STEM talent support – how to create innovative young researchers

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Background information (1): DLR - German Aerospace Center
Background information (2): The DLR_School_Labs
Our concept of talent support: PBLg & SEM
Best practice examples
…


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DLR – German Aerospace Center

Research Institution – Space Agency – Project Management Facility

- 40 research institutes and facilities
- 20 locations
- offices in Brussels, Paris, Tokio and Washington D.C.
- yearly budget: 1 B€ (research), 1.5 B€ (space agency), 1.3 B€ (project management)
- 9,000 employees, 1,800 in Oberpfaffenhofen and Weilheim

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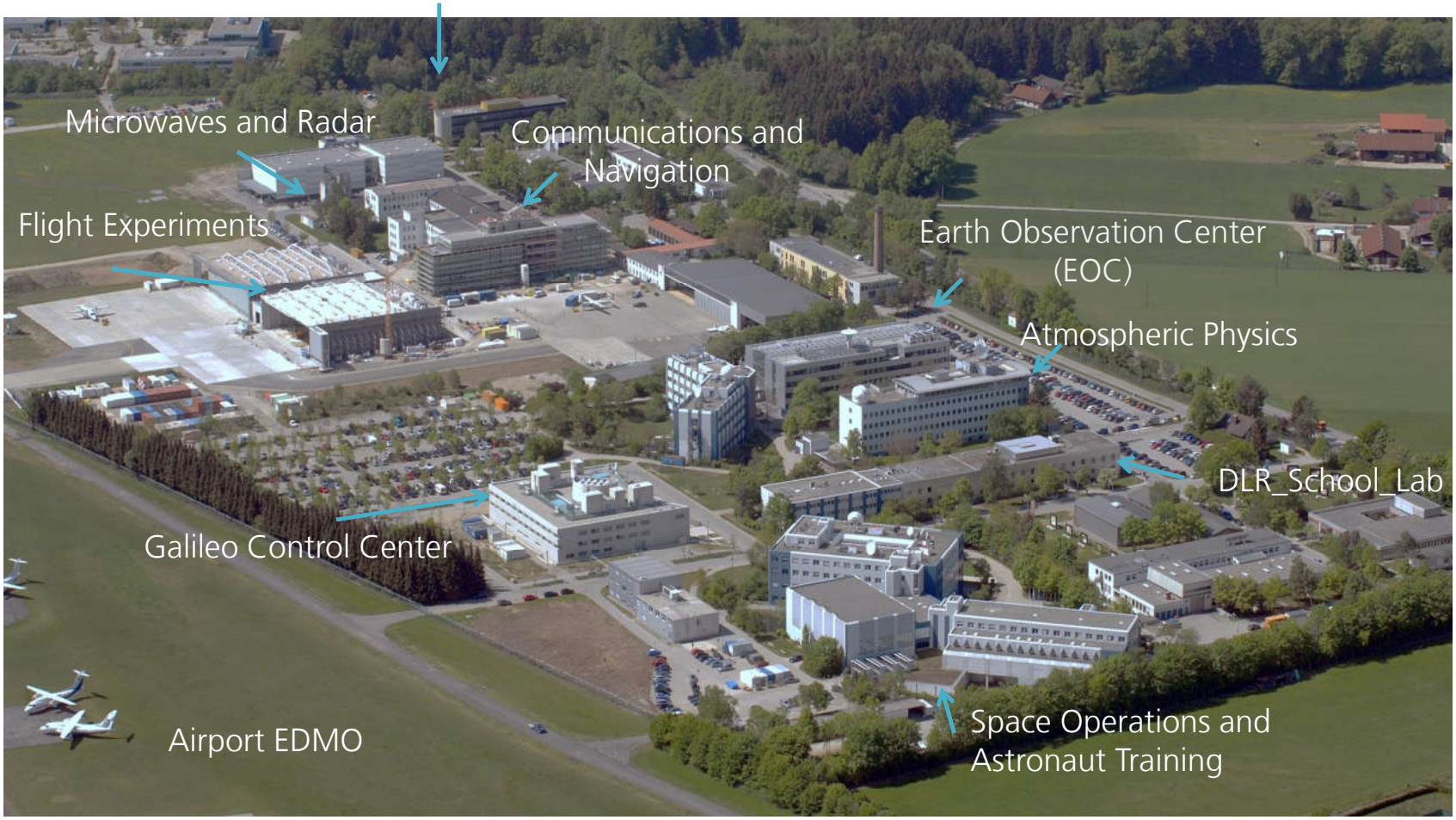
DLR Oberpfaffenhofen



