

15th IAA Symposium on Small Satellites for Earth System Observation

Program

May 04-08, 2025

Berlin, Germany



We wish to thank the following entities for their contribution to the success of this conference:



EXOLAUNCH



We wish to thank the following entities for providing us with four workshops - as a side event - at SSEO15. These external organizations are responsible for the workshop content and concept. The workshops will be held by external partners on site.



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From the Chairpersons

It is a great pleasure for us, the chairpersons of this symposium, to welcome the international community to the 15th IAA Symposium on Small Satellites for Earth System Observation (SSEO). The Symposium is hosted by the German Space Agency at DLR and the Technical University of Berlin taking place from May 4th – 8th, 2025 in Berlin.

We are especially excited to welcome you to this year's symposium in person. After the successful last edition of the Symposium in 2023, it is truly a privilege to be able to bring together again many international experts in the booming field of Small Satellites and its applications.

Small Satellites for Earth System Observation are nowadays a key part of the critical space infrastructure and of the highest societal relevance. In addition, they are an important facilitator for the UN Sustainable Development Goals. These missions can be conducted efficiently, provide increased opportunities for access to space and help to realize new capabilities and services. The design of such satellites, its bus and payload systems, cover a wide span: ranging from optimized off-the-shelf systems, with little or no requirements for new technologies, to innovative and tailored high-tech systems. Thus, new classes of advanced small satellites can be created – including autonomously operated satellites or employing onboard machine learning algorithms for increased agility or downlink efficiency, which render missions more efficient or open new areas of applications for science, industry, governments or the public. In addition, multi-satellite systems, such as constellations and formations, offer exciting opportunities for a new economy in space, when utilising small satellites.

We are building this year's edition on the success of past IAA Symposia, where authors from more than 35 countries, representing space agencies, industries, research institutes and academia, confirmed in their oral presentations and poster sessions that these missions can be conducted efficiently and offer opportunities for new applications and technological innovation.

The venue, the Ludwig-Erhard-Haus, provides an inspiring environment, excellently suited to let us explore the latest developments in the field. We have an incredible line-up of speakers, who will share their expertise and insights. We encourage students to present their work. IAA is pleased to serve as the principal sponsor of this symposium because its objectives complement and re-enforce the purpose of the Academy.

It is a pleasure for the German Space Agency at DLR to be the host of this symposium. The Agency undertakes statutory tasks in the space sector on behalf of the German Federal Government and implements the space strategy of the Federal Government, develops and manages the national space programme and represents the interests of the Federal Republic of Germany in space-related international bodies in accordance with the tasks assigned to it. The Agency advises the Federal Government and develop initiatives and strategic approaches for space policy. With its missions and projects, the Agency strengthens Germany's scientific excellence and expands the technological expertise and global competitiveness of German industry. Promoting the commercialisation of space technologies, the innovation potential of German SMEs and technology transfer are essential tasks of the industrial policy mandate. Space technologies and applications are intended to benefit people on Earth and improve the quality of life in Germany, Europe and the rest of the world. The Agency's space missions make a significant contribution to solving global and societal challenges. Examples include providing information on climate change and climate protection, the further development of digitalisation and communications technologies, and contributions to national security.

The Technical University of Berlin is pleased to be the co-host of the 15th edition of the symposium. The Chair of Space Systems has already brought into space 31 satellites for Earth observation, satellite communication, and technology demonstration, which were designed, built, and operated by students. Another three small satellites, currently in development, along with two mission studies extending beyond Earth orbit, underline TU Berlin's position at the forefront of academic research and innovation.

We are convinced that the personal interactions, shared experiences, and exchange of ideas are the heart of this symposium and make it so valuable. Thus, we are looking forward to meeting you in Berlin in May 2025.

Enrico Stoll Anke Pagels-Kerp René Laufer Chantal Cappelletti

General Information

Symposium Host

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Symposium Venue

The venue is located at:

IHK Berlin
Ludwig Erhard Haus
Fasanenstraße 85 Berlin

The closest train station is **Zoologischer Garten**, conveniently reachable via public transport. The best approach to the venue from Zoologischer Garten is via Hardenbergstraße. A dedicated entrance to the symposium has been set up at the northern entrance of Ludwig Erhard Haus.

