



ATLAS NEWS

for the Collaborative Research Centre 1667

First Issue – March 2025



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A Good Start

“With its first anniversary closing in, we can look back to a successful year for the Collaborative Research Centre ATLAS. Reflecting on our journey and successes so far, I am most impressed by the spirit displayed by both leading and new members of the team in our shared effort towards realizing sustainable access to Very Low Earth Orbit. Building on a solid foundation, we have fostered a thriving research community and a growing international network of partners. In the second year, I am particularly looking forward to witnessing innovative mission concepts defined by a new generation of researchers in the upcoming Satellite Design Workshops, wherein our collective research efforts shall manifest into something tangible. The future of ATLAS looks promising, and I am delighted to be part of this endeavour with such a talented and dedicated team.”

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The First Year in Review

After years of preparation, the Collaborative Research Centre 1667 ATLAS (*Advancing Technologies of Very Low-Altitude Satellites*) finally kicked off in April 2024, following a positive review on the campus of the University of Stuttgart by an international panel of experts appointed by the German Research Foundation DFG for this purpose. The Kick-Off was duly celebrated on 17 May 2024 in the presence of both ATLAS researchers and notable guests from academia, government, agencies and the aerospace industry, with many voicing their endorse-

ment and support for this new research endeavour.

At that time, with the inaugural assembly of the CRC having already taken place in February 2024, with many of the doctoral and post-doctoral researcher positions having already been filled, and with various of the many collaborations between the 17 scientific projects essentially already in full swing since the finalization of the funding proposal, ATLAS had already hit the ground running. In the months that followed, research activities and cooperation networks were developed further, with frequent exchanges between individual projects as well as on the level of each of the three project areas, but also within the entirety of the team. As a regular forum for this very purpose, the 'ATLAS Academy', provides a space for mutual scientific exchange, training for early career researchers, and expert courses on all matters concerning Very Low Earth Orbit. With Prof. Peter Roberts from the University of Manchester, lead scientist and coordinator of the pioneering EU Horizon 2020 DISCOVERER program in June 2024,



Figure 1: Spokesperson Stefanos Fasoulas and deputy spokesperson Sabine Klinkner, introducing the CRC 1667 ATLAS to the public at the Kick-Off event on 17 May 2024

and Prof. Hwanil Huh from Chungnam National University in Korea in December 2025, the first two of hopefully many renowned international guest speakers were invited to share their experience and insights with the team.



Figure 2: The team of the Collaborative Research Centre ATLAS at their first off-site in Roggenburg in September 2024

A first comprehensive mutual status update within the team took place over two days in September 2024 during the first ATLAS off-site team event at the Roggenburg monastery. Ongoing and initially dormant collaborations as well as a general team spirit were fostered and intensified through various activities promoting scientific discussions and opportunities for socializing.

The first year also saw many efforts to introduce and exhibit the activities of the new CRC both to the scientific community at various notable international conferences, and to the general interested public through such events as the University of Stuttgart's annual Science Day as well as through traditional and social media platforms (see also 'ATLAS in the Public Eye').

In mid-January 2025, the 2nd International Symposium on Very Low Earth Missions and Technologies finally saw ATLAS make its proper debut on the stage of the global VLEO research community. Hosted by the CRC on the premises of the University of Stuttgart, the symposium brought together more than 120 representatives from academia, agencies, and industry originating from 18 countries, and featured a total of 50 scientific contributions in the form of presentations and posters on a wide variety of research topics relevant to VLEO. The interest and resonance from the participants turned out overwhelmingly positive, many of which reported enjoying numerous valuable exchanges and experiencing the sense of a budding research community

taking form. After further enjoying the regional cuisine and an unparalleled view of the city at the conference dinner at Stuttgart's landmark television tower, many international participants will have left with a good impression of the 'Aero-space Land' as a European powerhouse of research and industry. Having itself followed up on the first symposium hosted as a virtual event by the EU H2020 DISCOVERER team in 2021, the CRC 1667 ATLAS is committed to continuing to do its part by (co-)organizing and supporting future iterations of the VLEO Symposium to keep the momentum going and the global VLEO community thriving.

The success of the symposium was further witnessed and praised first-hand by five of the seven members of the international Scientific Advisory Board (see also 'Meet the Scientific Advisory Board'), which convened on the following day to provide valuable feedback and advice for the future development of the CRC. In addition, the members of the Scientific Advisory Board have gone above and beyond in their support of ATLAS not only through their guidance during its first year, but also in their efforts to disseminate awareness of the CRC's activities and expanding its international network.