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Demonstrationsroboter „Justin“


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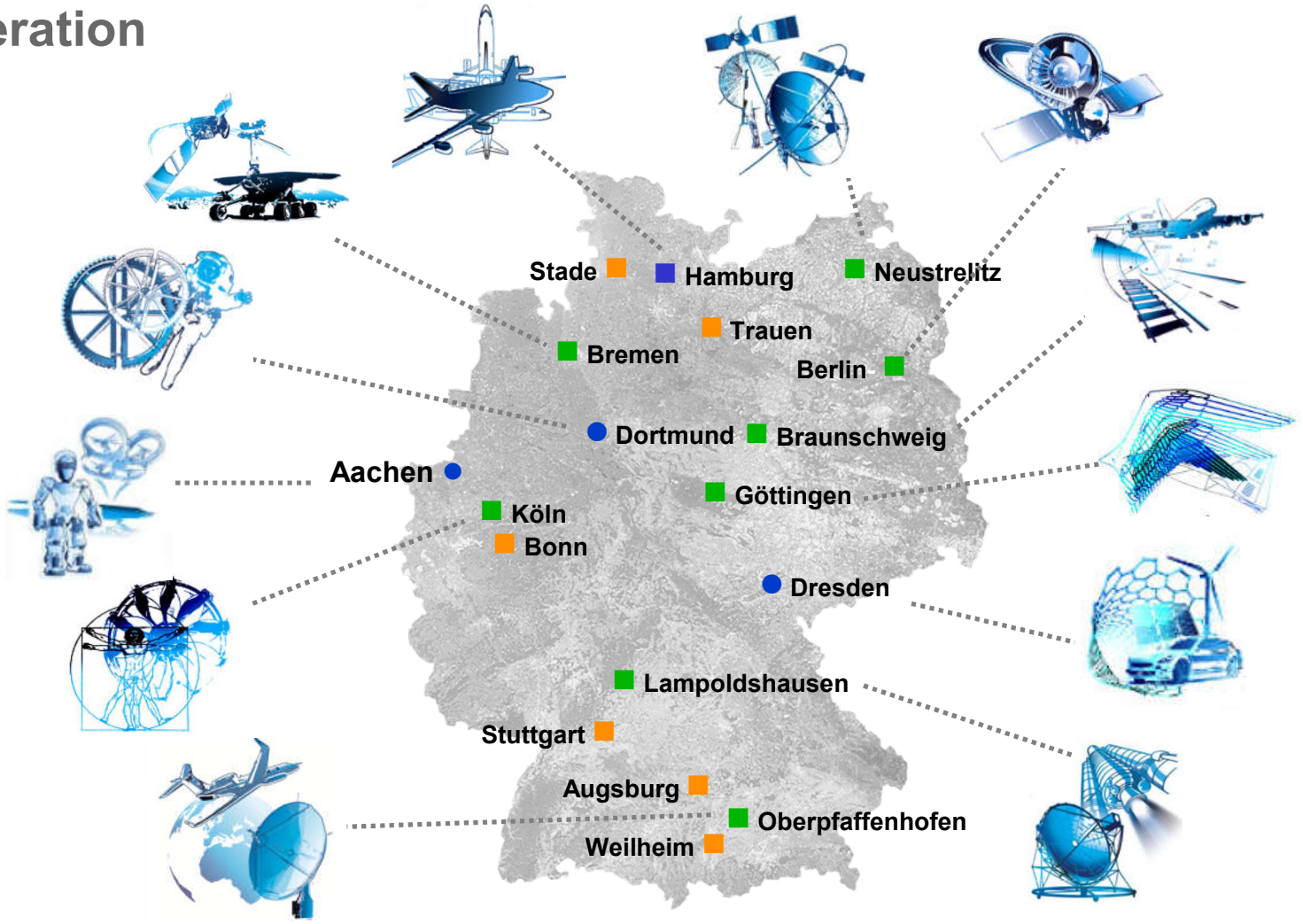
Promoting the Next-Generation Scientists

