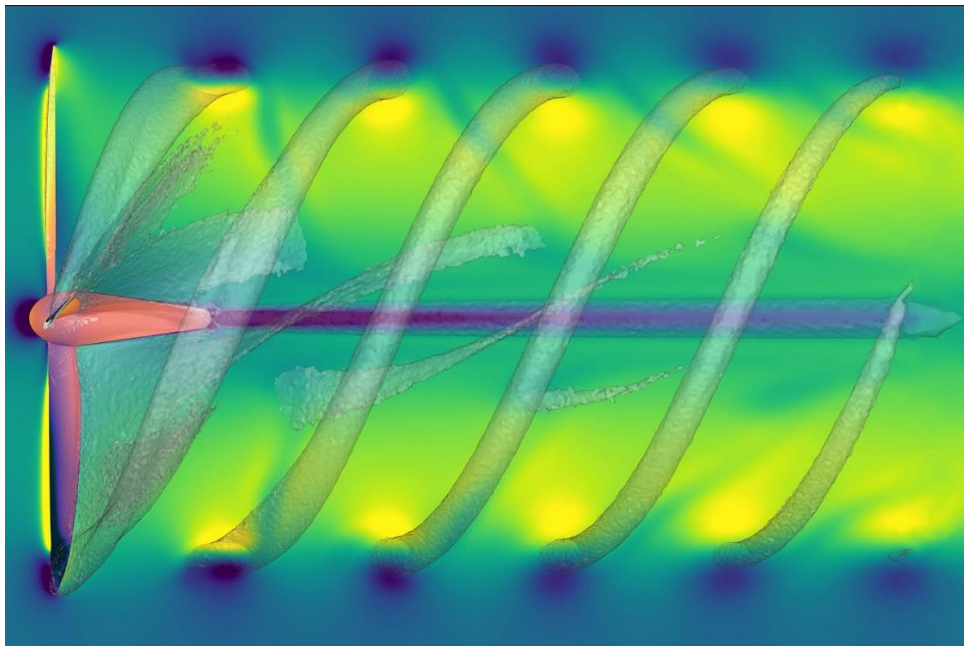
SE<sup>2</sup>A presented twice in TU Braunschweig's Picture of the month

The idea of the picture of the month is to highlight the diversity of research at TU Braunschweig. Please contact the management office, if you would like to contribute to this format and thus make SE<sup>2</sup>A more visible!

[Click here](#) to read more about the Picture of the month in February and [here](#) for more information on the August issue.

### February: Novel propeller design

The image was created as part of the SE<sup>2</sup>A project [B1.1 Propeller and wing aerodynamics of distributed propulsion](#) (2019 – 2023). It shows a novel propeller design specifically created for future aircraft with multiple propellers per wing. The image itself shows the four-blade propeller on the left. The coloured area shows the speed field in the centre, from blue (low speeds) to yellow (high speeds).