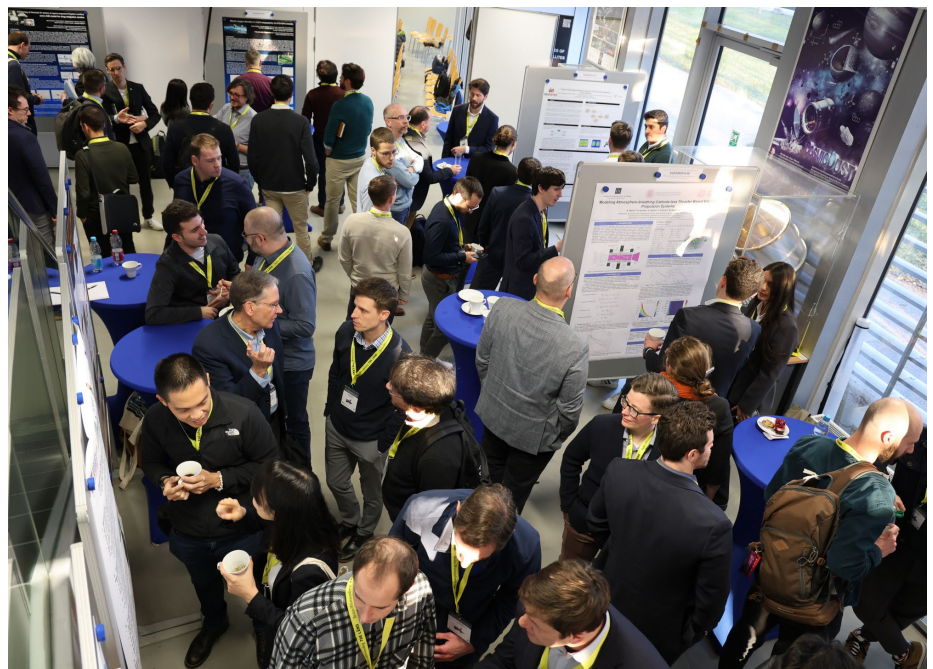


Figure 3: Animated scientific exchanges during the poster session of the 2nd International Symposium on Very Low Earth Orbit Missions and Technologies 2025 hosted by the CRC ATLAS

As of April 2025, one year after its official kick-off, it is expected that the team of the CRC 1667 ATLAS will be complete, with all scientific and technical staff positions having been filled in the meantime. This brings the total amount of team members to around sixty, including the 23 project leaders, ten directly involved or associated postdocs, approximately 25 immediately involved or associated doctoral researchers, as well as various Bachelor and Master thesis students and student assistants.

The second year of the CRC is anticipated to see increasingly visible progress within its constituent research activities. Our continuously expanding and deepening international network will result in increasing numbers of exchanges and collaborations with partners in academia all over the globe. Over the course of two Satellite Design Workshops, respectively planned in April and September 2025, interdisciplinary teams of researchers and students will formulate and develop their visions for the scientific exploitation of VLEO through exploratory satellite mission design studies, working closely together and under expert guidance.

Following up on an excellent start, the team of ATLAS researchers can thus look forward to an exciting and bountiful second year!

ATLAS in the Public Eye

The mission to establish the CRC 1667 ATLAS in the public eye and in the eye of the scientific community began early on. Even before the formal kick-off event, members of the ATLAS team were involved in the Girls' Day on 25 April 2024, showcasing the problem of VLEO satellite aerodynamics to young female school students. Shortly after, ATLAS presented itself with a small exhibition stand at the annual Science Day of the University of Stuttgart on 8 June 2024, where members of the interested public from all age groups could learn about the new research field and potentials of VLEO, and how the University of Stuttgart and its partners are contributing to making sustainable utilisation of VLEO a reality.



Figure 4: Veteran astronaut and ATLAS enthusiast Matthias Maurer posing with the logo sticker of the CRC 1667 ATLAS at the DGLR Raumfahrtkonferenz 2024 in Stuttgart

Within the academic community, the new CRC made its presence known at various conferences, including the *European Conference for Aero-Space Sciences (EUCASS)* in Thessaloniki, Greece, the *38th Small Satellite Conference* in Logan, USA, through keynote presentations and exhibition stands. At the *75th International Astronautical Congress* in Milan, Italy, members of the ATLAS team participated in a special interactive session on Very Low Earth Orbit, a format which was successfully repeated and evolved in the at the *2nd International Symposium on Very Low Earth Orbit Missions and Technologies*, which would subsequently be hosted by the team of the CRC 1667 ATLAS in Stuttgart in January 2025.