DLR_School_Labs

- 13 Student Labs
- 40,000 school students p.a.
- From primary school to university level
- Experimental workshops for school classes
- Student research projects
- Making science fascinating and more relevant



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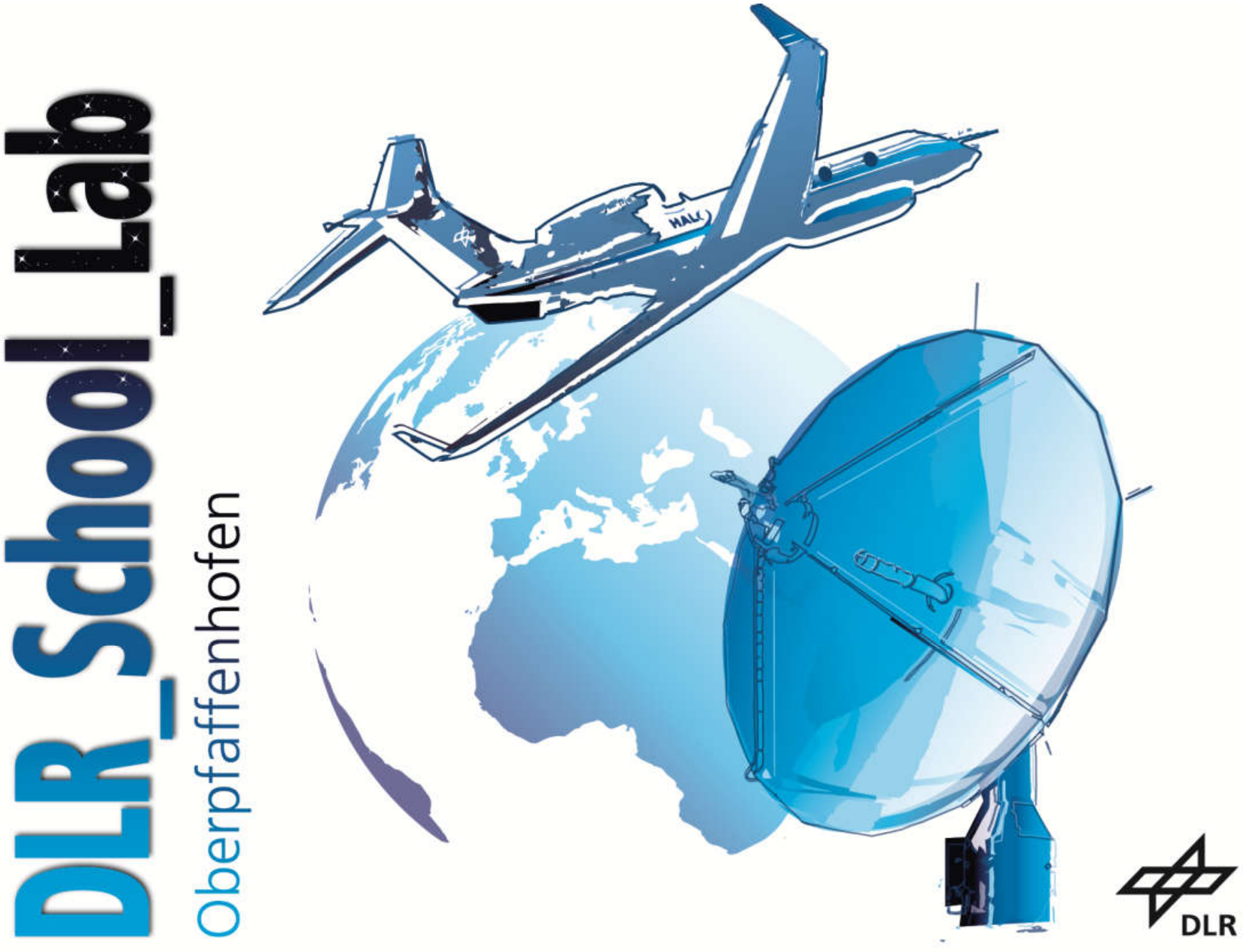

