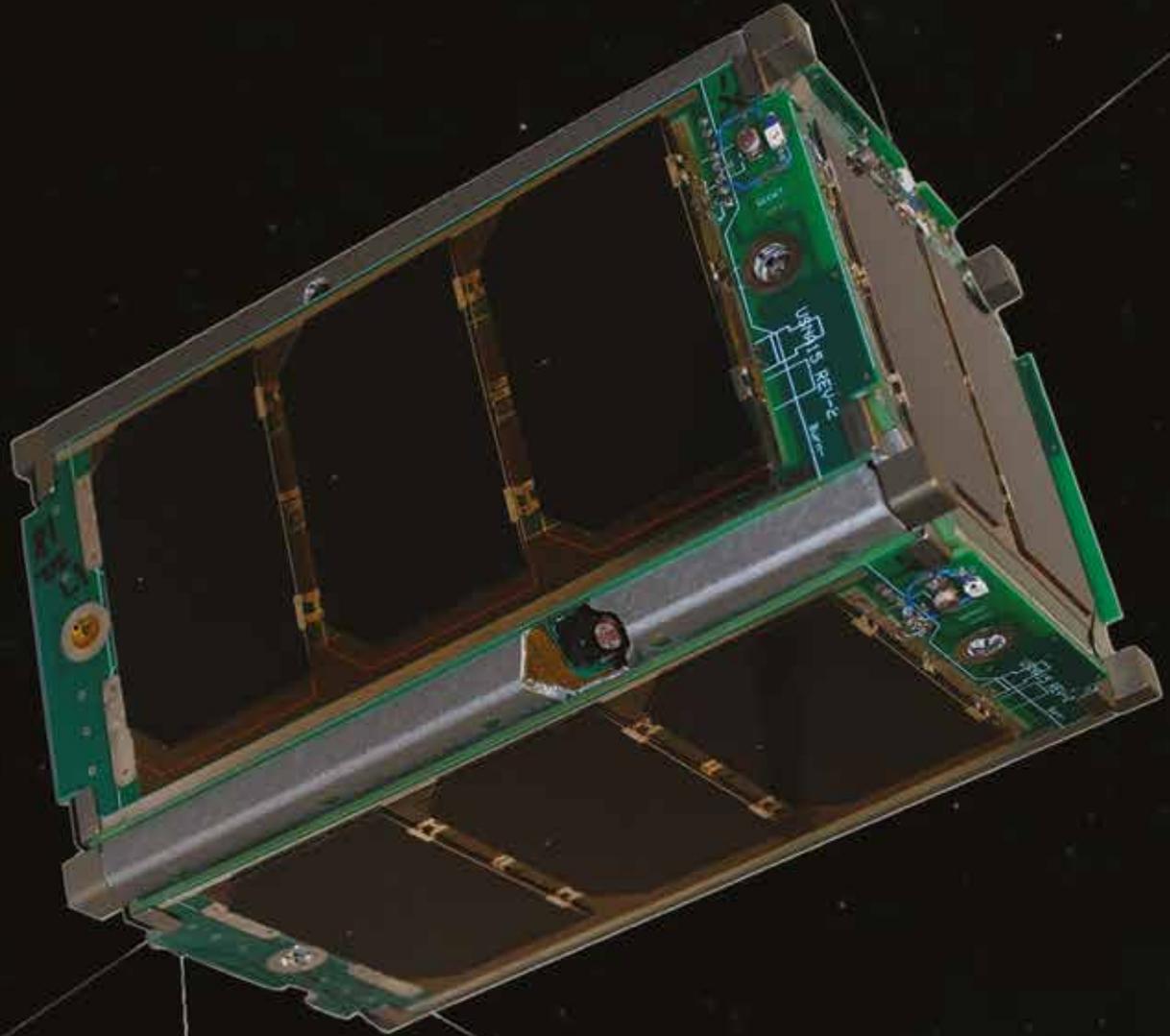


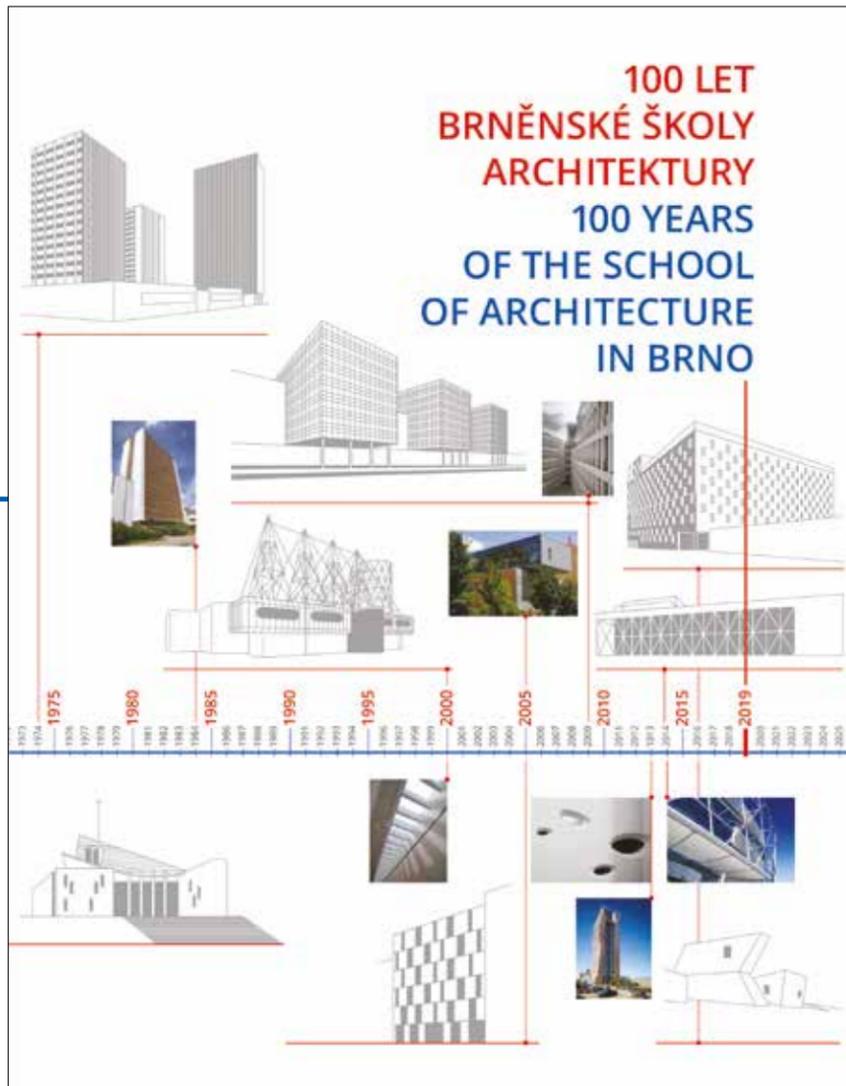
NEWS AT BUT

2020/2021



The PSAT2 satellite

is the result of teamwork between scientists from BUT and USNA



100

The publication by **Jan Hrubý** on the centenary of architecture education in Brno captures several generations that made school history.

It reminds us of the names imprinted on the subconscious of Brno architecture as well as those that may have slipped from memory but have left a strong legacy behind.

The book is homage to all who have shaped the centenary.

www.vutium.vutbr.cz



NEWS AT BUT

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NOT FOR SALE!

EDITORIAL



Dear readers,

As director of a research centre I have the chance to observe directly at the source how a seemingly small discovery, minor innovation or just an idea may cause a big breakthrough and, in the end, transform society, often within an incredibly short time.

To take an example, in the research group of Lucy Vojtová we are experimenting with regeneration of skin and the spine. New biomaterials for replacement of the full thickness of skin and creating an intervertebral bone fusion will be protected by patent for further clinical application later this year. We are currently working on a project of healing bone inflammation with the aid of newly developed antibacterial bone cement, in collaboration with the Motol University Hospital in Prague, as well as a project of the development of new haemostatic materials from biopolymers and a new project for healing chronic wounds. As has been shown by this year's situation with COVID-19 we should be able to appreciate scientific progress. At the moment of the spreading of the virus our eyes became fixed on scientists who made health protection and improvement of the quality of life their mission. I am proud that we at CEITEC BUT were able to quickly respond and almost immediately, in collaboration with the faculties, assembled and put into operation a makeshift line producing protective shields. Over thirty thousand units were delivered to hospitals, senior citizens' homes, schools and people in the front line thanks to volunteers, students, technicians and research workers.

Let us try to keep in mind how important science is for our society. After the "coronavirus time" has passed, there will be new issues and tasks before us to be addressed. Will there be enough water after 2050? Where will we draw energy from? Will our materials be resistant enough? I look forward to the fact that some aspects will be resolved with the help of discoveries from Brno.

Radimír Vrba
Director of Central European Institute of Technology (CEITEC) BUT

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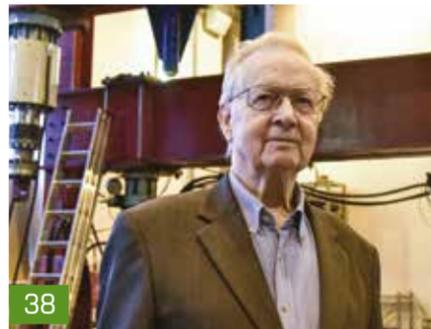
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The devices made by Photon Systems Instruments, a company from Drásov near Tišnov built by a BUT graduate, are used by researchers from NASA, Cambridge and Monsanto.



50

The Optical Communication Laboratory at the Department of Radioengineering FEEC serves both for teaching courses and research into scientific projects of global significance.



38

Jindřich Melcher has been working for the Institute of Metal and Timber Structures FCE for nearly 60 years. His teacher was Ferdinand Lederer, who designed the legendary Pavilion Z.



60

Thanks to the prestigious Marie Skłodowska-Curie fellowship programme the doctoral researcher Salwa Saafi from Tunisia travelled to Brno, where she is now in charge of the A-WEAR project at FEEC.

TOPIC

BUT at the time of corona

Hospitals, schools and offices. Places where the ideas and dexterous hands of the staff and students of Brno University of Technology have helped during the unexpected covid-19 pandemic, which raised a large wave of solidarity across society. An important role in this was played by universities. Let's take a look at some projects which arose in the spring months at BUT and helped, including over the ocean.

Radana Koudelová
Photo Andrea Němcová and Tereza Kadrožková

At the end of March a team made up of the staff and students of the Faculty of Electrical Engineering and Communication BUT developed a protective half-mask, the components of which can be made on commonly used 3D printers. You only need a few generally available items for its production. The mask can be partially adapted to the shape of the face to increase its efficiency to the maximum. Its creators have made detailed instructions including a video and the source code for production on a 3D printer available to the general public. As a result the mask began to help around the world. For example, it was printed by the staff of the Henry Mayo Newhall Hospital in California. It is now available in a range of sizes, including a version for children. A Czech company from Lanškroun asked for a licence for mass production. "We wanted to invent an alternative to the available makeshift means of protection as most of the resources on offer for 3D printed masks either require special machines

and material or they are not efficient enough. The material commonly used for 3D printing is relatively porous and there is no guarantee that you would not draw in air through it. We came up with a simple enhancement, to overlay the printed mask with a disposable latex or nitrile glove. This will make the mask impervious and it fits better on the face. At the same time it is from attested material which ensures it is not harmful to health," explained one of the authors of the half-mask from BUT, Václav Kaczmarczyk.

The Faculty of Chemistry developed a concept for a simple respirator, the production of which, using the method of vacuum thermoforming, could be inexpensive as with drinking cups. A respirator tested for the FFP1 and FFP2 protection level could become an affordable variant both for the health emergency system and the population in general. "As it is a plastic shell the respirator is incredibly light and relatively mouldable. It weighs less than 25 grams including the filter and rubber bands. For comparison, the lightest textile respirators are about 10 grams. Respirators with replaceable filters weigh up to ten times more. In addition,

our respirator is conceived so as to have an easily replaceable textile filter. The quality of the filter then determines the protection level. It is possible to use locally available filtration material. The material of the mask proper is washable and can be disinfected," added Radek Přikryl from the Faculty of Chemistry, who collaborated on the project with colleagues from the Faculty of Mechanical Engineering. Soon afterwards the whole team embarked on the development of this filter from materials that are decomposable in nature, which is important for application in developing countries without necessary experience in recycling. The project was a collaborative effort including a partner from the industry and experts from the Faculty of Chemical and Food Technology of Slovak University of Technology in Bratislava.

BUT produced over 36 thousand protective shields

Thanks to the collaboration of a number of faculties and units within BUT and several external partners we managed to expedite production of protective shields by employing the injection moulding method. The production and distribution of this aid was

launched as early as March by FabLab Brno in the South Moravian Innovation Centre. As the capacity of their 3D printers soon filled up they looked for other enthusiasts. Over time virtually all the BUT faculties became involved in printing parts of face shields before it was possible, thanks to CEITEC and FCH, to move over to more efficient production using injection moulding. "The shield consists of four parts, being the headband, chin, Plexiglas shield and a rubber band. We add instructions for use and naturally disinfect the shields. Injection moulding enabled us to ramp up production from 200 to roughly 2,000 units daily. In addition, the shields are mechanically and chemically more resistant," stated Luděk Žalud from CEITEC and FEEC, who was in charge of production logistics. With the help of a number of firms and institutions and financial support from the city we were able to hand out free of charge more than 36 thousand protective shields which went to medical personnel, pharmacists, shop assistants, to schools, offices, social workers and many other places. "Our initial goal was to produce roughly 10 thousand protective shields and preferably cover the needs



of smaller medical practices, shops and individuals as we expected that hospitals and health centres would be supplied by the state," recalled Luděk Žalud in an interview for CEITEC. In the end shields from BUT were redirected to many hospitals as well.

Hospitals and health centres were also helped by the anti-COVID disinfectant which was in short supply from the

very start. After receiving the necessary permits it began to be produced by the Faculty of Chemistry BUT, following an official recipe of the World Health Organisation. The permit granted to the faculty allowed production of the disinfectant for the needs of the organisational units of the state, the region, cities, municipalities and their contributing organisations. The first batches were handed

over to the Brno City Police, fire brigade in Brno-Žebětín and most importantly the University Hospital in Brno. As with the printing of protective shields the help of the team of Tomáš Opravil was again crucial in this endeavour.

Mechanical engineers vs. coronavirus

A robotic system from BUT that will save work of laboratory staff with samples of

covid-19 in the University Hospital Brno is an invention with the name openTube. The laboratory assistant will insert tubes with samples in place, activate the system and everything else works automatically. This solution for biohazard laboratories is the work of researchers from the Institute of Automation and Computer Science at the Faculty of Mechanical Engineering BUT. The openTube robotic

workplace was created on demand from the University Hospital which is planning its pilot deployment and testing. The researchers are in further negotiations with the Masaryk Memorial Cancer Institute and CEITEC laboratories. One of the possible applications is the preparation of samples taken from patients suspected to have covid-19. "The samples are digitally identified, unplugged, a pipette draws the fluid that the robot transports into a microtube or a depression in a cassette for 8 to 96 samples. The cassette again receives a digital code and identification of the position of each processed sample. In this way a batch of samples is made ready for further processing which consists of separation of the nucleic acid and the PCR test proper. The laboratory assistant monitors the whole process and controls it via an application that may be installed in a tablet or smartphone," explained Radomil Matoušek, head of the Institute of Automation and Computer Science at the Faculty of Mechanical Engineering, describing the operation of openTube, which he managed to develop with his four-strong team within a month. A dexterous laboratory assistant can complete the whole process a little faster, but unlike humans the robot never gets tired and the laboratory staff need not manipulate a potentially hazardous infectious sample.

Apart from the above described robotic system the Faculty of Mechanical Engineering, specifically the team of Radomil Matoušek,

created a germicidal radiator at the request of the University Hospital Brno. These radiators or lamps are devices used for disinfecting air and surfaces, for which they take advantage of UVC radiation, a part of electromagnetic spectrum invisible to man. The pandemic made germicide radiators scarce commodities and the University Hospital Brno turned to FME. "We furnished the radiator with an automated timer. After a defined time, which is now pre-set at 40 minutes, it will switch off by itself. This primarily relieves operators from the necessary control of the exposition period," added Matoušek, giving details on the working of the device. A similar radiator was developed by the FECC which donated it to a company in Břeclav.

Mechanical engineers also came up with the idea of creating a modified frame from flexible material that will enable a classic cloth face mask to better adhere to the face and prevent air from escaping at the sides. A simple solution which helps increase the cloth mask's efficiency during wear was tested by scientists from FME. They modified the already known concept according to their design, and made the final version available to the public so that anyone could produce a tailor-made compression frame on a 3D printer. Another idea from the same faculty was two types of single-layer face masks – EasyOn and PiggyNOSE. Both types can be immediately attached to the ears as they have no tying string. Files for the laser, instruction manuals

and other necessary material were again provided by the team free of charge so that anyone interested could use their know-how in these complicated times. About 60 cotton face masks were delivered by the researchers to the hospital in Vyškov, and dozens more to the Peace Corps and the city quarter of Brno-Centre, which handed them out to senior citizens.