Offices

- The SSEO15 symposium office will be co-located with the registration desk at the dedicated symposium entrance.
- Presenters are requested to arrive to the session room at least 10 minutes in advance of the beginning of their session in order to meet the session chairpersons for final preparations.

On-site Registration

The registration desk is set up at the dedicated Symposium entrance. On-site registration is open during the following times:

Sunday, 04 May	18:00 - 20:00
Monday, 05 May	08:00 - 18:00
Tuesday, 06 May	08:00 - 17:00
Wednesday, 07 May	08:00 - 18:00
Thursday, 08 May	08:00 - 16:00

Please use the possibility to register already on Sunday. We will have a small get-together in the venue on Sunday for all who register early!

You will receive a name badge and a conference bag during registration.

Name Badges

Please note, that name badges must be worn at all times in order to be admitted to the sessions and the social events. The following colors have been assigned:

Participants	white
Accompanying persons	blue
Exhibitors	orange
Organizers	green
Press	yellow

Language

The official language of the symposium is English.

Access to the SSEO15 abstracts and full papers

Starting at the first day of SSEO15 (5. May, 2025) the abstracts (PDF) will be published on the sub-page named "Abstracts" of the SSEO15 website. Only as a participant of the SSEO15 you will have access to all abstracts. The full papers of SSEO15 will be published here also, but at a later date and SSEO 15 participants will be informed by email.

Please note:

For the oral presentation itself: There will be no provision of your presentation/ contribution of the SSEO15 by the German Aerospace Center (DLR e. V.), host of SSEO15 for publication on the conference website SSEO15.

There will be also no provision of SSEO15 abstracts and later (after symposium) of the full papers of SSEO15 by Deutsches Zentrum für Luft- und Raumfahrt e.V., German Space Agency at DLR e.V, Department of Robotics, Digitalisation and AI I, Königswinterer Straße 522-524, 53227 Bonn (Host of the SSEO15) for publication to other public portals and information channels of German Aerospace Center/ German Space Agency at DLR or other external websites and tools.

The German Space Agency at DLR e. V., as host of SSEO 2025 is therefore not responsible for any other publication to other public portals or other external websites and tools.

Workshops – as side event – at SSEO15

The four workshops – as a side event at SSEO15 are not part of the scientific program SSEO15. As a special add on it is a platform to engage with the SSEO15 participants and the exhibitors for knowledge sharing, capacity building and networking.

The workshop content and concept are the sole responsibility of these external organizations. The workshops will be held by external partners on site.

SSEO15 participants are welcome to register on site on Monday, May 5, 2025, at the registration desk.

Please note: The number of participants per workshop is limited. Registration will be handled on a first-come, first-served basis by adding names to a registration list.

Lunch, Coffee Breaks

The registration fee of the participants as well as of the exhibitors covers the coffee breaks and the lunch buffet.

Symposium Schedule

Sunday, May 4, 2025

18:00-20:00 **Registration** (We will serve some snacks and beverages.)

Monday, May 5, 2025

08:00-18:00 **Registration**

09:00-09:40 **Conference Opening and Welcome**

Dr. Rainer Sandau, Director Satellites and Space Applications
of the International Academy of Astronautics (IAA)

Dr. Walther Pelzer, Director General of the German Space Agency at DLR

René Kleeßen, Director Organisation and Infrastructure of the
German Space Agency at DLR

Thomas Krause, Department for Economics, Energy and Public Enterprises
at the Berlin Senate

Dr. Stefan Franzke, CEO Berlin Partner for Business and Technology

09:40-09:50 **Key Note**

Matthias Wachter, Managing Director at NewSpace Initiative

09:50-10:30 **Session – Programmatic**

ESA Activities and Programmes on Small Satellites, *Stefano Santandrea*,
Head of the Small Satellite Platform Unit at ESA

EU Activities and Programs on Small Satellites, *Maria-Vittoria D’Inzeo*,
Policy Officer European Commission

