University of Zurich[UZH]

UZH Space Hub

Giving Science Wings

Publishing Information

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A Zeppelin NT in the morning mist at the
Dübendorf military airfield in June 2018
(R. Sablotny)

Contents

The UZH Space Hub is an aerospace innovation cluster run by the University of Zurich.

Biomedicine, life sciences, digitalization, and aerospace are the strategic themes dealt with in the UZH Innovation Hub.

The UZH Space Hub combines academic research in the fields of Earth observation, life sciences and astrophysics, and promotes their use within business.

The cover image shows the "Dragon" transport capsule carrying out a docking procedure with the International Space Station (ISS). Dragon regularly supplies the astronauts with everyday items, delivers new setups for scientific experiments, and picks them up at a later point in time to take back to Earth for evaluation. A number of experimental systems from the UZH Space Hub have already made their way to and from the ISS. The small photos on the cover page show themes that are characteristic of the three focus research areas of the UZH Space Hub (from top to bottom): using a hyperspectral camera installed in a Zeppelin airship to detect plastic in water (Earth observation); the Lucerne-based researcher Simon Wüest enjoying a parabolic flight (he is studying the behavior of chondrocytes in microgravity conditions); a computer simulation of the genesis of Jupiter.

Aspiring pilots with their teacher at the Dübendorf airfield in 1918. (DDPS)

The first steps taken by humankind on another celestial body: Astronaut Buzz Aldrin on the Moon as part of the Apollo 11 mission, 20 July 1969. (NASA)

Foreword

Giving Research Wings

Research and innovation have been two central themes of the Dübendorf airfield from its very beginnings. The first pilots operating from the airfield were characterized by an innovative spirit, technical expertise, and a sense of adventure. They stand at the very forefront of the history of Swiss aviation.

We now find ourselves in the age of space exploration and enjoy an unprecedented level of mobility. The horizons of humankind have expanded enormously, as air and space travel are developing at a rapid pace. Back in 1895, heavier-than-air flying machines were considered an impossible concept; however, these "impossible" flying machines took to the air on schedule ten years later. Just 74 years after the first successful aircraft launch, humanity landed on the Moon. In the space of only two generations, humankind had not only managed to take to the skies, but had also traveled into space and landed on another celestial body. Nowadays, space probes are exploring the Solar System, with humans set to follow them one of these days. Air and space travel were and still are a magnet for visionaries as well as the curious and bold among us.

A magnet for visionaries as well as the curious and bold among us – this is how Oliver Ullrich (pictured here in front of the A310 ZERO-G) sees the future of the UZH Space Hub.

The University of Zurich scientists from the UZH Space Hub rank among the most experienced experts in the world. They know that you can neither coordinate nor schedule ideas and ingenuity. It's quite the opposite, in fact: new developments often appear out of the blue, are provoked by external factors, are difficult to achieve, and take time to come to fruition. New developments have an unsettling effect, reveal our limits, and at the same time display the opportunities available to us.

Without a measure of entrepreneurial courage, no innovations would be able to realized, regardless of how groundbreaking they are. New developments also need the right environment to ensure that the first spark of an idea is not stamped out by a lack of encouragement and a sense of small-mindedness. The extremely strong partnership between the Innovation Park and the airfield in Dübendorf can be harnessed to develop a sense of curiosity and achievement, as well as knowledge and a willingness to take risks. This is what we stand for and what we work toward.

Prof. Dr. Dr. Oliver Ullrich
Director UZH Space Hub

A photograph of the University of Zurich's City Campus and the Limmat river, taken from the Zeppelin NT. The shadow of the Zeppelin airship can be seen on the university's main building. (R. Sablotny)

Foreword

Prof. Dr. Michael Schaepman
Vice President of Research,
University of Zurich
Professor of Remote Sensing,
Department of Geography

Dr. Maria Olivares
Head of Innovation
University of Zurich

Ready for Take-Off

Research, education and innovation for the UZH Space Hub

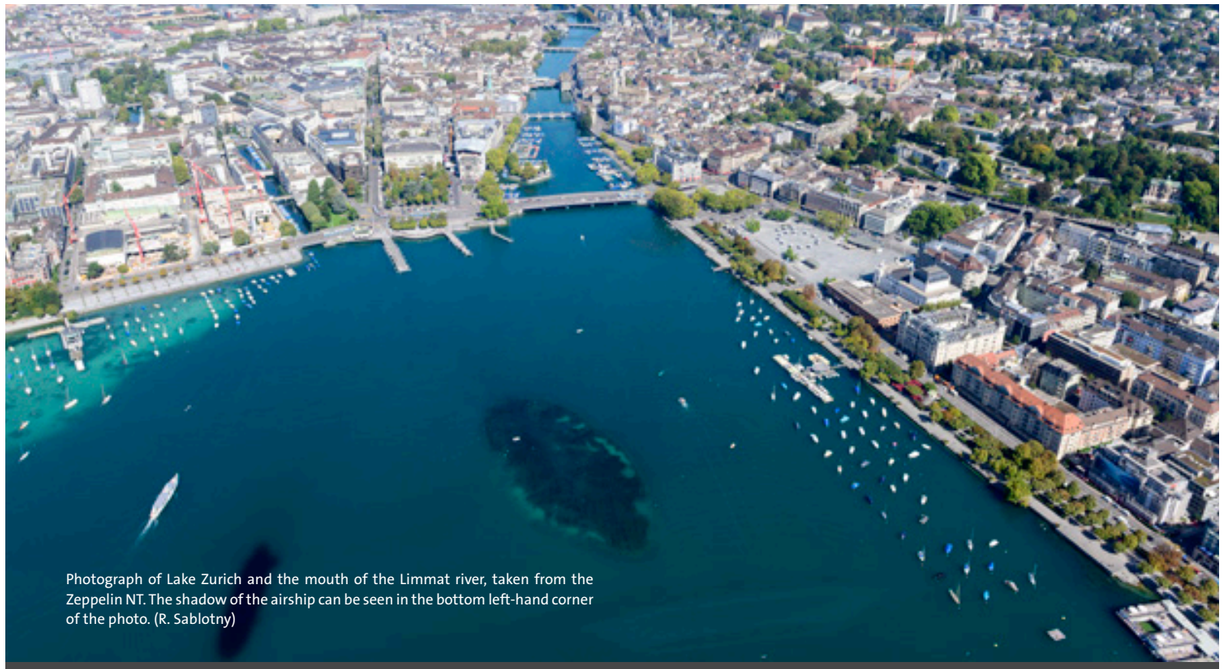
The University of Zurich (UZH) has a long tradition of innovation. Basic research serves as the ideal basis for innovative discoveries and inventions. In addition, research-inspired teaching provides the foundation for enabling students to develop their skills and achieve their learning objectives. In other words, it allows pioneering research to be efficiently translated into innovative applications through the interplay of interdisciplinary activities. Research, education and innovation are the cornerstones for realizing visions.

A great many discoveries and inventions made by the various disciplines from within UZH have proven to be extremely successful and useful for society as a whole, and have led to new products, services and applications. The innovative strength of UZH is not least reflected in more than 300 active licenses. In addition, a spin-off company is founded every two months. UZH has thus cemented its place as one of the most innovative universities worldwide.

Today, many novel technologies can be used in space. At the same time, space is providing the inspiration for innovative ideas to be realized in a wide range of areas. A number of applications, including GPS for example, are now an indispensable part of everyday life. In the future, the sharp demarcation between space and other areas will no longer exist though. This means that the vision of Space 4.0 will expand and build on the ideas of New Space with a focus on inspiration, information, innovation and interaction in space. New research, teaching and innovation enables to exceed existing boundaries and to open up new opportunities in space and aviation.

Novelity requires diversity. New points of view and innovative perspectives can only be developed by ensuring the interplay of non-technical and technical disciplines. At UZH – the largest comprehensive university in Switzerland – an emphasis is therefore placed on interdisciplinary collaboration. The UZH Space Hub is a good example of this: researchers from a wide range of areas meet here to discuss issues concerning every aspect of space and aviation, including mobility, robotics, medicine, astrophysics and remote sensing. The portfolio thus ranges from basic research to research-focused collaborations with partners from academia, industry and the startup scene. This represent an ideal basis for the innovations of tomorrow.

The UZH Innovation Hub as the platform for innovation and entrepreneurship at the University of Zurich provides dedicated support to the activities carried out at the UZH Space Hub. It strengthens the visibility of academic innovation successes and promotes entrepreneurial thinking among researchers and students through a wide range of offerings and activities. The UZH Space Hub – one of the thematic areas of the UZH Innovation Hub – is positioning itself at the forefront in this respect. Ready for take-off!



Photograph of Lake Zurich and the mouth of the Limmat river, taken from the Zeppelin NT. The shadow of the airship can be seen in the bottom left-hand corner of the photo. (R. Sablotny)

Vision

As a founding member of the ESA (European Space Agency), Switzerland was one of the first "space countries" in Europe. A large number of satellites and research missions to space are equipped with cutting-edge technology developed in Switzerland. Scholars from Switzerland hold leading positions in international research activities and are enjoying success on an international level.

Switzerland is one of the most innovative countries in the world, as was emphasized by Zurich government councilor Carmen Walker Späh and the federal councillor Johann Schneider-Ammann at the opening of the Innovation Park in Dübendorf on 2 February 2018.

Air and space travel rank among the key drivers of research, engineering and innovation, create significant added value, and play an important role for the Swiss economy. This will become even more pronounced in the future, as digitalization, self-flying aircraft, new Earth observation technologies, the exploration and use of space as a workshop for research, development and production as well as missions to explore the solar system and investigate the universe are tasks for which Switzerland is well prepared. The country can take on leading roles in these areas and in doing so enjoy economic growth and create a great deal of added value.

The UZH Space Hub brings together expert knowledge in the areas of Earth observation, space life sciences, astrophysics and aviation, thus helping to reinforce Zurich's position as a hub of innovation. The UZH Space Hub works in close collaboration with the Swiss Federal Institute of Technology Zurich (ETH Zurich), Empa (the Swiss Federal Laboratories for Materials Science and Technology), and other first-class research partners in a highly active aerospace cluster in the Innovation Park in Dübendorf.

The UZH Space Hub provides independent and direct access to key platforms for space and aviation, such as Earth observation missions, parabolic flights, suborbital flights and the International Space Station, at the Dübendorf airfield and via its partners located throughout Switzerland. It inspires brilliant young students and graduates and acts as a launch pad for new discoveries, technologies and enterprises. The UZH Space Hub gives ideas wings and removes the barriers attempting to stop this from happening.

Due to the Innovation Park and the airfield being situated close to established research facilities and companies, an ideal environment that is unrivalled in Europe has been created with a focus on research, development and entrepreneurship. The Dübendorf region is thus becoming a center of innovation for aerospace.

