Space Team Aachen

Ad Astra Ex Aachen

Our association

Technical and non-technical: We are doing it all!

Who are we ?

- Student initiative for **spaceflight projects**
- Rocketry, satellites, rovers and scientific experiments
- Events, marketing, sponsoring and STEM outreach
- **Over 200 active members** to date

Our goals

- Share **passion** for space exploration
- Participate in **international competitions**
- Provide **hands-on experience** for students
- Shape the future of aerospace research in Aachen
- Make Aachen a **center for aerospace** engineering in Germany

Space Team Aachen 2019

- Problem: No student initiative for technical projects in the field of aerospace engineering
- Solution: Founding of Space Team Aachen e.V.
- Development of the first model rockets on a small scale
- Launches from fields and parking lots (e.g. Bendplatz)

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Space Team Aachen 2023

- Over 200 active members
- Currently seven technical projects

- Successful participation in three rocketry competitions to date
- First German Team to launch at the Spaceport America Cup in New Mexico
  - First place in the category “Design and build quality“ with our rocket Aquila (out of 158 teams)

- Participation in two state subsidy programs
  - REXUS program with Project TRACE
  - DLR STERN program with the hybrid rocket STAHR

- Cooperation with a plurality of university institutes and industry partners

SPACE TEAM AACHEN PROJECTS

ROCKETRY PROJECTS

Project Alya – Regular Launches

Thrust Vector Controlled Rocket aiming for actively stabilized flight

Project Aquila Maris – Launch in 2024

Second iteration of our Aquila rocket launching from the North Sea in 2024

Project STAHR – Launch in 2024

First Space Team Aachen rocket rocket with SRAD hybrid propulsion system – part of the DLR STERN program

Project HOPPER – First flight in 2025

Vertical Takeoff & Landing Vehicle – First bi-liquid propulsion system of Space Team Aachen

COOLING EXPERIMENT

Project TRACE – Launched 14.03.2024

First student-developed transpiration cooling experiment

Atmospheric entry from 78,.5 km altitude and speeds up to Mach 3.2

Part of the DLR/SNSA REXUS program

SATELLITE

Project AQUIS – Launch in 2025

First object of STA in orbit

Student developed PocketCube satellite

ROVER

Project SCORPIUS ERC 2025

Scientific rover of STA

Participation in the European Rover Challenge 2025

Participation with a prototype in 2024

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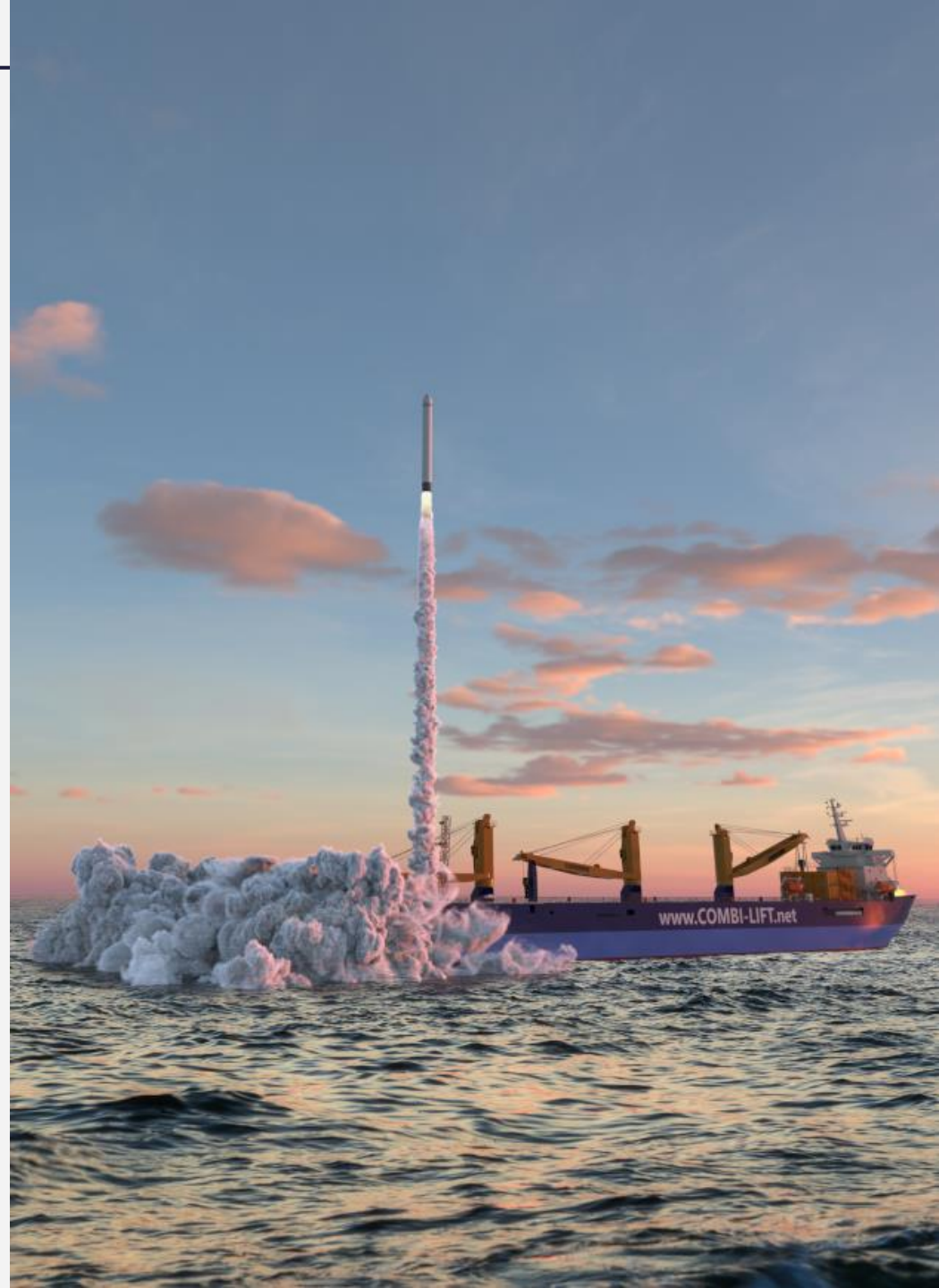
Aquila Maris – Supersonic rocket

- Successor to the competition rocket Aquila
- Cooperation with the **German Offshore Spaceport Alliance** (GOSA)
- Part of the first launch campaign of GOSA, 3rd Week of June
  - Space Team Aachen
  - Forschungsgemeinschaft Alternative Raumfahrt
  - DanStar
  - T-Minus

- Water recovery using parachutes and **floatation devices**

- **Livestream** of all launches provided by Space Team Aachen
- Roll-out: 2nd May, 18:30, Aachen Münchener Halle

- Size: **3 m**
- Weight: **26 kg**
- Apogee: **> 10 km**
- Top speed: **Mach 2**