DLR_School_Lab
Oberpfaffenhofen

Experiments

Instruction

Authenticity

JUSTIN

ASURO


Robotics

Experiments @ DLR_School_Lab Oberpfaffenhofen represent the research of all 10 DLR institutes

Experiment	Institute
1. Infrared Technology	Remote Sensing Technology
2. Laser Technology	Physics of the Atmosphere
3. Radar Technology	Microwave and Radar Technology
4. Optical Remote Sensing	Remote Sensing Data Center
5. Weather and Climate	Physics of the Atmosphere
6. Satellite Data Analysis	Remote Sensing Data Center
7. Satellite Navigation	Communications and Navigation
8. Robotics	Robotics and Mechatronics
9. Virtual Mechanics	System Dynamics and Control
10. Flight Team Simulator	Flight Operations
11. Mobile Rocket Base	Space Operations
12. ASUROnaut	Robotics and Mechatronics
13. Tunnel Boring Machine	Technical University Munich
14. GOME Experiment	ESA/DLR Earth Observation Center

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7. Satellite Navigation	Communications and Navigation
8. **Robotics**	**Robotics and Mechatronics**
9. Virtual Mechanics	System Dynamics and Control
10. Flight Team Simulator	Flight Operations
11. **Mobile Rocket Base**	**Space Operations**
12. ASUROnaut	Robotics and Mechatronics
13. Tunnel Boring Machine	Technical University Munich
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Mobile Rocket Base


Mobile Rocket Base


The Team


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Objective: Fascination Research
Gifted Students at the DLR_School_Lab Oberpfaffenhofen

Renzulli (2010): Three ring concept of giftedness

Self-regulated learning

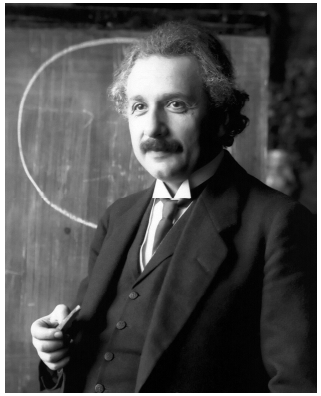


Figure: Wikipedia

„I have no special talent. I am only passionately curious." (Albert Einstein)

⇒ Curiosity is a strong (if not the strongest) driver of learning

⇒ From „instruction" to „construction"

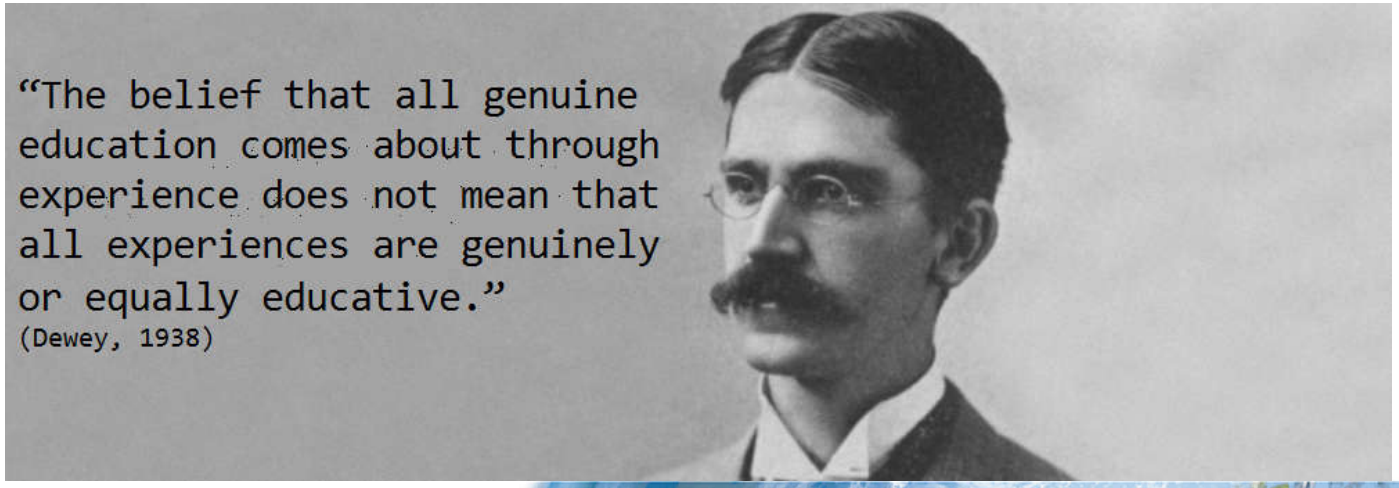
⇒ Gifted children are more capable of self-regulated learning (Fischer, 2004)