German Small Satellite Initiative, *Dr. Arianit Preci*,

Head of Department Robotics, Digitalization and AI, German Space Agency at DLR

10:30-11:00 **Coffee Break**

11:00-11:15 **Key Note**

Prof. Dr. Claudia Stolle, Director of Leibniz Institute of Atmospheric Physics (IAP)

11:15-12:45 **Session 1 – Mission 1**

Chairs: *Enrico Stoll, Andres Bolte*

dlr-iaa2025-33 High Resolution Thermal Imaging on a Small Satellite

dlr-iaa2025-43 Future Earth-Moon Navigation Based on Quantum Inertial Sensor Systems

dlr-iaa2025-156

Mission and System Design of the SmallSat Lunar Science Exploration Mission SER3NE

dlr-iaa2025-163 InnoCube LEOP Experiences of the fully Wireless Data-Bus

12:45-14:00 **Lunch Break**

14:00-15:05 **Session 2 – Instruments**

Chairs: *Rene Laufer, Sebastian Grau*

dlr-iaa2025-41 NIRCA MkII Front-End Electronics for Readout
and Control of High-Performance Space Image Sensors

dlr-iaa2025-58 S3LA - the single-photon counting laser altimeter
for the SER3NE mission to the Moon

dlr-iaa2025-60 A compact laser ranging interferometer for the SENSORIS mission

15:00-15:20 **Coffee Break**

15:20-16:40 **Session 3 – Data Processing**

Chairs: *Arianit Preci, Julian Bartholomäus*

dlr-iaa2025-53 Mass Memory Module for Earth Observation applications in Small Satellites

dlr-iaa2025-57 Ionospheric mapping with single-frequency GNSS measurements from commercial nanosatellite constellations
dlr-iaa2025-89 CubeSim: Simulation Framework for the Development of Small Satellites
dlr-iaa2025-140 Near Real-Time Satellite Operations Planning using Genetic Algorithms

16:40-17:40	Panel Discussion on Cybersecurity <i>Moderator: Andres Bolte,</i> Small Satellites Program Manager, German Space Agency at DLR <i>Magdalena Ostasz,</i> Head of the Department of Legal Advisors, AGH Krakow <i>Milenko Starcik,</i> Head of CyberSecurity, visionspace <i>Florian Göhler,</i> Department Secure IT systems for governmental and military space and communications, BSI <i>Jacques Kruse Brandao,</i> Global Head of Advocacy, TÜVIT <i>Johannes Willbold,</i> Researcher, Ruhr Universität Bochum <i>Linus Streibert,</i> Student (BEESAT 1 Hacker), TU Berlin
17:45	Group photo
18:30	Social Gathering

Tuesday, May 6, 2025

9:00-10:30	Session 4 – Mission 2 <i>Chairs: Alex da Silva Curiel, Rene Laufer</i> dlr-iaa2025-34 SOVA-S SMALL SATELLITE MISSION INNOVATIVE APPROACH FOR OBSERVING EARTH'S ATMOSPHERIC MECHANISMS dlr-iaa2025-52 CENSAT-1 Mission Concept: A CubeSat for Space Weather Monitoring dlr-iaa2025-98 Development of a Space Demonstrator of an optical Rubidium Two-Photon Atomic Clock dlr-iaa2025-154 System Design for Autonomous Down-to-Earth Optical Link Acquisition from LEO (ADEOLA)
10:30-10:50	Coffee Break
10:50-12:10	Session 5 – Formations and Constellations 1 <i>Chairs: Stephan Roemer, Enrico Stoll</i> dlr-iaa2025-54 Addressing challenges for magnetic attitude control of New Space earth observation missions dlr-iaa2025-100 Formation Flight with CubeSats: Flight Experience of the NanoFF Mission dlr-iaa2025-112 Possible applications of spinning tethered systems for Earth and Moon observation: an overview dlr-iaa2025-124 Using formation-flying to estimate bias-free drag coefficients for improved satellite orbit predictions
12:10-13:30	Lunch Break
13:30-14:50	Session 6 – Data Applications <i>Chairs: Tom Segert, Alex da Silva Curiel</i> dlr-iaa2025-92 Enhancing Aerosol Monitoring: Sensitivity Experiments for PoSAC design in G20 Framework dlr-iaa2025-138 Advancing Lunar Ice Characterization with a Dual-Instrument CubeSat Constellation: Combining Neutron and Near-Infrared Spectroscopy dlr-iaa2025-152 Leveraging GNSS-Reflectometry Onboard ISROs EOS-08 MicroSat-2C for Global Monitoring of Hydrological Variables dlr-iaa2025-164 GNSS remote sensing of the PRETTY CubeSat mission: a demonstration to validate models of ionospheric electron density