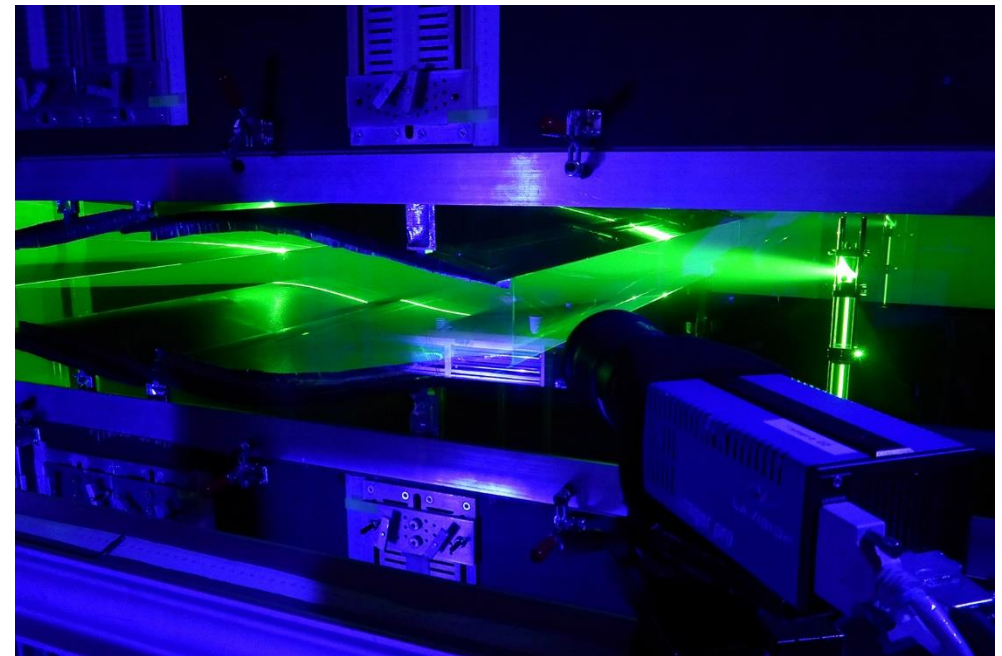


Picture of the Month February: Schematic representation of a novel propeller with a typical helical wake

### August: Flow field measurement in the wind tunnel

The Picture of the Month for August shows an impression of a flow field measurement using Particle Image Velocimetry (PIV) as part of the project [B1.5 - Sensitivities of Laminar Suction Boundary Layers for Large Reynolds Numbers](#). It shows the high-resolution camera in the foreground and the light section illuminated by the green neodymium YAG laser in the measurement section.

PIV measurements provide a detailed picture of the flow structure. This research provides information about the cause of frictional resistance, for example. The findings can be used to reduce the drag of airplanes.

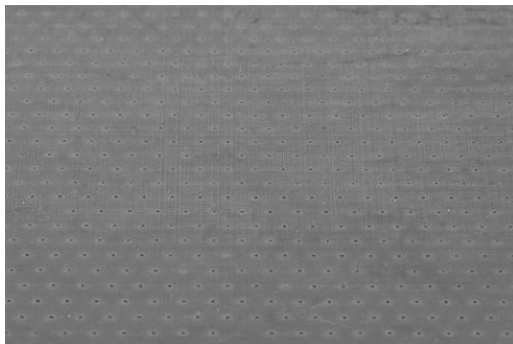


Impression of a flow field measurement using Particle Image Velocimetry (PIV)



## Successful wind tunnel testing of 3D printed extraction panels

The flow behaviour of aircraft, especially on the wing plays a role in reducing emissions and energy consumption. The SE<sup>2</sup>A project [Sensitivities of Laminar Suction Boundary Layers for Large Reynolds Numbers](#) (see also TU Braunschweig picture of the month August) links in with this circumstance. In an experiment, the researchers demonstrated that it is possible to achieve a laminarisation of the boundary layer using micro-perforated suction plates from the 3D printer.



*Micro-perforated surface of the suction panel*

In 2025, the project plans on developing and manufacturing a second version of the suction plate in order to improve the surface quality.

[Read more](#)

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## New project launched as part of the changING research club

"changING Regio" is the latest research project of the SE<sup>2</sup>A changING research club, which was kicked off in February with 19 participants. The research club deals with transferring knowledge of current scientific questions to pupils from schools in the Braunschweig region. In particular female students are given the opportunity to deal with technical questions and to strive for a technical career. More specifically, pupils from grade 11 to 12 get the opportunity to work together with institutes of TU Braunschweig and realizing own projects.



*Group picture of changING regio participants, Dr. Anne Geese and Dr. Dina Al-Kharabsheh*

**What's the difference from changING?** The hybrid format enables female pupils from the region, so not only from the city of Braunschweig and the closer surrounding, to experiment and learn more about the working world of researchers.

We are very pleased to have reached pupils from the region between Schöppenstedt, Bad Harzburg, Osnabrück and Lüneburg. The weekly online format allows easy participation

and can be perfectly combined with the school day without the need to commute to TU Braunschweig.