⇒ Project based learning: particularly suitable for self-regulated learning (Bönsch, 2002)

Project based learning (PBL) - motivation and characteristics

Motivation

- takes interests and needs of learners into account
- interdisciplinary approach
- supports students' engagement
- new role of teachers
- connecting "teaching world" with "real world"
- …



Project based learning (PBL): Motivation and characteristics

Characteristics

The starting point must be a problem **as real as possible** that the project group should solve

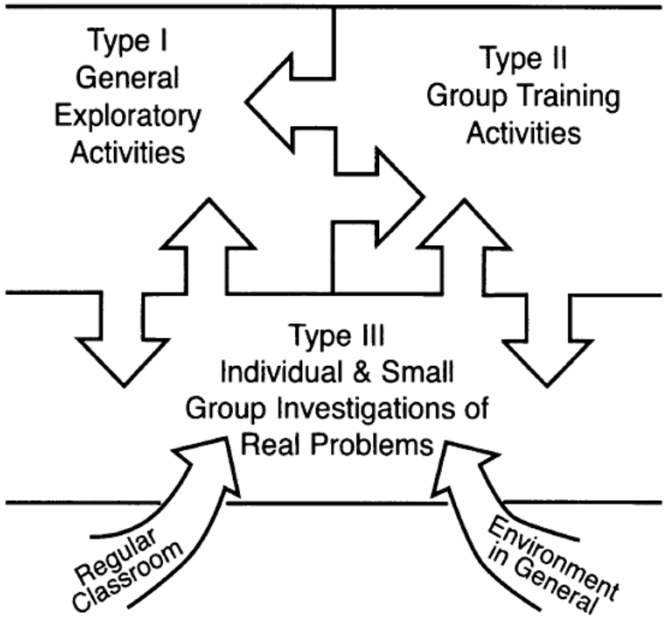
The aim of the project must be a work or **product** that should be provided to an external client

Problem solving has to be done by the **project group alone**

The framework for a project is always a **fixed schedule**.

The teacher has to act like a **coach** rather than like an instructor

Best practice: Gifted education at the DLR_School_Lab Oberpfaffenhofen



Schoolwide Enrichment Model
(Renzulli, 2010)

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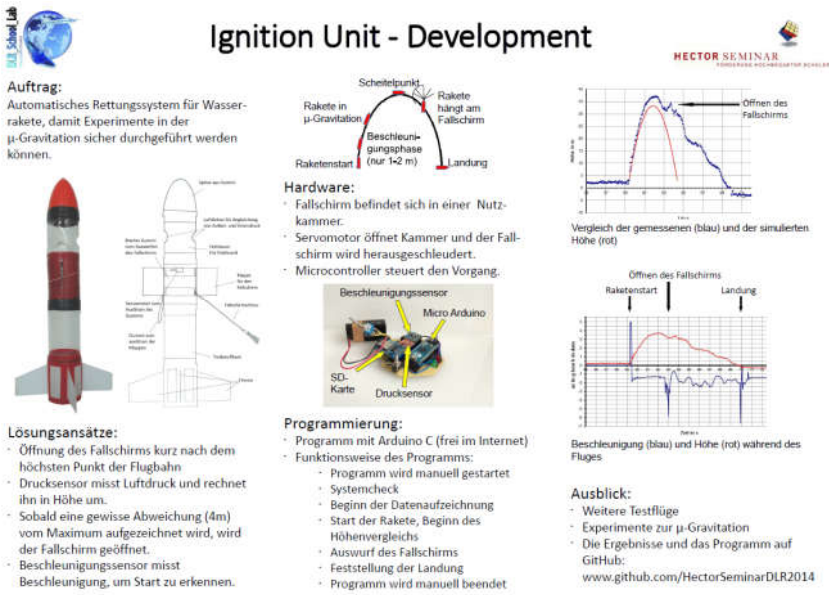
Best practice: Enrichment Projects of DLR_School_Lab OP with the Hector Seminar