Valuable help to the University Hospital Brno

Experts from BUT helped the largest South Moravian hospital in many different ways. FME provided laboratory for the measurement of protective aids and filters. During a week one of the laboratories of the Energy Institute FME normally used for studying aerosols was reconfigured to enable measuring filtration efficiency and pressure drop, which are two essential parameters that determine the efficiency of protective aids. For the University Hospital Brno they measured the filtration efficiency of respirators, tested the complete set of protective aids and the filtration efficiency of the filter employed in the lung ventilator.

BUT lent three thermovision cameras to the University Hospital Brno. Two cameras serving scientific purposes at the Energy Institute FME were installed and put into service by the researchers at hospital entrances. The third camera was lent by CEITEC BUT to the Children's Hospital which falls under the University Hospital Brno. The state-of-the-art research cameras were on loan to the beginning of May,

until the time when the supply of thermocameras was taken care of by the state. "Data and images from the thermovision cameras were sent to the central computer operated by medical students. If the cameras registered a raised temperature in someone, the students alerted the medical staff physically present at the entrance who ensured that the high-risk patient did not come into contact with others," described the researchers Ondřej Pech and Petr Kracík.

BUT established collaboration with the University Hospital of St. Anne in Brno as well. Together they tested increasing the disinfecting capabilities of 3D masks by metal coating. Experts from the Faculty of Civil Engineering led by Jan Podroužek experimented with applying antimicrobial coatings on the external side of the adapter of the face mask made by 3D printing in the strojLAB laboratory at FME BUT as well as door handles and handrails. Some microorganisms can remain outside a host for several days which is essential for spreading the disease. According to latest data this time can be considerably reduced on metal surfaces. In addition it is easier to disinfect a smooth surface than a rough printout from the 3D printer. This is very important in mass printed reductions for diving masks worn mainly by medical staff for several hours a day.

Zeros and ones can help, too

BUT computers became involved in research into the virus and development of a vaccine through the Folding@

home project. By installing the programme the user enables scientists to use the computing power of the processor or the graphic card, whereby thousands of users interconnect their machines into a 'supercomputer'. For a long time the team of Brno University of Technology held first position in the table of Czech universities in the extent of donated computer capacity (at the time of going to print FIT was followed by Czech Technical University). The activities of Folding@home were significantly supported by the Students' Chamber of the Academic Senate BUT, the Faculty of Civil Engineering and, for example, the Faculty of Information Technology. Virtually anyone could get

involved and a number of students of Brno University of Technology regardless of the faculty dedicated their personal computers to the cause.

The Faculty of Information Technology BUT decided to help the Dagmar Children's Home Brno by organising a charity collection of computer technology to assist the children in online education. People from the ranks of the staff, students and the general public, as well as from companies and other institutions who were interested could donate functional computers or tablets that the children's home could use in teaching. Who could not directly donate computer technology, FIT

made arrangements for a contract for a loan. The result of this activity initiated by Radka Báčová was the acquisition of nine notebooks, five tablets and two mobile phones.

A student of FEEC and her mate from FIT helped the general public by offering people an existing application called Don't Panic! designed for people with psychological problems. They can use the application for breathing exercises, and an exercise to distract one's attention. In the worst cases there are contacts to specialised assistance. The application has been downloaded for free by more than sixty thousand people, some of whom found it helpful during the difficult time

of the state of emergency and compulsory quarantine.

Students to students

Right from the start of the pandemic in March BUT students became actively involved in the nation-wide initiative Chci pomoci (I Want to Help). This is used for registration and the sorting of help by volunteers. Those interested could select from among activities such as help with shopping, provision of face masks and disinfectants, remedial classes and babysitting, taking pets out for a walk and many other. The force behind I Want to Help is the Academic Centre of Students' Activities (ACSA), led by the FIT graduate Jaroslav Švec. The initiative was supported by Student's Chamber

BUT and was embraced by a number of volunteers from among BUT students. One of the volunteers was Milan Klapetek, who lectures at BUT to senior citizens within the University of the Third Age. He prepared a series of videos for them that help senior citizens find motivation or hope and advise them on how to survive in the difficult times. A number of BUT students became engaged in a similar initiative called MUNI Helps co-ordinated by Masaryk University.

Volunteers from the ranks of the staff and students of the Faculty of Fine Arts established a workshop for sewing textile face masks on the premises of the Goose on a String Theatre which they handed out for free, mainly to social workers. Part of the face masks, specifically the fixation bands, were cut on a laser cutter by architects from the Faculty of Architecture BUT in the Modelling Centre. The project was considerably contributed to by Vojtěch Kandrát from FCH. More information on this initiative is available at www.sijemerosky.cz.

Students across BUT faculties offered voluntary remedial distance-learning classes, primarily to secondary and elementary school students who were at a loss with their schoolwork. They gave extra classes in mathematics, physics, chemistry and other subjects. One example to speak for all: "I am at home at the moment writing my diploma thesis, so I decided to help and give extra classes via Skype. Right now I am teaching mathematics to two boys

from elementary school and one secondary school student. When they receive a task that is beyond them, they will show it to me on the camera and I will explain how to solve it. In addition I teach chemistry to that secondary student," stated Kristina Stejskalová, a student at FEEC BUT in mid-March. Students of the Faculty of Business and Management have been in long-term collaboration with the Association of Foster Parents and offered extra classes there. For a change, students of the Faculty of Civil Engineering remotely helped senior citizens with software installation to enable them to communicate with their families.

BUT was the first Czech university to make a helpful step towards its students' halls of residence. From as early as 17th March it was decided to compensate them for the rent in the full amount, so that students who checked out could leave their things in the room with no worries about payment. From the start of the pandemic BUT management has been collecting information on the volunteering activities of students and staff in fighting the virus. Their efforts will be awarded in the autumn in the form of scholarships and financial rewards. ■



NEWS

SUCCESS



FME team won silver in the EBEC finals

Second place in the all-European finals of the EBEC 2019 (European BEST Engineering Competition) event was claimed by a four-strong team from the Faculty of Mechanical Engineering BUT. They qualified for the contest first with victory at BUT and then in the regional round of teams from the Czech Republic, Slovakia and Hungary. The final round of the competition in Italy brought together 120 best students from the whole Europe.

The foursome of young mechanical engineers comprising of Josef Pažourek, Jan Abrahám, Ondřej Sláma and Ondřej Švanda participated in the Team Design category. In Turin, Italy they had to prove their abilities and creativity in assembling a functional model of machinery following specifications by engineering companies.

From the Danieli company of Italy they received the task of upgrading a production line so as to increase the efficiency of processes, and their design was evaluated by the jury as the best out of 14 submitted designs. Although they captured only fourth place for the design of a special fire extinguishing system for Škoda Auto, both placements brought them up to second position overall. A total of 88 technical universities from the whole Europe took part in the competition last year.

(ed)

Ladislav Jackson:
An uncommitted
art historian is
of no value
to society



With the art historian Ladislav Jackson, since the last academic year a lecturer at the Department of Art Theory and History at the Faculty of Fine Arts of Brno University of Technology, on his affinity with Hradec Králové and search for Brno-specific themes, what Brno and Berkeley have in common, how to teach art history to future artists and the obligation of art historians to occasionally show civil disobedience.

Jana Novotná
Photo Igor Šefr

You specialise in 19th and 20th century architecture, mainly in connection with Hradec Králové, where you come from, but you have been living in Brno for a second year. Have you managed to find time to get acquainted with the Brno Architecture Manual, or BAM?
Yes, I have, but... although I expect I have exhausted the interesting themes related to modern architecture in Hradec Králové and would like to cast Hradec aside, I still don't seem to be able to shake it off. Together with my colleagues we are working on the Hradec Králové Architecture

Manual, and we are in negotiations with Paseka Publishers concerning the Modern Hradec guide, which should be another volume in the Modern Prague and Modern Brno series. As far as Brno is concerned, given the number of excellent historians of modern architecture who have been active here, and also thanks to the BAM that you mentioned, there were not many themes left for me. But I did find one which is linked with my California research, a forgotten but rather important interwar civil engineer and designer, who also termed himself an architect, although he studied civil engineering, Jaroslav Josef Polívka. He was a figure of world stature in the true meaning of the word.

What is his relationship with Brno?

Initially he worked in Zurich, then in Prague but simultaneously left a significant trace in Brno between the wars. From his diaries we know that at the turn of the twenties and the thirties he spent almost half of his working time in Brno, where he designed the Palác Jalta and the adjoining building (formerly Siemens), as well as apartment houses on the corner of Kotlářská St and Bayerova St and the functionalist palace of the Co-operative of Employees in Trade and Industry erected on the site of today's Scala cinema and converted by the architect Lubor Lacina in the 1950s. He was also the author of a number of unbuilt designs for Brno and there are several projects here where we have so far failed to identify whether they were

implemented or not. All in all, it shows that the trace that Jaroslav Polívka left behind himself in Brno was much more profound than just the Palác Jalta, which made him famous. The Palác Jalta was

Between 1938 and 1939 Polívka emigrated to the United States, worked at the universities in Berkeley and Stanford and after the war started to closely cooperate with the important American architect Frank Lloyd Wright.

the first big city multifunctional palace with a shopping arcade in Brno. Drawing on his experience with the Chicago and Habich palaces, Polívka introduced this type of building to Brno and it served as the model for similar projects in the city that followed.

How does Polívka relate to your research in California?

Between 1938 and 1939 Jaroslav Polívka emigrated to the United States and never returned. He settled in Berkeley in California where he worked at the university and simultaneously began to teach at Stanford University. In 1946 he started to closely cooperate with the important American architect Frank Lloyd Wright. This was his greatest lifetime achievement at age 60, thanks to which he is actually more famous in the United States than over here. As an emigrant he became persona non grata in Czechoslovakia after 1948 and fell into

oblivion. He died in California where he is buried. A considerable part of the prepared book called Californian Dreams will be dedicated to Polívka and his Californian period. There are plans for a possible future exhibition and a monograph.

What was it that brought you to California?

At the turn of 2016 and 2017 I was in California as a Fulbright scholar. After my return I didn't know exactly what to do as in the meantime I had severed all employment links. I sent in applications to a number of free position offers and one of them was for a lecturer at BUT and it turned out well.

What kind of students are the undergraduates at the Faculty of Fine Arts?

I worked at the Faculty of Arts in České Budějovice for several years, teaching future art historians. Education at an art school is essentially different, the students there do not need an encyclopaedic knowledge or an expert's eye and trained visual memory like art historians. Future artists can make do with a basic outline of art history but what they do need is to learn to think about the artworks and most importantly to talk about them. Language prowess needs to be cultivated so that they could express themselves in things related to art, as it can help them defend their own work, think critically about it. They have to be capable of informed self-reflection. For artists it is important to be able to step back a little from what they are doing and realise why they are doing it

and what position they take by their statement. Contemporary art should be increasingly more able to defend its own existence, whether in the field of art criticism or academic debate, but mainly in front of the public. Good art is vital for society but it should be accessible to everyone who is interested.

You are known for your commitment in public arguments related to endangered heritage monuments. Do you think that commitment is part of an art historian's job description?

No doubting about that – an uncommitted art historian is of no value to society. When someone completes a specialised type of education and acquires relevant knowledge and abilities one should use them for the benefit of society. Just take the ability to critically analyse the meaning of a visual message. I think that things simply don't work without com-

Between 1938 and 1939 Polívka emigrated to the United States, worked at the universities in Berkeley and Stanford and after the war started to closely cooperate with the important American architect Frank Lloyd Wright.

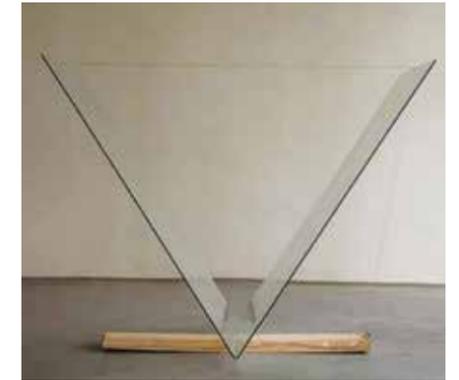
mitment of whichever kind. So, the idea that is quite common in the public space today – that it is necessary to separate art and politics and that art represents some timeless aesthetic values, while politics is something that makes art

dirty – is totally wrong in my opinion. Art has always been shaped to a great extent by circumstances outside of art, such as money, politics, power, the magic of various kind and belief in supernatural powers. Art has always been political, whether we like it or not. And the more political it gets, the louder it states about itself that it is not.

Endangering heritage monuments need not include solely demolition; it often involves insensitive reconstructions. Do you know any example of endangerment in Brno today?

A kind of a warning signal was the moment a few years ago when the owner of the International Hotel appealed for the revoking of the protected heritage monument status of the hotel and the Ministry of Culture obliged. Although no clearly endangering interventions in the monument have been carried out, because of what happened, they could be executed without any obstacles in the future. And then there is the whole huge chapter of art in the public space. In Brno this has been under close observation thanks to people who have been committed to this area for many years, but in other cities sculptures are being constantly removed and dumped or bought for the cost of the material. This is scandalous. ■

AWARD



Stanislav Libenský Award for an FFA student

The Stanislav Libenský Award 2019 went to Adam Hejduk, a student of sculpture at the Faculty of Fine Arts BUT, for his work Support. He created an object consisting of two glass plates rising from a wooden base and leaning away from each other, forming a V-shape. The object is held in place by strings which, after activation by a bow, transfer vibrations to the glass. Adam Hejduk sends sounds from the installation to his friends who modify them and after remix use them as a musical instrument.

The organisers praised the work stating that it transcends previous experience in the application of glass in art. As the main prize the awarded student received a three-week-long stay at the Pilchuck Glass School in the USA. In 2019 a total of 140 competitors sent applications to the competition which aims to present works by young glass designers, and 28 artists from 13 countries, including the USA, Sweden and China, made it to the finals.

(ed)

Jiří Tocháček: We already know how polymers degrade in the permanently frozen environment of Antarctica

Roughly five years ago the media informed us that scientists from BUT would be the first in the world to investigate the aging of plastics in Antarctica. Today things are slowly coming the full circle and the unique multidisciplinary project under the supervision of Jiří Tocháček from the Advanced Polymers and Composites research group of Josef Jančář from CEITEC BUT is publishing the first results. Since the time of their emergence synthetic polymers have literally flooded the world and although they degrade naturally, the speed of their disintegration is still much slower than the pace of their production. To attempt to change this is one of the project goals of Jiří Tocháček, an internationally recognised expert in polymer degradation and stability.

Jana Novotná
Photo Igor Šefr and the archive of
Jiří Tocháček

In polymer research you use the term "weathering". What is it?

Weathering is the ageing of polymers under the natural climatic conditions of our planet. It is one of the ways to learn more about the technical specifications of these materials and their reliability in the intended application. Exposed test sites are distributed throughout the world, but mainly in locations with higher intensity of solar radiation and

higher temperatures to reach results as quickly as possible.

How did you get the idea of Antarctica?

It all started in 2013, when the geochemist Lukáš Krmíček from the Faculty of Civil Engineering BUT returned from an expedition at the J. G. Mendel station run by Masaryk University on James Ross island in Antarctica. Although his specialisation has nothing in common with plastics, his feel for chemistry could not be held down and he noticed polymer pipes with damaged surfaces, serving as protection of cables connecting the individual workplaces in the station.

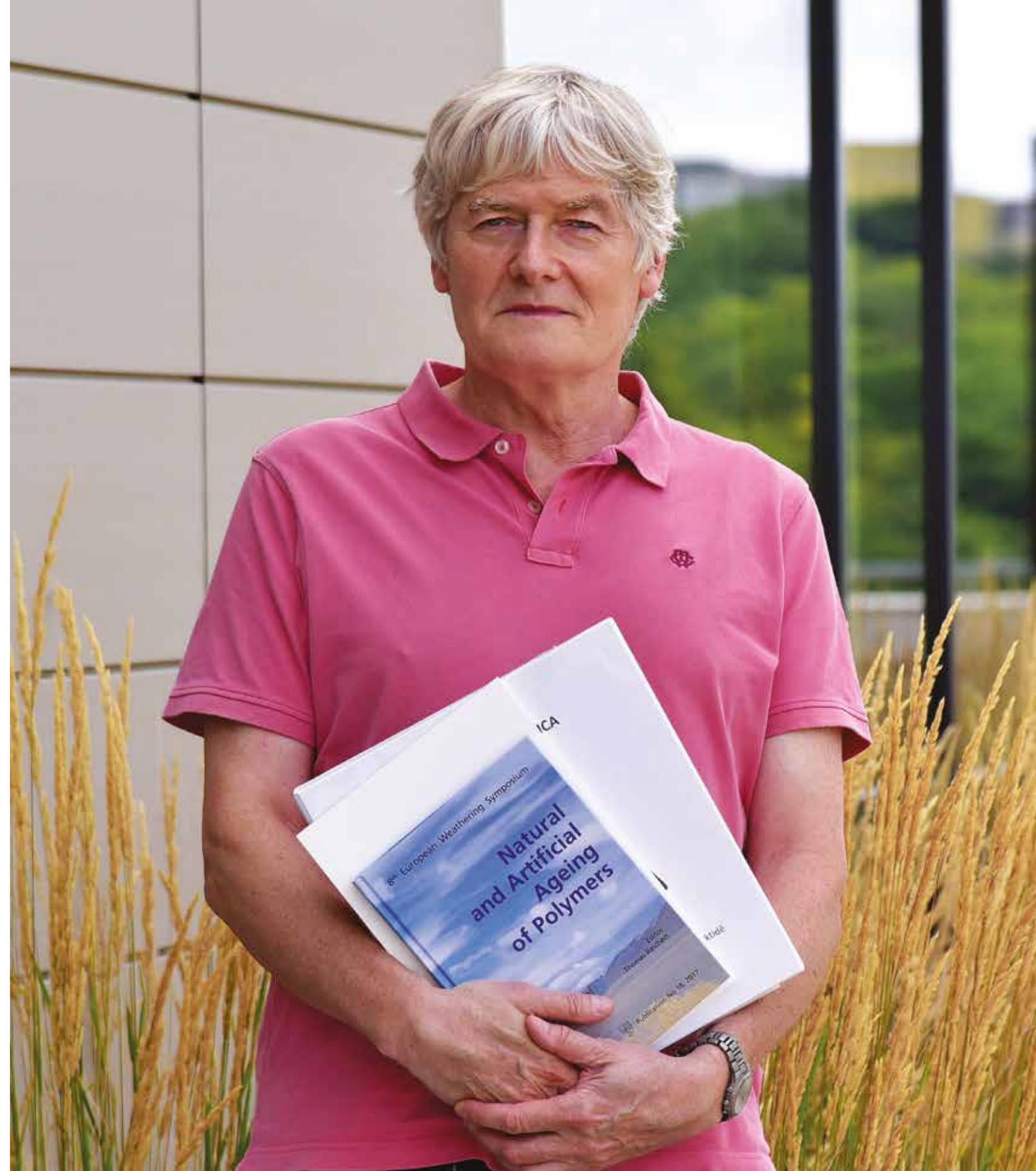
Although we didn't know each other at that time, a year later this was put right over a beer and things took a rapid turn.