14:50-15:10	Coffee Break
15:10-16:30	Session 7 – Subsystems Chairs: <i>Tom Segert, Nicolas Darkow</i> dlr-iaa2025-116 Development of an Advanced Micro-Propulsion System for Small Satellites dlr-iaa2025-147 SOS Star Tracker Algorithm: Static Open-Source Star Tracker for Agile Attitude Determination dlr-iaa2025-148 Configuration and AIT challenges of SPADEX Spacecraft Indias first Docking Mission dlr-iaa2025-150 Expanding the Capabilities of SmallSats through Deployable Antennas
16:30-18:00	Poster Session I
16:30-18:00	Workshops with <i>New Space Initiative</i> and <i>Julius-Maximilians-Universität Würzburg</i> The workshops will be held by external partners upon registration on site.
19:00	SSEO15 Dinner at Rotisserie Weingrün: ticketed event (<i>not included in the participant fee; attendance only for registered participants</i>).

Wednesday, May 7, 2025

09:00-10:00	Session 8 – Sustainability and Space Situational Awareness Chairs: <i>Stephan Roemer, Julian Bartholomäus</i> dlr-iaa2025-45 Optimizing Mission Planning for Multi-Debris Rendezvous Using Reinforcement Learning with Refueling and Adaptive Collision Avoidance dlr-iaa2025-63 Design and Analysis of an Event Camera Payload for Space-Based Object Detection on the EventSat 6U CubeSat Mission dlr-iaa2025-141 Sustainable Satellite Development in Thailand Through the School Satellite Project
10:00-10:15	Coffee Break
10:15-11:15	Session 9 – Between Automatization and Digitalization: Satellite Production Technologies Chairs: <i>Arianit Preci, Sebastian Grau</i> dlr-iaa2025-46 Automated production of Digital Sun sensors, the next step in satellite production optimisation dlr-iaa2025-64 Securing Satellite Command Systems: An Offline Voice Recognition Approach with Authentication dlr-iaa2025-143 Towards Cost-Effective and Efficient Production and Testing of NewSpace Technologies: Advancing Standardization, Digitalization and Automation in Satellite Development
11:20-12:20	Panel Discussion: Between Automatization and Digitalization: Satellite Production Technologies <i>Moderator: Nicolas Darkow</i> <i>Prof. Dr. Klaus Schilling</i> , President Centre for Telematics <i>Korbinian Nottensteiner</i> , Domain Head Future of Manufacturing, DLR Institute of Robotics and Mechatronics <i>Dr. Franz Georg Hey</i> , CTO LEO Space <i>Tom Segert</i> , CEO Berlin Space Technology <i>Alex da Silva Curriel</i> , Head of International Business Surrey Satellite Technology Ltd.
12:20-13:30	Lunch Break
13:30-14:50	Session 10 – Lessons Learned Chairs: <i>Sebastian Grau, Andres Bolte</i> dlr-iaa2025-31 Operational Learnings of Ground Track Control for Missions in Low Earth Orbit

dlr-iaa2025-73

Lessons from Foresail-1(p): Enhancing CubeSat Platforms for Space Science

dlr-iaa2025-99 BO goes Space: Setting up research-oriented learning by establishing access to real-world space exploration at BO using PocketCubes**dlr-iaa2025-158** Multi-organization Effort within an IAA Event, to Promote Concurrent Design for the Latin American Region