The times of Old Space, when space flight was controlled by major authorities with an excessive level of bureaucracy and when utilization of space was still considered to be expensive, elitist and of no worth to people on the ground are long gone. The liberalization of access to space in the era of New Space is making research and commercial activities in space considerably cheaper, simpler and more accessible. Space is being increasingly transformed into a workshop, a place for research and development, and an obvious destination for human mobility.

As a country that is a leader in both science and technology with a level of freedom and innovative capacity that is unrivalled in Europe, Switzerland – together with its partners – ought to be playing a leading role in space and aviation. In this respect, the Dübendorf airfield and its unique combination of aviation and research activities is particularly important.

Dübendorf could in future become a powerful center for the economy, industry, academic learning and innovation. A Center of Competence for space and aviation with international reach could be established here – at the exact location where Swiss aviation first began more than 100 years ago.

The opening of the third Swiss Parabolic Flight Campaign in Dübendorf, in which research teams, company representatives, and private individuals took part in June 2018. Photo: Natalie Dové from Dovespace and Oliver Ullrich. (UZH)

A helicopter approaching for landing at Dübendorf. (DDPS)

Dübendorf Airfield

The Dübendorf military airfield (ICAO code: LSMD) is today home to the operational command of the Swiss Air Force with the Air Operations Center (AOC), the Skyguide air navigation center, the "Air Force Center" with the Flieger Flab Museum and the Ju-Air association, as well as various maintenance companies.

The military airfield used by helicopters and Swiss Air Force fixed-wing and special aircraft belongs to the Swiss federal government and is located between the municipalities of Dübendorf, Volketswil and Wangen.

Dübendorf Reinvented

Research flights supported by the Swiss Air Force

In 2014, the Swiss federal government made the decision that the Dübendorf military airfield site would in future be used for military and civilian aviation, and that a national Innovation Park would be constructed on the site by the Canton of Zurich.

The Government Council of the Canton of Zurich attests that the Innovation Park will provide "first-class conditions for the optimal development and linking up of the economy and research". This combination of research activities and an airfield is a one-of-a-kind prospect in Europe and an advantage for the competitiveness of the Zurich economic region.

Thanks to the Swiss Air Force, UZH has been allowed to use the military airfield for research purposes for many years. From 2015 onwards, UZH and the university-affiliated, non-profit organization Swiss SkyLab Foundation organized three parabolic flights campaigns with the Airbus A310 ZERO-G and two research campaigns with the Zeppelin NT.

Research being carried out on the Zeppelin NT from Dübendorf airfield. (R. Sablotny)

The crew of the AVIRIS-NG research flights carried out together by UZH and NASA at Dübendorf airfield, headed by Andreas Hueni (second from right) and Michael Schaepman (second from left). (A. Hueni)

Research flights were recently carried out – in collaboration with the US space agency NASA – as part of the UZH Research Priority Program Global Change and Biodiversity. The aim of this is to further develop modern methods to measure biodiversity and to yield more reliable and robust knowledge about global change processes.

The good working relationship between UZH and the Swiss Air Force goes back many years, starting in the field of Earth observation and then also continuing into life sciences from 2010 onwards. As part of this working relationship, a small laboratory developed by UZH for cell experiments was installed in the munitions box of an F-5E Tiger in order to take measurements during parabolic maneuvers.

The UZH Space Hub speaks up for the complete retainment of the aviation infrastructure on the future civilian airfield, particularly for the entire length of the runway, which measures 2,355 meters. It is absolutely essential that this runway be so long, as otherwise serious research flights would not be able to be carried out. Such a large runway is needed so that large research aircraft such as the DLR A310 ZERO-G and A320 ATRA can continue to take off and land in Dübendorf.

Taking off to establish a microgravity environment: the starting sequence of the Airbus A310 ZERO-G at the Dübendorf military airfield. (R. Sablotny)

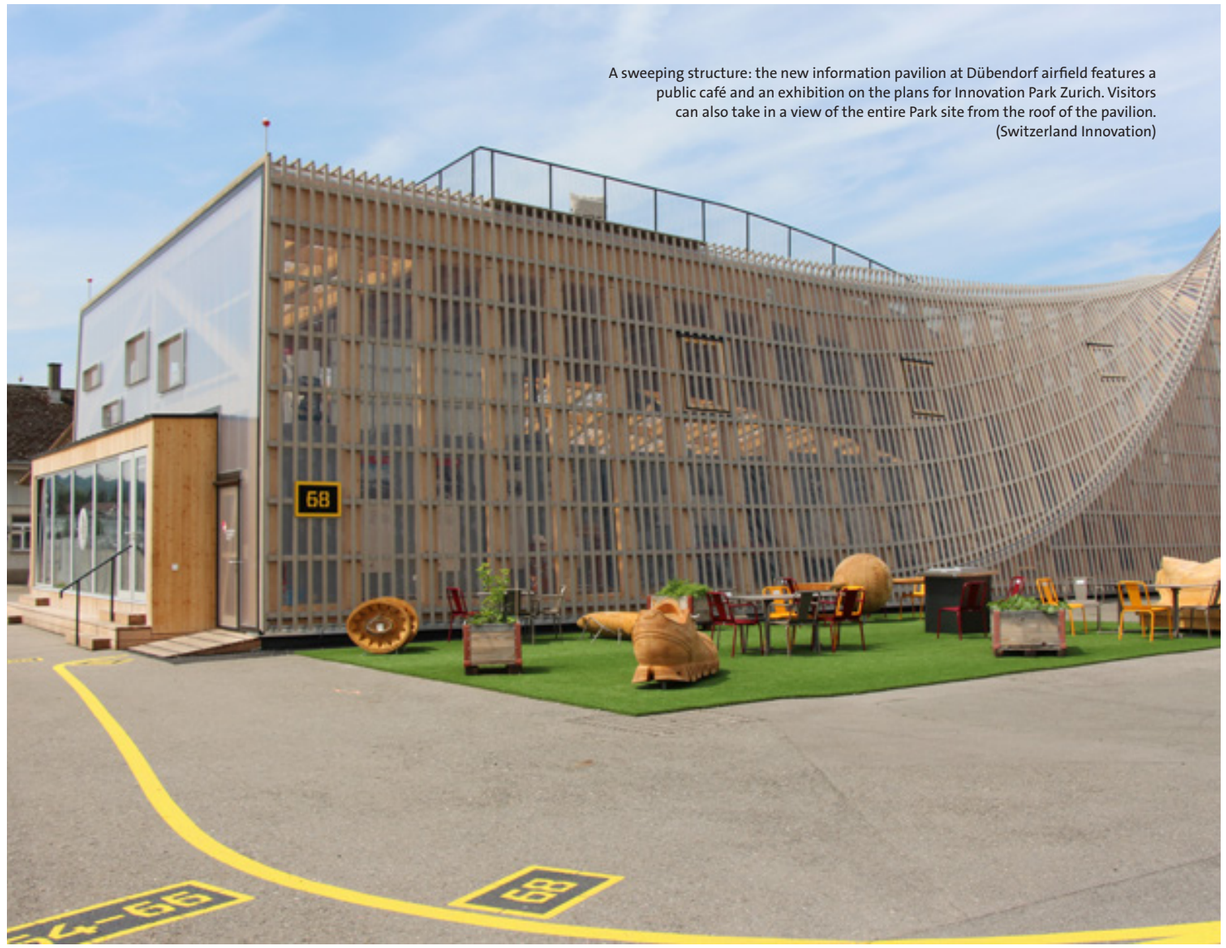
Innovation Park Zurich

The bus stop has already been named "Innovationspark Zürich", visitors flow in and out of the artfully designed meeting and information center, and self-driving vehicles and drones are tested in Hangar 3. Opened in March 2018 in the presence of many important figures, the Innovation Park Zurich is noticeably taking shape.

The worlds of academia, business and politics are coming together with high expectations behind this monumental project on one of the largest developable areas of land in the country. In the medium term, the plan is for the Innovation Park to house renowned research facilities and companies, which will devise new ideas for products and services, and then develop these quickly so that they are ready for market launch. The aim of the Innovation Park is for it to become an extremely attractive location for knowledge-based companies and thus ensure that the Canton of Zurich, and Switzerland as a whole, remains competitive as an international location.

To this end, we want to focus on the special innovative potential offered by academia and businesses from the surrounding region, for example mobility and transportation, advanced manufacturing, heath & life sciences, energy & natural resources, as well as digital technologies and data science.

Aerial photo of the Dübendorf airfield. (DDPS)



A sweeping structure: the new information pavilion at Dübendorf airfield features a public café and an exhibition on the plans for Innovation Park Zurich. Visitors can also take in a view of the entire Park site from the roof of the pavilion. (Switzerland Innovation)

The Innovation Park Zurich houses pioneers from local universities and research facilities. As part of the UZH Space Hub program, the first parabolic flight for performing experiments in a microgravity environment took off from Dübendorf airfield in 2016.

The Swiss Federal Institute of Technology Zurich (ETH Zurich) is also working on site with a focus on robotics and mobility, and the Swiss Federal Laboratories for Materials Science and Technology (Empa) is developing modern production technologies here.

Scientific work is initially being carried out in the existing hangars, which are gradually being converted into laboratories and offices. Construction of the new buildings will begin once the current planning process has come to an end. The next step is for companies that fit the profile of the Innovation Park to set up their operations here.

The airfield, hangars and the attractive environment being developed for the future, offer the ideal research conditions for the UZH Space Hub.

"A great many skill sets and competencies are pooled together in a small space in Dübendorf," says Oliver Ullrich, Director of the UZH Space Hub. "This center is the only one of its kind in Europe and provides an environment for academia and business organizations to carry out unhindered research – both on the ground and in the air."

Research

In November 2016, Prof. Jan Wörner, Director General of the European Space Agency (ESA), explained his vision of Space 4.0, i.e. the upcoming era of openness and cooperation in space flight with new knowledge, new growth, new tools and new inspiration. In the old Space 3.0 concept, space flight was largely shaped by the interests of the national space agencies, whereas in Space 4.0, we will see a rapid change in space flight, with more space-faring players, private investors, new applications and new technologies being involved. Humankind has expanded its mobility, its sphere of influence and its horizons in space. Universities play a decisive role in generating and utilizing new knowledge.

The UZH Space Hub takes research to the skies at the Dübendorf airfield. It is bringing together three fields of study from the University of Zurich that have research projects that are extremely relevant for aviation and space flight: Earth observation, space life sciences – this field focuses on biomedical research under space conditions – and astrophysics. As part of the Innovation Park Zurich, the UZH Space Hub is working hand in hand with national and international partners from research and industry, as well as the Swiss Air Force. This provides academia with access to the requisite flight platforms, whether it be directly in Dübendorf or via partnerships all around the world. A nucleus has been created.