What makes Antarctica attractive for you as a researcher? Antarctica was an untouched territory in this respect, nobody had organised a similar systematic experiment with plastic there before. It's not just a romantic continent full of snow, ice and penguins. Year by year more and more plastic waste reaches its shores, floating in from different parts of the world. This makes the problem of the natural degradation of plastics in the local environment more

acute day by day. Given the very low temperatures and short sunlight period, at first glance the environment in Antarctica may seem friendly to polymers. On the other hand, it is Antarctica over which the ozone anomaly, which enables some components of the sun's radiation to pass through more easily, is most evident.

How difficult was it to organise this logistically complex project?

Over a few weeks we put together a team of researchers from different disciplines and institutions who were interested in collaboration. From Masaryk University they were the Antarctic scientific station master Pavel Kapler and the climatologists Kamil Láška and Klára Čížková, followed by Michael Tupý from the Fatra company, Radka Bálková and Petr Poláček from BUT, Jan Merna from the University of Chemistry and Technology Prague and Zdeněk Buráň from Polymer Institute Brno. During a relatively short time we prepared test samples of



purpose-made polymers at CEITEC BUT that were installed on test panels. Five panels were handed over to the nearest expedition at the end of 2014 and in January 2015 the samples were exposed in Antarctica. The second series of five panels serving as a control was exposed in parallel on the rooftop of the library of the Faculty of Science MU. This was the launch of the unique long-term research project into the degradation of synthetic polymers under the climatic conditions of the continent with no existing data on its effect on the life of polymers.

How did you evaluate the samples?

The exposed polymers were removed each year and brought back by the expeditions of scientists who regularly visit the station. The samples were continually processed and evaluated in

the laboratories of CEITEC BUT and other participating organisations. The first preliminary results were known after retrieving the first round of samples, but for the sake of reliability and rigour it was necessary to obtain much more data. Only results after three years of exposure could be considered well grounded. In August 2019 they were published in Polymer Testing (Elsevier), one of the renowned journals dedicated to the properties and behaviour of synthetic polymers. Given the topicality of the subject lectures on this theme were accepted at two foreign conferences, one of them being the 9th European Weathering Symposium EWS, held in September 2019 in Basel, Switzerland.

What did the research reveal?

The results have indicated that the environment in

Antarctica, despite its low temperatures, is by far not as friendly to polymers as was initially expected. The impact of the hole in the ozone layer permitting the passage of a higher percentage of the UV component of the global sun's radiation has shown itself to be very important. And although the results obtained up till now have proven that degradation due to external exposure is faster in Brno, representing typical climate conditions in Central Europe, the difference was surprisingly not huge. In addition, apart from radiation proper, in Brno it is augmented by air pollution in the atmosphere typical of an industrial agglomeration, which is completely missing in Antarctica.

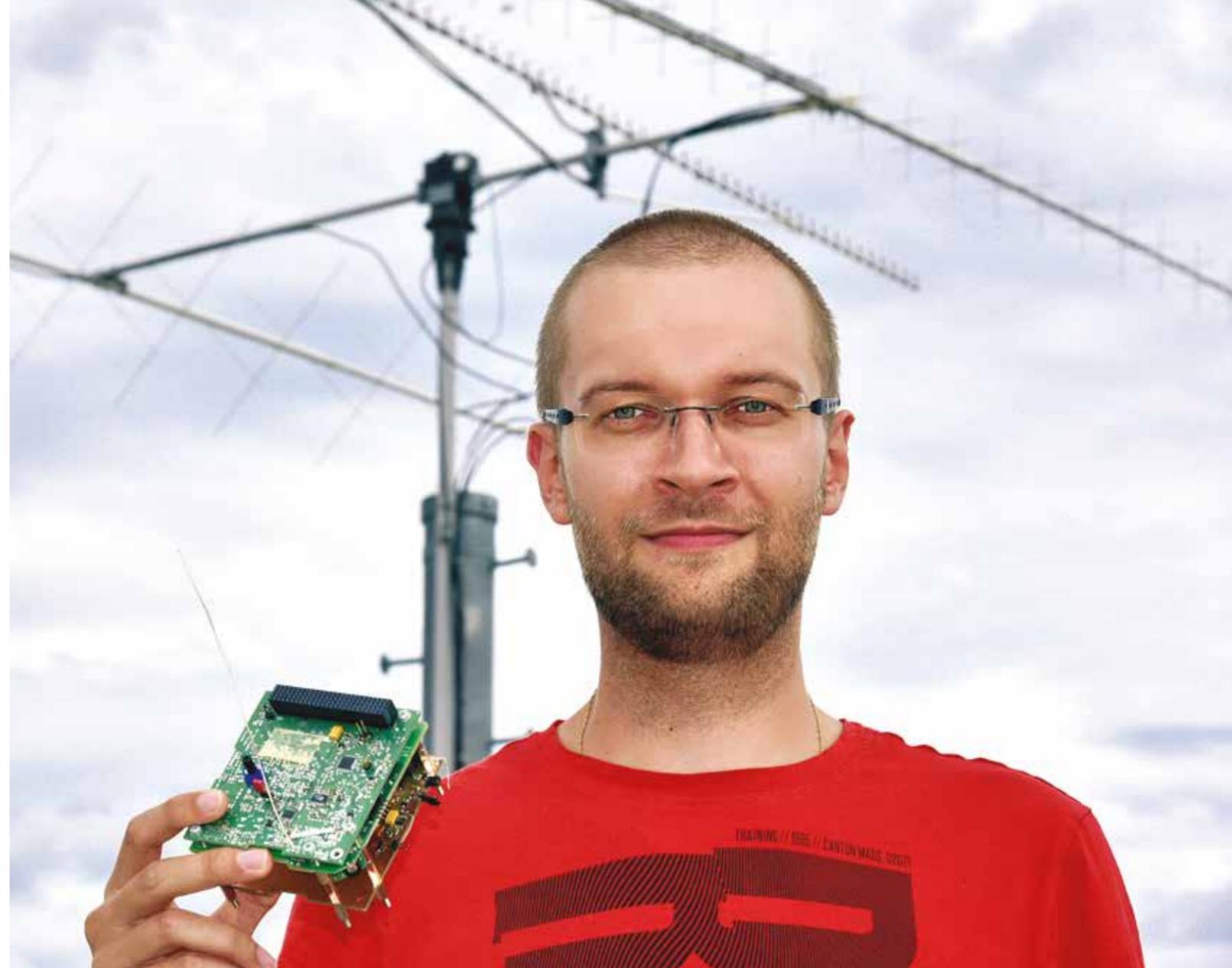
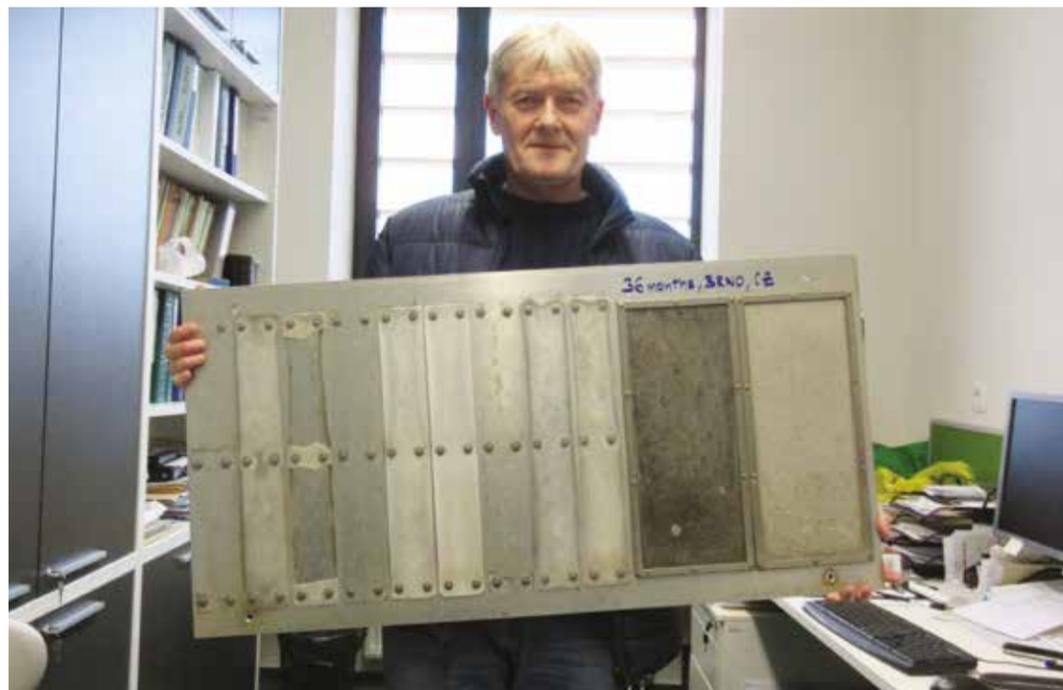
How did you find resources to finance the project?

Given the necessity of a quick start there was no time

to submit applications and wait for an uncertain result. Consequently, the project has a rather specific method of financing – it has no dedicated resources of its own but has been supported by several different grants from the Ministry of Education, of which only one was directly assigned to the logistics of materials and equipment transported to the station. This lack of homogeneity in financing showed as kind of an advantage as it did not present a serious administrative load. Quite the opposite, it greatly suited the specific and long-term nature of the project, where the workload was greatest within a few months after taking samples and for the rest of the year we waited for the next round of samples which were processed exclusively by nature.

What was it like to work in this large multidisciplinary group?

The fact that the project is multi-institutional and, in a way, multidisciplinary is quite unique. Although the principal subject of research is polymer degradation, only a half of the authors of the publication are polymer experts. The others are geographers, geochemists and climatologists who worked together in preparing the samples, characteristics of the radiation and the logistics. Without their participation the implementation of this project would be unthinkable. Collaboration with them was excellent, simply because they all liked to collaborate and were convinced without reservation about the importance of their work. ■



Signal from space sent to amateur radio operators via a satellite made by FEEC experts

What for Aleš Povalač and Tomáš Urbanec from the Department of Radioengineering at the Faculty of Electrical Engineering and Communication BUT started as a project for free evenings and weekends, over the course of four years metamorphosed into a satellite orbiting in space. For an object of the United States Naval Academy (USNA) they designed and developed two key systems to attend receiving signals, communication with amateur radio operators from the whole world and sending off images captured by a miniature camera. The PSAT2 satellite together with additional twenty-three objects was placed to orbit in June 2019 by the famous Falcon Heavy rocket.



Zuzana Hübnerová
Photo Igor Šefr and the archive of Aleš Povalač

"It started as a project and ended as a success many people can only dream about, "The equipment that we worked on with my colleague Urbanec was more of a hobby. It would be difficult to find sponsorship or financial backing through an

official project as it was a run over a long distance with an uncertain result," explained Aleš Povalač with a smile. According to him, working on a satellite is magnificent but it can't be taken for granted that an unprofessional apparatus will finally make it to orbit and will work. "At the moment when it stops operating after launch you can't repair it any more," added the second of the designers, Tomáš Urbanec.

But this did not happen to the team from FECC BUT. The satellite on which they collaborated with the United States Naval Academy endured the launch and so far has been working in space without any problem. But it was not the first successful co-operation. The Czech specialists continued a successful series of previous projects with the American team. "The United States Naval Academy is able to participate in the space programme and may occasionally place its own object on orbit. While in the past the satellites were designed with scientific research in mind, this small CubeSat, on which we worked together, is more of a demonstration of technology. It is used by specialists mainly to test or verify something. The PSAT2 satellite is an amateur radio satellite serving primarily the community of amateur radio operators around the world," explained Povalač.

In practical terms this means that the frequencies on which it relays are co-ordinated exactly for ham radio operators. "They have a possibility to send out their signal to the

satellite, which functions as a responder so that it sends the received signals back. This allows us to use the satellite to establish amateur radio connection," explained Povalač in more detail. As he describes, amateur radio connection means that two stations will exchange information on whether and how well they hear each other, their call signs and existing location. "This type of connection via a satellite is a matter of prestige for ham radio operators as it requires equipment and good technical knowledge at both stations," added Tomáš Urbanec with the proviso that the Czech co-designers are simultaneously users of the satellite as they are all amateur radio operators. "We are members of the OK2KDJ radio club at BUT and we know the ham radio community, we have contacts abroad which is useful. Stations from around the world become connected and regularly send us reports that they heard the satellite. We receive reports from America, Australia and Japan. We have information that the satellite works and for them it is a chance to receive interesting data and image specifications," explained Urbanec.

Apart from text the satellite from the workshop of Czech experts is capable of relaying images as well. "The satellite primarily has two modes. One of them is text communication, when the individual letters transmit rather slowly, but the amateur radio operators can exchange messages. The second mode sends images in the form of audio. It is termed slow television.

The transmission of a single image lasts from several dozen seconds to minutes," described Martin Pospíšil, another project participant, who underlined that in the case of image transmission using audio the downloading of the image is accompanied by characteristic interference and noise. "It's not the most sophisticated technology, but on the other hand it is a standard in the field. As a result, every amateur radio operator in the world knows what it means when he hears this signal and how to decode it," added Pospíšil.

Thanks to a minicamera and the possibility to send audio images the team from FECC BUT now owns a unique collection of photographs of the Earth and space. "Radio stations around the world even managed to capture moments immediately after the launch of the satellite. When we did the count we discovered that just ten seconds after the release of our satellite from the rocket the camera activated itself and shot the first images. They made it clear to us that we were successful," remarked Aleš Povalač.

According to the Czech team it was the first piece of information about the satellite after two years. "We sent our part of the equipment to America in 2017. It was then completed and tested by our American colleagues. In addition, the date of the start of the rocket kept being postponed, so our satellite just lay down somewhere in the US and we waited to see whether it would maybe fly somewhere sometime. We

could not even exclude with certainty an error during the loading into the rocket and making connections. When the first pieces of news arrived directly from the satellite we were overwhelmed with joy over here that we made it and everything worked as it should," confirmed Tomáš Urbanec.

How long the satellite is yet to revolve around the Earth is not known at present. "The estimate is plus minus five years, but that's for rough orientation only. It has ballast inside, being a weight which is in there to secure maximum momentum of the satellite. In this way we ensure that it will stick to orbit and not descend too quickly. This ballast weight maximizes the lifetime in orbit," explained Aleš Povalač.

The Czech team would like to gradually provide access to more functionality and specifications for the ham radio community. "Naturally we will keep monitoring the state of the satellite to possibly intervene when necessary. But so far everything looks good. We have lots of ideas about what could be improved. But we try to hold ourselves back and we wait to see whether we might be able to participate in a new version of the satellite," ended Povalač. ■

Samuel Dušek: If you prove your ability on the job, doors will be open to you



“Students are afraid that if they go abroad for an internship and prolong their study they will lose a year of their life. I think they will lose nothing. Quite the opposite. They will gain so much experience that they will be able to draw upon it for the rest of their life,” says Samuel Dušek, a student of the Faculty of Electrical Engineering and Communication BUT, who completed a year-long internship with Analog Devices, an Irish company specialising in the production of semiconductor chips.

Hana Marko
Photo archive of Samuel Dušek

When Samuel Dušek returned to the Czech Republic in August last year, just a few days after arrival he admitted that he missed living in Ireland. “I have gone through all phases – shortly before leaving for abroad I didn’t feel like going at all, I was afraid



of losing my background. The first half-year was exhausting, but the second was magnificent and full of experiences. On departure I realised that I would miss the life that I had created for myself there over the year,” says the former student of the fifth year of microelectronics at FECC BUT. He joined the Irish branch of Analog Devices, specialising in the development and production of silicon circuitry, in July 2018. He took up the position of a co-op student in a team of analogue designers who developed integrated chips. “The process of the production

of electrical engineering equipment consists of several stages. It’s a good idea, when an electrical engineer who works most of his life in the same position, tries them all out. The boss let me work for three months on software development, and the next three months on a chip, which I later measured and tested over the same period. In the last three months I had an opportunity to write my diploma thesis. I gained plenty of experience,” described the student.