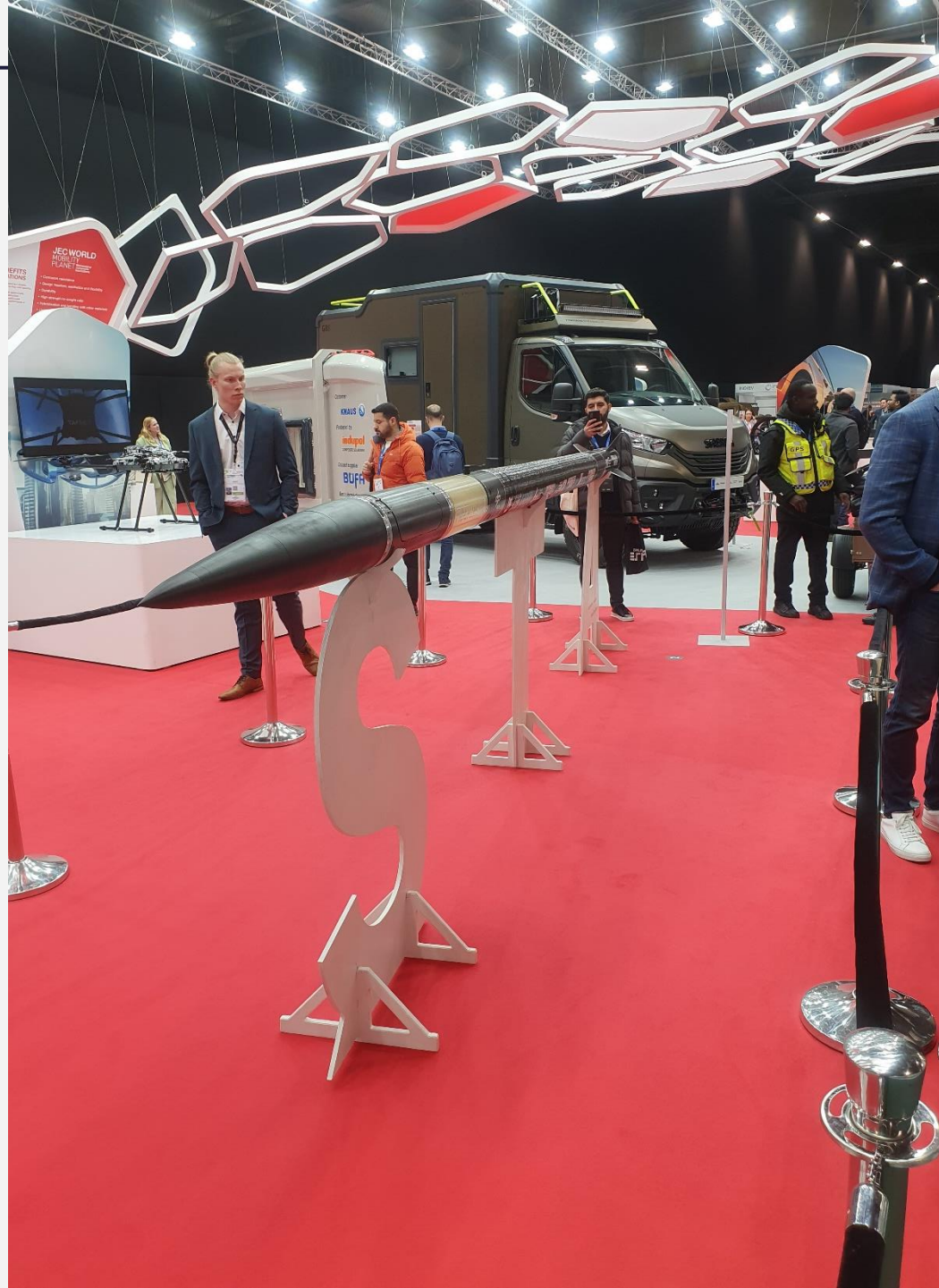
STAHR – Hybrid rocket

- Part of the **DLR STERN program**
- Launching from the European Space Range in Kiruna, Sweden
- Currently the **largest project** of STA

- All systems developed by our students
  - Parachutes and recovery event mechanisms
  - **Hybrid propulsion system** including filling station
  - On board electronics and ground support equipment
  - Payload experiment

- Roll-out: 28th May, 18:00, Aachen Münchener Halle

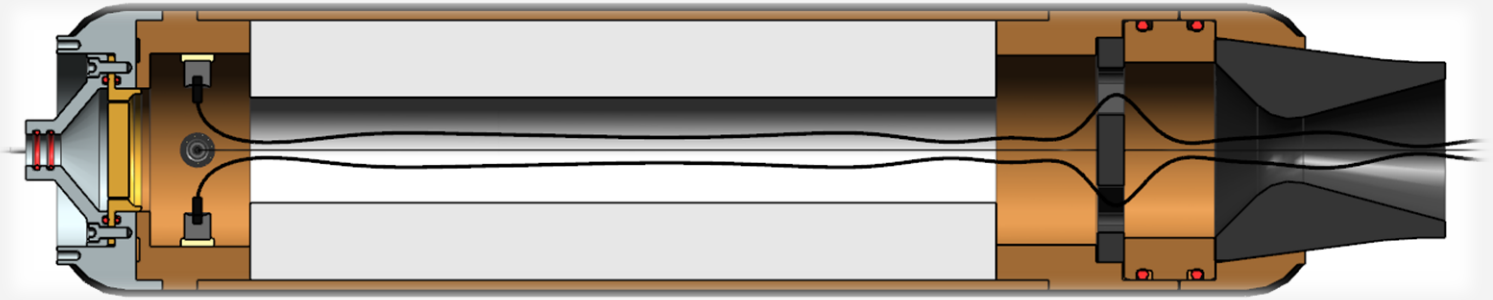
- Size: **~ 5.5 m**
- Lift-off mass: **80 kg**
- Apogee: **> 40 km**
- Top speed: **Mach 1.6**



STAHR rocket engine

- **Hybrid engine**
  - Paraffin based solid fuel
  - Nitrous oxide as oxidizer

  - Components are safe to handle
  - “simple” to work with

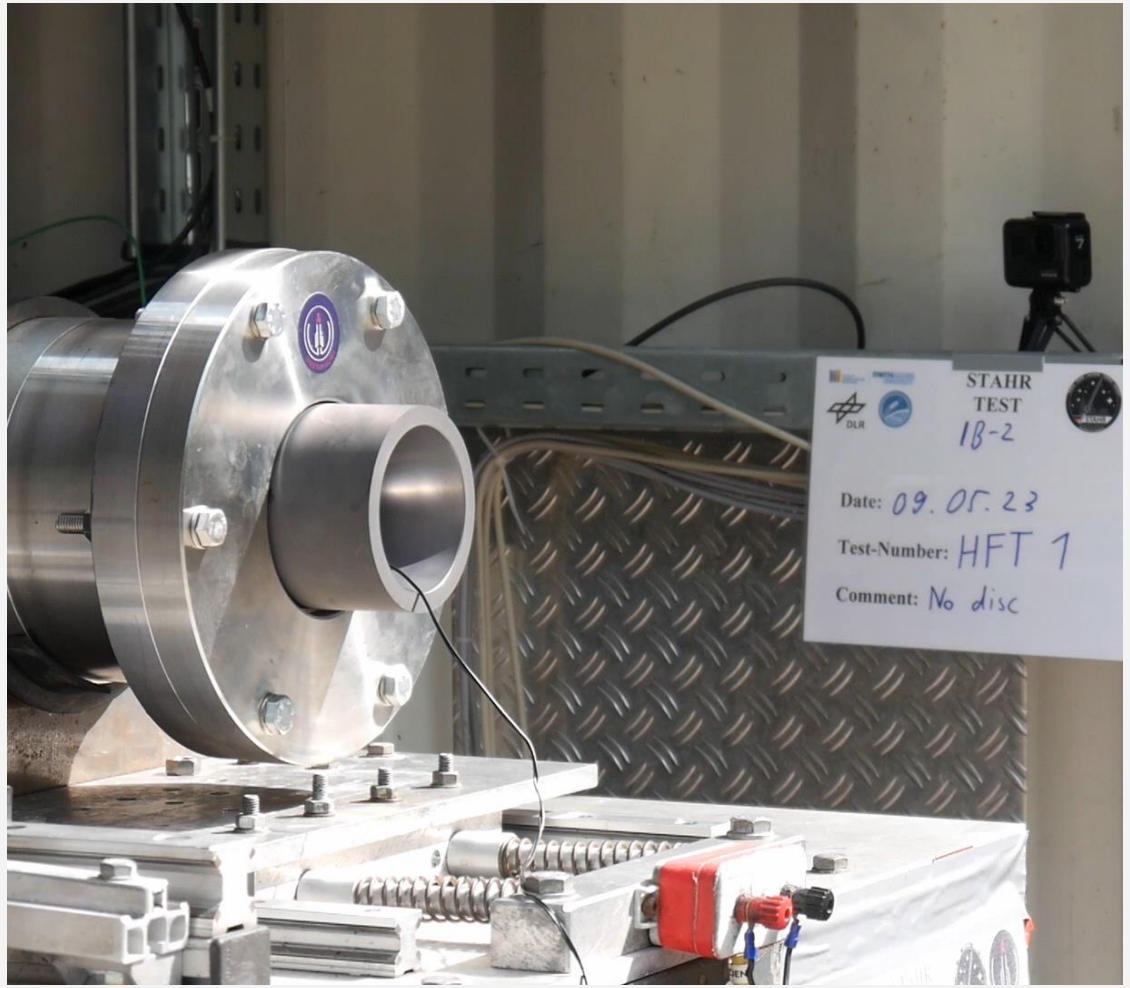


- STA Test bench at Stoßwellenlabor of RWTH Aachen
  - Tests of demonstrator engine DETLEF
  - Designed in the scope of a bachelor thesis
  - **500 N of thrust and burn time of 5 s**

- Test bench M11 at DLR in Lampoldshausen
  - Tests of „battleship“ engine and of flight version
  - **4.5 kN of thrust and burn time of 40 s**