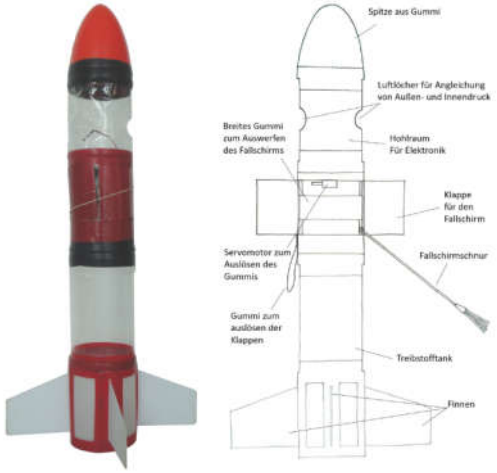
2004	Space Robotics
2006	Geophysics/ remote sensing
2008	Galileo Satellite Navigation
2010	Mars Robotics
2012	Galileo-Simulator
2014	**Ignition-Unit-Development**
2016	**High Altitude Ballooning**
2018	Flying home from the lower Stratosphere
2020	<under development>

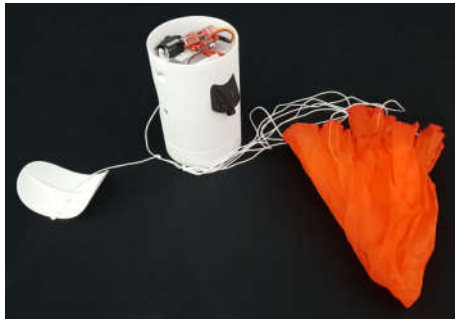


Best practice: Enrichment Projects with the Hector Seminar

Characteristics

- Inspiring subjects
- Clear and easy-to-understand objective
- Challenging task
- Product orientation
- Real (!) research