14:50-15:10 Coffee Break

15:10-16:30 Session 11 – Special Aspects**Chairs:** Tom Segert, Alex da Silva Curiel**dlr-iaa2025-36** Liliium CubeSats: Towards Agile and Responsive Space**dlr-iaa2025-38**

AquaWatch-AUK A Bilateral Programme for Integrated Water Quality Monitoring

dlr-iaa2025-145 Disrupting the Monitoring of Environment over Tropics with Small/Very Small Satellites: The Equatorial Sentinels Concept**dlr-iaa2025-153**

Robotic Arms based Docking Simulator for Removal of Earth Observation CubeSats

16:30-18:00 Poster Session II

16:30-18:00 Workshops with Planet and ILS

The workshops will be held by external partners upon registration on site.

Thursday, May 8, 2025**09:00-10:30 Session 12 – Student Competition****Chairs:** Rene Laufer, Enrico Stoll**dlr-iaa2025-125** RADIANT – Radar-based Awareness with Distributed Illuminator Networks**dlr-iaa2025-151** The Sapling CubeSat Mission: Stanford University's First Fully Student Developed Satellites**dlr-iaa2025-162**

Developing a Modular Platform for Reduced Gravity Research on Sound[1]ing Rockets

dlr-iaa2025-167

Observation of Cosmic Dust in High Elliptical Earth Orbits Using Micro Satellites

dlr-iaa2025-171

4 years of StudOps: Utilizing Retired Spacecraft for Novel Education and Research

dlr-iaa2025-172 Mission Analysis and Optimized Concept of Operations for In-Orbit Demonstration of Autonomous Optical Link Acquisition for a SmallSat in LEO

10:30-10:50 Coffee Break

10:50-12:10 Session 13 – Missions 3**Chairs:** Rene Laufer, Julian Bartholomäus**dlr-iaa2025-102** Czech Ambitious Missions covering high demands of today's Earth Observations and Astrophysics**dlr-iaa2025-108**

Overview of mission concepts enabled by the modular LEOS-100 small satellite platform

dlr-iaa2025-129 Mission concept design for a high resolution deployable infrared telescope hosted on a small satellite**dlr-iaa2025-136** Power-Up - Upscaling the TUBiX20 Microsatellite Platform for QUEEN

12:10-13:30 Lunch Break

13:30-14:50 Session 14 – Below and Beyond LEO**Chairs:** Chantal Cappelletti, Stephan Roemer**dlr-iaa2025-78**

Mission Analysis and Platform Design for the EarthNext CubeSat VLEO Mission

dlr-iaa2025-127 Moonraker: Mapping the Moon with High-Resolution LiDAR
dlr-iaa2025-139 Hybrid Navigation Techniques for Beyond LEO CubeSat Missions

14:50-15:10 **Coffee Break**

15:10-16:30 **Session 15 – Formations and Constellations 2**

Chairs: *Enrico Stoll, Chantal Cappellitti*

dlr-iaa2025-83 CubeSats swarm mission for Studying Escaping Radio waves (CSER)

dlr-iaa2025-84 Tethered Satellite System for Cross-Track Formation Flying:
Architecture and Performance Analysis

dlr-iaa2025-109

Beyond VIBES Pioneer: What is Next for the Consumer Electronics Revolution in Space?

dlr-iaa2025-117

Challenges of Implementing a Pushbroom Imaging Spectrometer on Small Satellites

16:30-17:00 **Symposium Summary**

Chairs: *E. Stoll (TU Berlin), Rene Laufer, Chantal Cappellitti*

Awards Best Paper Presentations and Best Poster Presentations

Awards Student Competition

Poster Sessions

Poster Session I - Tuesday

dlr-iaa2025-14 Impact of the Pitch Axis Momentum Wheel Misalignment on the Attitude Performance Applied to Low Earth Orbit Microsatellite

dlr-iaa2025-15 Development of an Error-Correcting IP Core for CubeSat Memory Protection

dlr-iaa2025-16 Design and Validation of an Advanced Lithium-Ion Capacitor-Based Battery for Nano-Satellite Applications