Research Topics

Earth Observation

Synthetic aperture radar (SAR) Lab
Environmental SAR
Spectroscopy Lab
LiDAR (Light Detection and Ranging) Lab
Spectroradiometric Observing Systems
Laser Scanning and Vegetation Structure
Light-Matter Interactions and Biodiversity
Spatial Genetics
Spatial Ecology and Remote Sensing
Remote Sensing of Water Systems
Earth System Science
Glaciology and Geomorphodynamics
Proximal and Remote Sensing
Remote Sensing Laboratories Services

Space Life Sciences

Gravitational Biology and Biomechanics
Space Biotechnology
Space Medicine
Fluid Physiology
Musculoskeletal System
Tissue Regeneration
Alternatives to animal experiments
Hypoxia and extreme environments

Astrophysics

Cosmology
Large scale structure
General relativity
Galaxy formation
Interstellar medium
Stars and planets
High Performance Computing
Data Science

Robotics

Vision-based navigation of micro aerial vehicles (MAVs)
Event-based vision
Active vision
Machine Learning
Autonomous Flying

A vista of the Sun setting over the Gusev Crater on Mars on 19 May 2005; photo taken from the Mars Exploration Rover Spirit, NASA. (NASA, JPL)

Earth Observation

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The TEXUS-54 suborbital rocket launching into the skies at the ESRANGE Space Center near Kiruna,

Space Life Sciences

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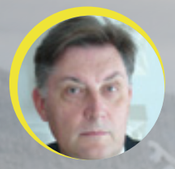

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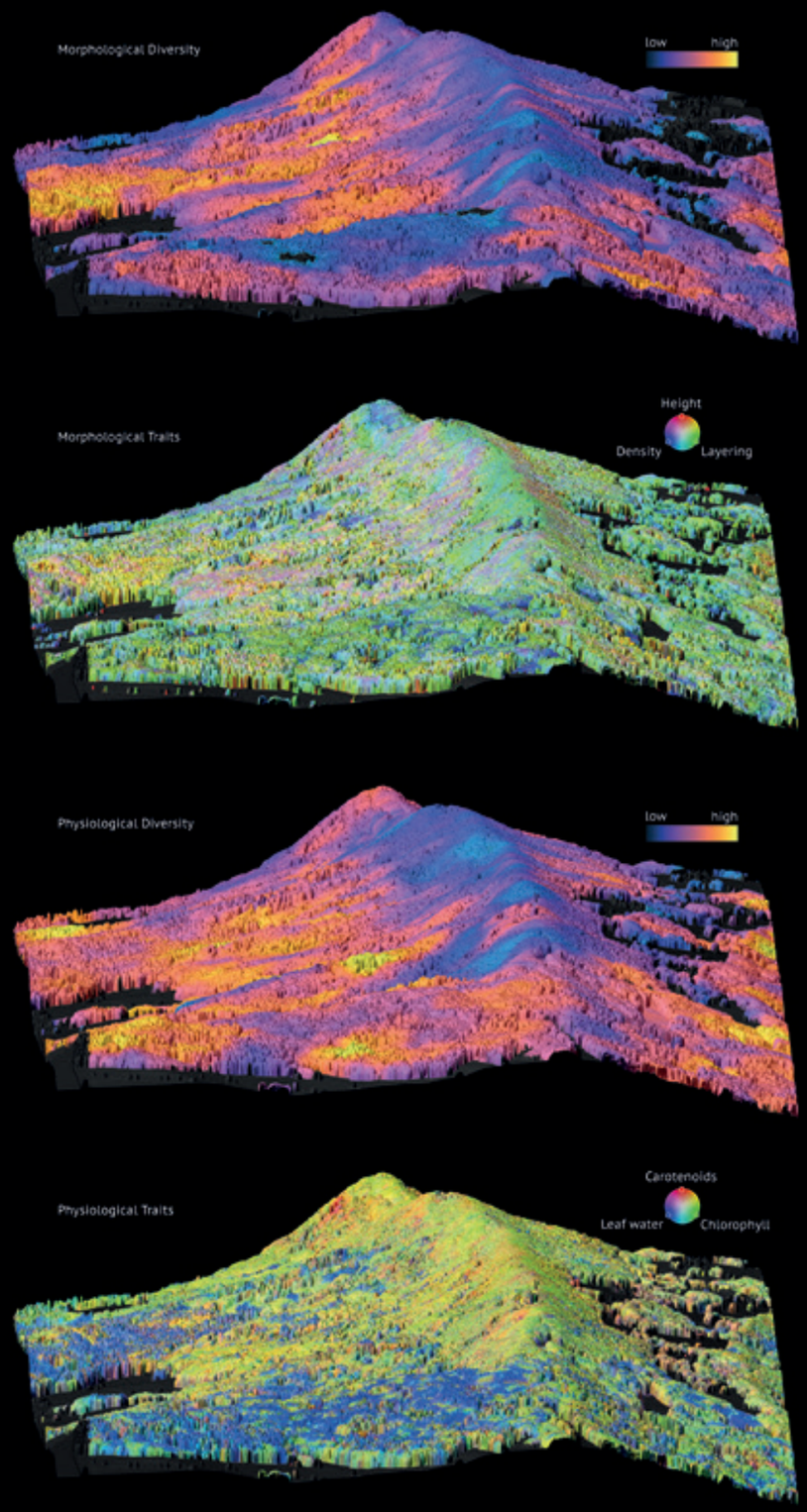


Mapping biodiversity with morphological and physiological traits of the Lägern forest. (RSL, UZH)

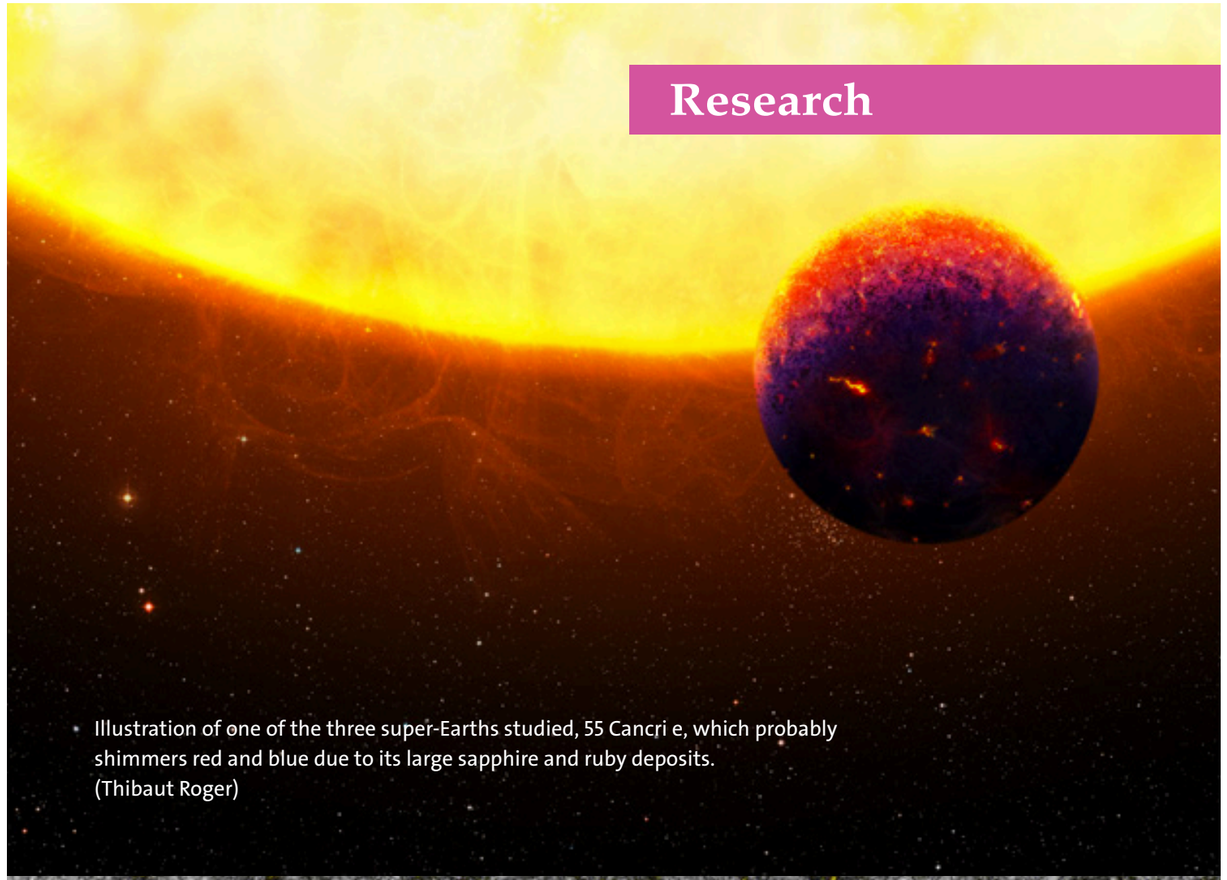
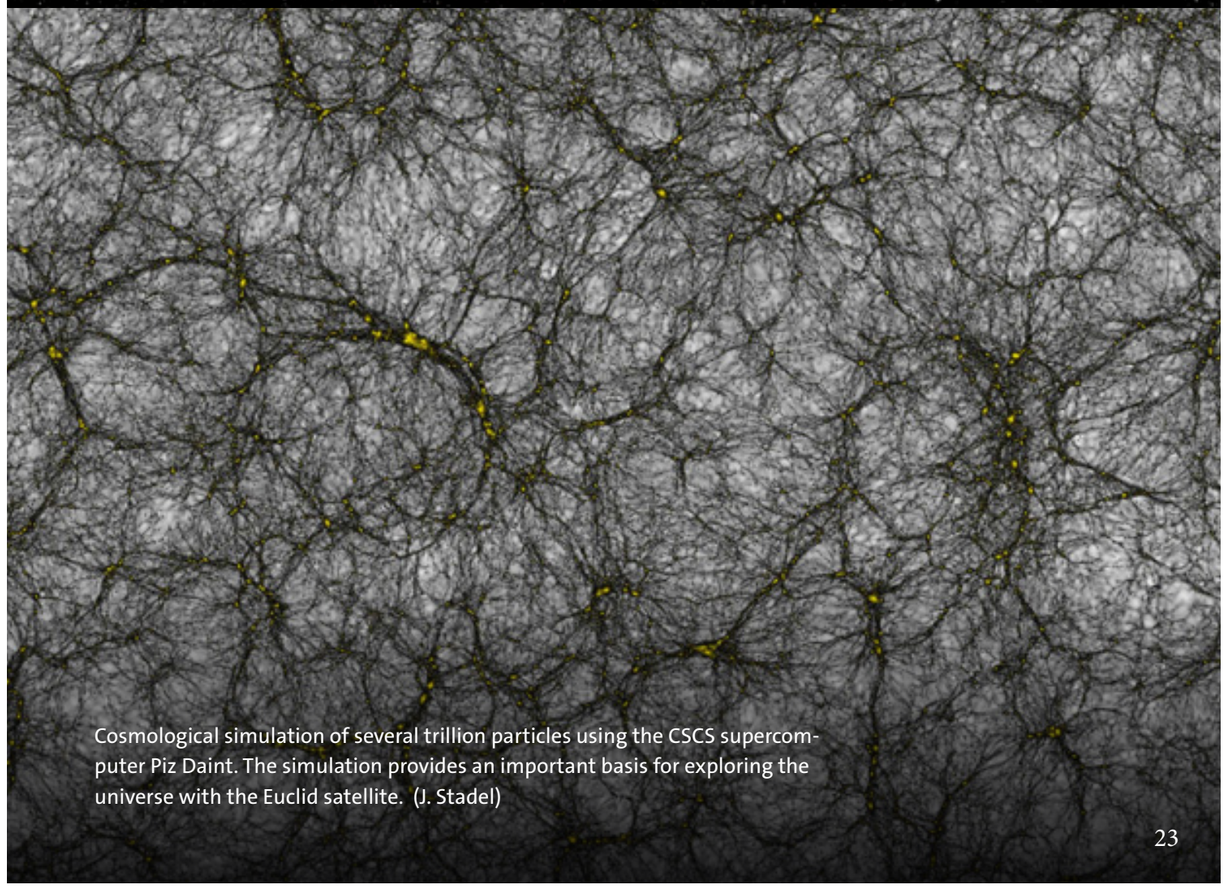
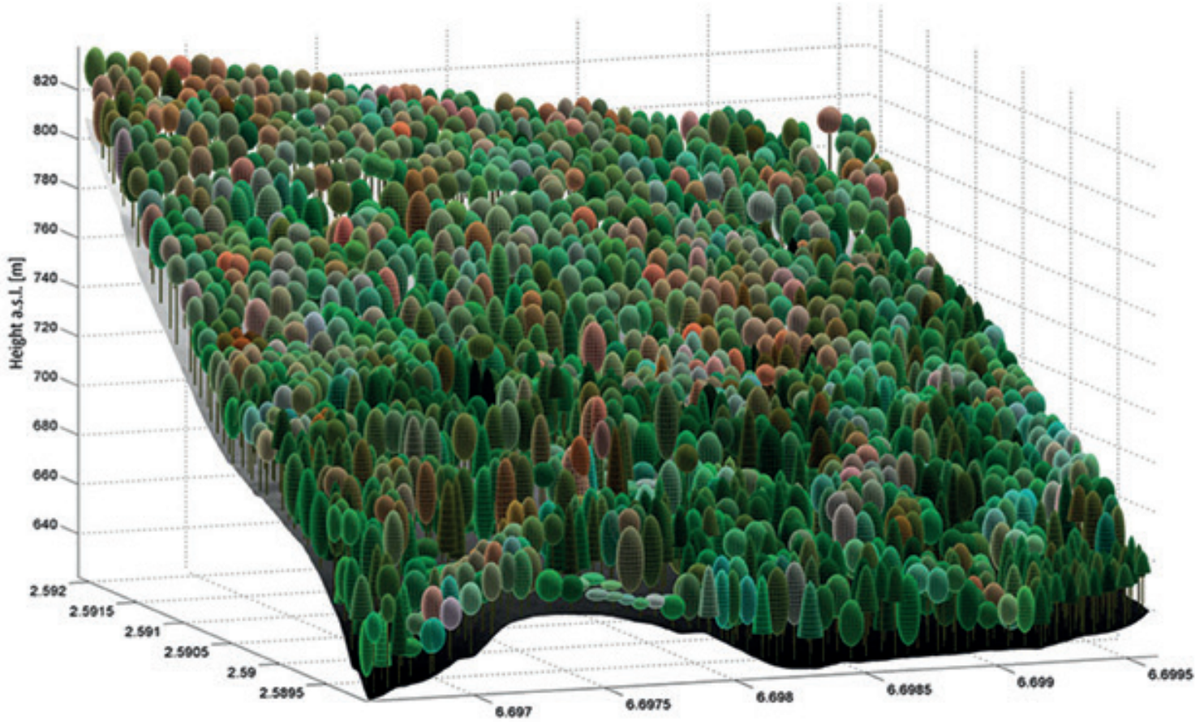