In order to make its activities visible outside the Collaborative Research Centre, ATLAS is also represented on social media, in particular on Instagram and LinkedIn. Both platforms are used to advertise upcoming events, and provide brief reports and impressions of recent events. During the Christmas period, all

sub-projects were presented in the form of an Advent calendar, in which project area managers participated with short videos. ESA astronaut Matthias Maurer also expressed his enthusiasm in the CRC ATLAS and its research activities with a contribution to the calendar.

The ATLAS website provides a central hub for information on the CRC and its projects to the interested public, as well as a portal through which interested parties can inform themselves about and register for events such as the aforementioned symposium or the *VLEO Satellite Design Workshop* hosted by the CRC.

SWR published a podcast in its "SWR Kultur Wissen" segment entitled "Uni Stuttgart forscht an neuen Satelliten für niedrige Umlaufbahnen" (University of Stuttgart researches new satellites for low orbits), in which the spokesperson of the CRC, Stefanos. Fasoulas, discusses the advantages of VLEO and the technical challenges involved in the efficient realization of such satellites.

Aside of activities in the digital media, the ATLAS team is eagerly looking



Figure 5: ATLAS team members Prof. Michael Saliba and Dr. Claudiu Mortan from the Institute of Photovoltaics (IPV) presenting cutting-edge Perovskite solar cell technology to the Lord Mayor of Stuttgart, Dr. Frank Nopper, and to the Rector of the University of Stuttgart, Prof. Wolfram Ressel, in front of the ATLAS exhibition at the Stallwächterparty 2024 in Berlin

forward to the April issue of the DGLR magazine, wherein the Collaborative Research Centre and its leading research questions will be presented to the German-speaking aerospace community.

Members of the general public that are interested in learning more about the CRC 1667 ATLAS are cordially invited to visit our stand at the annual *Space Day* event in the Planetarium Stuttgart on 12 April 2025 or at the University of Stuttgart's annual open doors event *Tag der Wissenschaft*, where you can find us in the Space Centre Baden-Württemberg (RZBW) on the University Campus Stuttgart-Vaihingen on 24 May 2025!

Links



Web: www.sfb1667.uni-stuttgart.de



Instagram: www.instagram.com/atlas_crc1667/



LinkedIn: www.linkedin.com/groups/13031383/

What's New in VLEO?

It is safe to say that interest in VLEO is gaining momentum in the international aerospace as well as adjacent research communities. Various ongoing activities and design studies were presented at the 2nd *International Symposium on Very Low Earth Orbit Missions and Technologies* that was hosted by the CRC ATLAS at the University of Stuttgart. Let us now take a brief look at recent developments in the world of VLEO.

Table 1: Upcoming public events featuring the CRC 1667 ATLAS in 2025

Event	Where?	When?
Space Day	Planetarium Stuttgart	12 April 2025
Tag der Wissenschaft	RZBW, Pfaffenwaldring 29, University Campus Vaihingen, Stuttgart	24 May 2025

The EarthNEXT project, which is part of the Italian Space Agency's (ASI) Alcor small satellite fleet program, is a planned 16U VLEO CubeSat Earth Observation mission being developed by a team of small and medium business enterprises and the University of Naples Federico II, which features a Microwave Electrothermal Plasma Thruster (MEPT) to extend its orbital lifetime [1].

Understanding the very environment of VLEO is critical. The European Space Agency (ESA) is taking a leading role in this area with its planned Keystone activity focused on Atomic Oxygen (ATOX) observation in the thermosphere. ATOX, a highly reactive form of oxygen, is a major constituent of the VLEO environment and a primary cause of material degradation and drag on spacecraft [2].

In the UK, Thales Alenia Space (TAS-UK) and partnering companies are developing the Skimsat satellite demonstrator, designed for extended operations in VLEO, incorporating aerodynamic control and drag compensation by ion propulsion [3].

Across the Atlantic Ocean, the US Defense Advanced Research Projects Agency (DARPA) is partnering with Redwire to implement the SabreSat program, developing a novel satellite, with unique VLEO capabilities [4].