Dušek positively acknowledges the company’s approach,

when they let him work on real-life projects right from the start. "I appreciate that the supervisors put their trust in me from the beginning. I was able to work on things of great value which must have cost the company a lot of money. Experienced colleagues were willing to spend three hours with me to explain something. But they told me they could also learn something by talking with me about things. When you worked hard and proved your ability, doors were wide

open to you. Not just in terms of a financial offer, but job opportunities as well."

Despite excellent working conditions and a good team the first half-year of life in Ireland was challenging. Dušek had to get accustomed to rainy weather and a different rhythm of work. "I like to sleep when it's dark and live when it's light. In the Czech Republic I would go to work at six to be able to do some sports in the afternoon. The Irish are used

to going to work at nine and returning home at six. But my colleagues advised me not to go out in the evening. The city of Limerick, where I lived with my girlfriend, has been nicknamed 'stab city'. It was once ruled over by the mafia, which used screwdrivers and knives to settle accounts. And these attacks still happen occasionally," explained Dušek.

As he maintains, increased safety measures are reflected in the relationship with

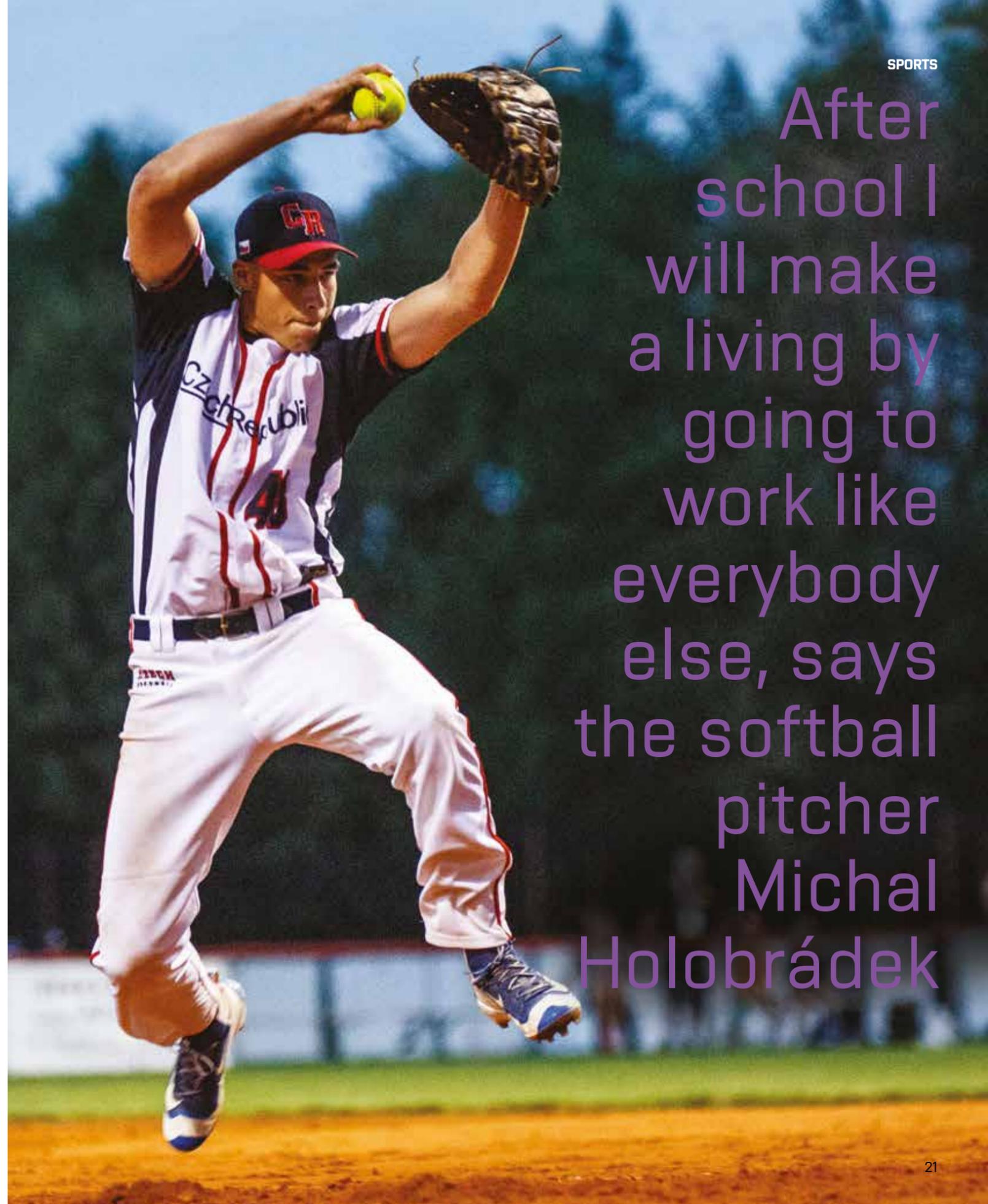
children. "When I told my Irish colleagues at work that when I was in first class parents let me walk alone to school a few kilometres away they were in shock. They thought I was pulling their leg. In Ireland this situation would be immediately examined by social care," described the student mentioning the cultural differences. In his words, it was one of the reasons why he could not imagine a family life in Ireland.

In the end he caught up at the weekends with the sporting and travelling activities that he had to do without during the week. "We travelled through the whole of Ireland. Beautiful countryside. Almost every weekend we set off to a different place. If they had a more welcoming weather, I believe Ireland would be tourist destination number one," evaluated Dušek who devoted himself to his favourite hobby of photography when discovering the new country.

To students who are weighing up an internship in Analog Devices, Samuel Dušek can only recommend it from his experience, "It would be a shame to miss out on an excellent opportunity merely because of a lack of information or out of apprehension of the unknown," emphasized Dušek stating that the Irish development firm offers a great number of internships at various positions every year. ■



After school I will make a living by going to work like everybody else, says the softball pitcher Michal Holobrádek





Jana Novotná
Photo Jan Beneš

He is at home in Břeclav, plays softball for Havlíčkův Brod, studies in Brno and spent the summer in Pennsylvania. This is the current life map of Michal Holobrádek, a sought-after softball pitcher who has so far finished the second year of Managerial Informatics at the Faculty of Business and Management BUT. Although he has already devoted two of his summer holidays to a world softball competition, after school he will make a living by taking a job. Men's softball is a purely amateur sport.

How did you get to playing softball? And what is the difference between softball and baseball?

My first encounter with softball was in the scout group in Břeclav. When a year later a softball hobby circle was established at our elementary school I joined and have stuck with softball ever after. The basic difference between softball and baseball is that in softball the throw is made with an underhand motion while in baseball with an overhand one. As a result some people think that softball is much slower than baseball, but it's not like that. The best pitchers in the world can throw at a speed of around 130 km/h, so when they are pitching from 12 meters away, it is fast. The other difference is the larger ball in softball and shorter distances between bases. But the basic idea of the game is identical – try to hit the ball and run around four bases.

How did a native of Břeclav become the pitcher of the Hippos from Havlíčkův Brod?

When we were starting with softball in Břeclav, we all learned to pitch as it is useless for players to specialise at an early age. During the first years I played in the position of catcher and my elder brother, also a student at BUT, was the pitcher. Then we changed roles and it has remained so until now – I pitch and he is my catcher. I joined Havlíčkův Brod as it was the nearest team for which I could play in the extraleague in the category of up to 16 years, and because there was no junior or men's

team in Břeclav I have stayed in Havlíčkův Brod.

Last year you spent your summer holidays for the second time in Pennsylvania in the US. How did it come about that the Americans chose you for their team?

The ISC World Championship tournament, which can be compared to a world championship of softball clubs, takes place every summer in August. In its quality and prestige it equals the traditional world championship, to say the least. The tournament is attended by nearly 40 teams from the US and Canada which invite players from the whole world, so it is a meeting of the best of the best. I visited the tournament for the first time two years ago thanks to my team mate from Havlíčkův Brod who had travelled to the US before and arranged a place for me in the team of Pennsylvania. We scored a huge success and came 7th. Last year I played in the tournament for the same team and we finished 13th.

What does the American engagement bring to you, sports-wise and socially?

From the sports side it is probably the best that can happen to a softballer. You have an opportunity to play for two months at various tournaments against the best players in the world, which you can otherwise do only every second year at the world championship. Socially, the contribution is undoubtedly in learning about a different culture. My temporary home is situated in an agricultural area, where

the nearest larger town has hardly 5,000 inhabitants. Maize seems to be grown everywhere and it does not resemble the America from films even remotely. And there is a numerous Amish community living there. So it is also a great contribution to expanding my cultural horizons.

You are just starting the third year at the business faculty. How do you manage to mix university studies with sport at the top level?

Combining sport and study is quite demanding. During the week I have training every day after school, whether softballing or exercises in the gym. But so far I have fulfilled all of my duties and I firmly believe that I will still find enough time for study. I have already learned to blend study with other hobbies. I don't have a single weekend free and during the week I arrive home late which does not give me much time to prepare for school but so far I have coped.

Last year the world men's softball championship was held in the Czech Republic for the first time, where the Czech national team finished 8th. Was it a disappointment?

Yes and no. Our goal was to achieve the best historical result for the Czech team which would have been 5th position. Unfortunately, we did not succeed – in the crucial match we were defeated by the favourites, Canada. If we had won, we would have been in the semi-finals, among the four best. On the one side I regret it a

little, but at the same time I think we have nothing to be ashamed of. We managed to get to the play-offs, which would normally be considered a great success. We will all remember the world championship, no doubt about that, also thanks to the unbelievable atmosphere that our fans created. Our matches were seen by around three thousand spectators, which is about 2 950 more than at our regular extraleague contests. These are the moments that will remain with us in our memories!

With all of that, can you still find some time for scout group activities?

I have been a scout since I was eight and I currently lead a group of teenage scouts aged 15 to 20, in Břeclav. It gives me another chance to fulfil myself, do things that make sense to me, and last but not least to mentally relax from softball and study. In the scout group I met my best friends and my girlfriend – the scout group environment is where my most powerful experiences and memories come from. ■

CEITEC Nano can be visited by anyone with a clear research goal



Jana Novotná
Photo Igor Šefr

Since 2016 the CEITEC Nano laboratories have been the largest cleanroom nanocentre in the Czech Republic, providing facilities for research into materials, advanced-materials and nanotechnologies to internal and external users from the academic community and industry. Michal Urbánek, today head of the unit, has been there from the very beginning.

The laboratories fall within the national research infrastructure of the Czech Ministry of Education, which also largely finances them. "In return the Ministry requires that we have as many users as possible across a most varied spectrum. The laboratories can therefore be accessed by students or scientists from the whole world under the same conditions," says Michal Urbánek and adds that for students from local

universities the Brno address is a great advantage as they can use the laboratory more comfortably. The workplace is unique even on the broader scale of the Central European region – around 30 % of users come from countries outside the Czech Republic and Slovakia. "It's about 23 nationalities, with highest representation from Austria, followed by Poland, Hungary, and surprisingly Germany, we also had here one Mexican, and people regularly fly in from UK. The most faraway user from Ethiopia found us on the internet, obtained a scholarship and spent three months here," enumerates the laboratory boss.

The facility itself is divided into four laboratories: a nanofabrication lab, with production of nanostructures and nanoparts, a nanocharacterisation lab, where the produced samples are tested, a structural analysis lab, which concentrates on material structure examination, and a computer tomography lab with X-ray aided 3D mapping of materials and parts. When Michal Urbánek leads us to the cleanrooms of the first two laboratories, we stop in the corridor at the planning table. "Every authorised user can make an advance reservation over the internet for a certain

period of time at one of our 80 devices. We are here 24/7," explains Urbánek and adds: "Some of our apparatuses are extremely loaded, so we had to introduce a special measure – during regular working hours users may reserve a device only twice, and if they want to work more frequently, they need to come after 5pm."

Cleanroom laboratories are characterised by controlled air quality. "This is mainly to prevent dust particles from falling on nanoobjects, as they are bigger than the parts that we produce or investigate here," explains the head of the laboratory. "The air pressure in the cleanrooms is higher than in the surrounding spaces, generating a draft, so if dust particles do occur in the corridor the higher pressure will keep them out."

In the nanocharacterisation laboratory you can examine the shape, chemical composition and structure of samples, as well as their properties, such as electrical, optical or magnetic. "A typical example of what we can produce here is a chip or sensor on a silicon plate, which is connected via golden wires with the capsule of a standard integrated circuit. As a matter of fact we not only produce nanoobjects here, but when we want to examine them, we have to be able to connect them to the outer world, with devices of normal size, which is called microcontacting," says Michal Urbánek.

We take a look into the nanofabrication laboratory. "Here the ceiling is made up



of filters, from which the air falls down by the shortest route, and if it hits a particle falling off people it will carry it straight to the floor which is perforated and the air will be re-filtrated there," explains the laboratory supervisor, describing the safety measures in a laboratory producing the most sensitive things, such as structures of nanometric dimensions which can be observed only under special electron microscopes. "We produce microfluid channels here through which a solution flows to a microanalysis. Before, you needed to take a whole syringe of blood, today one drop is enough. We also study the problems of micro/nanoelectromechanical systems and many other attractive vistas in research

and development," adds Urbánek.

What makes the CEITEC Nano laboratories unique? "It's not so much any particular apparatus, rather it is the fact that we have a great number of top class equipment units, together making up a complete technological and analytical line so that a scientist can carry out research here from almost 100 percent in one place without having to travel elsewhere," says the laboratory boss. "The laboratory operation costs us about 50 million crowns per year, investments into equipment are around 800 million crowns. From the Ministry of Education we receive 27 million annually, while other funds come from our own projects and user

fees which amount to about 6 million crowns." More than a half of the users are students at all levels of study, and the others are researchers. Among the Brno faculties most users are from CEITEC BUT, followed by other BUT faculties, while those from Masaryk University come mainly from CEITEC MU and the Faculty of Science.

This level of interest still does not completely exhaust the huge potential for research and development in the field of modern technologies which the CEITEC Nano laboratories represent. One of the reasons is the fact that the academic world is still not fully informed about this potential. To improve this situation, the laboratory organises a presentation event within Brno University of

Technology taking place in the autumn.

"We would like to increase students' awareness that they can come to the laboratory but at the same time we would want to be sure that they will use the laboratory with a clear goal," emphasises Michal Urbánek. Whether a student comes here depends primarily on their instructor who has to be familiar with the possibilities that this shared laboratory offers. For each student the instructor has to pay a contribution of 30 thousand crowns per year. Compared to the possibilities and equipment that the laboratories offer, the amount is merely symbolic and hardly covers 10 percent of the real operating costs of the laboratory. This is made particularly clear after comparison with similar workplaces in the world where similar access costs multiples of that amount.

"In addition every registered user may bring a visitor who can walk through the laboratories with the user and observe the experiments. For example, a doctoral student may bring a bachelor's student who can gain an idea of whether it will pay to visit the laboratory. Our priority is to have as few bureaucratic obstacles as possible, and as a result we can provide access to someone with a serious interest within five days," sums up Michal Urbánek, head of CEITEC Nano. ■

GRADUATE

My task is to give back to people the chance to choose, says the strategist and mental couch Radim Valigura



Whether you want to achieve excellent results in sports or business, according to Radim Valigura, you need to learn to handle your energy in the first place. A graduate of the Faculty of Business and Management BUT he became acquainted with the mysteries of so-called energy psychology as a top-class tennis player and later the coach of the former world number one Martina Hingis. After the end of their collaboration and return from Switzerland he decided to concentrate more on this area and connect it with his knowledge of how firms work. Today he helps both athletes and managers to connect body and mind and manage their own energy more efficiently. He maintains that many people today give in to the impression that things happen to them in their life and they cannot change anything. Radim Valigura tries to teach them that no one is a victim and we all have the possibility of a choice. It only depends on how effectively we can work with pressure from the external environment.

Zuzana Hübnerová
Photo archive of Radim Valigura

After the first year at the Faculty of Business and Management BUT Radim Valigura received an offer which could not be turned down. He was invited to Switzerland to be a sparring partner of the world tennis legend Martina Hingis. Radim Valigura, who then played tennis in the first league, took up the opportunity, suspended his studies and left for four years abroad. "In the course of three years I made a gradual transition from the role of the sparring partner to the role of Martina's coach," described Valigura. When the collaboration ended he was

facing the decision of what to do next. "At a relatively young age I took a peak backstage of the big world of professional sports. I could have stayed but there was hardly

After the first year at the Faculty of Business and Management Radim Valigura received an offer which could not be turned down. He was invited to Switzerland to be a sparring partner of the world tennis legend Martina Hingis.

anywhere to go any higher. I decided to return, complete

my studies and extend the scope of opportunities in my future professional career," added Valigura.

Although he opted for the Company Management and Economics course at the Faculty of Business and Management, his interest in working with body and mind persevered. "I have always been curious about why it was that Martina Hingis could so perfectly cope with pressure and deliver excellent performance. In the end I landed with so-called energy psychology. Just like physics gradually transforms from physics of the traditional Newtonian type, energy psychology is a superstructure of traditional psychology," explained Valigura.