Illustration of one of the three super-Earths studied, 55 Cancri e, which probably shimmers red and blue due to its large sapphire and ruby deposits. (Thibaut Roger)



Cosmological simulation of several trillion particles using the CSCS supercomputer Piz Daint. The simulation provides an important basis for exploring the universe with the Euclid satellite. (J. Stadel)



The image shows a three-dimensional model of parts of the Lägern. Here, UZH researchers are testing new methods of recording the effects of climate change on biodiversity.
(UZH / R. Leiterer)

Earth observation

Researchers in the area of Earth observation are looking to obtain a better understanding of the Earth and its ecosystems. Using special sensors installed on drones, aircraft and satellites, the researchers collect information on the processes taking place on the surface of the Earth and in the atmosphere.

By taking repeated measurements, it is possible to document any changes and record human impact on regional, national and global ecosystems.

Earth observation has taken up residence in the Department of Geography at the University of Zurich. The academics in the largest geography department in Switzerland are involved in a great many international academic cooperations, for example the GlobDiversity project funded by the European Space Agency (ESA), which is studying the biological diversity of global ecosystems. With the help of an imaging spectrometer named APEX, researchers can, as another example, measure the concentration of emissions in the atmosphere or the health of plants from an aircraft or an airship.

The Zurich-based geographers are using drones as platforms for taking high-resolution aerial photos. When used in combination with the information provided by radar satellites, these images allow, for example, warnings to be issued when there is an avalanche risk in the Alps.

In the Spotlight

MEREDITH SCHUMAN

Ecologist
Professor
Remote Sensing Laboratories
Department of Geography

"The UZH Space Hub provides my research with completely new perspectives," says a delighted Meredith Schuman. The American professor researches and teaches remote sensing within the Department of Geography. Her work could catapult biodiversity research to a new level: Schuman and her team want to use the genetic characteristics of plants to determine the diversity of ecosystems and the way in which these are changing – with all measurements taken from airborne platforms. The UZH Space Hub has promised the academics easy access to drones, aircraft, and in the future satellites.

At the moment, a team of scholars including Meredith Schuman are working together with NASA to develop an extremely sensitive spectrometer. The aim is to be able to use the spectrometer from lofty heights to analyze plants all the way to a molecular level, record their reactions to environmental changes, and document how they interact and coexist with other organisms. This will fill important gaps in the understanding of natural communities and enable new approaches to the observation and management of these communities under climate change.

"It would be cool to have an experimental garden on the Space Hub grounds," says Schuman, who studied molecular biology in the US before moving to Jena to conduct research in molecular ecology and then joining UZH in 2018. In an experimental ecosystem, she could study the correlations between the phenotypes and genetics of plants under standardized conditions. "It would be wonderful to be able to show interested members of the public our research facilities in Dübendorf," proclaims Schuman.

In the laboratory at the ESRANGE Space Center near Kiruna, Sweden, tests are being prepared to be carried out during an experimental suborbital rocket flight.
(R. Sablotny)

Space life sciences

Our bodies are perfectly attuned to the gravity on Earth. This helps our bones, muscles, organs and immune system to function properly. The strength of the force also known as gravitation has not changed for around four billion years, i.e. since our planet Earth came into being.

Gravity has for a long time been taken for granted. This only changed when humankind made the voyage into space and was exposed to weightlessness there. Fundamental research is just beginning to understand the influence that gravity has on life on Earth, organisms as a whole, and individual cells. Conversely, it is becoming increasingly clear what would happen to the body in the absence of gravity.

For example, your sense of balance would decline, bones and muscles would deteriorate, and the immune system would become weaker. To ensure that astronauts remain healthy in spite of this, aerospace medicine has come up with numerous strategies.

This also benefits preventative healthcare and therapy for normal Earth dwellers, particularly older people. The targeted use of microgravity is becoming increasingly interesting, i.e. as a tool for producing tissues and organs.

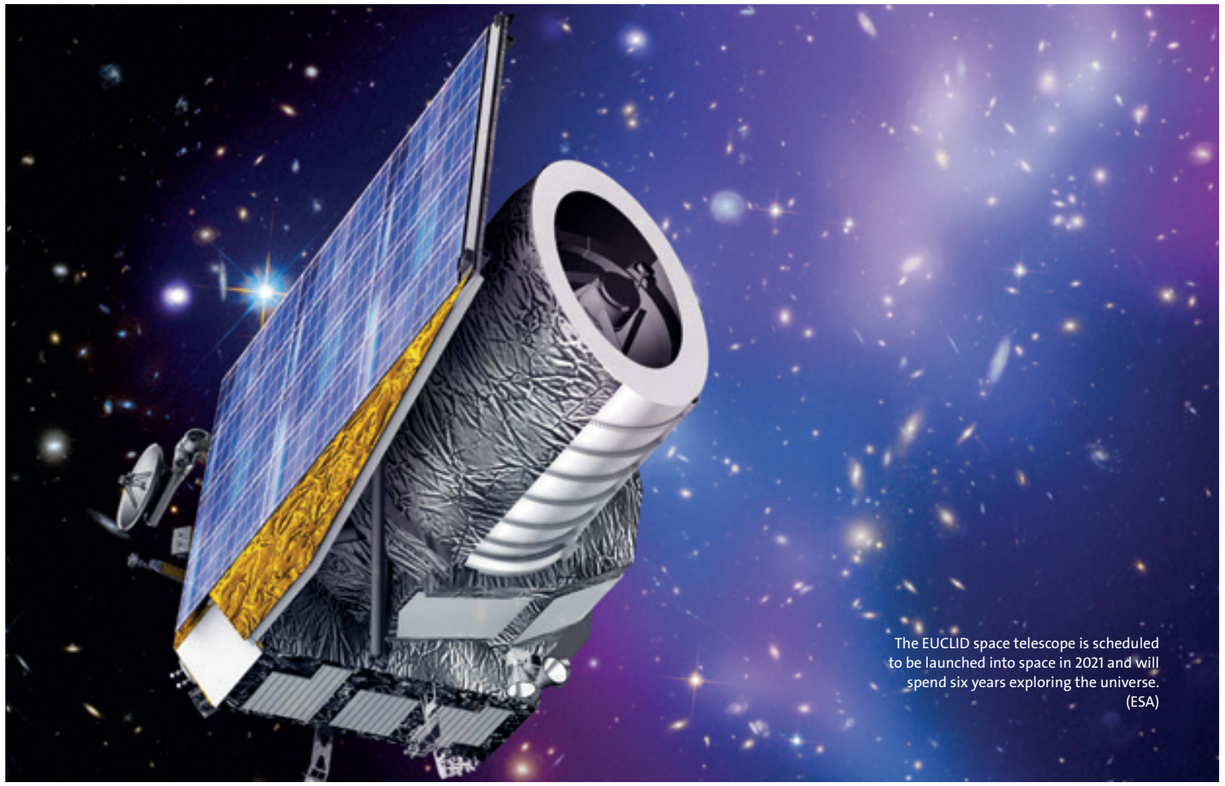
In the Spotlight

CORA THIEL

Molecular Biologist
Research Group Leader
Institute of Anatomy
Coordinator Space Life Sciences of the
UZH Space Hub