Test bench in Aachen - DETLEF

Test bench in Lampoldshausen - INES



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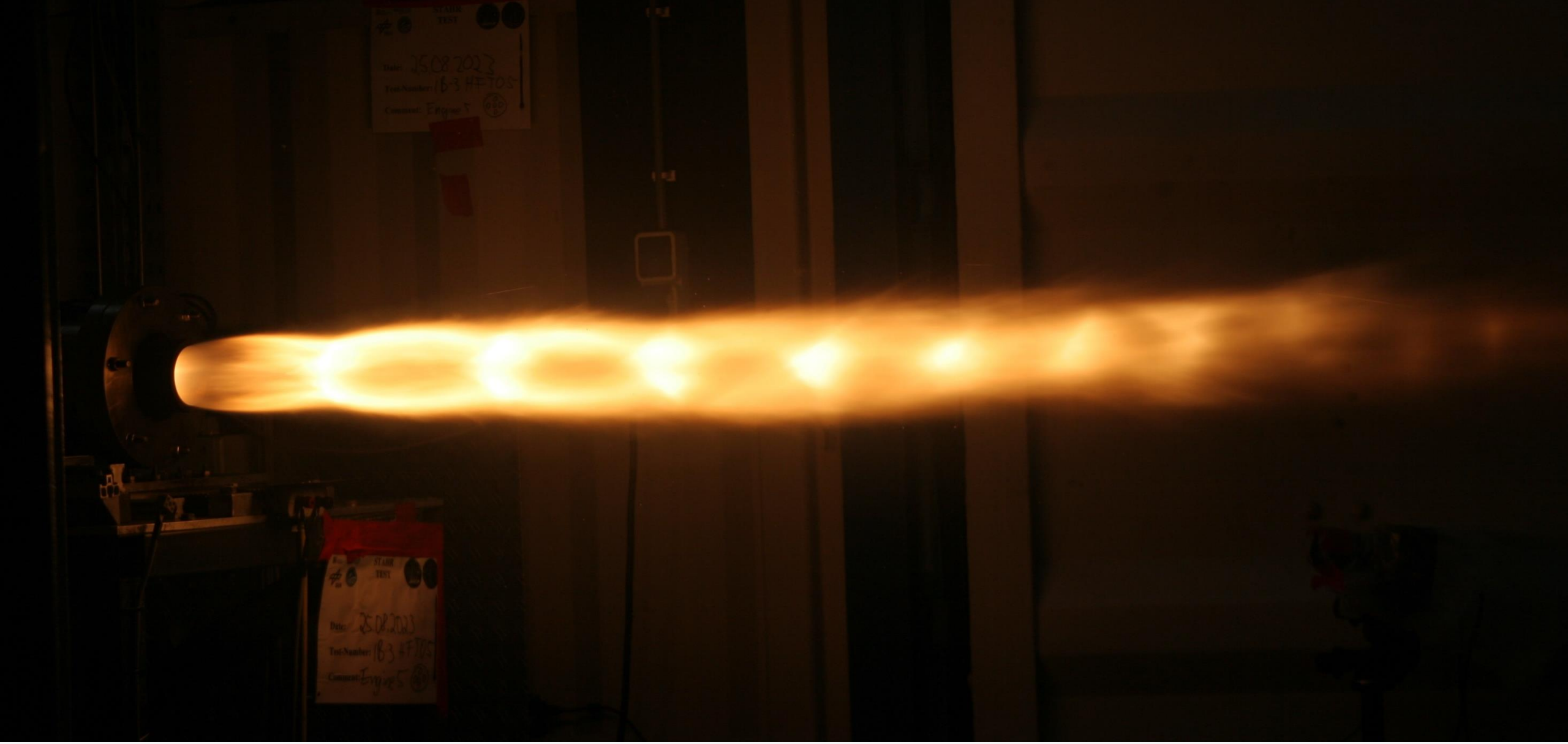

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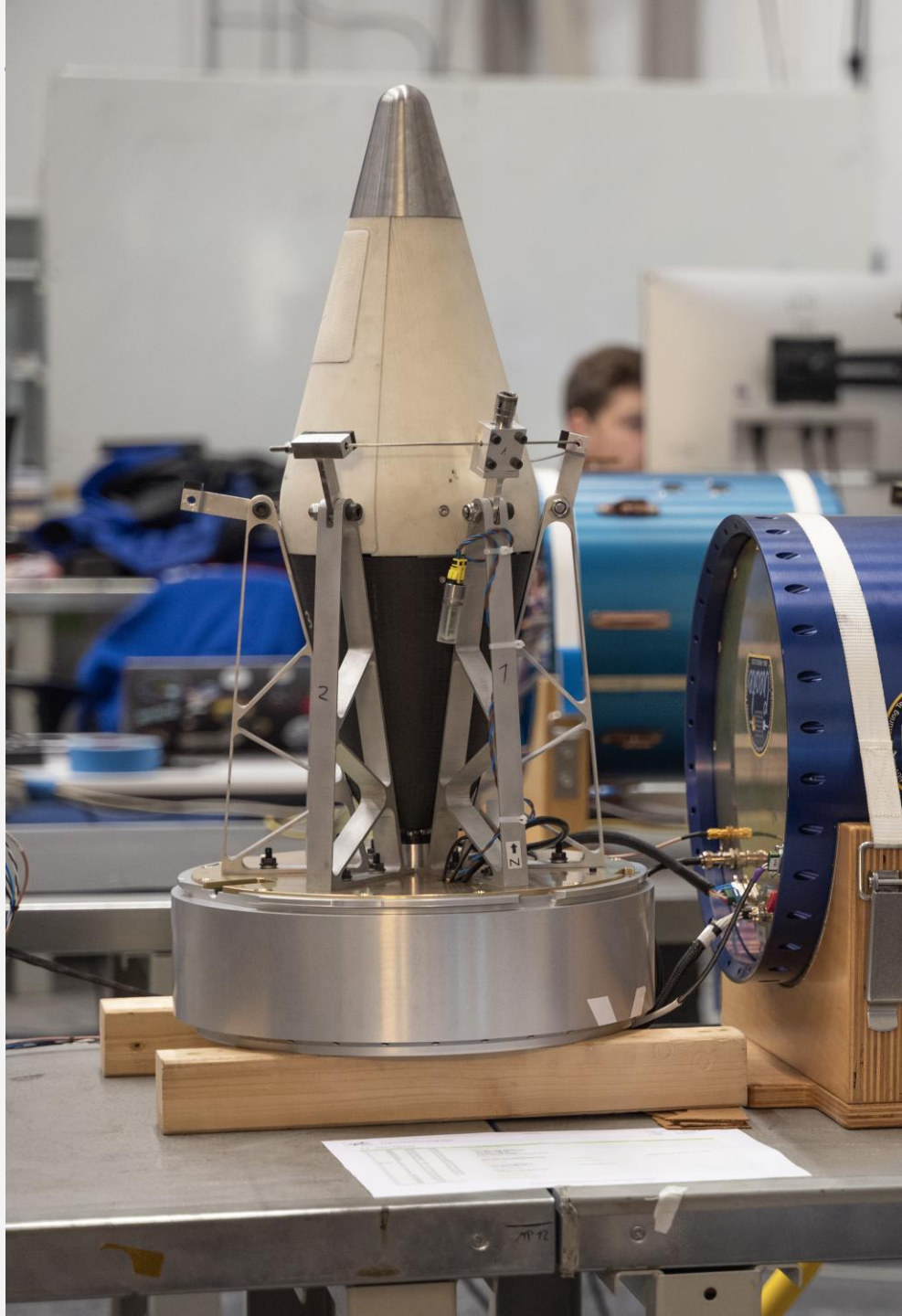
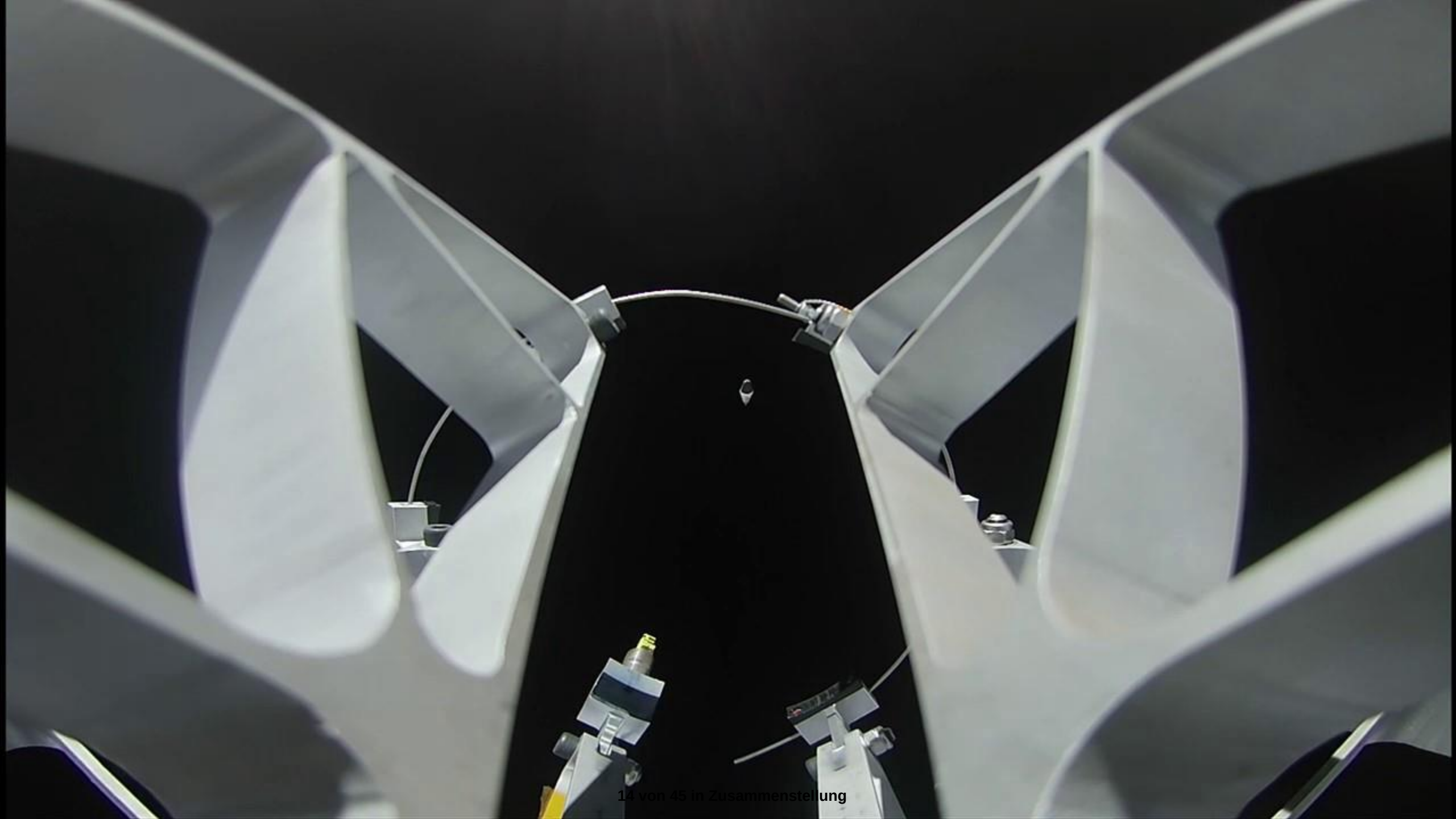
TRACE – Experiment on transpiration cooling