During his studies at BUT he did not sever contacts with his Swiss colleagues and began to regularly return to the country and assist in the development of athletes and firms. "The world of sports was small for me and studies at BUT helped me understand how business and corporations work. My history in sports combined with economic education and thanks to collaboration with Martina I met people who showed me how I could apply my experience from sports to strategic consultancy in business and management," added Radim Valigura.

Today he helps firms overcome new challenges and changes and to survive crises. "I counsel companies on how to get stronger from the inside. It is crucial to understand that the organism

of each individual works by the same logic. This means that it has a certain mental and physical setup and, most importantly, energetic readi-

Thanks to my collaboration with Martina I met people who showed me how I could apply my experience from sports to strategic consultancy in business and management.

ness that affects the two components. A top sportsman realises this perfectly, as physical results can be seen immediately. A firm can be looked upon as an organism, too. It has its mental setup in the form of vision and strategy and a method of management. It also has its physical body, being the people, products and facilities. And, above all, it has its energy or dynamics, which is manifested by how people in the company communicate with one another, how committed they are and how willing they are to concentrate on the substantial things that lead to resolving a situation. These three components influence one another. The mental setup affects our emotions and emotions are the source of our energy which in the end moves our body. And it also works the other way round. Physical movement generates energy, which changes our mental setup. At any rate, at the moment when I set up my head in some way, my body responds accordingly.

The result is either flexing or releasing the muscles depending on the level of stress that corresponds to the given setup. You are either tense or relaxed. A firm reacts in the same way. When the management is doing well, there is high energy in the firm, employees are relaxed, motivated and put up a good performance. At the moment when the company fails to fulfil its vision and strategy, people are tense and just like the muscles in our body will become weaker or blocked," explained Valigura.

According to him, the level of success of managers and athletes depends primarily on their ability to work with energy. "I teach them to 'breathe through' difficult situations by broadening their context and giving them a different perspective on the matter. When they get to grips with the energetic principles of their organism, they will equally understand what is happening in their firm. If we raise the energy level in our organism, the centre of conscious thinking in our brain will start to work and we are able to think strategically, that is from a long-term perspective. The same happens in the company. People have a tendency to solve details at the moment when they do not have the strength and energy to address the whole. By increasing energy, micro management will again become macro management. I employ different techniques to help company management to effectively direct its energy and retain this

long-term view even in the challenging times of changes and crises" added Radim Valigura.

He admits though that many people still search for the esoteric and supernatural in his work. "There is nothing esoteric in working with energy. Athletes do it every day. When I don't put energy in a shot, the ball simply doesn't fly. Who has experience in martial arts, is certain to know what we are talking about. But people need the same energy everywhere, for example, in decision making and communication. Energy is a key to change," emphasised Valigura.

In general, according to Valigura, people still do not work too much with energy.

I teach clients to connect with themselves, to become conscious of themselves. Today we tend to be completely disconnected from our bodies and conscious mind and often feel that things are happening to us.

Unlike athletes, managers don't know how to relax. "Learning to relax is one of the fundamental things. With athletes the logic is very simple. If they don't take a rest, they will not perform well and will have nowhere to hide from responsibility for a bad result, as opposed to a corporate manager. Managers are often unable to

switch off and, unfortunately, do not consider it important. They are working all the time and frequently the only way to relieve themselves is through alcohol, medicines and other external stimuli," stated Radim Valigura.

He thinks there is no universal solution to these problems. "The first thing that I do with clients could be simply called centring. They learn to connect with themselves. They become conscious of themselves. Today we tend to be completely disconnected from our body and conscious mind. Consequently, we often slip into the role of victim and feel that things are happening to us. We are unable to realise that the given situation is caused by our setup and incorrectly focused attention. I use a number of tools, such as specialised forms of the Business Master Key managerial tool or the Mental Supremacy® methodology to understand the relationships as well as all the traditional approaches to centring, including conscious breathing, kinesiological exercises, different forms of physical training, visualisation and meditation. But at the base level I give back to people the chance to choose. I help them realise that in every situation we always have a choice and that wherever our attention goes our energy goes with it," concluded Radim Valigura. ■

Dragon 9 on the race track



Members of the TU Brno Racing team had a busy summer 2019. In July and August they took part in the Formula Student international races in the Netherlands, Hungary, Germany and the Czech Republic with the Dragon 9 racing car. The best placing was achieved by the students' car in the Netherlands and the Czech Republic where it claimed bronze. At the races in Most the team also came first in the engineering design category. The young designers successfully completed the ninth season in a row and are already preparing for the tenth in which they will design and build the first electric formula car, alongside one with a combustion engine. ■



(ed)
Photo archive of TU Brno Racing

Board games from Brno celebrate success around the world

The workshop of Czech start-up Boardcubator has produced several board games loved by fans around the world. The team of enthusiasts from Brno that is behind games like Space Race and Project L launched a number of very successful campaigns on the Kickstarter crowdfunding platform. At the same time they created a community of passionate board game players who can't wait to see what Boardcubator is going to come up with next.

Zuzana Hübnerová
Photo archive of Boardcubator

For more than a year, Silvie Dovrtělová, a graduate of the Faculty of Business and Management BUT, has been taking care that all games arrive in perfect condition and on time anywhere in the world. According to her, board games are undergoing a renaissance and demand for them, particularly in America, is huge. It takes about a year for the Brno team to develop one game and during their work they have to take into

consideration even things like the politics of Donald Trump. Boardcubator was launched by Jan Soukal, who had solved IT security issues of companies on his job and in his free time devoted himself to playing and inventing board games. He created his own card game called Space Race, but didn't know how to distribute it among people. At that time he met Marek Loskot, who had experience with campaigns on crowdfunding platforms, such as Kickstarter. Those who are interested have an opportunity there to financially support projects they like in exchange for various bonuses and rewards. "Our campaign was very successful and we managed to collect the money necessary for production and distribution," confirmed Silvie Dovrtělová, who is primarily in charge of the logistics in the company. It was then that Jan Soukal, nicknamed Suki by his colleagues, and Marek Loskot, called Mára, decided to make the project a full time job and to establish a firm that will enable board game creators to bring their ideas to the market.

The opportunity was taken by Adam Španěl, who presented his idea for a game originally



entitled Mosaic Maker and subsequently renamed Project L to the founders of Boardcubator. "Together they completed the game's development and again offered it to the community on Kickstarter. As far as demand and collected money are concerned, in the end Project L was even more successful than Space Race," added Dovrtělová and explained that now they are facing a difficult period of sending the completed game to all those who supported them and ordered the game, reminiscent of Tetris. Specifically she has the task of dispatching the game to more than seventy countries around the whole world. "It is very demanding in terms of co-ordination and paper work. I have to think about going through the customs, and to find the cheapest way of sending the games, so that customers would not pay high

postage fees, as we definitely don't want to make money on that," clarified Dovrtělová and added that right now she is concerned particularly about American politics and threats by Donald Trump. "In August it was announced that from December they would raise the customs fee from 0 to 10 %". Initially they even talked about up to 25 % which would mean extra costs for Czech producers.

On a general level, Boardcubator operates like this: first, creators publish an idea for a game. If the gaming community likes it and supports it, the phase of final development, production and distribution is ready to start. "The whole process usually takes about a year. But we are simultaneously working on cutting the development time. In the future we want to offer a

game which is essentially complete," noted Dovrtělová. In the first published games they let the gaming community have its say in the final version. "For those people it's a way of life. Many of them write to us with comments several pages long and ideas for improvement. From time to time our developers put those suggestions together, browse through them and sort out which are relevant and which are not. But in the vast majority people ask for a change of colour or shape of the game components," stated Silvie Dovrtělová.

The game is always tested in several rounds by the Boardcubator team. "Once we are clear about the basic game mechanics and what the individual game components will look like, we create a prototype. This is then tested. We play the particular game and say to ourselves what we like in it and what not. Based on this a new prototype is created and again tested. Sometimes it happens that we sit the whole afternoon in the firm and play. We have to push all work aside and play," described Dovrtělová. These days customers and players of games by Boardcubator are most frequently Americans. But according to Dovrtělová there are no fundamental cultural differences in the board game community. "Family games are particularly popular. In this case people look at the price and want the game to be appealing. Another category is so-called figure games. Here the players are more like collectors and like it when there are many components in the game. Then they

do not hesitate to pay a high price. As a result many producers offer special editions of characters within crowdfunding campaigns and guarantee the buyers that they will not be able to buy them elsewhere and so on," described Silvie Dovrtělová and added that board games inspired by a concrete computer game are very successful as well.

As Silvie Dovrtělová elucidates, the success of the Brno team in a highly competitive gaming environment is given both by the fact that they are good at campaigns and in communication with the gaming community, and by the games themselves. "Jan Soukal, who is responsible for new games, tries really hard to think about everything down to the last detail – to invent interesting game mechanics and exclude the random element. So that it would not be based on the cast of the dice, and the result of the game would be completely in your hands," explained Dovrtělová. In the future Boardcubator would like to continue down the path of developing their own games. As Silvie Dovrtělová says the firm is planning more campaigns and gradually hopes to build an even greater renown and enlarge the community of people who will want to support the group of enthusiasts from Brno over the long term. "For the time being we are doing it more for fun rather than to be financially saturated," ended Dovrtělová with a smile. ■

RESEARCH



Researchers at CEITEC BUT are assembling a unique magnetic resonance device

Petr Neugebauer and his team presented a unique device which turns upside down the established principle of measuring electron paramagnetic resonance. It happened on 12th November 2019, on the occasion of the opening of a new laboratory at CEITEC BUT.

Thanks to an ERC grant the head of the laboratory and main researcher Petr Neugebauer is assembling a revolutionary spectrometer for paramagnetic resonance and he counts on its commercial production in the form of technology transfer after the development has finished. Neugebauer received 2 million EURO from the European Research Council for research, development and assembly of the device. The new spectrometer of paramagnetic resonance may bring a significant shift in many disciplines, such as physics, chemistry and medicine.

The idea itself is revolutionary in that it turns upside down paramagnetic resonance which has to date mainly operated on the principle of a variable magnetic field under invariable frequency. The new method works in an invariable magnetic field with a fast frequency change, which, apart from the obtained spectra, will enable the revealing of the relaxation times of various materials which are presently a big unknown. The new method makes measurements faster, more complex and more precise.

(ed)



We still don't know much about plants, says the creator of instruments for NASA, Oxford and Monsanto

Martin Trtílek from Photon Systems Instruments, or PSI, supplies instrumentation for plant research to the most prestigious institutions and the largest agricultural companies. Every day researchers from NASA, Cambridge and Monsanto handle instruments conceived and developed in Drásov near Brno by Martin and today a nearly 100-strong team. A graduate of the Faculty of Electrical Engineering and Communication created his first instrument for plant research at the beginning of the 1990s. Today he has five hundred of them under his belt and his head is still bursting with ideas.

—
Zuzana Hübnerová
Photo archive of Photon Systems
Instruments

According to Martin Trtílek, the fact that he has devoted most of his career to studying plants and inventing instruments for their research was basically down to coincidence. "Someone calls it destiny. During my studies I developed and produced instruments. I caught the attention of people from the Academy of Science who asked me whether I could develop instrumentation for the study of plants and other organisms for their application. Shortly afterwards I met my future colleague who was working in the USA at that time. Thanks to this encounter I developed several instruments for the laboratories of the University in Illinois," said Trtílek describing his beginnings. The said colleague was the scientist Ladislav Nedbal, with whom they subsequently



Occasionally I bring a seed or two from a business trip abroad and plant it into the soil at home. I built a garden which takes care of itself and requires minimal intervention.

and sell are intended for research into CO2 sequestration and should directly assist in addressing the high volume of carbon dioxide in the atmosphere," explained Trtílek. Climate change is an increasingly topical subject for PSI and a number of the current activities and research are heading in this direction. "We try to help and bring a concrete solution to the issue," added Martin.

Alongside the instruments described above, PSI has made a

name for itself by the so-called FluorPen – a hand-held device measuring photosynthesis. One was transported to the International Space Station where it is used by experts from NASA. Apart from instruments intended primarily for research the company offers mass-produced devices that may be encountered in vineyards or offices. The spectrometer from Drásov measures both the intensity of light from which plants benefit and the correct level of illumination in the office. WinePen is used by agriculturalists to determine the sugar content in grapes.

Regardless of the number of instruments, in Martin Trtílek's opinion there are still many things about plants that we don't know. "To take an example, we are not familiar with the complete function of their genetic code. We are

unaware of a whole number of mechanisms that occur in a plant. How does it come to terms with a change in the conditions in the environment where it grows. As it has no option to run away from unfavourable conditions, it has to develop several mechanisms to survive them," emphasised Trtílek.

But as he says he spends less and less time on research and development proper. Today most of his working day is taken up by company management. "Most of my time is dedicated to the activities around the company. Although research and the development of instruments is what I enjoy the most, to be honest I get to it only rarely. On the other hand, I am relatively successful in my research and even the scarce time that I can reserve for it brings some results. In addition,

I have an excellent team around me, which successfully implements our ideas," added Trtílek.

That there is no dearth of ideas in Drásov is confirmed by Martin Trtílek when he is describing the dream projects or research planned for the

The FluorPen, a hand-held device measuring photosynthesis, was transported to the International Space Station where it is used by experts from NASA.

future. "I think that every man has some unrealised or unfinished things in the drawer. For myself, it is an instrument to search for life on Mars. It was to have been produced but financial issues prevented it. I also have plans to move into the field of medicine as many of our things find an application there. And it's also a chance to help people. Plants are fine, but we belong to homo sapiens," ended Trtílek. ■



founded PSI. Today Nedbal is no longer active in the firm, which is solely run by Martin Trtílek.

Being a graduate in electrical engineering, he had to become versed in biology. "The transition from the disciplines of physics and electronics to biology was more or less spontaneous in my case. I simply worked on solving requirements for instrumentation which made me gain an insight in biology. It was not so difficult to extend my previously obtained knowledge. The most arduous

aspect was to lead scholarly conversation with people who are top scientists in their field of research. I had to gain an overview including the highly detailed and specialised areas of their research," noted Trtílek.

But as he says he has a natural liking for plants and likes to take care of them even in his leisure time. "I really like flowers and various plants. Occasionally I may bring a seed or two from a business trip abroad and plant it into the soil at home. The problem is that plants from around the

whole world need a lot of care as each of them requires different conditions and types of care. Admittedly, I don't have time for that which clearly limits my potential to cultivate. I built a garden which takes

Someone calls it destiny...thanks to an encounter with my future colleague who was working in the USA at that time I developed several instruments for the laboratories of the University in Illinois.

care of itself and requires minimal intervention. I only add something new from time to time," added Martin Trtílek. And it is the differences between plants that are the research focus of PSI. "We study the differences between the individual phenotypes and our instruments help experts determine even those not discernible with the naked eye," elucidated Trtílek. The phenotyping lines developed in Drásov are designed, for example, to search for plants that are more resistant to climate change. "The bioreactors that we produce

Jindřich Melcher: In designing structures we have to ensure safety, reliability and robustness



Jindřich Melcher has been working for the Institute of Metal and Timber Structures of the Faculty of Civil Engineering BUT without interruption since 1962. With his acclaimed built projects and experimental research he continues the legacy of Ferdinand Lederer. As a member of his team he has developed into an internationally respected expert. He is the author of a number of specialised studies, over 400 publications and textbooks, a member of many international scientific organizations, including an elected member-correspondent of SSRC (Structural Stability Research Council) with headquarters in the USA. In November 2019 he received the Gold Medal of BUT in Brno for outstanding lifelong achievements in scientific research and his merits in the development of the Faculty of Civil Engineering.

Jana Novotná
Photo Igor Šefr

Professor, was your selection of the Department of Steel Structures made on purpose?

In fact, it was a coincidence that I got there. I was originally determined to go to the Department of Concrete Bridges, because at that time Karel Zůda had returned from the UK and he could sway us students that we all wanted to build concrete bridges. But then I received a letter at home with an offer for the position of a student research assistant at the Department of Steel Structures under Professor Lederer. I had just been on a placement in East Germany and my parents did not want it to fall through, so they answered that I accepted it. I knew about Lederer that he had designed Pavilion Z at the Brno Trade Fair, so I went to see him and as it was very interesting I stayed there.

How did it feel to work with Professor Lederer?

We learned to design real-life structures which are safe from the point of view of reliability. Together with Professor Lederer we did, for example, the roofing over the largest ice-hockey stadium in the country in Olomouc, which has been in place until today. The swimming stadium in Brno or the Festival Buildings in Karlovy Vary architecturally designed by the Machonins. Lederer got this job thanks to his reputation, and we did the designs for three film projection auditoriums with him. In a similar way, but alone, we did the structure in the Bobby Centre, where the traditional ball of our faculty is held. It is a classic pipe structure with spherical thin-walled joints,

everything is welded together, the whole structure sits on supports and is stable with minimal hazard.

What is the lifetime of a structure?