Cora Thiel is from her own experience familiar with all the opportunities provided by research in microgravity. The UZH biologist and department head has already sent her experiments into the skies with rockets, in reduced-gravity aircraft, and to the International Space Station (ISS) – and to do so had to pass elaborate approval procedures outside of Switzerland. “Having access to the UZH Space Hub means that we have to deal with much less bureaucracy and makes our work massively easier,” says the spokesperson for the space life sciences research cluster. She is looking forward to working together with the interdisciplinary teams in Dübendorf: “The UZH Space Hub will bring together scientists from completely different fields of expertise and is a breeding ground for new research ideas.”

A research finding that Cora Thiel and Oliver Ullrich published following experiments carried out on the ISS attracted global recognition. The finding showed that the immune cells of mammals adapted fully to weightlessness in less than a minute. “This is very fast and indication that that our cells are better able to cope with weightlessness than previously expected,” says the experienced biologist, who has been carrying out research at UZH since 2012. In her next project, she and Oliver Ullrich want to find out how cells experience changes in gravity and what happens internally during and as a result of these changes. The Zurich-based academics want to conduct the relevant studies as part of an International Space Act Agreement with NASA. The results should help to assess the risks of long-term missions in space.



The EUCLID space telescope is scheduled to be launched into space in 2021 and will spend six years exploring the universe. (ESA)

Astrophysics

How did the universe and its galaxies, stars and planets come into being? What role do mysterious forces such as dark energy play? And what does the future have in store for the cosmos? These questions are being looked into by the astrophysicists at the University of Zurich, who specialize in computer-aided predictions of cosmic correlations and analyses of observational data.

To help develop these predictions, the academics use supercomputers in the Swiss National Supercomputing Center (CSCS) in Lugano. They are also involved in major international space missions aimed at collecting and analyzing new observation data. An example of this is the JUNO probe that was launched by NASA in 2011 to investigate the gas planet of Jupiter. The spotlight is currently on the EUCLID mission, in which the space probe created by the European Space Agency (ESA) is scheduled to be launched into space in 2021 to investigate how the universe is expanding and the role that dark energy, dark matter and gravity play. Preparations for the mission include a simulation of the way in which the galaxies are dispersed, which was created by UZH researchers. The modelling skills of the Zurich-based astrophysicists are also in demand for LISA, an ESA mission scheduled to begin in 2034. The challenge here is to collect the signals generated by colliding black holes in order to better understand how galaxies come into being, among other things.

The experiences gained from working with the LIGO Scientific Collaboration should prove beneficial to this work. UZH is a member of this international consortium for observing gravitational waves, as well as being a member of LISA and ACES (Atomic Clock Ensemble in Space). As a result, the general theory of relativity should be able to examined in greater detail from 2020 onward.

In the Spotlight

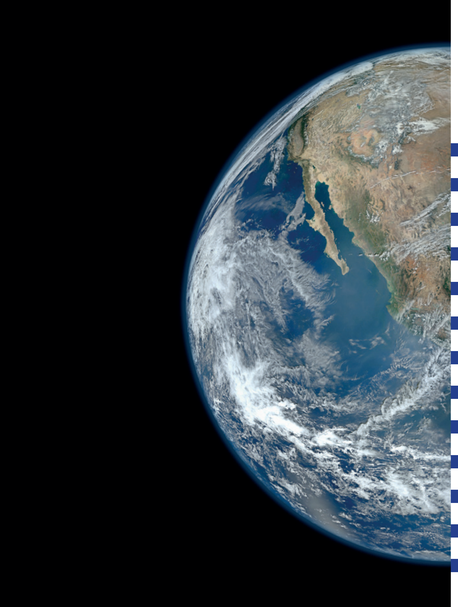
ROMAIN TEYSSIER

Astrophysicist
Professor of Computational Astrophysics
Center for Theoretical Astrophysics and Cosmology
Swiss delegate to the Euclid Consortium Board
Coordinator Astrophysics of the UZH Space Hub

"Our particular strength is in being able to analyze large volumes of data," says Romain Teyssier, spokesperson for the field of research of astrophysics at the UZH Space Hub. We have used this special expertise to help academics in other disciplines, e.g. in Earth observation projects. Together with colleagues from the Institute for Computational Science at the University of Zurich and from astrophysics research groups, Teyssier is looking forward to entering into enriching cooperations within UZH Space Hub. "This also opens up completely new opportunities for our students," says Teyssier.

The 50-year-old professor of computational astrophysics currently spends a large number of his working hours preparing for the EUCLID space mission. Within this mission, he is mainly interested in the distribution of matter in the universe. He applies his hypotheses to elaborate simulations and uses the supercomputers at the Swiss National Supercomputing Centre in the Canton of Ticino to test their plausibility.

"A separate space data center would be ideal for our work," says Romain Teyssier, who has been teaching and researching at the University of Zurich since 2013. The astrophysicist believes that such a data center for space research would not just benefit the UZH Space Hub: "Every academic in the country should be able to benefit from this." He continues by saying that this would not lead to a medium-term increase in the visibility of just Swiss astrophysics, but also of Swiss space research as a whole.



UZH Space Hub: Research Platforms

The UZH Space Hub uses various aircraft and air bases within Switzerland and abroad to carry out its research. The portfolio of aircraft ranges from drones that fly at ground level to deep-space probes. The flight platforms that the UZH Space Hub can offer itself or arrange to use include: drones, Zeppelin NT, A310 ZERO-G, APEX/ARES, F-104, MASER, FALCON 9, and the ISS

Drones	Flight altitude: 0–150 m Strengths: Highly mobile carriers of payloads/sensors	Areas of application: Unlimited, even urban areas and over difficult terrain Operator: UZH Space Hub
ZEPPELIN NT	Flight altitude: 150–3,000 m (usually 300–600 m) Strengths: Able to carry out precision maneuvers, float in exact positions, fly extremely slowly and remain in the air for a long time	Areas of application: Earth observation, environmental monitoring and agriculture Operator: Deutsche Zeppelin-Reederei (DZR), Friedrichshafen
A310 ZERO-G	Flight altitude: 5,000–10,000 m Strengths: The only crewed microgravity research platform in the Earth's atmosphere, large experimental area	Areas of application: Physics, materials science and engineering, biology, medicine, and technology testing Operator: Novespace, Bordeaux
APEX/ARES with small satellite	Flight altitude: up to 5,000 m Strengths: High-resolution imaging spectrometer	Areas of application: Earth observation, biodiversity research and environmental monitoring Operator: UZH Space Hub
F-104 Starfighter	Flight altitude: up to 23,000 m Strengths: Supersonic flight and microgravity parabolic flight for up to 2.5 min	Areas of application: Experiments in microgravity conditions and simulations of suborbital space flights Operator: Starfighters, Kennedy Space Center, USA
MASER rocket	Material Science Experiment Rocket (MASER) Flight altitude: 280 km (maximum ordinate)	Strengths: research in microgravity Operator: Swedish Space Corporation (SSC)
FALCON 9	Carrier rocket Strengths: High flight frequency, reliability, can be partially reused, and high payload (up to 23 t)	Areas of application: Uncrewed supply flights to the ISS, and transport of scientific experiments from Earth to the ISS and back Operator: Space X
ISS	Flight altitude: 400 km Goal: Carry out research into the Earth and space Name: International Space Station	Operator: NASA (USA), Roskosmos (Russia), ESA (Europe), CSA (Canada) and JAXA (Japan)
ESA Sentinel	Flight altitude: 700–800 km Goal: Earth observation	Operator: ESA Start: Multiple satellites since 2014
ESA FLEX	Flight altitude: 700–800 km Goal: Measurement of photosynthesis activities among vegetation	Name: Fluorescence Explorer Operator: ESA Planned start: 2023
EUCLID	Instrument: Space telescope Goal: Carry out research into dark energy and matter	Operator: ESA Planned start: 2022
JUNO	Instrument: space probe Goal: Carry out research into the genesis and evolution of Jupiter	Operator: NASA Start: 2011
LISA	Instrument: Three probes, arranged as a triangle with 2.5 million km between each probe. Preparation mission: LISA Pathfinder (with UZH involvement).	Name: Laser Interferometer Space Antenna (LISA) Goal: Measurement of gravitational waves Operator: ESA Planned start: 2034

The Right Platform for Every Question

Most of the UZH Space Hub flight platforms are used to answer questions from a wide range of academic fields. The icons next to the aircraft provide information about which fields have already made use of each of the "laboratories in the air". We expect that other areas of application will be added.

- Earth Observation
- Life Sciences and Medicine
- Astrophysics
- Biodiversity and Agriculture
- Digitalization
- Physical Sciences
- Technology
- Robotics

Currently active research flight operations from the Dübendorf military airfield: Airbus A310 ZERO-G, Airbus A320 DLR-ATRA, APEX/ARES (Cessna Caravan and Dornier 228) and the Zeppelin NT.
(R.Sablonty/DLR/UZH)

It's Like Being in Space
Swiss Parabolic Flights

An extreme climb followed by a controlled dive, following the course of a ballistic parabola – this is how microgravity conditions are created in the Airbus A310 ZERO-G (photos on the left) for 22 seconds. These conditions – also known as microgravity – are the same as weightlessness in space, but can be achieved via parabolic maneuvers within the Earth's atmosphere without the need for expensive space technology. This is also why the research flight campaigns that the UZH Space Hub has been regularly organizing in Dübendorf since 2016 are always booked out quickly. Parabolic maneuvers are carried out over the Mediterranean Sea or the Atlantic Ocean. In up to 15 maneuvers per flight, academics study the impact of weightlessness on people, plants and cells in order to understand how gravity influences life on Earth.