- Part of the **DLR / SNSA REXUS program**
- First student experiment on transpiration cooling, third world wide
- Testing end validation of a reusable heat shield in a free flight experiment
- Launched 14th March of 2024 out of Esrange, Sweden

- Argon as cooling gas
  - 3D printed pressure vessel for pressures up to 1200 Bar
- SRAD Recovery system
  - Supersonic hemisflo ribbon parachute

- Separation altitude: **~ 78,5 km**
- Heat load: **34 000 W/m²**
- Speed at reentry: **Mach 3.2**





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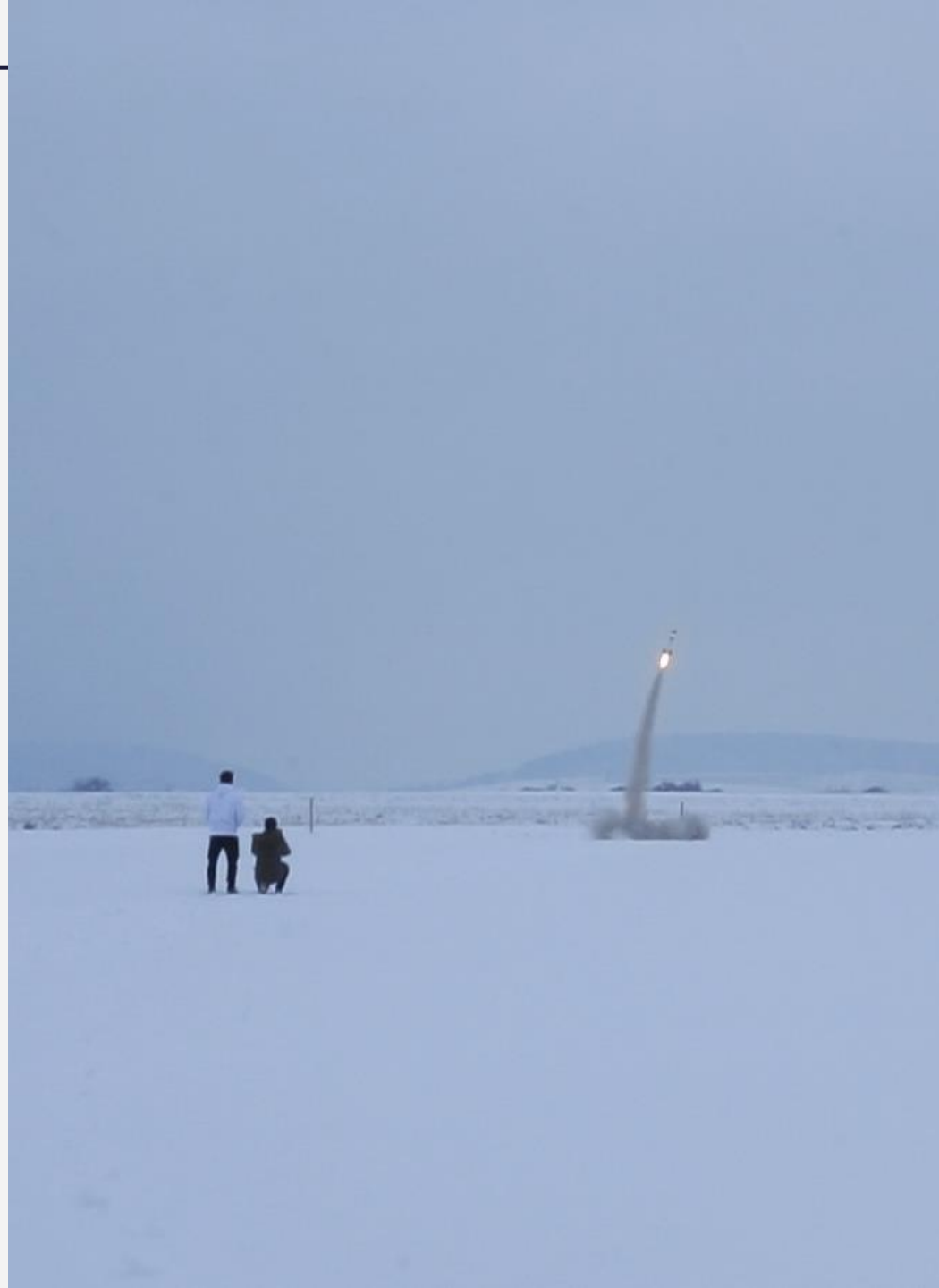
ALYA – Versatile testing platform

- Platform for **control technology experiments**
- Rapid iterability, fast reusability, modularity and cost effectiveness
- Single stage recovery system
- Entirely self devolved

- Current Experiment
  - Aerodynamically instable design
  - Engine gimble for **active stabilization**
  - Electronics for active flight control

- Size: **0.7 m**
- Lift-off mass: **1.8 kg**
- Gimble range: **± 15°**



Hopper – Vertical takeoff and landing vehicle

- Development of a fully reusable rocket system
- Contribution to rapid reusable launch vehicles in Europe

- First **bi-liquid engine** STA
  - 3D-printed engine for complex cooling structure and quick design-iterations
  - Storable green propellants ethanol and nitrous oxide

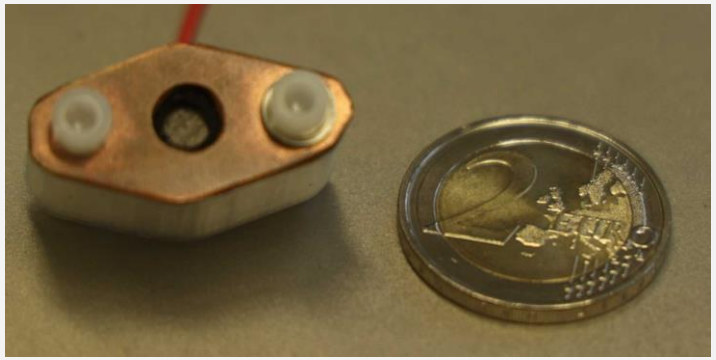
- Size: **~ 5 m**
- Lift-off mass: **200 kg**
- Thrust: **2 kN**
- Diameter: **~ 0.4 m**
- Hover time: **60 s**