Earlier it used to be said that the structure should be safe in terms of the general principles of probability, later, that it should be reliable, and today it is generally stated that it should have good resistance. Consequently, safety, reliability and resistance are the three categories that we have to ensure. The life of any construction work is not infinite. Water dams have the longest durability, they are massive blocks which can last one or two hundred years, but our structures only fifty sixty years. It is counted on that the building will become obsolete naturally through use or morally and something else will be designed in its place. Material characteristics also play a role, such as corrosion, or the way it is stressed and, above all, maintenance in the process of using it. In addition, we have a tendency to do slim, thin-walled structures to reduce their weight, which naturally increases the risk. When Ferdinand Lederer was designing Pavilion Z, he did not know one hundred percent how it would turn out, but he was given an offer and he went for it. This is our disadvantage as opposed to architects – they will complete the design but when it falls down it's someone else's fault. When, for example, the bridge in Genoa collapsed a few years ago, they said on TV that the architect proposed a new solution. But it couldn't have

been an architect because they are mainly concerned with the visual expression without more detailed attention to resolving the complex issue of the resistance of the load-bearing system.

A major part of your work consists of experimental research. Does research have to be crowned with implementation in order to prove its validity?

Some things are purely theoretical, such as deriving the relationships in the

standards, naturally we do that as well, but we have always done implementations. For example, when we were working on the Rondo sports arena with a pre-stressed wire rope structure, we tested the wire rope modulus of elasticity. This is interesting: in building structures we do not have such strict safety requirements as, let's say, in the structural frames above mine shafts. There the wire rope that transports miners up and down has to be replaced after five years even if it looks good

on visual inspection. But for us it's still good, so we take it, establish the elasticity modulus and use it. And it's those wire ropes that were used in the structure of the Rondo arena.

Is it the successful implementations that bring fame to the designer?

Today the accent is laid mainly on publishing in high-impact journals although I say to myself that it should not go too far with the impacts. It should be the work that is

valued. Take Lederer – he has a number of water works behind himself. In his time he was given an opportunity, via built projects for the Brno Trade Fair he got further to other things and built a number of them. Later we, too, did several high-profile implementations, such as the Boby Center (architectural design by HEXAPLAN INT. Brno) that received the Building of the Year 1993 Award, or the South Moravian Gas company (architectural design by the A PLUS studio

from Brno), which was granted the European Steel Design Award in 2001. So I may say that the work should play a decisive part, but when you look around at construction projects in Brno, it's not easy to get something done. Winning an important order in competition is much more difficult than publishing a short article. A significant contribution to our work is the development and application of a unique method of vacuum stressing of load-bearing structures enabling us to verify the mechanism of damaging and altering flat and bar-shaped structural members from metal, wood, glass, composites and combined materials.

Which implemented project from your field is the most valuable from your point of view?

Lederer's Pavilion Z. This structure is as unique today as it was then, still not fully appreciated. Nobody knows about the things that happened there. When it was being assembled in 1958 we were on the site as students. The structure was hung vertically on wire ropes from the central pylon and the dome was gradually woven on the ground – it was always raised by a metre or two, the next section was woven and so on and so on, but then catastrophe struck. While they were hoisting it vertically, it curled up like a piece of cloth. Nobody took into consideration that a shell like that had to be raised along the tangent at the end. After reconfiguration, it proceeded upwards smoothly.

In connection with this we might mention another interesting piece of information which is not generally known. About 3 years after completing Pavilion Z in Brno a similar pavilion was built at the trade fair grounds in Bucharest, Romania. Professor Lederer was not invited to collaborate or asked to grant approval with adopting the Brno system, but in the end the situation resolved itself naturally: when the building of the Romanian pavilion was finished, the structure collapsed. Those who were not completely informed about the authorship and the circumstances of its design were quick to reach a corresponding conclusion: Lederer's lattice dome in Romania collapsed. Nevertheless, the point of the problem was soon clarified by the circumstances of the collapse. During the installation of exhibits an aeroplane was suspended from one of the wire ropes of the roof structure and the extreme local stress on the roof shell triggered its breaking and a collapse of the whole roofing system, adapted to standard surface loading by its own weight, snow or wind, but not to a locally concentrated stress from suspension.

How much has your discipline changed since the time of your studies?

The fundamental element in our discipline continues to be dimensioning or calculation of the structures based on construction mechanics and knowledge of the real-life effect of load-bearing components. We have technical documents that aid us in

designing – for example, for designing steel structures it used to be the ČSN standard, today it's the European EN document. The student has to learn to design, which does not concern appearance, but the relationships that he or she needs to master. We have a number of publications originally issued in English and now in Czech translation as well, and there you have the word design, but contrary to the general understanding in our country it does not imply appearance but structure. Today mastering the discipline consists of adopting documents valid in a number of countries which almost tally with the EU. In addition, we use the European Steel Design Education Programme so when someone wants to know whether the course that we teach here is at the same level as in Austria or France we can clearly say yes. We have a total of 28 volumes of ESDEP in English in which the complete programme is elaborated in detail.

How did you procure them?

Organisationally, the system was created in the Steel Construction Institute in Ascot, Great Britain which we visited with our colleagues, where we gave talks on our activities and have been in touch ever since. When we want to do something that should comply with at least European requirements, we have something to look into. But when I ask students from Spain or Portugal who arrive here on the Erasmus programme whether they know it they have never heard about that. We have the complete discipline

available to us, from material to construction, so nobody can blame us that we do not work at the level that is common in other European countries. Interestingly, they are reference materials for learning to design steel structures, but there is nothing remotely similar available for concrete structures, timber structures or geotechnology, not to speak of other specialisations.

In the end, what would be your arguments if you wanted to sway an undecided potential student to study your discipline?

Our discipline has the background of practice, it has the background of theory and the connection of theory and practice is undoubtedly important. The prospects for finding a job are good, our students have no problem in finding a position. Given the content and specialisation of the courses it is easy to go on a temporary placement abroad during the studies. I think it is a great opportunity for those who want to create load-bearing structures of buildings, industrial, sports and business facilities and bridges. ■



An IFE graduate who left for Iceland to work as a tourist guide on a glacier



It's a story fit for a novel. Kateřina Šardická graduated in real estate engineering from the Institute of Forensic Engineering BUT and left for Iceland where she today works as a tourist guide on the glaciers. Except that it was not that easy. Initially she studied religions and social anthropology at Masaryk University and when she began to miss mathematics she additionally enrolled in the business economics course at the Faculty of Business and Management BUT. Afterwards she opted to continue with a master's course at the Institute of Forensic Engineering, mainly to improve her chances of a good job. And as she had never been on Erasmus, she decided to spend at least the last holidays abroad and headed to Iceland.

Jana Novotná
Photo archive of Kateřina Šardická

"The original plan was to go there just for the summer – sort of a last chance to travel somewhere before I started to lead an adult life, so as not to regret it later," says Kateřina. She took up a job in a hotel and met her Icelandic boyfriend. This changed everything. After the holidays she flew back to the Czech Republic to complete her studies and returned to Iceland. She intended to master Icelandic on the job at the hotel but it didn't work. Her boyfriend worked as a guide on the glaciers where they would walk together at leisure so she said to herself why not give it a try. "I entered in the Hard Ice 1 course which complies with the AIMG (Association of Icelandic Mountain Guides) criteria. I learned to handle the rope, assess the terrain, find a path for people who are standing on crampons for the

first time in their lives so that it would be safe yet still interesting," says the graduate of Brno University of Technology. The course ended with the crevasse rescue test: if the client falls through into a crevasse the guide must be able to climb down to them, secure them, climb up again and pull up the client, and naturally all of that in the shortest possible time.

After she successfully passed the tests, this native of South Moravia with a diploma in forensic engineering began to guide tourists on the Icelandic glacier. In the summer season she usually catches three tours a day, and spends up to 13 hours in the terrain, while in winter it is only 9 hours because of light. "In general clients come 15 minutes before so we have time to show them how to wear the harness, we adjust the crampons for everybody and give them an ice-axe and possibly a helmet

depending on the type of tour," says the rookie guide who had to get used to spending the day out in any kind of weather and in torrential rain pretend she was enjoying it. "I gradually worked myself into the state that I am enjoying it," laughs the young engineering graduate and emphasises that in communication with clients she often can't manage without immense patience. "Not all clients speak English, and before we set off on the glacier, they all have to be clear about things related to safety. As a result I often use hands and legs to make myself understood." A bonus in this work is when you are social and are able to share the excitement from the experience with the tourists.

Kateřina's clients are most often ordinary tourists who crave a different experience from their holidays. "If they do have any experience in climbing they usually write ahead to say they would be interested in a private tour, and we venture to places where I would not take a normal group, we have a go at ice climbing and so on. But standard tours are often booked by families with children, couples or elderly people fulfilling their life dream – our youngest visitor was 6 years old, and the oldest was an 83-year-old Japanese," says Kateřina. The overwhelming majority of clients stand on crampons for the first time in their life and this determines the speed of walking and the time spent on the glacier. Can one be a guide on glaciers for one's whole life? "Walking all day on ice exerts great stress on the knees and joints in

general, so it is probably up to each individual. It depends on how you care for yourself and how your body copes. I know a guide who has been working all of his life and he's over 60 – probably the oldest guide in Iceland."

Before Kateřina decided to make the U-turn, she had never considered herself to be particularly impulsive. "I might be a bit, although I naturally think everything over. Before we started the Melrakki Adventures company with my boyfriend, we thought about that for a long time. But ever since we met we have been talking about having our own company focusing on guiding, and when else to do it but now, when we're young and don't have a family?" says the BUT graduate and adds that if it fails they may take on a job again, but if they didn't try they would have to think about it all the time. "It's the same for me with Iceland. I can return home anytime but it's important to try. I would say that the older you are the more difficult it is to cut the bonds, so I am glad I found the courage at the last minute and flew from the nest," ponders Kateřina and simultaneously admits that she misses home every day.

She had to accommodate to great cultural and climatic differences in Iceland. "The contrasts are great. From crazy weather via the way people spend their leisure time to what is available in the shops. The wind is constantly blowing in Iceland, in winter the force of the wind is so great they have to close some sections of roads as the wind could



overturn a car. People are used to helping one another, maybe because there are so few of them – Iceland's population is roughly the same as that of Brno. Icelanders spend a lot of time in open-air thermal pools. Including in winter, when it's

snowing, they sit outside in whirlpools or swim in heated swimming pools. And many people indulge in knitting," adds Kateřina and admits that she has already picked up knitting, too. In winter there are only four hours of daylight,

and when the weather outside is bad there is not much else to do.

Can a BUT graduate put her education to work in Iceland? When they were founding the guiding company with her

boyfriend she applied some knowledge from the Faculty of Business and Management – creating a business plan, calculation of costs and so on. But her knowledge from the Institute of Forensic Engineering will probably go unused. "I would have to become acquainted with their complete legislation, which is understandably different to that in the Czech Republic, and due to the language barrier it is inaccessible to me for the time being. The method of building houses in Iceland is completely different from ours, timber buildings predominate, you have to take into consideration the natural elements, mainly the wind, and in areas where the tectonic plates meet, the risk of an earthquake, and I would have to study all of that," says Kateřina. So far she has no Plan B ready for returning home with her Icelandic boyfriend, although they have visited the Czech Republic together several times and he likes it a lot over here. Trees, among other things ... there are none in Iceland. ■

Crossing the border with BUT

In the academic year 2019/2020 the Department of Foreign Relations BUT organised the traditional photo competition capturing the experiences and observations of students from their foreign placements, internships and summer or winter school. The three best photographs were selected by a committee and by students on Facebook with the result of six awarded photographs presented below. ■

(ed)

1st place by FB:
Michal Jurko from FCH,
Yellow Light (Poland)



1st place by the committee:
Zdeněk Pokorný from FME, The
St. Alexander Nevsky Cathedral
(Bulgaria)



3rd place by the committee:
Kateřina Bortlová from FCE,
Inverted Prayer (Switzerland)



2nd place by FB:
Radek Kubíček from FME, The
Way Is the Goal (Norway)



3rd place by FB:
Magdalena Urmínová from FIT,
Small, but Wonderful World
(Portugal)



2nd place by the committee:
Ondřej Hanousek from FCE, Lost in
Asia (Vietnam)

The Chybík+Krištof architectural studio from Brno is the best in the world



Hana Marko
Photo archive of the Chybík+Krištof studio

The Design Vanguard 2019 prize for young talented architects, given annually by the legendary American Architectural Record magazine, has been received in international competition for the first time by Czechs and Slovaks. The Chybík+Krištof studio of two graduates of the Faculty of Architecture now ranks with other famous names – Sou Fujimoto or Smiljan Radić.

Architectural Record is one of the oldest magazines dedicated to architecture and design. It has been published without interruption for 128 years and since 2000 has awarded the Design Vanguard prize to young and talented architects. This year's award for a visionary style of work with architecture and urbanism was received by the Chybík+Krištof studio, founded nine years ago by two graduates of the Faculty of Architecture BUT – Ondřej Chybík and Michal Krištof.

"It is one of the most prestigious competitions with participation by young architects from the whole world. Competition is fierce and we are happy that the prize was finally won by someone from the Czech Republic and Slovakia. It might be partly attributed to our frequent travels abroad during our studies

at the Faculty of Architecture BUT. We discovered that taking part in various international competitions and presenting one's work in an international environment is the daily bread in our profession. In this way Czech architecture is exported to the world and people start talking about it," stated Ondřej Chybík.

In the competition the Chybík+Krištof studio presented a selection of five of its projects. One of them was the precinct of the Lahofer winemaking company with a visitors' centre and an amphitheatre on the roof in Dobšice near Znojmo. "We try to integrate the Moravian landscape directly into the building of the wine producer. The vault of the building adjoining the rows of the vineyard is made up of boards with a span of 2.75 metres between them, which is the

width of a vineyard row. The slope of the amphitheatre resembles the shape of the slopes in the surroundings," explained Michal Krištof, describing a project that was completed in June 2020.

"We attempt to design every project specifically for a given site, context and client. We don't want to copy someone or something else, or even ourselves. We aim at lightness and understated originality. And we find the elimination of wastefulness to be increasingly important to us – we are after a compact quality of solution. This does not mean that we concentrate on small projects only. It is in the big ones that it is necessary to behave responsibly," added Chybík, explaining the philosophy of the studio, which today employs more than 50 architects and has branches in Prague, Brno and Bratislava.

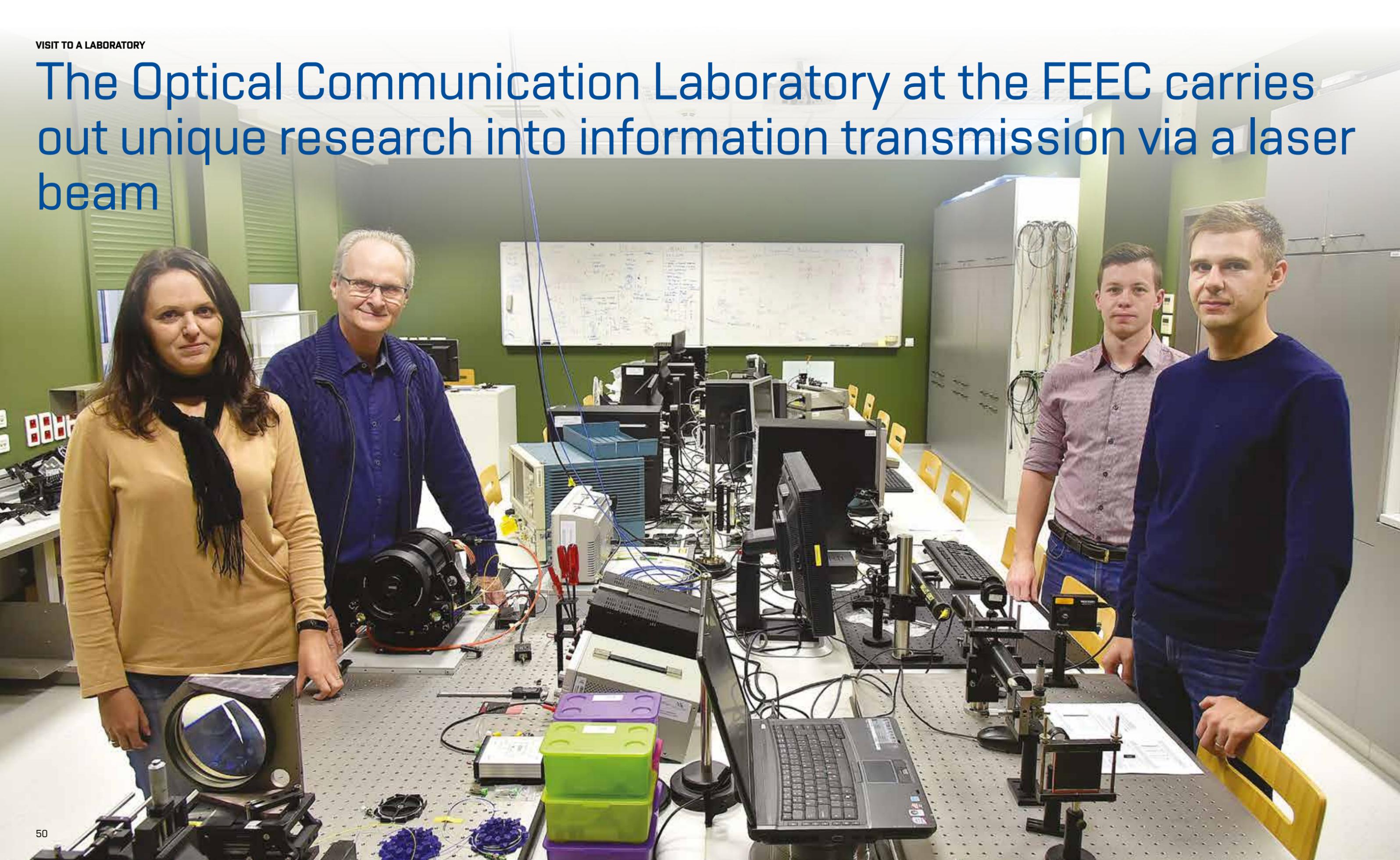
"Right now we have around 40 very different projects on the table. We are interested in everything with a possibility of added value from the work of the architect, interiors or exteriors," said Krištof at the time of receiving the award in June 2019. At that time his studio was working on the design of a small bar in the Znojmo brewery and the extension of Terminal 2 at the

Václav Havel Airport in Prague. "We want the resulting visitor's experience to be of the same high quality in both projects. Our other projects include the headquarters of Lesy ČR, a number of apartment buildings in Prague, Brno, Olomouc and Ostrava as well as the reconstruction of Brno's Zvonařka bus station," added Krištof.