First a climb and then a nose-dive: the parabolic maneuver of the A310 ZERO-G microgravity aircraft. (Novespace)

More than twenty different experiments dealing with biological and physical issues have now taken place on board the parabolic flights organized by the UZH Space Hub. For example, researchers from the University of Zurich have studied the way in which human tissue responds to the lack of oxygen in microgravity environments – an important issue for extra-vehicular activity in space. An experiment carried out by the Swiss Federal Institute of Technology looked into the how gravity affects the sense of orientation and behavior of phytoplankton, the basic food source of many sea creatures. Also, the Swiss-Israeli start-up SpacePharma used a parabolic flight to test scientific hardware to see whether it could be used on small-scale satellites. New opportunities have also be opened up in the field of regenerative medicine following experiments carried out on parabolic flights. Cells come together to form complex, three-dimensional structures in microgravity environments more quickly than when subjected to the effects of gravity. This has already been proven using heart and nerve cells. Chondrocytes also seem to behave in a similar fashion, as indicated by the experiments carried out by biomedical engineer Simon Wüest from the Lucerne University of Applied Sciences and Arts. In the longer term, patients with arthrosis could benefit from this discovery. And perhaps even entire organs may be able to be created from the stem cells of a patient in microgravity laboratory one day in the future.

In the Spotlight

OLIVER ULLRICH

Director UZH Space Hub
Professor of Anatomy (UZH)
Professor of Space Medicine (EAH Jena)
Professor of Space Biotechnology
(Otto-von-Guericke University Magdeburg)

"The previous research flight campaigns with the Airbus A310 ZERO-G show that the Dübendorf airfield is ideally suited for aviation research," says Oliver Ullrich. The professor of medicine was the person responsible for bringing parabolic flights to Dübendorf in 2015. Ullrich remembers that the idea was not a sure-fire success and that he had to overcome many obstacles. In the end, he was able to bring the French company Novespace, specialists in parabolic flight, on board with its converted Airbus aircraft.

The first parabolic flight was carried out at a time when not much academic work was being performed at the Dübendorf airfield. This all changed with the commencement of research flight operations, and now airships are being used in addition to the regularly operating ZERO-G aircraft. The Swiss Parabolic Flights flight program, launched jointly by the Swiss Skylab Foundation and UZH and supported by a whole host of partners, is inextricably linked with the Dübendorf airfield and places on the flights are quickly booked up.

Swiss Parabolic Flights has also enjoyed a great deal of success due to the special financing model developed by Oliver Ullrich and Natalie Dové, CEO of Dovespace in Burgdorf. It is different to those of the major state programs run by space agencies such as the European Space Agency (ESA), whose microgravity flights are very expensive for researchers. In the flights run by the UZH Space Hub, the costs are split between industry, academia and private individuals – so taxpayers' money is never used. Private individuals can arrange to take part in the research flights via Dovespace and their contributions have supported science and education, while simultaneously allowing them the opportunity to enjoy the feeling of weightlessness.

The financing model is unrivalled throughout the world and makes parabolic flights considerably more affordable for academia. In addition, projects carried out on parabolic flights give researchers from Switzerland access to grants from European institutions. Furthermore, studies that have undergone preparations on parabolic flights have been able to be completed on the International Space Station in a record time of three months.

Zeppelin NT

Used for environmental monitoring, biodiversity research, and precision agriculture

For the people of the region of Zurich, the Zeppelin NT is becoming a familiar figure, as the imposing airship has been able to be seen in the skies over the Swiss city many times since 2017. Several Swiss research facilities have carried out tests on board the "flying cigar" to determine its suitability for scientific purposes, such as measuring air pollutants and studying ecosystems. In so doing, the special advantages of the Zeppelin NT – the two-letter acronym stands for "New Technology" – stood them in good stead: The airship can fly non-stop for up to 24 hours and remain stationary in the air for long periods of time, which is extremely important for some measurements.

Long deployment times and highly accurate flight profiles combined with the many ways in which state-of-the-art sensor systems can be installed on board make the Zeppelin NT a highly interesting research laboratory. The airship has already completed a large number of test flights – taking off from Dübendorf and flying over Lake Zurich, the city of Zurich, and the Canton of Zurich – and has been used for applications in environmental monitoring, atmospheric chemistry and agriculture. In terms of the latter, the ship has flown over agricultural test fields in Lindau (Canton of Zurich) and Wädenswil several times in order to collect data on vegetation and soil conditions. This data can help to conserve the amount of fertilizer used, monitor plant health, and improve agricultural efficiency through more-accurate and more-resource-efficient farming methods.

Research with a view of the Alps: the scientists sit in the engine pod under the helium-filled envelope of the Zeppelin NT. (F. Schneider)

Research Infrastructure

Piz Daint Supercomputer
(Swiss National Supercomputing Centre)

UZH Space Hub infrastructures

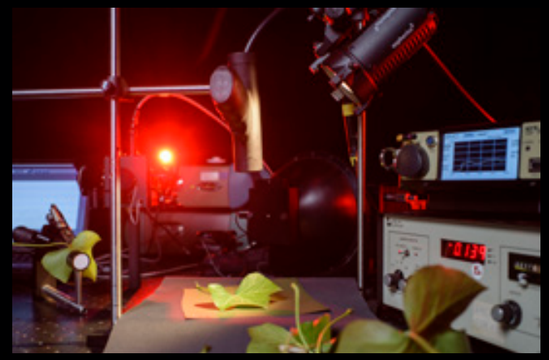
- Airborne Prism Experiment Imaging Spectrometer (APEX)
- National Point of Contact for satellite images (NPOC)
- Spectral Information System (SPECCHIO)
- Spectrometer Lab
- Goniometer
- The UZH Science IT (S3IT) system (cutting-edge cloud, cluster and supercomputing systems)
- Swiss National Supercomputing Centre (CSCS)
- Parabolic Flight research hardware
- Ground Simulation Hardware
- Ground Labs

UZH technology platforms

- Functional Genomics Center Zurich (FGCZ)
- Viral Vector Facility (VVF)
- Nanobody Service Facility (NSF)
- Center for Microscopy and Image Analysis (CMI)
- Cytometry Facility
- Zurich Integrative Rodent Physiology (ZIRP)
- The Center for Magnetic Resonance Imaging of the University Hospital of Psychiatry Zurich/ Department of Child and Adolescent Psychiatry and Psychotherapy (MRZ)
- Core facilities of the Department of Biochemistry (e.g. Protein Crystallization Center)


Sentinel-2 (ESA)


Goniometer (RSL,UZH)


Spectroscopy Lab (RSL,UZH)

With the new "Sentinel" generation of satellites, the European Space Agency (ESA) intends to monitor the environment on Earth more accurately than ever. The Sentinel satellites will constantly scan the earth surface in order to detect volcanic activities and oil spills in the seas and oceans, record the way in which land use is changing, and measure climate-damaging gases in the atmosphere, among other things. In the event of natural disasters, the Sentinel satellites will also provide rescue forces with information on potential access routes into the area affected. A large number of UZH research teams are involved in the Sentinel missions, e.g. as part of the University Research Priority Program Global Change and Biodiversity.
Pictured here is Sentinel 1. (ESA)

Teaching

Acquiring Knowledge and Inspiring Innovation

Studying at UZH means gaining first-hand knowledge. It also means learning to think independently and critically, embracing different perspectives, and finding out how to develop new ideas and gain new knowledge. As a research university, teaching at UZH is inspiring and research-based, and junior researchers are encouraged and supported in their careers. UZH has the largest and most diverse range of Bachelor's and Master's degree programs in Switzerland, with more than 100 major subjects to choose from as well as many different possible combinations of subjects. The university offers attractive PhD programs with a Graduate Campus that holds courses and events, providing students with ample opportunity to gain additional qualifications and access to topics relevant to their research – students can even gain project funding via the GRC Grants. In the subject areas of Earth observation and astrophysics, there is a selection of special Master's programs, while the space life sciences subject area features specialized courses for Master's students in the Biomedicine degree program. Students can also take part in research-based internships and research projects in the initial phase of every degree program.

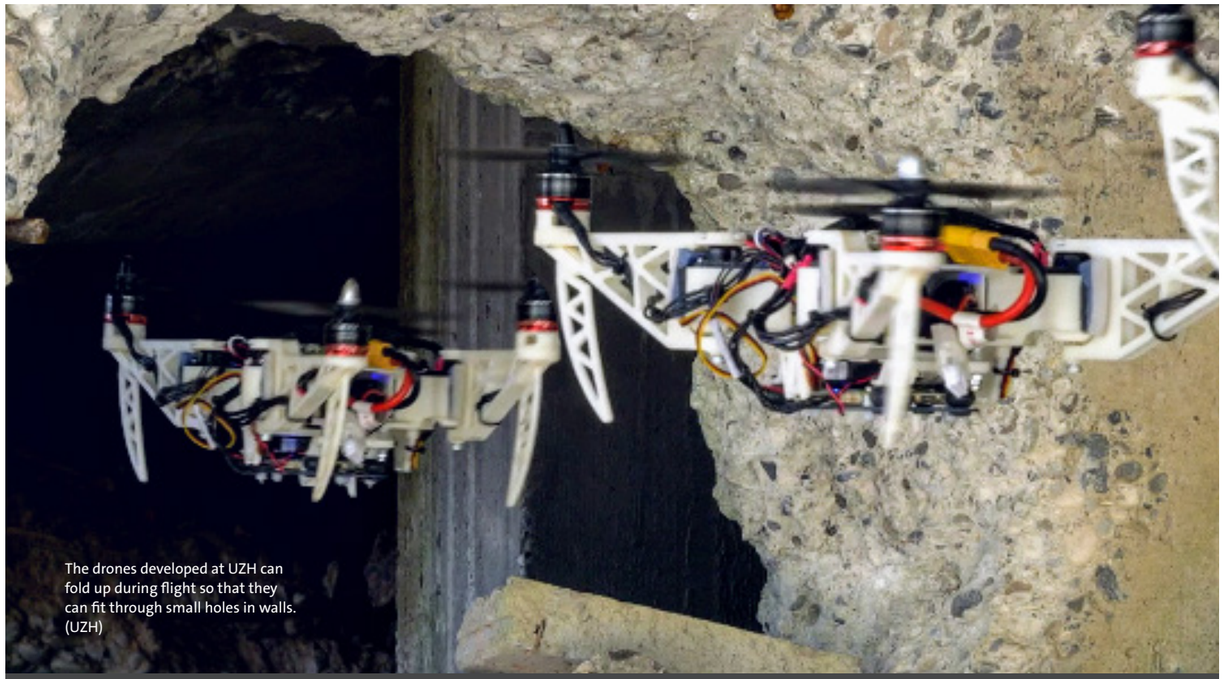
Aimed at future entrepreneurs, UZH holds lectures and seminars on the topic of entrepreneurship, in addition to specialized UZH programs such as the UZH BioEntrepreneurship & Innovation Program, the UZH Digital Entrepreneurship Program and the UZH Innovators Camp. In addition to this, the UZH Innovation Hub also puts together an extensive package for the acquisition of entrepreneurial expertise, which includes training sessions, workshops and courses from external partners.