*Tessa Horenburger (left) and Dr. Dina Al-Kharabsheh packing experiment kits to send them to the participants*

**What has happened so far?** The pupils received a kit with equipment for experimenting in advance.

In the online meetings, for example, they have been looking at the development and optimisation of aircraft components and the importance of 3D printing.



*Looks like fun: changING pupils during a practical session*

In another session, the question of how an aircraft actually flies were explored and linked to real-life examples. *“The intensive preparations and our experience from the research clubs in recent years are paying off”,* says Dr. Anne Geese, leader of the project, and refers to the Covid pandemic. Due to the pandemic, some of the regular changING events were already taking place online. *“Together with the institutes, we developed exciting formats that we can now continue to use”,*



*Another fun practical session*

explains Dr. Geese. In May, the pupils finally got to know each other in person, and visited the participating institutes on site. The expansion of changING to further regions is intended to encourage more young women to venture into disciplines in which women are underrepresented.

The hybrid character of the format is designed to make it easier to participate.

We hope to welcome these enthusiastic and interested pupils to the TU Braunschweig as students in the future!

Special thanks for the ongoing engagement to: Florian Siebert, Jan Kube, Mats Overbeck, Jorge Bustamante, Andrés Arango and everyone else involved.

[Click here](#) to read more news about changING and the project changING Regio.

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## NEWS FROM THE SE<sup>2</sup>A RESEARCH TRAINING GROUP

### SE<sup>2</sup>A Summer School for doctoral researchers

This year’s SE<sup>2</sup>A Summer School for doctoral researchers takes place as “Cross Project Research Retreat”. Successfully piloted in recent years, we are giving our doctoral researchers the opportunity to work on a project idea in a small group of their own choosing. The format is aimed at fostering cross project collaborations between the cluster projects. Many groups came together over a period of three to five days and produced great results already.

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## Social Event - "Walk and talk" in the Harz Mountains

The social event took place as part of the SE<sup>2</sup>A Doctoral Seminars - by doctoral researchers - for doctoral researchers. This series of events mainly includes workshops and courses and this time a "Walk and Talk" event. Fourteen PhDs (and one dog) from all cluster areas in Braunschweig and Hannover took part in this event. Over the course of around four hours, the participants hiked through the Harz Mountains that afternoon, enjoying nature and discussing projects, ideas and current challenges. At the end, there was coffee and cake at the summit for refreshments!



Group picture of SE<sup>2</sup>A doctoral researchers during their "Walk and Talk"

## Visibility of SE<sup>2</sup>A Doctoral Researchers

Who are the faces behind the valuable research of the SE<sup>2</sup>A 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"



SE<sup>2</sup>A Young Researchers Gallery on the SE<sup>2</sup>A Website



## Yongtao Cao



Project C4.2: Reliable, Efficient and Lightweight Electric Propulsion Drive Systems with Distributed Energy Supply

Institute for Drive Systems and Power Electronics @Leibniz Universität Hannover

✉ [yongtao.cao\(at\)ia1.uni-hannover.de](mailto:yongtao.cao(at)ia1.uni-hannover.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 SE<sup>2</sup>A? ▾



"The most gratifying aspect of my research would be the potential implementation of methods or concepts developed by our team in future electrified aircraft, enhancing aircraft safety, and, crucially, saving lives during emergencies."

Yongtao Cao M.Sc. - Institute for Drive Systems and Power Electronics, Leibniz Universität Hannover



*An example of how the young researchers will be portrayed on the SE2A socials*

## NEWS FROM THE SE<sup>2</sup>A DIVERSITY PROGRAMME

Open now:

SE<sup>2</sup>A International Female Programme – International Master's projects

The SE<sup>2</sup>A Programme aims at excellent female students from abroad who are about to start their Master's thesis. Participants are given the unique opportunity to work within a SE<sup>2</sup>A project and use their results in the context of their thesis. In addition to interesting insights into research practice, they specialize in a possible future field of work during their studies.