AQUIS – PocketQube satellite

- Development of a **2P PocketQube satellite –** 10 cm x 5 cm x 5 cm
- Ground station at FH Aachen

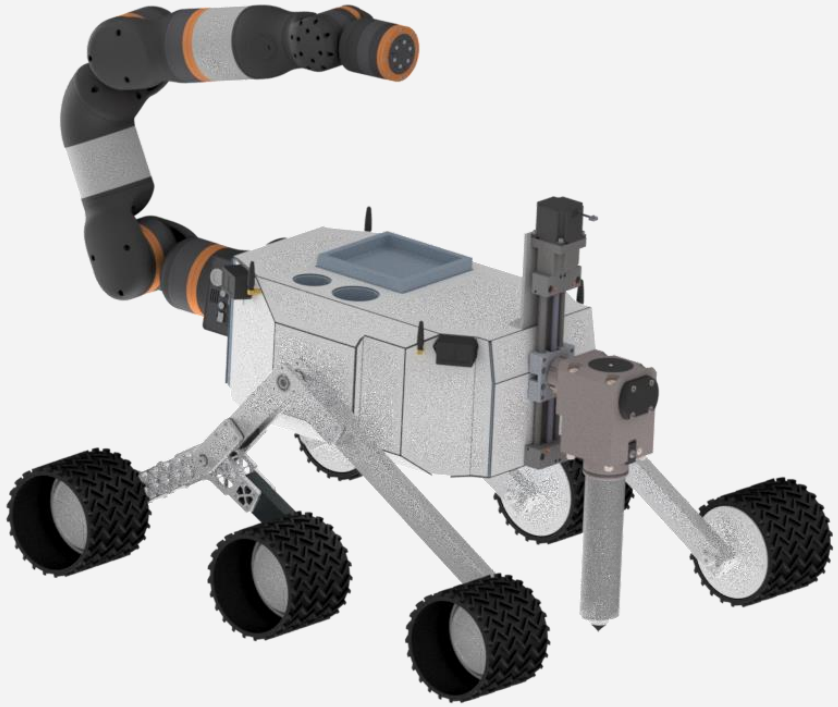
- Active attitude determination and control
- **Camera** for earth observation
- Electric power system consisting of **deployable solar panels** and a battery cell
- SRAD onboard computer for data handling and control algorithms
- Self developed **vacuum-arc thruster** for active deorbiting

- New iteration every year



SCORPIUS – Competition rover

- Participation in the **European Rover Challenge 2025** in Poland
- First rover project of Space Team Aachen
- **LiDAR** for autonomous navigation
- A* and D* **path planning algorithm** in combination with SLAM and Monte Carlo method
- Sample collection via drill and robotic arm
- Use of the **Rocker-Bogie-System** as suspension



- Mission duration up to **45 min**
- Weight: **75 kg**
- Drill depth: **30 cm**
- Robotic arm with **6 DoF**

Prototype rover

- Set to compete at ERC 2024 to gain experience
  - Procedures
  - Documents to be submitted
- Fewer capabilities but fully functional

Past competitions

European Rocketry Challenge 2020

- Inaugural European rocketry competition
- Participation and win with CARL

European Rocketry Challenge 2021

- Participation with CARL 2
- Second iteration with active altitude control system

Spaceport America Cup 2023

- Participation with Aquila as the first German team
- Most points of all in category “Design and build quality“

Vergangene Wettbewerbe

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Non-technical field

Marketing, sponsoring and IT

Non- technical fields

Sponsoring

Search for sponsors, industry and institute partners

Marketing & Social Media

Management of the social media channels – e.g. Instagram

Event Management

Organization of recurring events and work on public relations

Photography & Videography

Capturing the adventures of Space Team Aachen

IT Management

Management of the IT infrastructure – e.g. the website

Science night – RWTH Aachen

- Presentation of the work of Space Team Aachen to a broad audience
- Exchange about spaceflight with all age groups
- Emphasis on younger generation
  - Create excitement about spaceflight
  - Career in this field is possible for all
- Promotion of acceptance of spaceflight
  - Critical exchange about rocketry, dual-use and the environment
  - Clearing up of misunderstandings

Advertisement and recruiting

Space Team Aachen Open day

- Multiple presentation spread out throughout the day
- Presentation and exhibit of all projects

Bonding fair at RWTH Aachen

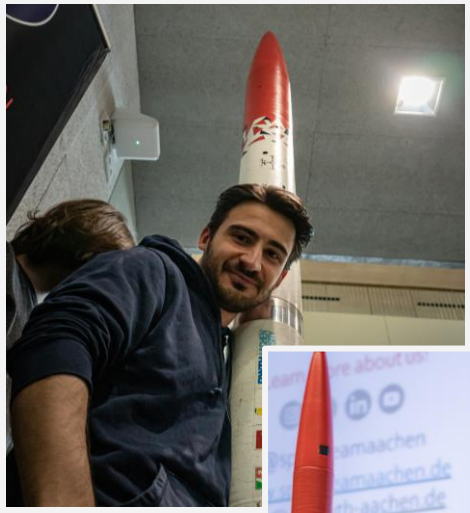
- Representation of STA with own information stand

Day of the student initiatives

- Open information event for all students
- Information stands of all student initiatives in Aachen

Advertisement in lectures

- Presentation of Space Team Aachen in lectures and tutorials



Association

General assemblies

- Presentation of the current state of Space Team Aachen and election of a new board

Summer and Christmas parties

- Party

Rudi Rocket

- Space Team Aachen internal dinner-hopping event

Workshop weekends

- Knowledge exchange across projects on a specific topic

Sprint weekends

- Project specific co-working

Why support student initiatives?

We are taking over the world

Our value is in ...

... our people

- Large pool of future aerospace engineers
- Hands on experience in **solving real world problems**
- Experience in working together as a team
- High level of motivation and dedication
  - Shown by participation in **extracurricular activities**

... our knowledge

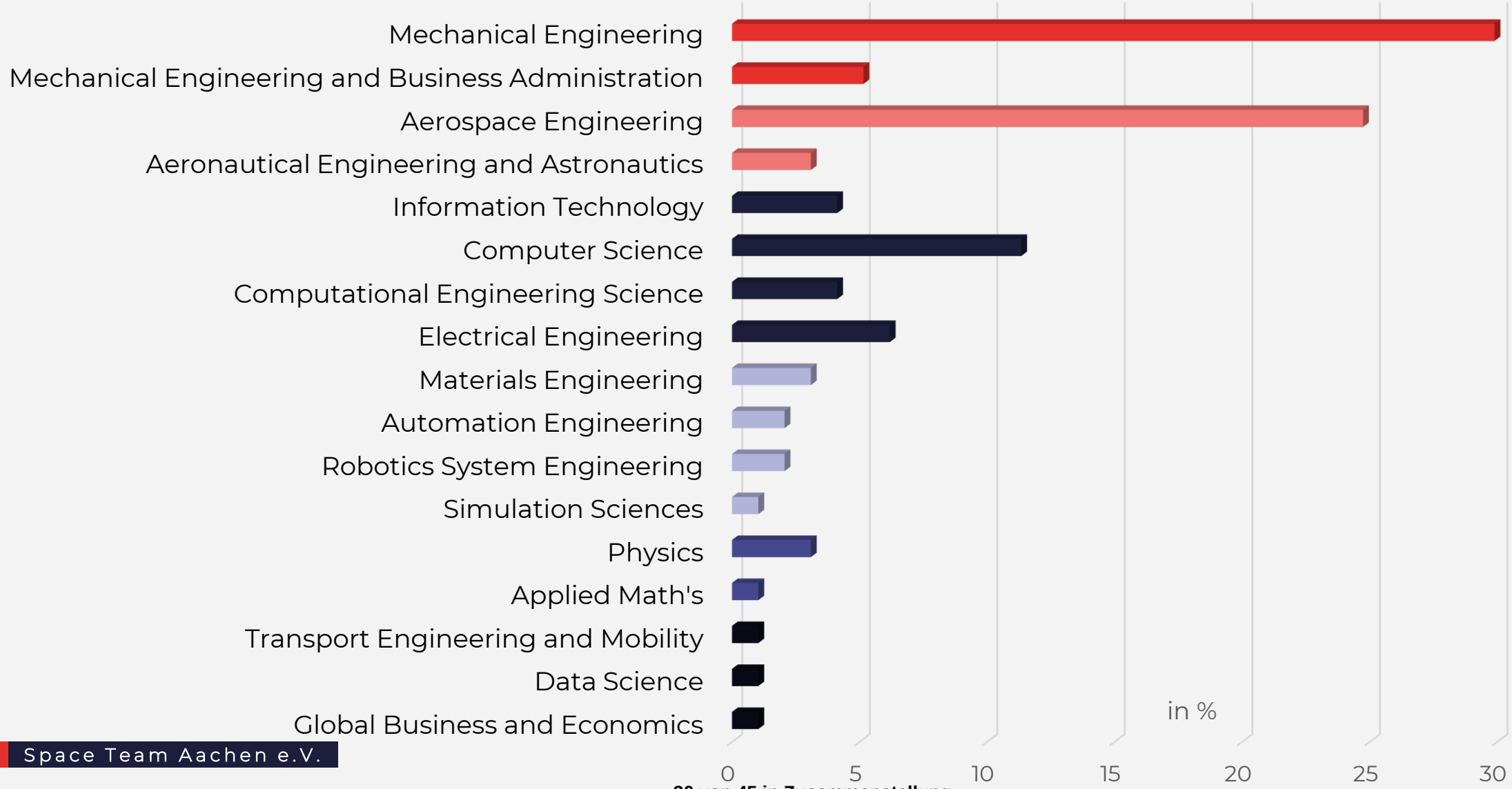
- Covering many relevant topics in aerospace
- More than could ever be taught in class
- Never ending **thirst for more**