The UZH Innovation Hub also connects people interested in founding a company with the startup scene, advising them as they bring their idea to market, and building bridges with business and industry. The hub fosters the transfer of research results into products and services, and offers options for seed funding, including the UZH Entrepreneur-Fellowships, the UZH Life Sciences Fund and the TDA Translational Grants. Networking events and alumni meetings make it easier to engage with like-minded people and meet potential investors.

The University of Zurich is proud of the increasing number of UZH spin-offs and startups and supports them by providing the UZH Startup label. UZH spin-offs are extremely successful, with a survival rate of 94% after five years. UZH placed in the top ten of the Reuters Innovation Ranking 2019 "Europe's Most Innovative Universities". And is thus one of the most innovative universities in Europe.

Links:
UZH Innovation Hub: www.innovation.uzh.ch
UZH Graduate Campus: www.grc.uzh.ch
ZH degree programs: www.uzh.ch/cmsssl/en/studies

Outside the entrance to the Unversity of Zurich's main building in the city center. (UZH)



The drones developed at UZH can fold up during flight so that they can fit through small holes in walls. (UZH)

Creating Value

The UZH Space Hub is home to experienced researcher and developer who have learned their skills from scratch. They know that true innovation cannot be planned, nor to be forced, nor even to be predicted – not by pseudo-precise planning management, not by research bureaucracy, not by fancy structures, and not by the latest equipment. Innovation comes as a result of freedom, competency, inquiring minds and a willingness to take risks. Innovation is developed within and by people – very special people.

The UZH Space Hub wants to bring these people together and create the conditions and structure in which innovation can come into being, i.e. a place of freedom and entrepreneurial spirit in which people are given the full ability to express themselves in an environment unrivalled throughout the rest of Europe.

Dübendorf offers a strong partnership between the Innovation Park and the Dübendorf airfield in an environment featuring a high level of expertise in aerospace science and technology. The Zurich region is a hotspot for new companies thanks to its active start-up scene, attractive start-up funding such as provided by the ESA Business Incubation Centre Switzerland (ESA-BIC), venture capital and a stable and favorable economic environment.

A large number of ideas and innovations already bear the signature of the "Dübendorf innovative spirit", including the development and testing of Earth observation sensors for carrying out research into our planet's ecosystems and for detecting plastic pollution in the seas and oceans, as well as the optimization of approach procedures for minimizing noise in aviation and for better turbulence prediction on airliners.

Microgravity environments could prove to be highly effective tools in the field of medicine, e.g. for the manufacture of human tissue and organs, for replacing animal trials and for transplants. Following successful preliminary testing, these studies are now being continued on the International Space Station.

And finally, the Swiss parabolic flight program that was launched in Dübendorf has for four years provided simple and cost-effective access to microgravity environments. Universities and industrial companies have already enjoyed great success with the offering. A considerable amount of research funding has been raised in Switzerland, with Swiss companies taking advantage of the opportunities to use the testing facilities right on their doorstep.

Modern research and aviation work go hand-in-hand at the Dübendorf airfield, providing a huge boost to the economy, industry, academia and innovation – in exactly the place where a pioneering spirit, hard work and proficiency gave rise to Swiss aviation more than 100 years ago.

Plastic waste

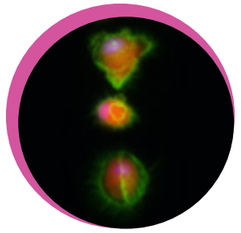
A project led by Andreas Hueni (Remote Sensing Laboratories RSL at UZH) is testing hyperspectral imaging sensors to enable the spatial mapping of plastic waste in future. In 2018, the camera was mounted on a fixed-wing airplane and on the Zeppelin NT. As part of this campaign, plastic test bodies were deployed in the pond on UZH Irchel Campus and in the Greifensee region, which were then able to be detected from the Zeppelin NT, both on different flight routes and at different altitudes. This research can help to locate plastic pollution in the planet's seas and oceans more accurately.

Autonomous flying

In future, flying robot systems will be aware of their surroundings, be able to respond to them, and thus be able to move without the need for external control and human assistance – and this is precisely what UZH robotics researcher Davide Scaramuzza is working on. Such systems can yield major advantages in inaccessible and dangerous areas and be used in rescue operations. Scaramuzza's team recently developed a new drone that can retract its propeller arms to such an extent that it can fit through narrow gaps and holes, thus allowing it to help rescue teams in the event of natural disasters.

Biodiversity

A King Air B200 was guest at the Dübendorf airfield in 2018 and served as a flying laboratory. Michael Schaepman and Andreas Hueni from the Remote Sensing Laboratories RSL at UZH have organised this joint imaging campaign with NASA/JPL and have flown the instruments APEX (UZH) and AVIRIS-NG (NASA/JPL) simultaneously over the Lägern test site (CH). The data is used for mapping trees in the target area and observe their state of health. These campaigns also help to develop future generations of satellites with the aim to monitor biodiversity across the entire planet.



Tissue regeneration

In microgravity environments, cells come together under certain conditions to form three-dimensional tissues and organ-like structures. This 3D tissue could be manufactured in a microgravity environment from human donor cells and then used in both regenerative and personalized medicine, and also as a replacement for animal trials. Weightlessness can in this fashion be used as a tool for producing new tissue. The research project conducted in collaboration with Airbus DS is led by Oliver Ullrich and Cora Thiel (UZH).

A Falcon 9 rocket launch at Cape Canaveral. The rocket developed by SpaceX launches satellites into space and provides the International Space Station with supplies. (Space X)

Partnerships

A Strong Network
Within Switzerland and with the rest of the world

As is always the case in life, in order to get something done, you need to find the right partner – this also holds true for the UZH Space Hub. Partners are available from areas such as academia, industry, the government and politics, both from Switzerland and abroad. Many of the relationships built within the UZH Space Hub have developed from several years of trustworthy collaboration and have proven themselves in the ups and downs of daily work. They provide access to key research platforms and lead to scientific findings and innovations useful for society.

Team zero-gravity meet Team Earth Observation: The UZH Space Hub team at the Dübendorf airfield. (R. Sablotny)

Practical Test Passed

The worlds of aviation and research come together in Dübendorf

Thanks to the support of the Swiss Air Force, UZH has been able to use the Dübendorf military airfield for research purposes for a long time now.

For example, Oliver Ullrich, UZH Space Hub Director and Chairman of the Board of Trustees of the Swiss SkyLab Foundation, has already organized two research campaigns with the Zeppelin NT. In addition, the Swiss Skylab Foundation makes it possible for a wide range of institutions and companies to gain access to the microgravity environments created on parabolic flights.

As a result, a whole host of special physical, technological, biological and medical experiments have been carried out as part of the Swiss Parabolic Flight Program. SpacePharma is one of these examples of space start-ups, which took advantage of this opportunity to successfully test a mini laboratory for the International Space Station. A team led by Michael Schaepman, professor of remote sensing and the vice president responsible for research and innovation at UZH, achieved a breakthrough with a self-developed, high-resolution spectral camera named APEX (for short). The camera was installed on a research aircraft and was able to record and document the biodiversity of the area over which it flew. The next step for the highly sensitive technology are satellites as observing platform. Working in collaboration with Empa, SWISS, Skyguide and the DLR (German Aerospace Center), test flight campaigns will be carried out with the DLR Airbus A320 ATRA (Advanced Technology Research Aircraft) in the area surrounding Zurich Airport, and will be coordinated by Swiss SkyLab.

By making improvements to the LNAS pilot assistance system and changes to the aircraft itself, it should be possible to reduce the noise generated in landing procedures. Another Swiss Skylab aviation project, which will be conducted together with DLR, ETH Zurich, ZHAW, SWISS, Lufthansa, EasyJet, MeteoSwiss, the National Center of Atmospheric Research (USA) and the International Airline Transport Association (IATA), aims to improve turbulence prediction on passenger flights. Dübendorf passed the practical test for research flight activities with flying colors and has been commended as an unrivalled location in Europe for carrying out sophisticated and complex research projects.

Links: www.skylab.swiss, www.empa.ch, www.ethz.ch, www.zhaw.ch/de/engineering/institute-zentren/zav

ESA astronaut Samantha Cristoforetti working on the BIOLAB in the European COLUMBUS module of the International Space Station. (NASA)

Probes, Satellites, Rockets and the Space Station: The UZH Space Hub provides a great many

The scientists at the UZH Space Hub are extremely visible on an international level and some of them have taken on management roles in major multinational research missions. UZH has connections with NASA space flight and science programs via several high-ranking research agreements, also known as Space Act Agreements.

The partnership with Space Florida also allows UZH to work closely with the aerospace sector in Florida, which comprises some 17,000 companies. Via Space Florida, the institutions and companies associated with the UZH Space Hub are able to use the Kennedy Space Center infrastructures, including the shuttle landing facility (with the world's largest runway, measuring 4,572 meters in length and 91 meters in width) as well as the production and integration halls and the research laboratories. In addition to this, the working relationship with the US National Lab provides direct access to the International Space Station. With its laboratories and offices on site, the UZH Space Hub has a permanent presence in the Space Life Sciences Labs (SLSL) at the Kennedy Space Center.

All in all, the research facilities and companies in the USA rank among the best partners of the UZH Space Hub. These robust partnerships have grown as a result of many years of trustful collaboration. In Europe, the partnership with the Swedish Space Corporation (SSC) makes it possible for us to use its suborbital ballistic rockets, as well as test autonomous aircraft in a vast, uninhabited area and one of the largest airspaces approved for air traffic in Europe. These opportunities are provided to us via the ESRANGE Space Center near Kiruna, 150 km north of the Arctic Circle. Airbus Defence and Space (Airbus DS) and Deutsche Zeppelin Reederei (DZR) both have their headquarters in Friedrichshafen, which is situated on the northern coast of Lake Constance. UZH Space Hub teams are working together with Airbus DS on the manufacture of tissue and organ structures in microgravity environments and in the area of Earth observation.