Please contact the [Management Office](#) if your project would like to offer a position. We are looking forward to your proposals! **More Information and open positions on the [SE<sup>2</sup>A website](#).**



## RESEARCH

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)**:

### 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 and conversion. [More information](#)



## Extended cooperation in aviation research: TU Braunschweig, TU Delft and ISAE-SUPAERO Toulouse sign memorandum



Europe has become a leading centre for research and development of sustainable aviation technologies and practices and is actively working towards a greener aviation sector.

*TU Braunschweig Vice President Prof. Dr.-Ing. Peter Hecker, Prof. Henri Werij, Dean of the Faculty of Aerospace Engineering at TU Delft and Olivier Lesbre, Managing Director of ISAE-SUPAERO*

TU Braunschweig, TU Delft and ISAE-SUPAERO in Toulouse are three of the most renowned research centres in this field and are now extending their cooperation.

A Memorandum of Understanding (MoU) has now been signed to strengthen the collaboration, which is also emphasising the relevance of the work within the Cluster of Excellence SE<sup>2</sup>A. The expansion of the collaboration through the MoU aims to exchange views on current issues while also developing long-term strategies regarding the entire aviation industry. This results in sharing each other's infrastructure as well as the exchange of researchers and data.

[Click here](#) to read more in the TU Braunschweig magazine.

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## SE<sup>2</sup>A International Fellowship: Prof. Manbir Sodhi visits the SE<sup>2</sup>A Cluster of Excellence

Prof. Manbir Sodhi is a Professor of Mechanical, Industrial and Systems Engineering at the University of Rhode Island, USA, with a research focus on Operations Research and Global Product Sustainability. As part of the SE<sup>2</sup>A International Fellowship Programme, Prof. Sodhi was a guest of Prof. Thomas Spengler at the Institute of Automotive Management and Industrial Production for a three-month research stay.

Prof. Sodhi primarily contributed his expertise to the SE<sup>2</sup>A project [SUstainability Modeling and Analysis of Future aircraft systems II](#). He worked with Dr. Alexander Barke on issues relating to the design of a European production network for Sustainable Aviation Fuels (SAFs). For this complex planning task, an optimization model is being developed that identifies paths for the transformation of the current kerosene production network into an SAF production network, taking into account ecological and economic sustainability aspects.

In the SE<sup>2</sup>A projects [Simulative Evaluation of Future Scenarios \(STENOS\)](#) and [Simulation and Optimisation of Air Transport Processes \(SOAP\)](#) he also acted as an advisory exchange partner for the researchers of the projects.

The Cluster of Excellence SE<sup>2</sup>A offers long-term research stays for excellent experienced researchers from abroad at the two recognition levels defined as "SE<sup>2</sup>A-Fellowships" and "SE<sup>2</sup>A-Awards". Close collaboration during a research stay with the scientists of the Cluster of Excellence SE<sup>2</sup>A fertilizes scientific exchange in a direct way, and creates joint research results.

[Click here](#) for more information on the SE<sup>2</sup>A International Fellowships.

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## EVENT ANNOUNCEMENTS

### Summer School for Advanced Sustainable Aviation Technologies I 02 - 13 September I Braunschweig



Knowledge about methods and technologies will be given in lectures held by professors from TU Braunschweig and the partner universities TU Delft and Tampere University as well as from aviation industry experts during the virtual phase.

[More information](#)

### DLRK 2024 I 30 September – 02 October I Hamburg



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](#)

### Science & Art! Fly High – Short film night with panel discussion I 26 September



SE<sup>2</sup>A will proudly present the new image film for the first time. After a panel discussion with our experts, you can look forward to short films and institute tours.

[More Information](#)

### SE<sup>2</sup>A Summer School for Doctoral researchers 2024



This year, the SE<sup>2</sup>A doctoral researchers will work in small groups on project ideas of their own choosing. The „Cross Project Research Retreats“ take place at individually set dates.





The SE<sup>2</sup>A-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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