... our vision

- Innovation and sustainability
- Future **entrepreneurship ambitions**

Our members: The future employees and CEO’s in aerospace

Aerospace and New Space are in our veins: Our fields of study



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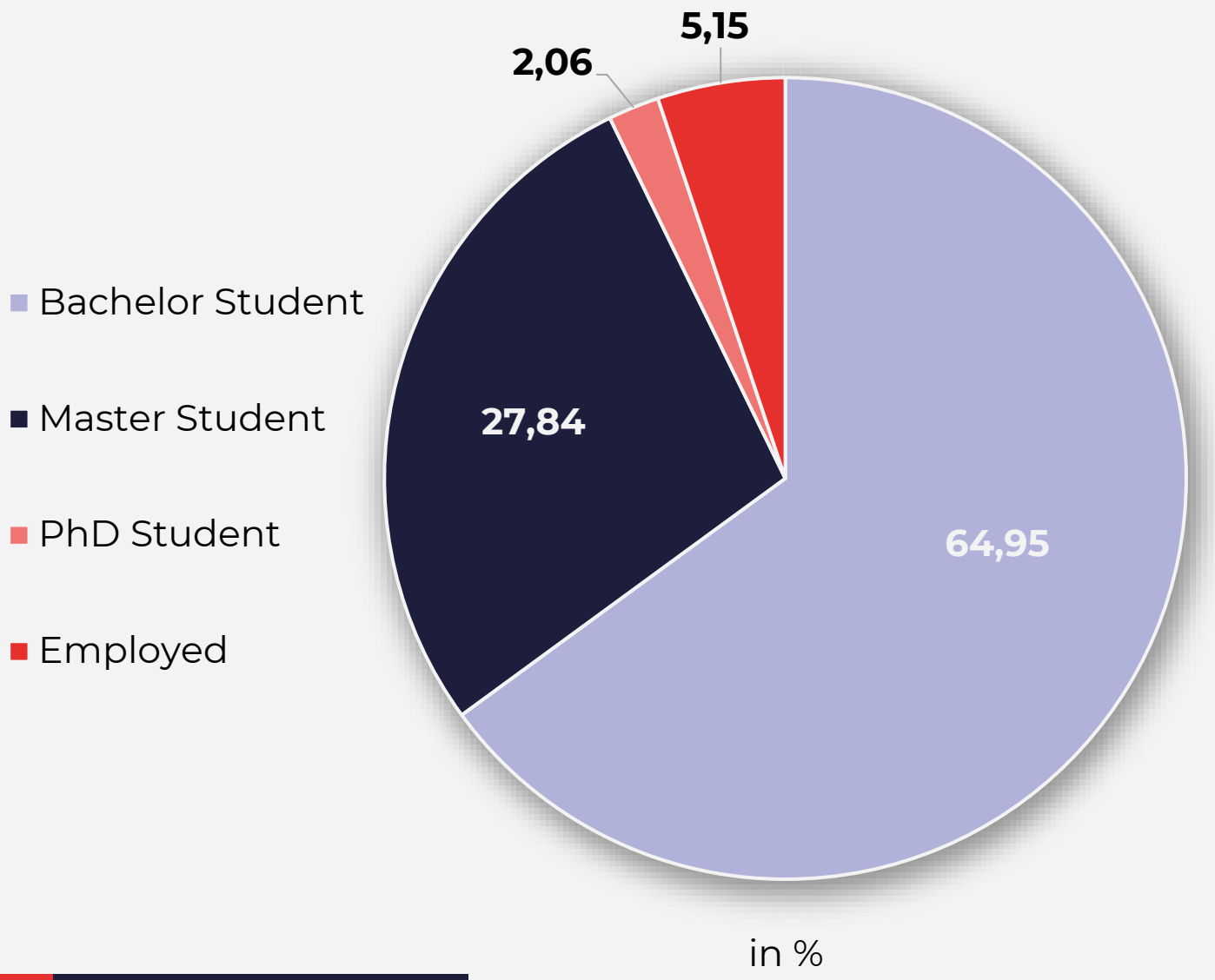
Our members: The future employees and CEO's in aerospace

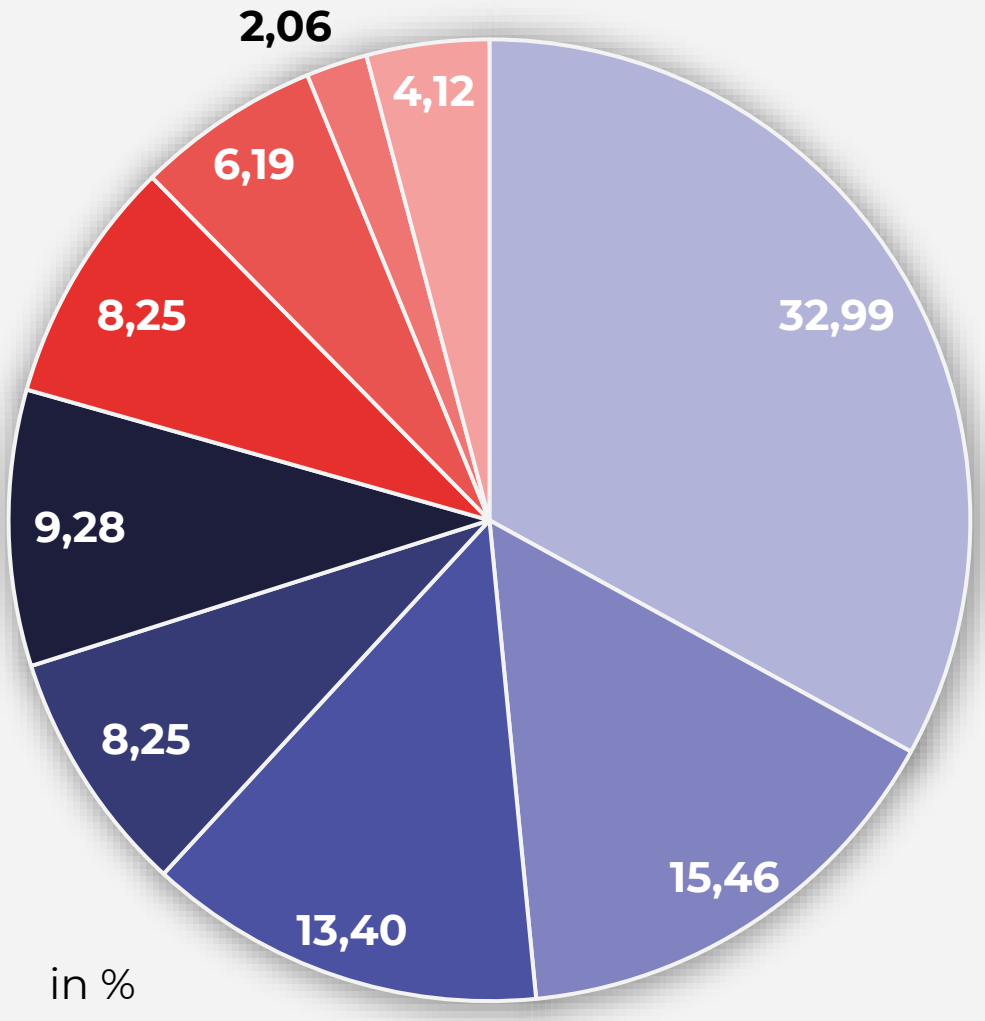


All fields and all levels

- Majority of members studying at RWTH Aachen University
- Percentage of FH Aachen students growing as STA expands its presence
- Space Team Aachen is open to all in the Euregio Maas-Rhein
  - Aachen – Germany
  - Liège – Belgium
  - Maastricht - Netherlands