The launch of the Space X CRS-6 on 14 April 2015 at Cape Canaveral. (Space X)

A visit from NASA Associate Administrator, Thomas Zurbuchen (from left to right): Christian Schwarzenegger, Vice President Faculty Affairs and Scientific Information, Michael Schaepman, Vice President Research, Thomas Zurbuchen, NASA Associate Administrator, Science Mission Directorate, Yasmine Inauen, International Relations Office UZH, Tanya Gant Ward, Public Affairs Officer U.S. Embassy in Switzerland, Oliver Ullrich, Director UZH Space Hub and Romain Teyssier, Professor of Computational Astrophysics. (Fabio Schönholzer)

The Zeppelin NT has been a frequent visitor to the Dübendorf airfield. Measuring 75 meters in length, it is the largest semi-rigid airship in the world and offers unique advantages for Earth observation, atmospheric research, and in future also precision agriculture thanks to its outstanding flight performance parameters (long flying time, ability to float in accurate positions and ability to fly extremely slowly). It has already demonstrated its value on many research flights for UZH, ETH Zurich and Empa over Swiss soil, as well as for the Swiss SkyLab Foundation.

Much smaller aircrafts will soon be able to help out in the field of Earth observation. For example, the drones developed by senseFly can be put to good use in the areas of landscape and town planning, agriculture and environmental monitoring. And the transports drones tested by the Matternet company could in the foreseeable future be used to deliver goods in urban and remote rural areas. This means that urgently needed replacement parts could then be delivered faster to customers and medical samples could be transported much more quickly to laboratories.

Links:
Deutsche Zeppelin Reederei: www.zeppelin-science.de
Swedish Space Corporation: www.sscspace.com
Airbus Defence and Space: www.airbus.com/space
Space Florida: www.spaceflorida.gov
senseFly: www.sensefly.com
Matternet: www.mttr.net

Global Network

How innovations are developed in partnerships

Space Flight

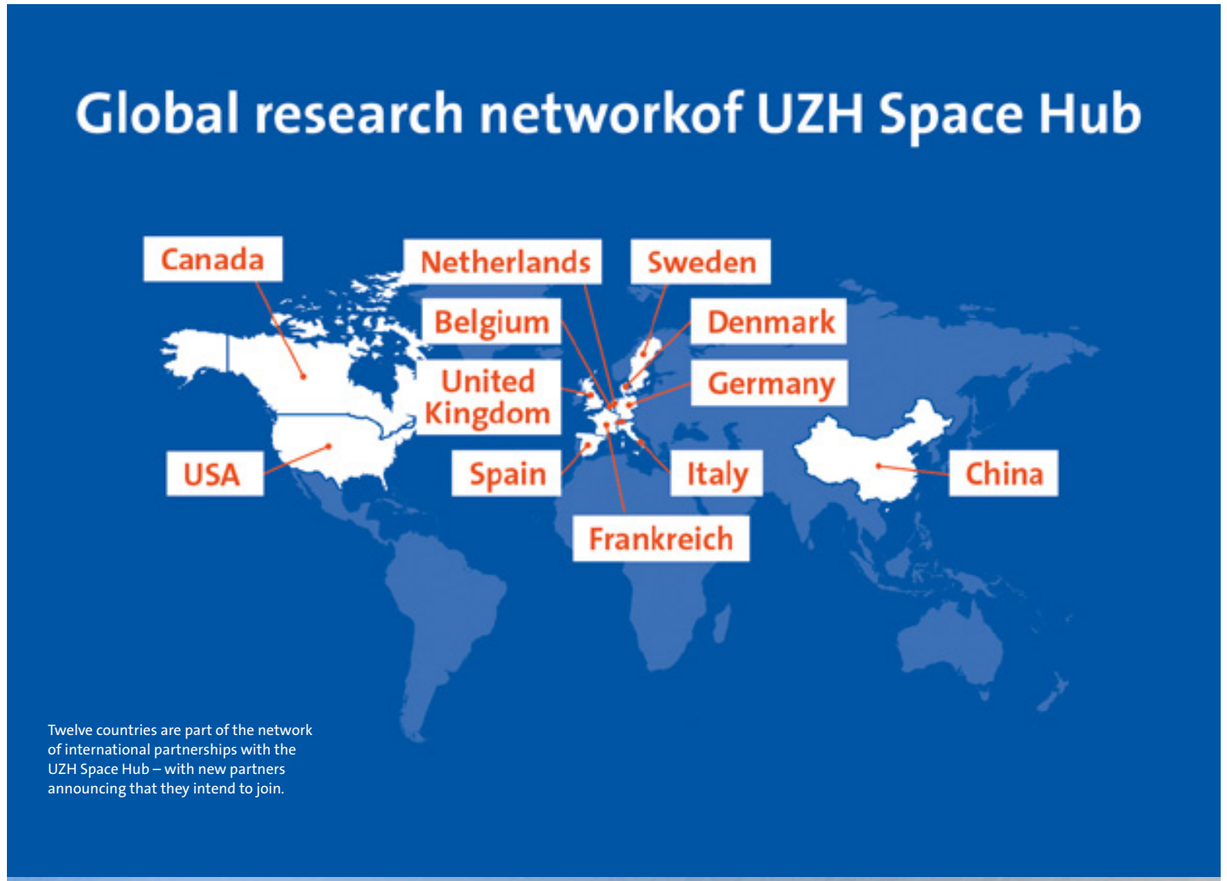
Space flight will in future become increasingly accessible and cost-effective, develop new products and methods for use on Earth, and expand the horizons of human mobility enormously. At the UZH Space Hub, companies can develop their ideas and test them in both local and global infrastructures.

Aviation

With the added value standing in the double-digit billion range, aviation is an extremely important contributor to the Swiss economy. A number of aviation companies are now carrying out research and testing programs at the UZH Space Hub. The combination of laboratory and testing infrastructure in an environment with first-class research facilities and highly trained junior academics should prove beneficial to aviation in Switzerland.

Industry

Ideas are brought into the world by acts of entrepreneurship. The UZH Space Hub supports the innovation process by providing expertise and knowledge, infrastructure, a network, advice and assistance in the search for capital and funding. Established companies can also benefit from private public partnerships with the UZH Space Hub. Here, you can enter into working partnerships with companies on a national and international level. Through such partnerships, already existing technologies can be further developed and new technologies created.



Twelve countries are part of the network of international partnerships with the UZH Space Hub – with new partners announcing that they intend to join.

The NASA Vehicle Assembly Building is one of the largest structures in the world. Spacecraft and rockets are assembled in the 160-metre-tall building. (NASA)

The UZH Innovation Hub
Supporting entrepreneurship and innovation

Skills & knowledge

We promote innovation by raising awareness among students and researchers, providing entrepreneurial competencies and facilitating the initial steps of founding companies.

- *Lectures, seminars, and workshops in the fields of innovation and entrepreneurship*
- *Programs at UZH*
- *Courses, training sessions and camps*

Infrastructure

We create the basis for innovation with excellent conditions for cutting-edge research, the latest technology platforms and space for creative collaboration.

- *Co-working spaces and labs at UZH*
- *Technology and innovation parks*
- *Spaces for startups*

Networks and advice

We accelerate innovation by connecting those interested in founding a company with the startup scene, advising them on their way to being ready for the market and building bridges to members of the business community.

- *Knowledge and technology transfer*
- *Advice for entrepreneurs*
- *Networks and communities*
- *Advising & coaching by experts*
- *Accelerators, incubators, and competitions*

Capital and funding

We make innovation come to life by putting research into practice, supporting spin-offs and providing seed funding.

- *UZH Entrepreneur-Fellowship*
- *UZH Life Sciences Fund*
- *TDA Translational Grants*
- *Partnership with ESA BIC Switzerland*

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Pioneers Welcome

The UZH Space Hub is an innovation focus of the University of Zurich. It brings together the space and aviation activities of the University of Zurich. Furthermore, together with academic partners ETH Zurich and Empa we aim to strengthen aerospace activities - as one of the initial thematic areas of the Innovation Park Zurich - by pooling all our experience, expertise, networks and infrastructure. Here, there is an airfield (including air-traffic control, workshops and maintenance operations), hangars and an innovation park located in close proximity to one another on an attractive site with a great deal of space for new developments. This facility is the only one of its kind in Europe. The task at hand now is to bring together new resources and ideas, and break down any barriers. Why not come help us shape the future of space and aviation in Dübendorf? Let's make research fly!

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Kennedy Space Center
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Successful launch:
All of the people involved in the first Zeppelin NT research flight pose for the camera after landing.

An artist's impression of how the Innovation Park Zurich could look in a few years. (Switzerland Innovation)

Innovation Park Zurich Contact

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Appendix

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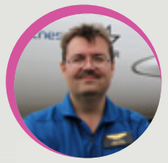

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In the morning mist: The Zeppelin NT airship on the runway of the Dübendorf airfield in June 2017.
(R. Sablotny)

UZH Space Hub Partners

Cooperations within Switzerland and abroad

- Air Force Center
- Airbus Defence and Space, Germany
- Swiss Federal Office of Meteorology and Climatology (MeteoSwiss)
- Swiss Federal Office of Civil Aviation (FOCA)
- Chinese Academy of Sciences (CAS), China
- The German Aerospace Center (DLR), Germany
- Deutsche Zeppelin Reederei (DZR), Germany
- Dovespace
- Swiss Federal Institute of Technology Lausanne (EPFL)
- Swiss Federal Institute of Aquatic Science and Technology (Eawag)
- Swiss Federal Laboratories for Materials Science and Technology (Empa)
- Swiss Federal Institute of Technology Zurich (ETH Zurich)
- Swiss Federal Department of Defence, Civil Protection and Sport (DDPS)
- University of Applied Sciences Jena, Germany
- ESA Business Incubation Centre Switzerland (ESA-BIC)
- Flugplatz Dübendorf AG
- Gamaya
- Greater Zurich Area (GZA)
- kiwi microgravity, Germany
- Lucerne University of Applied Sciences and Arts (HSLU)
- National Aeronautics and Space Administration (NASA), USA
- Nanoracks, USA
- Novespace, France
- Otto von Guericke University Magdeburg, Germany
- Swiss Air Force
- senseFly
- Skyguide
- Space Florida, USA
- SpacePharma, Switzerland and Israel
- Swedish Space Corporation (SSC), Sweden
- SWISS International Airlines
- Swiss SkyLab Foundation
- Swiss Space Center (SSC)
- Switzerland Innovation Park Zurich
- Top Motion GmbH
- University of Basel
- Inselspital University Hospital of Bern
- University of St. Gallen
- Leipzig University, Germany
- UniversityHospital Zurich
- Zurich University of Applied Sciences (ZHAW)

Key Figures

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International Collaborations	Belgium, China, Denmark, Germany, United Kingdom, France, Italy, Canada, Netherlands, Sweden, Spain, USA

The lists on this page represent a current selection.

From drones to space probes: The UZH Space Hub possesses a huge inventory of flying research instruments (see double-page spread in the middle of the brochure).