Design Vanguard has taken its place with many other awards and successes of the Chybík+Krištof studio. For the Furniture Gallery in Brno with a facade decorated with chairs the young architects claimed one of the prizes of the Czech Award for Architecture and the Grand Prix of Architects 2017. The very first significant undertaking by Chybík and Krištof was the design for the national pavilion at the World EXPO in Milan, Italy in 2015. The pavilion used modular architecture which allowed for reassembly in 2018 and re-opening it to the public on the premises of the KOMA company in Zlín. ■



The Optical Communication Laboratory at the FEEC carries out unique research into information transmission via a laser beam



The Optical Communication Laboratory at the Department of Radioengineering of the Faculty of Electrical Engineering and Communication was the brainchild of Otakar Wilfert. Established in 1997 in the building on Purkyňova Street 118 it was used from the start for courses in optical communication, photonics, quantum electronics and laser technology. After the faculty moved to the new building on Technická Street 12 it was transformed into a first-class facility which serves both as a laboratory for teaching courses and an important scientific research unit.

Jana Novotná
Photo Igor Šefr

Present at the birth of the new laboratory was again Professor Wilfert, who put forward the requirements for the procurement of instrumentation and supervised even the selection of suitable decoration in the

laboratory, which is striking at first glance with its unusually dark olive-tinged walls. "The significant items among the first purchases include a tunable laser, special optical laboratory table, mechanically precise and resistant to shock, the Fourier spectrometer, capable of precise measuring

of the optical radiation spectrum, and other auxiliary devices," recalls Otakar Wilfert. The uncommon colour of the laboratory walls is related to reflections of laser radiation and work safety. As laser radiation can hit the eye even through reflection from the walls and it reflects better from lighter walls, it was necessary to choose the darkest possible shade for the wall decoration. "Ideally black, but it would be rather depressing, so our olive green is kind of a compromise," explains Lucie Hudcová, who is guiding us through the workplace.

Currently the Department organises a bachelor's course in Basic Optical Communication and Optoelectronics, which is more practically focused, and a mathematically and physics-wise more demanding

master's course in Quantum and Laser Electronics.

As laser radiation can reach the eye even through reflection from the walls and it reflects better from lighter walls, the laboratory was decorated with olive green paint.

Teaching takes place in the front section of the laboratory while the rear section is reserved for scientists and students working on their projects. Research concentrates on different areas of optical sensors, optical communication, particularly on the transmission of information through open space using a laser beam. The results of the scientists from Brno's faculty of electrical engineering are really unique in these fields. "As a standard, using laser radiation in open space we can transmit information over a distance in the order of kilometres, but in special applications you can relay it over hundreds of kilometres. In optical fibre links these distances can be even longer. The transmitted optical radiation is affected by many factors – a number of optical phenomena on the transmitting and receiving lens, atmospheric phenomena, such as rain and fog, or turbulent atmosphere, as well as non-standard events such as when a flying bird interrupts the laser beam for a moment. And given that the laser beam is very narrow, it is very difficult to aim the transmitter at the receiver," explains Otakar Wilfert, who can himself boast

of numerous publications and projects.

At the time of our visit the team of Otakar Wilfert was in motion on the roof of the faculty and experimentally verified whether an adaptive system assembly worked successfully. "Adaptability helps the beam which is going from the transmitter to the receiver to continually maintain the correct direction and if it deviates due to atmospheric phenomena, the system can redirect it correctly again," clarifies Otakar Wilfert. "The laser beam has two fundamental properties. It can concentrate a relatively great amount of energy onto a very small spot, when a hole can even be burnt in the material under certain circumstances, and it has an ability to concentrate a great amount of information into a relatively short time interval, which is related to the high transmission speed."

When browsing through the laboratory it is impossible to avoid noticing a bundle of cables hanging from the roof and mismatching the otherwise impeccable appearance of the workplace. An explanation is provided by Peter Barčík, who specialises in research and development in the field

After certain corrections the results of their laboratory research can be used to model the atmosphere on Mars, which is typically filled with dust after frequent dust storms.

of optical fibre and cable-less links. "These are optical fibres related to our applied research. As we test optical communications on the roof, we need to get the obtained information down to the laboratory here to analyse it," explains the researcher. "An optical signal can be processed in a number of ways, for example, using a spectrometer. We have a test unit down here for a receiving optical system – it is one of our prototypes. An optical fibre situated in the focal point of the telescope collects received light from the open space. Connecting an optical bundle to an optical fibre is rather problematic and quite difficult. As a result we use various adaptive systems that may compensate for, let's say, the vibrations of the console on which the connection is fixed, or the negative impacts of the atmosphere on the optical bundle. It is a complex system," says the young scientist.

The innovation of the concept lies in the fact that it works with optical radiation which enables the links to achieve greater transmission speed compared to radio communication. "When they are properly configured photonic connections exhibit transmission speeds higher by an order than traditional optical links that you can buy from commercial sellers," explains Lucie Hudcová and adds: "Presently there are plans for using optical cable-less networks for general purposes as only traditional radio connections will not be able to cover the increasing demands of society."

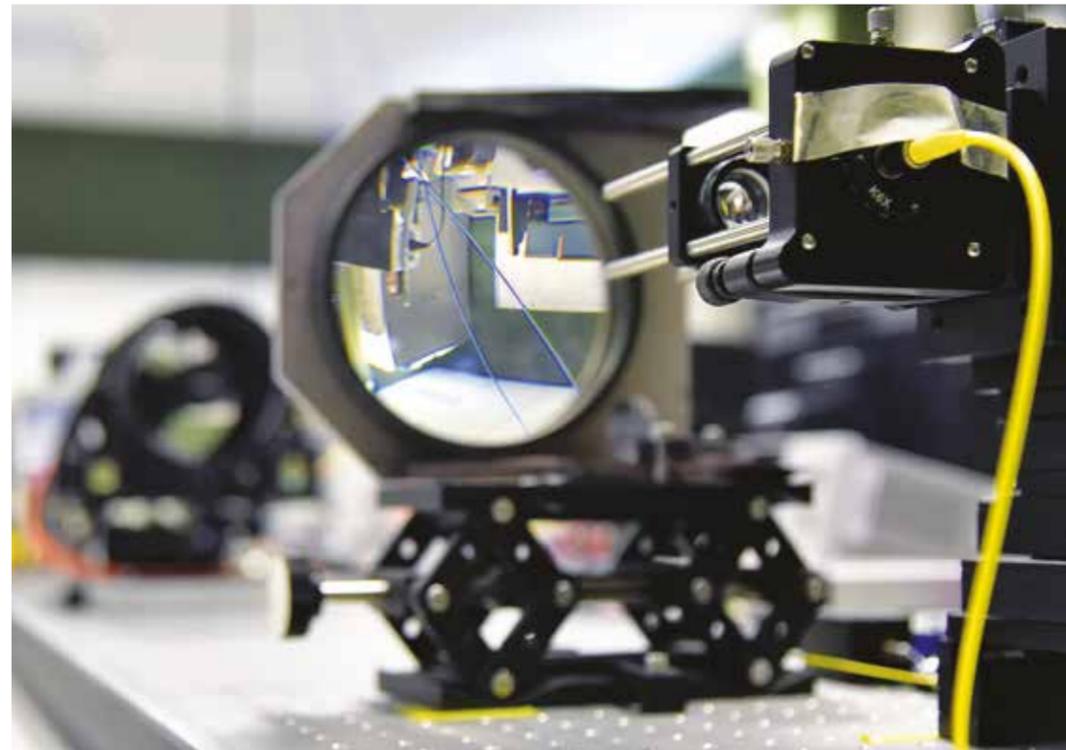
Important past projects undertaken by this Department included, for example, the development of an optical cable-less communication system with the aim of increasing the availability of the connection over time. "Right now we have several heads around the republic which are used to study the events in the atmos-

The transmitted optical radiation is affected by many factors – a number of optical and atmospheric phenomena, turbulent atmosphere, and non-standard events such as a flying bird.

phere and the effect of the atmosphere on the laser beam. For example, on the Milešovka mountain we can study the propagation of the laser beam in an almost vertical direction, which is unique. Milešovka is exceptional for having the worst weather in the republic which provides us with a great opportunity to study negative atmospheric phenomena from an optical perspective," describes Otakar Wilfert. Another extraordinary output is the statistical model of the link. "Under real-life conditions no link operates at 100 % all of the time. But when you analyse the weather conditions on the selected site, you can statistically determine at which time intervals or with what probability the given connection will work. This gave rise to the concept in which optical links co-operate with radio connections – so-called hybrid links," explains Lucie Hudcová and Otakar Wilfert adds: "Rain does

not inhibit optical connection like fog does, while fog does not hinder radio connection. We needed to solve the problem of switching – recognition, when it is more advantageous to use an optical link and when radio connection is more beneficial."

Another field of research is modelling different atmospheric phenomena which affect the quality of the optical bundle. Based on the synthesis of a stationary model, which is concerned with modelling connections in the laboratory, and a statistical model, which captures the modelling of the atmosphere outside, a complex model was developed and its computer version is administered by the PhD student Petr Skryja. "Our young colleague can find a site in the computer model, where the link is situated, he can enter the performance parameters of the given link, even the path of the Sun in the sky, and based on the synthesis of the stationary and the synthetic model can provide users with comprehensive information on the availability of the given link working on the selected site," explains Otakar Wilfert. But scientists from FEEC are looking into the future as well. After certain corrections the results of their research can be used to model the atmosphere on Mars, which is typified by a transmission environment filled with dust after frequent dust storms. ■



Andrea Konečná: When you step out of your comfort zone ideas will start to arrive

She opted for the study of physical engineering and nanotechnologies at the Faculty of Mechanical Engineering BUT instead of physics at Masaryk University mainly due to a better chance of finding a job in one of the high-tech firms and an opportunity to go on a placement abroad during the study. In the end Andrea Konečná experienced nomadic academic life to the full. It brought her plentiful experience in the most varied approaches to doing science and first-rate collaborators. After a five-year-long tour of world scientific institutions she is slowly returning to Brno.

Jana Novotná
Photo archive of Andrea Konečná

Where did the promised placement at the Institute of Physical Engineering take you?

Students go out on a placement during the fourth year mainly within the Erasmus programme. The director of the Institute Tomáš Šikola managed to establish contacts with a number of top (not only) European research institutions, where students leave to work on research projects. I

chose a stay in San Sebastian in the Basque Country, where I spent half a year in the Theoretical Nanophotonics group under the supervision of Javier Aizpurua. I became involved in calculations related to harnessing electron bundles that we commonly use in electron microscopes for atomic imaging in examining the optical properties of nano particles or nano structured materials with high 3D resolution. I was so captivated by the subject that I also researched it as part of

my diploma thesis at BUT and continued to collaborate with the group in San Sebastian, where Javier Aizpurua offered me an opportunity to continue with doctoral studies.

You like to verify your calculations in experiments.

Although in my work I make do with a pencil, paper and a better computer, it is great to have experiments together with calculations. During the whole of my study I was in contact with several experimenters in the field of electron microscopy and spectroscopy, who either verified our calculations by experiments or whom we helped with the interpretation of their experimental results. In 2016 I received a grant from FEI (today ThermoFisher Scientific) and the Czechoslovak Microscopy Society thanks to which I was able to cover the costs of internships with several collaborators of ours. First I spent three months at Rutgers University, a year later two months at Arizona State University and during the last year of my doctoral study

three months at the Oak Ridge National Laboratory. All the internships were excellent as I drew on new ideas and themes for work, but I also found out about the different ways of leading a research group and conducting research as such and the differences between

European and American science. In addition these research internships together with conferences where I could present our results helped me establish a network of contacts and find first-rate collaborators. I continue to work with some of them even

during my present post-doctoral position in Barcelona.

How did you get to the Institute of Photonic Sciences in Barcelona?

I received the offer for a research position in Barcelona indirectly via the tutor for my

PhD studies, who is on very good terms with my new tutor, Javier García de Abajo. He was able to win the European ERC grant for the whole group which in its specialisation partly overlaps with my previous research subjects. Although I hesitated for some

time over whether to accept the offer, as I had originally thought about a non-academic position in Brno, in the end I decided to give it a try. So far I have not regretted it, I am assured that the "new" Javier is justifiably one of the leaders in the field. And whatever





my next position is I expect that the experience acquired here in Barcelona and in San Sebastian will definitely prove useful.

Can you try and explain to a lay person what it is you find so fascinating about the atomic world?

From a long-term perspective I have been amazed by the scope of information that we can retrieve from an “ordinary” electron microscope – it is not for nothing that it is said to be a diminished synchrotron. As I mentioned, using electrons we can make images with a resolution down to individual atoms, which is fascinating in itself, but we can also measure emitted light, X-ray radiation or the electron spectrum after passing through a substance. We can correlate this data and find nearly everything about

the given sample. We have the best microscopes in the world today – you can take a look at how the individual atoms in a substance vibrate. Not to speak of various special techniques and approaches that are being installed in electron microscopes, so there is still a lot of space for enhancement and innovation, including on the principle of other physical methods than are those currently used.

Why are you planning to return home? It seems that you would not get lost abroad.

The way things usually work abroad is that a young scientist has to complete a “round” of positions in several research groups, at best in different countries, and then they’ll start to attempt to win a steady position and found their own group. Naturally, there are

exceptions when people spend their whole academic life in a single institution, but normally scientists have to accept that “nomadic” life. It makes sense. When you step out of your comfort zone and are under slight stress, new ideas will usually start to arrive. This is augmented by the fact that you are in a new group which researches different scientific subjects or where you learn new methods and technical approaches to solving problems.

Personally, I will paradoxically feel like leaving the comfort zone on returning home. Both for personal reasons and because I see interesting opportunities at home. For example, in Brno we have excellent scientific instrumentation within CEITEC and this gives rise to newly emerging

groups led by young scientists who are not afraid to come forward with ambitious projects. I, too, will soon be able to take this opportunity and work on my own project. I managed to receive a grant where I will be able to apply my know-how, and I will also collaborate with scientists from the team of Tomáš Šíkola, with whom we should complement one another. We have partly tested it during another project in which I collaborated with them during my doctoral studies.

What did the nearly five-year-long tour of the map of world science give you?

Apart from comparing the different approaches to “doing science” from the level of the individual up to large institutions, it mainly gave me excellent collaborators. And it’s not just about collaboration, the important aspects are mutual inspiration and ideas, which can arise in the office, or while having a talk over an afternoon coffee on the campus of Arizona State University or during a weekend trek in the hills above the town. All in all, I feel enthusiastic when I see how the subject of electron spectroscopy in connection with nanophotonics is moving on, including thanks to the work of the research groups in which I gradually found myself. And besides, sometimes an idea is really enough and you don’t even need first-rate equipment. ■

CO-OPERATION

To be successful you need to fit hundreds of parts together, says the boss of Flowmon Networks

Hana Nečasová, FIT BUT
Photo archive of Flowmon Networks



Together with a colleague from the Faculty of Information Technology, they were the first employees of a start-up which operated from a single room. Today Jiří Tobola is the head of a company which is one of the leaders in monitoring and analysing network traffic and employs 130 staff. "I consider all of this an incredible story of the success towards which research at school can guide you," says the current boss of Flowmon Networks. The firm was established thirteen years ago as a university spin-off, and today has more than a thousand customers around the world.

You started as a "garage firm" and today you are among the leaders in the field. How did you manage to succeed?

It was a winding road. At the beginning it was academic research where we wanted to compete with Cisco with our products. It was an ambitious but not very reasonable idea. We had to go back to the start and find our own way. At that time we focused our attention on monitoring and safety of computer networks. Our unique prototypes were favourably received by the European Commission, which proposed that we should go commercial. That was the beginning. The technology was the work of a group of scientists around the CESNET association, Flowmon Networks emerged later as a spin-off firm, in which the university has an interest.

What are the advantages of being linked with the academic world?

Firstly, it's the opportunity to collaborate with the university over the long term. It's easier for us to make arrangements for a common project or specify the subject of a diploma thesis. It is a powerhouse which helps us innovate our products. Regular collaboration with universities is an integral part of the development and innovation process in Flowmon Networks today. We share a number of research and development projects. And our customers encounter the results of our cooperation every day.