dlr-iaa2025-17 Enhancing the radiation-hardening capability of high-density memories through the implementation of robust error detection and correction codes

dlr-iaa2025-18 IMPACT OF LTDN DRIFT ON RADIOMETRIC PERFORMANCE: INSIGHTS FROM THE IMAGING PAYLOAD OF ALSAT-1B SATELLITE

dlr-iaa2025-21 Analysis of Thermal and Mechanical Loads on a Separation Mechanism for Microsatellites: A Finite Element Method Approach

dlr-iaa2025-29 AI-Based Attitude Control for Restricted Reaction Wheels

dlr-iaa2025-30 Bridging Gaps in Distributed Space Systems: A Digital Twin Solution

dlr-iaa2025-40 A low cost, small satellite constellation approach to rapidly monitor Land Surface Temperature for Urban and Agricultural applications over UK and Europe, with optimized cross calibration to ESA and Copernicus missions.

dlr-iaa2025-56 A Model-Driven Approach for Enhancing Satellite Flight Software Development: A Case Study on the AOCS of Alsat-1B

dlr-iaa2025-68 Quantity is a quality - Benefits of Distributed Satellite Systems and Constellations Against Anti-Satellite Weapons

dlr-iaa2025-70 Data Handling and Storage Subsystem for INS-2 series of Nanosatellites

dlr-iaa2025-71 Software-Defined Radio Ground Station for a Small Satellite Mission

dlr-iaa2025-72 The development of the Seeing Imagers for New Space missions

dlr-iaa2025-77 Wireless LiFi based UART for Earth Observation Sensors

dlr-iaa2025-79 Active Spacecraft Potential Control for Small Satellites

dlr-iaa2025-88 Monitoring and Study of Self-Isolated Tribes using CubeSat Imaging in LEO

Poster Session II - Wednesday

- dlr-iaa2025-80** CNN-Based System for Change Detection Onboard Earth Observation Small Satellites: Design Approach to FPGA Hardware Implementation
- dlr-iaa2025-90** High-Performance Ion Propulsion System for Small Satellites
- dlr-iaa2025-91** The START-1 and START-2 CubeSat Missions for In-Orbit Demonstration of Multiple Payloads
- dlr-iaa2025-94** Gas bearing reaction wheels: A breakthrough for high-performance pointing missions?
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- dlr-iaa2025-96** Hardware in-the-loop ACS Testing and System End-to-End Tests in the ACS Test Facility for Nano to Small Satellites
- dlr-iaa2025-97** From Low-Resource Subsystems to EO Payload Computer: Enabling Flexible, Scalable CubeSat Software with an OS Abstraction Layer
- dlr-iaa2025-105** A cost effective, compact and spectral efficient design of reconfigurable data transmitters with enhanced reliability for Nanosats
- dlr-iaa2025-111** GLITCH (Gamma Light Interference In Technological Circuitry and Hardware)
- dlr-iaa2025-113** Deployable Thin-membrane Antenna Prototype for Small Microwave Earth Observation Satellites
- dlr-iaa2025-115** A CubeSat scaled mission for the in-orbit demonstration of a spinning tethered system for artificial gravity
- dlr-iaa2025-118** Optimal manoeuvring of small Earth Observation platforms for frequent re-targeting
- dlr-iaa2025-126** A Swarm Architecture for Small Satellites Pointing towards Common Moving Targets
- dlr-iaa2025-133** Overview of the CAM Payload of the APTAS Student CubeSat Project
- dlr-iaa2025-135** Testing Approach for the Foresail-1p CubeSat
- dlr-iaa2025-137** Autonomous formation flying in the traffic
- dlr-iaa2025-144** Control of robotic arm equipped with imaging camera as end-effector for power-efficient remote sensing using small satellites
- dlr-iaa2025-157** Four IOD Missions supported by the Triton-X Platform for Smallsats
- dlr-iaa2025-165** Comparative Design Evaluation of Satellite-Analogue Robotic Arm End-Effectors
- dlr-iaa2025-166** The use of plasma generators for the reuse and recycling of spacecraft solar cells
- dlr-iaa2025-169** WOBBLE2