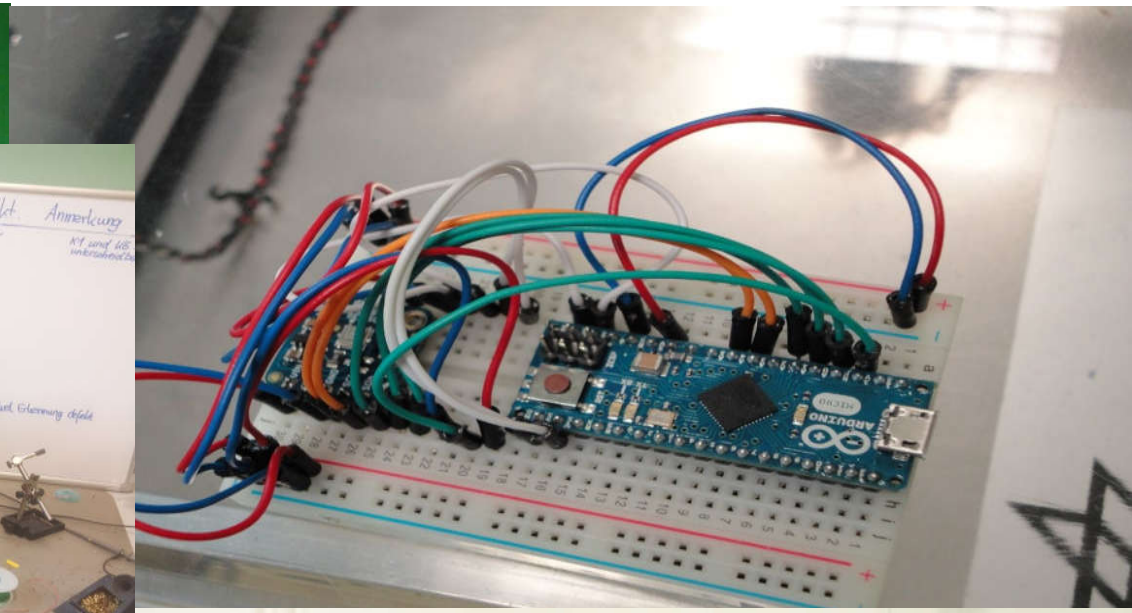


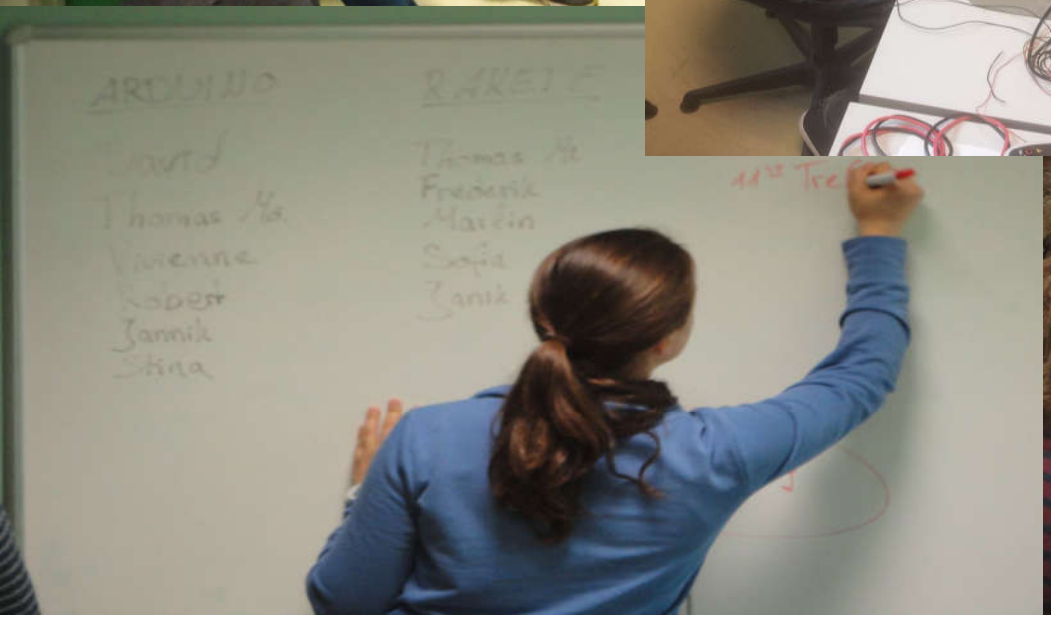


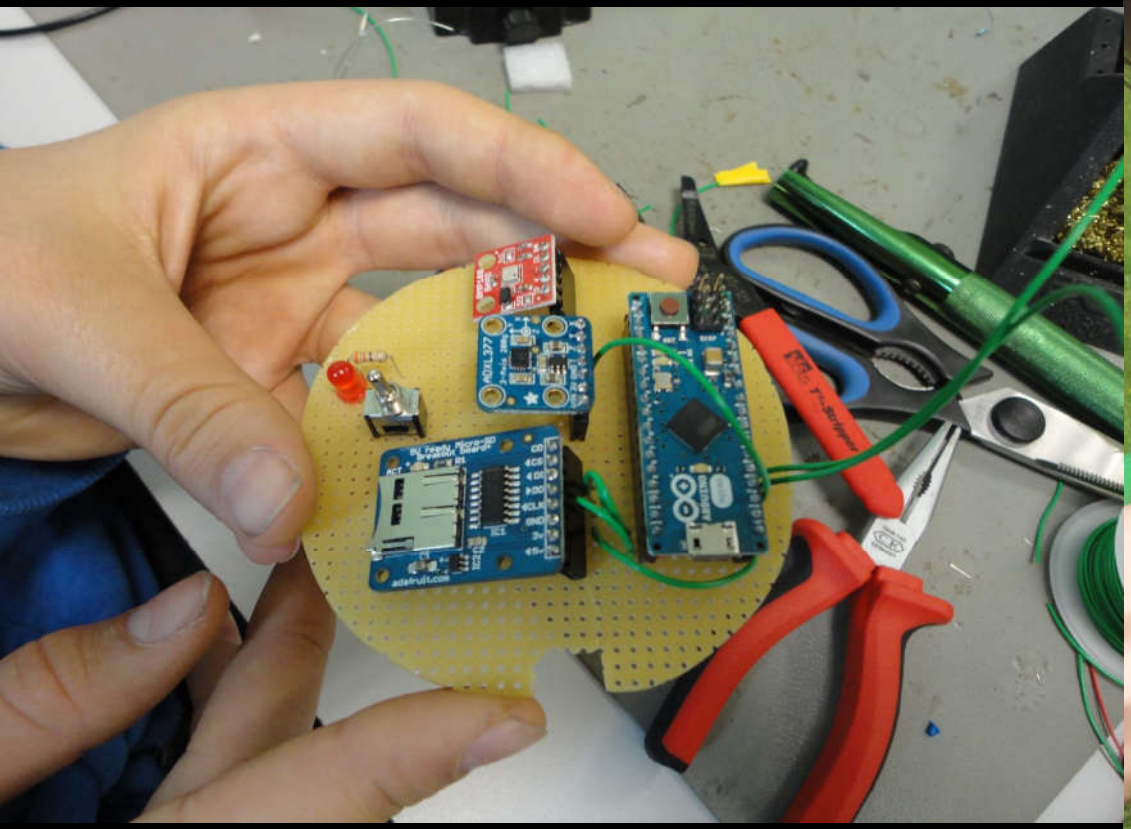
- Rockets, Satellite technologies, robotics, atmosphere research…
- E.g.: “Create a safe (!) recovery system for a model rocket”
- The parachute must open automatically
- The system will be used for teaching at the DLR_School_Lab
- Product invention, basic research


HELMHOLTZ-TAG

Flst. Anmerkung


ARDUINO


ARDUINO
RAKETE
Thomas
Vivienne
Robert
Jannik
Stina
Thomas
Frederik
Marvin
Sofia
Janik



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Enrichment projects related to space: opportunities and challenges

Opportunities

- ✓ Very motivating
- ✓ Close connections to current research
- ✓ Various possibilities to continue
- ✓ Interdisciplinary approach
- ✓ Lots of different subjects and objectives

Challenges

- ✓ Technically demanding
- ✓ Scientific skills
- ✓ Cooperation with research facilities necessary
- ✓ Availability of required technology
- ✓ Role of the teacher


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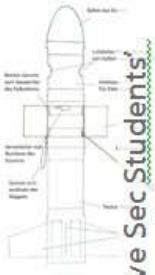
STEM Talent Support by Innovative Sec Students' Experiments in Aerospace Science and Technology



Ideas for an Innovative Sec Students' Experiment

Context: _____

(reference to „real" research, main topic (e.g. robotics, rockets, satellite navigation…)

Target Group: _____

_____

(age, (fore)knowledge, qualification, number of participants etc.)

My „Nerd Field" : _____

_____

(special subject, in which the supervising teachers (!) already have in-depth expertise and competences, e.g. arduino, water rockets, functionality of GPS and Galileo etc.)

Project Goal:

_____

_____

_____

_____

(innovative product, research subject… - possible approach: „If I had the time, I'd like to try/develop the following in my "nerd field":…")

Type of Product: _____

(basic research/feasibility study, product, possible spin-off…)

Realization:

(time frame, general framework at school – how could this project be made concrete? Which supervisors/ framework conditions would be necessary?)

Would you like to distribute your project idea and receive other ideas by email?
Please enter your email addresse here:

Date: email:

_____


Thank you for your attention!
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Contact: dieter@hausamann.de
NASA

Literature

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