The Denver-based company Albedo is poised to launch its first, phone-booth-sized commercial Earth observation satellite Clarity-1 this month, ultimately operating at altitudes below 300 km and serving as a forerunner for a planned VLEO constellation [5].

In Asia, Singapore is about to make its presence felt in VLEO. Together with its partners, Nanyang Technical University is in the final stages of preparing the launch of its ELITE (Extremely Low Earth Imaging and Technology Explorer) VLEO technology demonstrator satellite, scheduled for mid-2025. ELITE carries payloads for high-resolution imaging as well as

atmospheric data collection. The satellite platform features a Hall effect thruster designed by Aliena, as well as active aerodynamic control capabilities to manage and mitigate aerodynamic drag [6].

The China Aerospace Science and Industry Corporation (CASIC) had already announced plans for a 300-satellite VLEO constellation back in 2023. This ambitious undertaking clearly signals the strategic significance that VLEO is gaining. In this context, C-Space's QK-1 test satellite is an early bird, gathering critical data about operations in the challenging VLEO environment [7, 8].

As these and many more ongoing activities demonstrate, the race to conquer and explore the "inner edge" of space is well and truly underway.

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Meet the Scientific Advisory Board

The international Scientific Advisory Board (SAB) of the CRC 1667 was formed in early 2024 and comprises a panel of seven distinguished experts from the fields of aerospace engineering, geodesy and atmospheric physics. Acting as a consulting body, the SAB monitors the activities of the ATLAS team, providing guidance as well as helping to promote the CRCs research activities and expand its international network. Join us in the following as we briefly introduce each member of the SAB.

Dr. Tim Flohrer is the Head of the Space Debris Office of the European Space Agency in Darmstadt, and one of the continent's leading experts on the surveillance and tracking of space objects. This gives him a uniquely qualified perspective both on the increasingly precarious conditions for satellites operating in traditional Low Earth Orbit (LEO) in terms of collision risk and on the practical challenges associated with ensuring situational awareness and responsiveness for large-scale satellite operations in the highly dynamic environmental conditions of Very Low Earth Orbit (VLEO). With various projects in ATLAS addressing these very issues, Dr. Flohrer's pertinent background and expertise is valued highly by the ATLAS team.

Prof. Vaios Lappas is a Professor in the Department of Aerospace Science and Technology at the National and Kapodistrian University of Athens with an extensive research background in a diverse range of spacecraft technologies, including, but not limited to, electric propulsion, attitude control, CubeSats, and (distributed) autonomous aerospace systems. With this diversified expertise, his guidance is considered particularly valuable for the support of those ATLAS projects focusing on technologies and methods to enable, automate and optimize sustainable satellite operations in VLEO.



Figure 6: Members of the ATLAS Scientific Advisory Board. From left to right: Dr. Tim Flohrer (ESOC), Prof. Claudia Stolle (IAP Kühlungsborn), Prof. René Laufer (Univ. Luleå), Prof. Peter Roberts (Univ. Manchester) and Prof. Vaios Lappas (Univ. Athens). Not pictured here: Dr. Anke Pagels-Kerp (DLR) and Prof. Christian Siemes (TU Delft)

Prof. René Laufer is Head of Subject for Space Systems at the Kiruna Space Campus of the Luleå University of Technology. His wide scope of research interests includes small satellite technology, space situational awareness, systems engineering, project management, education, and public outreach, amongst many others. A generalist and passionate science communicator, the CRC ATLAS 1667 benefits greatly from his experience in its international engagement e.g. through his support of the Satellite Design Workshop.

Dr. Anke Pagels-Kerp is the Divisional Board Member for Space at the German Aerospace Centre DLR and oversees the research and development programme of the agency's space research institutes. An astrophysicist by training, Dr. Pagels-Kerp's professional experience covers a wide variety of subjects relevant to the CRC 1667 ATLAS, and includes e.g. leading the development of the *European Data Relay Satellite* system (EDRS). Her broad technical expertise as well as her experience in coordinating research programs comprising large networks of researchers are considered invaluable in providing guidance to the CRC 1667 ATLAS as a coordinated research programme.