* not all alumni participated in the poll

Our members: The future employees and CEO's in aerospace



- Under 1 semester
- 1 to <2 semesters
- 2 to <3 semesters
- 3 to <4 semesters
- 4 to <5 semesters
- 5 to <6 semesters
- 6 to <7 semesters
- 7 to <8 semesters
- Founding member

Once in Space Team, we stay

- Vast majority of members stay until they finish university
- Participation in different projects during time at Space Team Aachen
- Large portion of new members reflects recent growth

* not all alumni participated in the poll

* Rookies participated more

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We’re spacing out: Companies that benefited from Space Team Aachen so far

RFA Rocket Factory — 2 Employees, 3+ Interns

isar aerospace — 1 Intern

ArianeGroup — 2 Interns, 1 Thesis

The Exploration Company — 3 Employees, 1 Thesis

MT AEROSPACE — 1 Intern

esa European Space Agency — 1 Intern

DLR

Institut für Raumfahrtantriebe:
- 1 PhD Employment
- 3 Thesis
- 4 Interns

Mobile Raketenbasis:
- 1 Thesis
- 1 Intern

Institut für Aerodynamik und Strömungstechnik
- 1 Thesis (Cologne)
- 1 Thesis

Summer School
- Multiple participants

ATMOS — 1 Intern

antwerpspace An OHB Company — 1 Intern

AIRBUS DEFENCE & SPACE — 1 Intern

INTELSAT — 1 Intern

EC® — 1 Intern

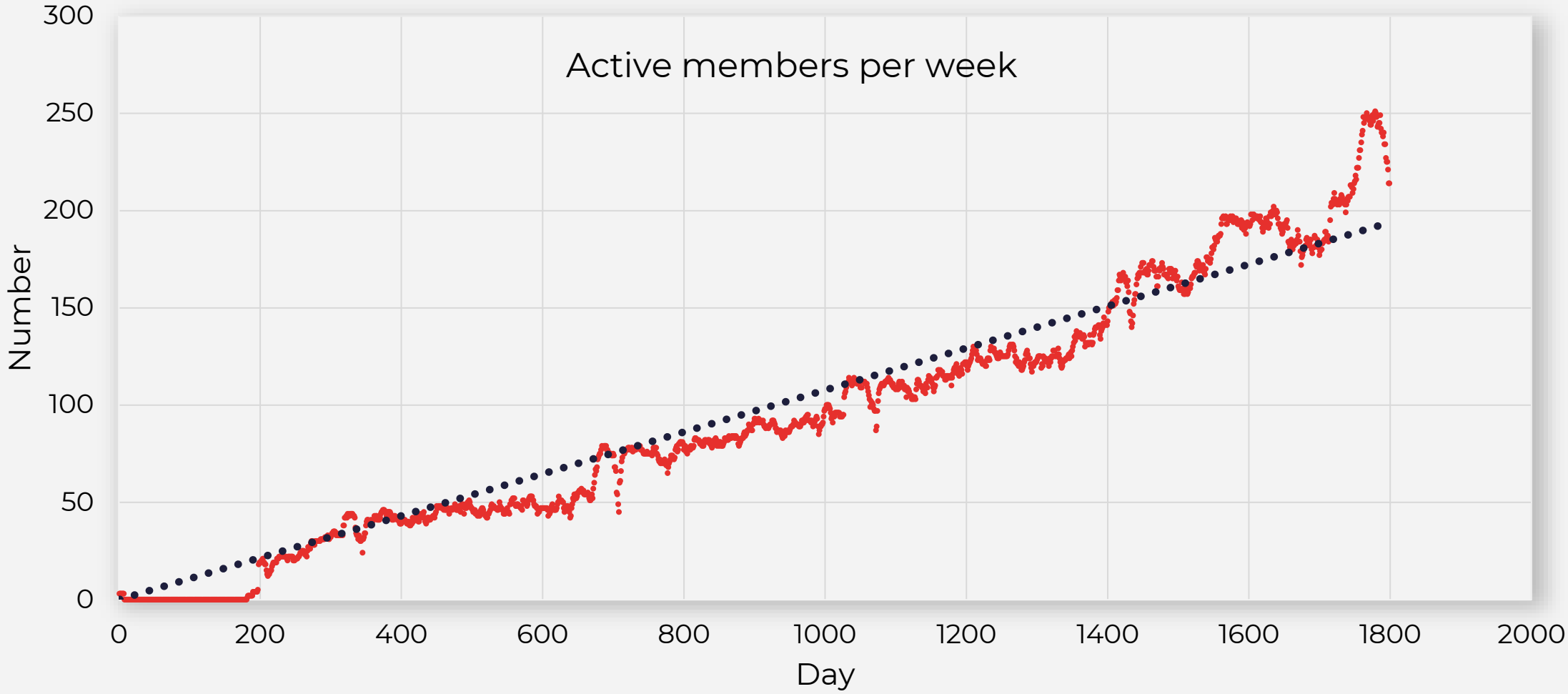
AIRBUS — 1 Intern

Lufthansa Technik More mobility for the world — 1 Intern

DIEHL Aviation — 2 Interns

ARROWTEC — 1 Intern

Our members: The future employees and CEO’s in aerospace



Steady growth:

- One new member every 10 days

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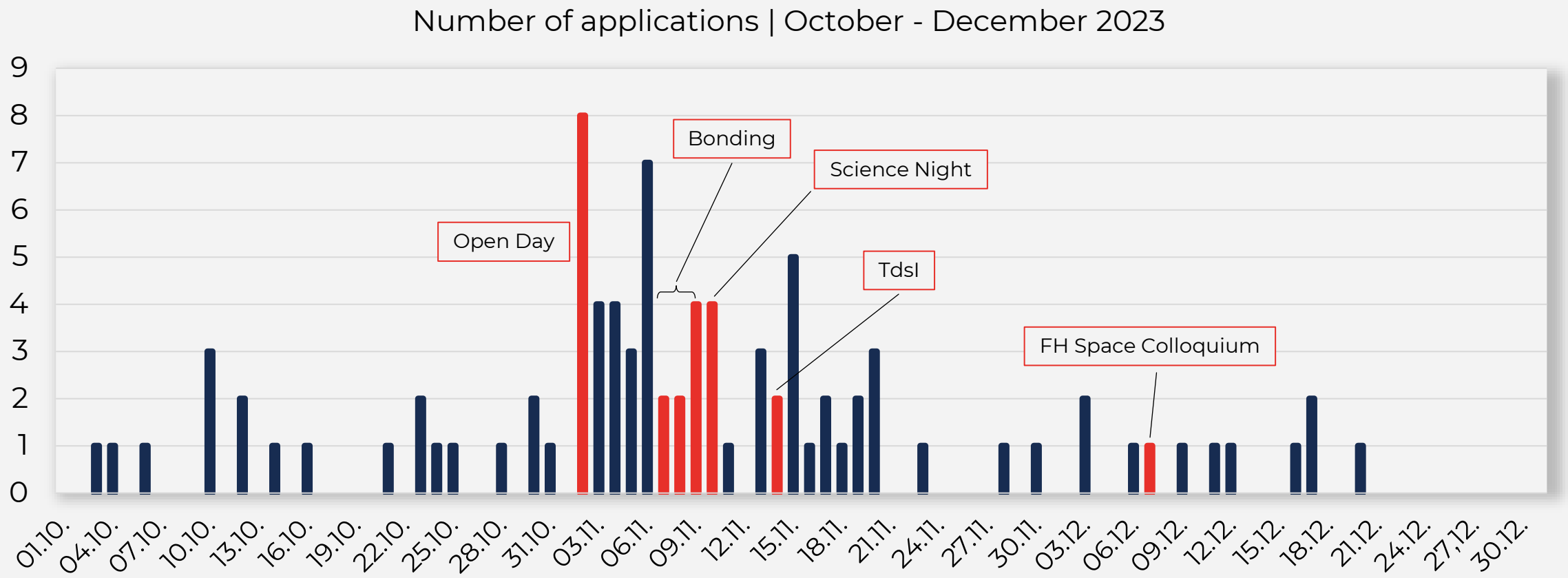
Our members: The future employees and CEO's in aerospace