You have experienced the university environment as a student. What were the benefits for you?

I consider all of this an incredible story of the success towards which research at school can guide you. I enrolled at the Faculty of Information Technology in 2002 when it was a novelty and kind of strange to work on projects in groups. But it was the right preparation for real work in firms. It is great that so many research groups operate at school and there are many projects. From the second term I had a chance to do research work in the Liberouter project. Apart from receiving a welcome grant it meant doing a bachelor's or diploma work with real impact and not just for the table drawer. In the end the Liberouter project gave rise to the Flowmon company. I only regret that I didn't manage to complete my work at school with a doctoral study, but unfortunately it soon became clear that doing research and at the same time going

commercial was a huge problem timewise.

Thirteen years ago Czech universities had little experience with commercialisation. And it was probably the same with you and your experience in business ...

It was indeed an area where experience was lacking the most. We received important support from the South Moravian Innovation Centre, which provided us both with spaces and valuable consultations, seminars, legal service and contact right from the beginning, and then the arrival of Rostislav Vocilka who took up the position of executive director. He brought with him the necessary experience from ICT firms in which he used to work. Specifically, experience in building up sales, placing brands on the market, team management and establishing and restructuring firms.

Are good technology and capable management the blueprint for success?

To be successful you need to fit hundreds of parts together. And if one of the seemingly lesser things wouldn't have been there, we might have not managed to make it. In my opinion, the basis of success is a team of the right people, motivation to achieve something and being strong in technologies. The product itself kept changing over time and will continue to change but if you have the right team around you can achieve unexpected and unplanned successes. When I look back – we came at the right time, with the right technology and we had a lucky hand in our acquisitions.

Technologically, the success of Flowmon went hand in hand with the change in companies' approach to the security of their IT infrastructure.

What exactly has changed?

At the time of founding Flowmon it was obvious in the global market for security solutions that the existing method of protecting IT infrastructure based on guarding network perimeters and terminal stations was no longer sufficient. Traditional tools can save a firm only from some particular attacks. Consequently, there was a need for a technology that would provide for visibility inside network traffic and analyse unusual behaviour. Technology that could cover the blind spots in company security.

At the beginning there was the development of unique technology. Do you still bet on development today?

Without technological development we would not have been where we are now. And if we want to be among the leaders in the field, the process of innovation and development is absolutely essential for us. It is one of the reasons why this year we have been engaged in the greatest number of research and development projects in the company's history and we are assigning more and more of our capacity to them.

When you became company director in 2018 you set ambitious goals. Has the current covid crisis changed anything in them?

Our long-term goal is stable. To build a global technological

company that will give an attractive job to more than 800 people and will be the world leader in monitoring and security of network traffic. But we had to revise the short-term aims. In January we launched another round of expansion to the USA and wanted to reinforce our branch with new people in sales and marketing. After two months we had to suspend and postpone this activity.

Do you see anything positive in the current situation?

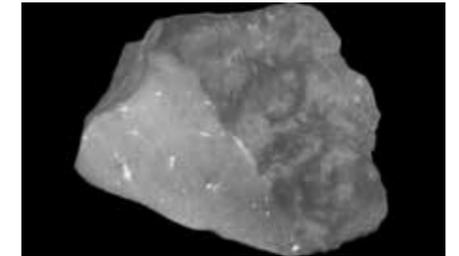
We all know about the giant problems experienced by the tourist industry, hotels, flight companies, and obviously we are in for an economic recession. On the other hand, there are positive things – suddenly it is possible to organise web meetings including Japan and America, which were originally against this. Agendas are transferred into electronic form and I believe that when we look back after five ten years, we will say that it was the time of the acceleration of digitisation, when our mums and grandmas learned to "skype".

Flowmon Networks helps firms administer and secure their network infrastructure through modern technology monitoring and analysing the behaviour of computer networks based on data flows. Unlike many existing technologies, they are capable of identifying unknown threats merely through their unusual behaviour in the network. In 2007 the firm started as a spin-off of Brno University of Technology, Masaryk University and CESNET (Czech National Research and Education Network). Thanks to its own research and development, partnerships with universities and world technological leaders, Flowmon Networks is today one of the fastest growing technological companies in the field – it has more than a thousand customers in 43 countries around the world.

The current crisis presents new challenges in your field – it seems like an ideal time for cybersecurity attacks.

Yes, the covid pandemic is an opportunity for attackers. Over the last months of the pandemic we saw ransomware hitting really hard again. We could watch the high-profile cases in the media but the real extent was much greater. Unfortunately, the reality today is such that company security ends at the level of the necessary minimum, being the antivirus protection of stations, perimeter protection using a firewall and infrastructure monitoring to check the availability of servers and key services. This is where a false sense of security is generated. You have to realise that hundreds of devices communicate in your network without any control or protection, such as cameras, printers, even X-rays and magnetic resonance. We see the pandemic as an opportunity. Firms are discovering that IT infrastructure is critical for their operations and they need to protect it. ■

COLLABORATION



CEITEC BUT helped create a holographic model of a meteorite

Using microCT with voxel resolution of 80 µm scientists from CEITEC BUT analysed an unusually large piece of meteorite weighing 1,320 g and sized roughly 11 × 15 × 4 cm, found in 2016 near the German village of Stubenberg in Lower Bavaria.

In connection with creating its virtual 3D model the Ries-kratermuseum in Nördlingen contacted scientists from the CT laboratory at CEITEC BUT, who determined the composition of the meteorite's surface and thanks to CT measurement segmented particles of metals and sulphides that it is composed of. Based on the obtained data they created a holographic model of the whole meteorite and its inner structure. As a result museum visitors can switch between images of the different structures and learn about the complex composition of the meteorite.

(ed)

From Tunisia to Brno in pursuit of a scientific career



When she was twenty-six Salwa Saafi received the irresistible offer to become a doctoral student in the prestigious Marie Skłodowska-Curie programme. As the innovative training programme requires students to travel out to one of the partner universities with their research, she moved from her native Tunisia and settled in Brno. At the Faculty of Electrical Engineering and Communication she is now experimenting with the options of connecting smart watches or glasses in industrial applications.

Tereza Kadrnožková
Photo Igor Šefr

How did you get from Tunisia to Brno University of Technology? Tunisian university education is similar to that in France. You have two so-called prep years with really intensive instruction in mathematics and physics and afterwards you pass a national examination. Depending on your position in the exam you can choose where you will go to university. When I was sitting for the exam, there were around a thousand of us, of which nine hundred passed and I was thirty-seventh. Although I initially thought that I would study energetics, in the end I went to a top university for telecommunications and I don't regret it as thanks to that I am here. I felt certain I wanted to do a doctoral degree abroad, as I could not find a suitable study programme in the telecommunications field in Tunisia.

How did the moving and involvement in study at the university go?

The university helped me to do all the necessary paperwork and as another PhD student moved to Brno before me I came to a furnished flat. I find the WISLAB laboratory at the Department of Telecommunications of the FECC where I work and which is led by my tutor, to be absolutely motivating. We meet every week and discuss what we are doing. That I was received well may be indicated by the fact that in the very first week I arrived in Brno I received an e-mail saying there was a meeting on Tuesday and I should come. It's great that theory meets practice there. All are top experts and easy to work with. I can do a large portion of my work from home, but recently I needed to work in the laboratory on some calculations and I would leave around eight in the evening. It takes up nearly all of my time but I am doing what I wanted and I enjoy it.

What are you researching in your project?

The whole A-WEAR project focuses on wearable devices, such as watches or glasses. We experiment with localisation, machine learning and communication between these devices, which is my field. I have an extra specialisation

where I concentrate on using these devices in industry. The potential applications include a helmet or glasses enabling extended reality. For example, production lines could operate even better with the aid of wearable devices. Instead of standing at the line and comparing how many units of a given product have passed on the belt and how many it should be according to some documents, you would wear smart glasses. It would be able to recognise what kind of object is sitting on the line, how many have been produced, and in extended reality you would see how many remain to be done. You wouldn't need any papers in hand. Via a smart watch you would be able to send the information to your supervisor or to the warehouse where it would be received by truck operators. I try to discover how to use contemporary technology, such as Wi-Fi or 5G, for the transmission of signals between devices. Today we can use the 5G network but 6G and 7G are around the corner. I equally try to find alternatives to the Wi-Fi network which is in use today, as the requirements of up-to-date technologies are higher than Wi-Fi can offer. It is also about setting some standards and mapping out the situation in order to know what we need to work on in telecommunications.

Studying in the Marie Skłodowska-Curie Innovative Training Network is quite specific. In what way exactly?

Our doctoral studies last only three years, which is not very common. The programme is very intensive as we need to comply with the same requirements. It's not that we would have fewer publications or acquired credits. Willy-nilly you will learn to manage your time. There are five universities involved and each doctoral student studies at two. I will be in Brno for two years and spend a year at Tampere University, but it alternates so it will not be two uninterrupted years. Within the project we work together with the other doctoral students. Each of us has four tutors with whom we are in close contact. At the same time I work with colleagues from the WISLAB laboratory and industrial partners, where I will also have a placement over several months before completing my PhD where I will be able to verify whether my project is applicable in practice.

What are your plans after completing your doctoral studies?

Research is my passion. I worked for two years in Tunisia and had a chance to go abroad to work but I chose the career of a scientist. I know what I want and I go for it. I often think about that and I guess that I will probably stay abroad. If there will be a work opportunity for me there. It is still valid that the field of my research is the main thing for me so I will go where I will be able to continue it either in post-doctoral studies or in the position of a researcher. I might even be here in Brno – we will see. ■

COMPETITION



Chicken Wings came 7th in the Air Cargo Challenge

FME students from the Chicken Wings team scored a phenomenal success with the FausT plane in the Air Cargo Challenge 2019 competition. A total of 27 teams competed for victory in Stuttgart, Germany. Four days before departure the BUT students faced a grave problem – during the last training flight the plane was fatally damaged and the young designers had to build it again. It took exactly 96 hours from the plane's crash to the repeated maiden flight.

In Stuttgart FausT successfully passed the technical inspection and during competition flights in international competition came 7th overall. This was a considerable improvement compared to the last edition of the Air Cargo Challenge in 2017, when the team ended 13th. The designers are particularly proud of their system of loading dead weight, which was one of the best, and are determined to come back for victory in the next edition.

From this year the team has expanded from Brno to Prague – alongside students of the Institute of Aerospace Engineering FME BUT it has brought onboard students of Czech Technical University in Prague, mainly from the Department of Aerospace Engineering. Such collaboration between two universities within a single students' team is unique.

(ed)

SPORTS



Petr Horvát from FCH is European Champion in orienteering

At the European Universities Orienteering Championship (EUOC), which was held in 2019 for the first time in Olomouc and surroundings the student of the Faculty of Chemistry BUT Petr Horvát won gold medal and became European University Champion.

"I was running as fast as I could from the first checkpoint, there was nothing to wait for. I had a very good feeling throughout the race. I caught good speed after start where there were long runs, and I managed to maintain it in the more technical passage that followed and I didn't do a mistake there, which was very important. Then I realised that I was going well and I am glad that I didn't make any big mistakes afterwards," said the winner from BUT immediately after finishing.

Petr Horvát also represented BUT at the Winter Universiade 2019 in Krasnoyarsk. This multifunctional sportsman regularly excels both in orienteering and swimming or ski orienteering.

(ed)

The education system in Denmark is based on confrontation between teacher and student, says Lukáš Arbeit



Horseshoe Bend in Arizona

Although Lukáš Arbeit was a student with a penchant for travel, he never took part in an official programme of students' mobility and went his own way. During studies at the Faculty of Business and Management he hopped off to America for a year, where he discovered his inner desire to study abroad. After completing the bachelor's course he set off to Aalborg University in Denmark. There he received his master's degree in science and later made good use of his valuable experience in his seminar paper at the Institute of Forensic Engineering where he enrolled after returning from Denmark.

Jana Novotná
Photo archive of Lukáš Arbeit

His dream to travel across America came true when he studied Business Economics at the Faculty of Business and Management. He passed the recruitment procedure for YMCA and left for San Francisco in California for a year. "I thought the level of my English was decent, but during the first month I was struggling. I worked with colleagues from the whole world and the most difficult part was to understand their different dialects and accents," admits Lukáš. In his free time he explored national parks and the cities. He was strongly impressed by his visit to Stanford University in the heart of the

legendary Silicon Valley, within easy reach of San Francisco. He was immediately overcome by a desire to study there but after he learned how expensive it would be he quickly sobered up. But he became hooked and started mulling over other possibilities of studying abroad. In the end he decided in favour of Aalborg University in Denmark and he set off there after completing his bachelor's degree.

"I opted for the International Business course at the Aalborg University. The university is considered more of a scientific rather than an academic institution, where the individual departments cooperate on a professional level," explains Lukáš and adds that as a result of that they are all equals and the prevailing relationships are those of colleagues. He decided to describe the specific features of the Danish education system in a seminar paper for the Business Ethics course. As he says in his work, unlike in the Czech Republic, where instruction includes multiple subjects during the semester, in Denmark there is only one subject on the curriculum which the students study for roughly a month and a half. The current subject of instruction is always linked with real life in Danish society and a particular issue that a firm wants to approach from a different perspective than that offered by professional agencies. "Universities in Denmark closely collaborate with local companies and invest a lot of money in R&D (Research and Development). This provides universities with a source of

real-life cases for the students, who come forward with new ideas for society, and in turn can get a good job opportunity during their studies," clarifies Lukáš.

The form of instruction is adapted to this and as such is considerably different from that we have grown accustomed to at home. "In the first week the teachers introduced us to the focus of the subject, or engineering activity as they called it. One subject was usually taught by a number of different lecturers. Instruction took on the form of something like discussion when students asked questions or argued with teachers about the validity of their statements," says the BUT student. "The Danish instructors are experts in their field with many specialised publications and respected results behind them and in addition to teaching they work for various companies as well. But during their absence they were always available through Skype and were ready to give us their private phone number for consultations," explains Lukáš and emphasises that the relationship with students in Denmark is highly professional and that of colleagues. The introduction to the problem was followed by "Problem Formulation" which was built on linking theoretical instruction with the formulation of a real case of one of Danish companies. Throughout the whole project the company cooperated with the students via a contact person and gradually acquainted them with all the processes and operations of the firm, or its branch or factory.

During work on the project the students were divided into groups of three to six people. "As the students came from five continents, long before the first problems caused by different cultures and customs emerged. Additionally, it might happen that the same brief was understood differently by different people, and it was also difficult to find agreement on the division of work and the results," enumerates Lukáš Arbeit describing the possible pitfalls of collaboration in international teams. After learning the theory the groups started to work on their projects, which the BUT student compares to a diploma thesis in terms of difficulty. About ten days before the examination the project had to be submitted for inspection for potential plagiarism and then handed over to the examination committee. Afterwards the students prepared themselves for the examination proper.

First, the group stood before the examination committee as a team. Apart from representatives of Aalborg University the committee incorporated an external member from another university who invigilated the impartiality of the examiners, and representatives of the company for which the research was done. "The examination lasted two and a half hours. The students' presentation took 50 minutes during which they elaborated on further possible steps in research, different interpretations of the results and answered questions by the committee. Each student had to be able to justify every sentence used in the project and

prove knowledge of other techniques than the one applied," says Lukáš and describes the examination procedure at the end of which each member of the committee talked with every student. Afterwards the resulting mark was announced followed by open discussion on the subject. Over two years of study Lukáš Arbeit had a chance to work on projects for such companies as Lego, Air Iceland, Škoda Auto as part of the VW concern, NOWACO, Ramboll and others.

Lukáš's experience suggests that compared to the Czech Republic the education system in Denmark is based to a much greater extent on confrontation between the lecturer and students. "Everyone can come up with their idea, attempt to defend it, or learn to admit a mistake. In the beginning I couldn't find the courage to oppose the lecturer or argue with a company director. But everyone is open to new ideas and likes to hear an opinion from a different perspective, which I very positively acknowledge. The study is very demanding in terms of time. One project follows another, which means a lot of time is spent in the library studying specialised articles and publications. But this gave me a much broader outlook and helped me meet many people from different corners of the world," concludes Lukáš Arbeit who successfully completed his studies at the Institute of Forensic Engineering in the academic year 2019/2020. ■

NEWS

EXPEDITION



Photo: Jana Hoderová

For the team of Miloslav Druckmüller the solar eclipse of 2019 was the most successful in the history of observations

The total solar eclipse over South America occurred on 2nd July 2019. The team from the Institute of Mathematics at the Faculty of Mechanical Engineering BUT led by Miloslav Druckmüller was on site and it was the leader's 11th expedition to a total solar eclipse.

As Miloslav Druckmüller stated last year's observation was unique by the breadth of research: "We had 41 different instruments, which were largely new. We collected the greatest volume of data making it the most successful eclipse of all time." As the leader explained in detail, the final image was created by complicated mathematical processing of 129 photographs with exposition times from 0.001 to 1.024 s.

According to the original plan the expedition from BUT was to observe the solar eclipse at three sites: the main observation spot in Rodeo in Argentina, traditionally manned by Pavel Štarha, the Cerro Tololo observatory in Chile and Mascasin in Argentina. Given the unfavourable weather forecast the team was forced to withdraw from the Mascasin site but they managed to arrange for positions at the Mamalluca observatory near Vicuna in Chile.

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