Prof. Peter Roberts from the department of Spacecraft Engineering at the University of Manchester is considered one of the world's leading experts on Very Low Earth Orbit. His primary activities focus on the research of aerodynamic materials and models for attitude control in rarefied flow environments. Having headed the EU Horizon 2020 DISCOVERER project, which culminated in the successful *Satellite for Orbital Aerodynamics Research* (SOAR) CubeSat mission, the research of Prof. Roberts and his colleagues has laid much of the groundwork upon which the CRC 1667 ATLAS builds. He has shared many of the valuable lessons learned in the DISCOVERER programme with the ATLAS team during a special guest lecture given in June 2024 and served as co-chairman for the 2nd *International Symposium on Very Low Earth Orbit Missions and Technologies* in January 2025.

Prof. Christian Siemes from Delft University of Technology is an expert in satellite geodesy and atmospheric accelerometry, who has contributed significantly to ESA's highly successful GOCE and SWARM satellite missions. Additional research interests include the study of gas-surface interactions in rarefied flow environments and how these affect satellite drag. The breadth and

depth of his expertise in science mission data processing and analysis is invaluable particularly for the support of those projects of the CRC wherein the derivation of high-quality data products from various sources play a major role, as well as those with a focus on further exploring the scientific potentials of VLEO in the areas of geodesy and atmospheric physics.

Prof. Claudia Stolle is the director of the Leibniz Institute of Atmospheric Physics in Kühlungsborn, and a Professor of Atmospheric Physics at the University of Rostock. Having worked e.g. on the development of precise atmospheric models as well as contributed to ESA's SWARM satellite mission, Prof. Stolle's guidance is instrumental in developing and expanding the activities and expertise within the CRC ATLAS on the subject of atmospheric physics of the lower thermosphere and its various effects on VLEO spacecraft.

Recent Publications

Despite less than a year having passed for ATLAS, initial findings have already been presented to the scientific community through various contributions both at international conferences and in peer-reviewed scientific literature.

The peer-reviewed articles include a study that was conducted by the team of Project C05 around Prof. Hobiger from the University of Stuttgart's Institute of Navigation (INS) in partnership with Airbus Defence and Space. The article discusses the challenges arising from an inaccurately determined offset between a satellite's actual centre of mass and the phase centre of its global satellite navigation network antenna on the precise orbit determination (POD) for agile satellites. This is particularly relevant for satellites operating in VLEO, which are subject to volatile environmental conditions and will in many cases face a relatively greater need for frequent attitude adjustment manoeuvres on account of their shorter communication windows with ground stations [1].

In collaboration with colleagues from Naples (Italy), Sao José dos Campos (Brazil) and Daytona Beach (FL, USA) the team working on ATLAS Project A06

conducted a study on the utilisation of dynamic aerodynamic drag to avert collisions with space debris in VLEO within a warning time of 24 hours. For this purpose, a systematic analysis was conducted to assess the trade-off between the collision miss distance and the relatively increased orbit degradation by example of the University of Stuttgart's upcoming SOURCE CubeSat mission [2].

Another article, published by the team of ATLAS Project A02 and colleagues, documents the extension of the open-source gas and plasma PIClas simulation software by the inclusion of state-of-the-art models for catalytic gas-surface reaction mechanisms. Whereas this study received co-funding from Airbus Defence and Space GmbH, ArianeGroup GmbH, and a grant from the European Research Council (ERC), this extension in functionality of the PICLas tool, which is well-suited for the simulation of the rarefied and highly reactive flow environment of VLEO, is highly valuable to the CRC 1667 ATLAS, with many projects actively employing this software [3].

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What's Next for ATLAS?

The ATLAS team is pleased to announce that the first international VLEO



Figure 7: Logo of the upcoming International VLEO Satellite Design Workshop (SDW), to be hosted on 16-22 September 2025 in Stuttgart

Satellite Design Workshop (SDW) will take place in the week of 16-22 September 2025. Providing an opportunity for up to 40 students and young professionals from around the world to tackle challenging VLEO science and engineering problems, two competing teams will conduct a design study to conceptualize a VLEO satellite constellation. Students and young professionals interested in participating at the SDW are encouraged to stay tuned for further information on how to register via the ATLAS homepage and social media channels.

In preparation for this event, an internal workshop will be held in April 2025, during which the doctoral researchers of the CRC ATLAS will themselves conduct such a design study, in the process preparing and refining tools, interfaces, task outlines and processes in preparation for the event in September 2025.

This newsletter is brought to you by the management office of the Collaborative Research Centre 1667 ATLAS at the University of Stuttgart. The CRC 1667 is funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project-ID 516238647 – SFB1667.

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