91 total applications in Q4 2023

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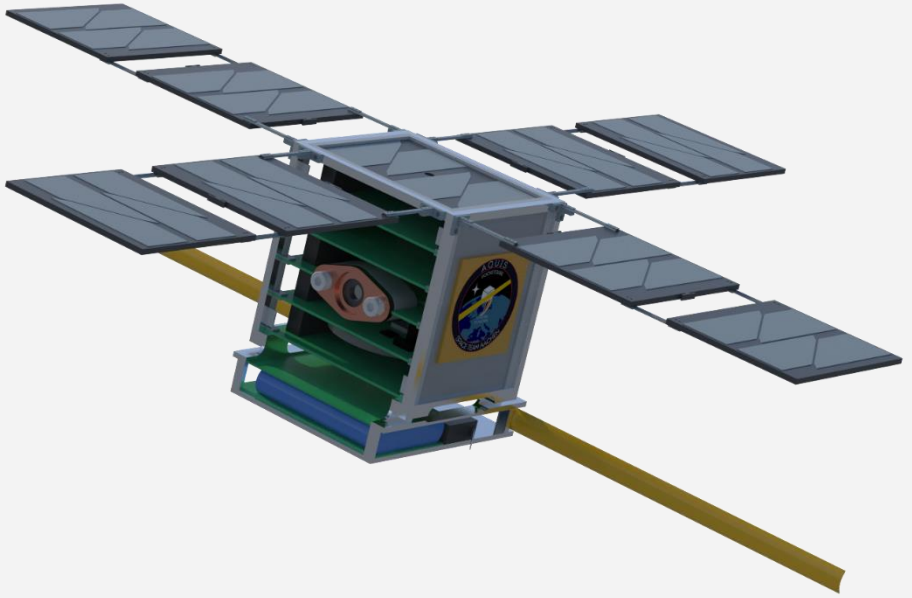
Entrepreneurship at STA

- Ambition to sprout many successful **aerospace startups -> push in this direction**
- Aim to make Aachen a center for aerospace in Germany and even Europe
- **Target:** Providing the **framework** to make spin-offs a reality – while benefiting STA
- Space Team Aachen as stepladder into the world of business ownership
- Space Team affiliated businesses as sponsors of Space Team Aachen in return for initial help

Space is expensive

The cost of our projects



Project costs

Project STAHR: **Total cost of 591.900 €**

- Project duration: 3 years (January 2022 – December 2024)
- Covered by DLR STERN Program

Project Hopper: **Conservative estimation of 94.500 €**

- Project start August 2023
- Secured funds* c.a. 32.800 €

Project Aquila: **Total cost of 44.900 €**

- Project duration 1 ½ Years (October 2021 –June 2023)
- Travel expenses covered largely by members (~755 € per person)

Project TRACE **Total cost (excl. sponsoring) ~40.000 €**

- Project duration 3 ½ years (October 2020 – March 2024)
- Travel expenses to be covered partly by members (despite REXUS)

Project Scorpius **Rough estimate of 30.000 €**

Project AQUIS **Total cost of 44.000 €**

- Build costs c.a. 4.000 €
- Launch and operation c.a. 40.000 €

*based on partnerships between STA and companies in other projects

Funding of Space Team Aachen

Association

- Membership fee: 5€ / month
- Sponsorships
  - Software
  - Manufacturing capabilities / material / products
  - Work- and event space (CI)
- Private donations

➢ Insurance for all Space Team activities

➢ Marketing

- Difficulty in securing non project specific monetary sponsorships

Projects

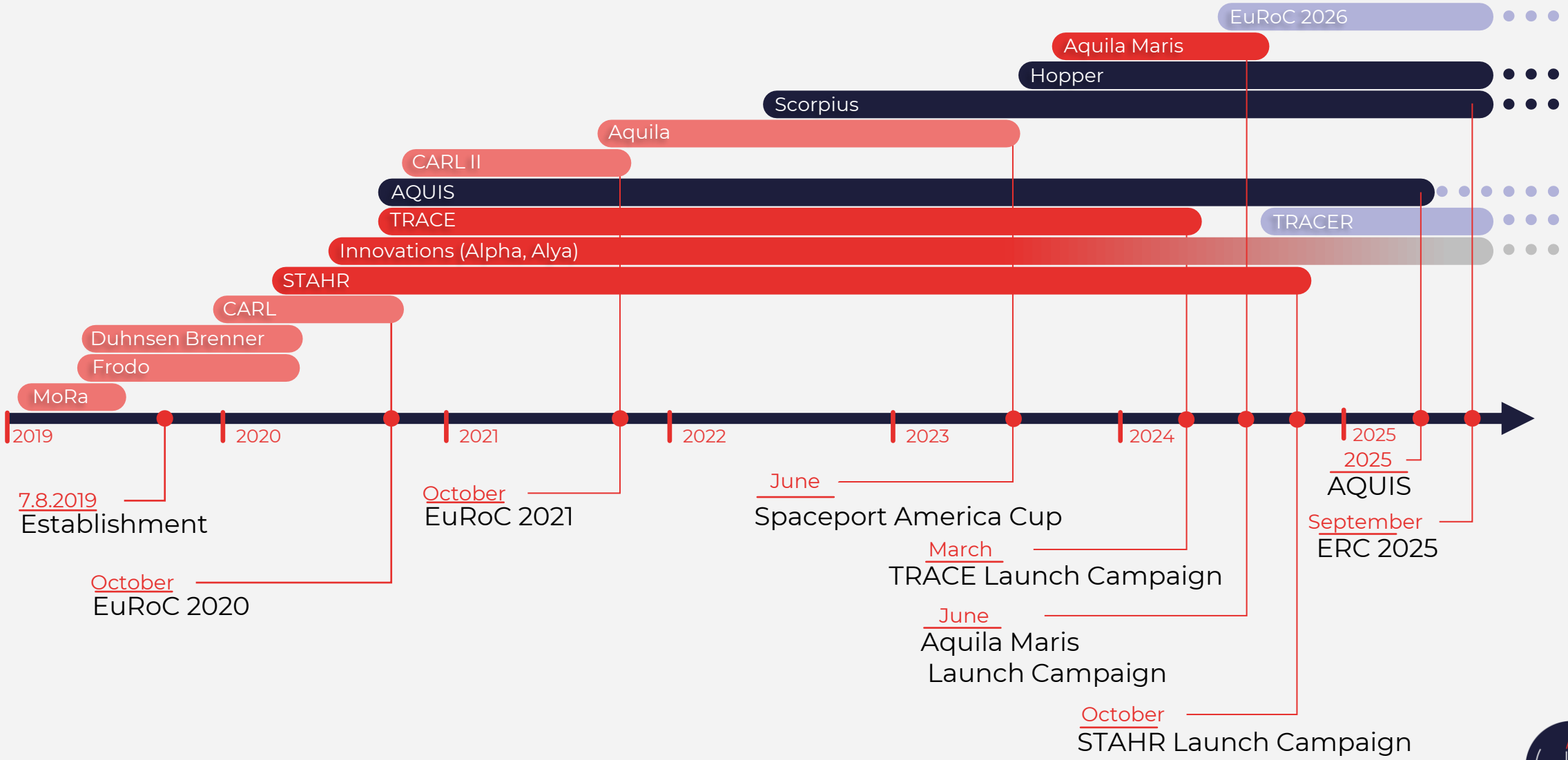
- Industry partners
  - Mainly products and software
- Institute partners
  - Expertise
  - Testing facilities
  - Storage and some workspace
- Pro RWTH and other foundations

- Government funding
  - Project TRACE – REXUS program
  - Project STAHR – DLR STERN program

Outlook: What next?

Future projects and ambitions

Timeline – Everything all at once



Projects end – and new ones start

Options for the next projects

Hybrid rocket (EuRoC 2026)

- Competition rocket
- 3 km SRAD hybrid category

Ad Astra (Balls 2026, possibly 2027)

- Two stage solid sounding rocket
- Target: Cross the regulatory boundary to space

New REXUS Project / TRACE follow up

- Possibilities:
  - Follow up on TRACE experiment
  - Further investigations into reentry

Long term ambitions

Competitions

- Yearly participation at EuRoC
- Occasional participation at SAC
- (Bi-) yearly participation at European Rover Challenge (ERC)

Satellites: Yearly iteration of AQUIS

Dream big: Path to orbit

- Multi-stage rocket
- Project on cryogenic propulsion
- Look into turbo-pups
- Orbital rocket (2035): Cubesats

Thank you very much for listening

Let’s make space for space together!

Thank you very much for listening

Are you on board?

SPACE TEAM AACHEN

SOCIAL MEDIA

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