UTC CHAIR

Tomorrow's glass invented at UTC

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JOINT LABORATORY

FuseMetal, a breeding ground of skills

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PROF. CLAIRE ROSSI, A SCIENCE PASSIONARIA

Professor Claire Rossi, was appointed Executive Vice-Chancellor & Director of UTC-Compiegne on December 2022

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FROM THE PRESIDENT'S DESK

Faced with the urgency of climate change issues, making a success of the ecological transition has become the challenge of our century. This implies rethinking and reframing our economic and social model by placing a sustainable approach at its centre, which notably involves question of "sobriety". This is, of course, an approach that will call into question our habits of consumption, production, choice of materials, mobility modes, etc. The energy transition, health, the industry of the future and sustainable urban planning are all issues at the heart of the concerns for the world tomorrow. Indeed, it is a future that must be considered without delay and requires the mobilisation of all concerned.
Both public and private organisations must adapt to this new situation and provide innovative solutions to meet it. To achieve this, UTC has a lot to offer. Recognized for its modular pedagogical model as well as for the very high level of its academic research, the UTC community must display its ambition to go further by renewing - with both agility and innovation – several key elements to meet the stakes of tomorrow. Internally, this will involve policy questions of 'decompartmentalizing' the scientific and engineering curriculum specialties by reinforcing transversal approaches, by encouraging the research and the transfer of innovation and by implementing some daring new pedagogical evolutions.
UTC is also part of a territory and distinguishes itself by the quality of its links with many companies. It is important that that our University revitalizes its image and its positioning in relation to the major challenges ahead, as a privileged partner with external companies, particularly the SMEs engaged in this great battle. It will also be a question of reinforcing our presence in the heart of the territory and within our alliances: the Alliance Sorbonne Universities and the Group of the French Universities of Technology, not forgetting inter alia to increase our international aura, our open vista to the international scene also being one of the strong markers of UTC since its origin. Thus, although there are many challenges in front of us, 50 years after its creation, UTC is more than ever the institution with the best designed model to be able to take them on and succeed.

Prof. Claire ROSSI
Director, President & Vice-Chancellor

PORTRAIT

Claire Rossi, a science passionaria

Professor Claire Rossi, was appointed Executive Vice-Chancellor & Director of UTC-Compiegne on December 8, 2022 for a five-year term of office.

Claire Rossi grew up in Lille; her mother who was an English teacher and later a national education inspector and her father who was a lecturer in law, then magistrate and deputy director of economic law at the French Ministry of Justice. Now 43 years of age and following suit to eight previous directors, she became the first female Director of the University of Technology of Compiegne 50 years after its creation. Concerning her school and academic career, Claire Rossi admits to a particular feature: "I went to school like everyone else until I was 10 years old, but then I was home-schooled, taking correspondence courses from the CNED. I liked what had supposed to be a temporary solution so much that I continued at home till my baccalaureate.

What did this experience bring her? "It provided lots of flexibility. I worked in shifts, mainly in the evening and even during part of the night. I was able to take courses at my own pace. I did, for example only maths one week, then physics another week and then chemistry. Working by block-studies had a real advantage: I was able to progress more quickly through the programme. This situation, which may seem somewhat disjointed, suited me well because it allowed me to work independently. In a way, it prefigured the work of a research scientist who has to know how to manage, adapt, etc.," she says.

Didn't this difference in relation to others restrict her social interactions? "Not at all. I took part in various activities such as music, theatre and sport. These activities allowed me to mix with all sorts of people, different cultures and different ways of thinking," she says.

Did her relationship with science during these years? "I was passionate about science in general, physics and chemistry and especially palaeontology. From the start I wanted to become a researcher in this specialist field. My parents made enquiries and a researcher at the Museum of Natural History in Paris advised me to do a preparatory class to seek admission to Ecole nationale supérieure (ENS)," says Claire Rossi.

Determined, she followed this advice and signed up for a preparatory class. "But the preparatory class disappointed me, not so much because of the intense classroom rhythm but because of the overriding and pervasive curriculum cramming aspect. Where is the added value of a prep class teacher if in class he/she repeats for 2 hours what is in the textbook? The teacher must, in my opinion, offer a synthesis, a vision, a rhythm and above all teach students to think for themselves. This is what the lecturer-cum-research scientists at UTC do, for example,' she explains.

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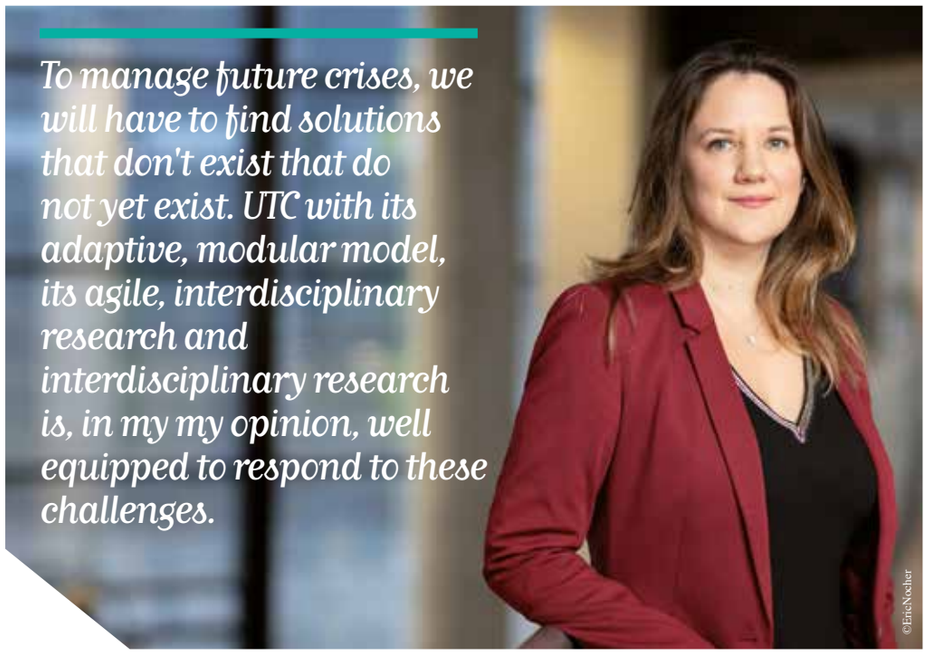
This was certainly a disappointment, but it had the merit of giving birth to another passion: chemistry. This is how she was admitted to the Ecole nationale supérieure de Chimie de Toulouse, since renamed INP-ENSIACET. During her final year of engineering studies, she also completed an advanced diploma (DEA) in agroresources and was successful to do an internship at the Structural Biology Institute in Toulouse. "The world of research, the experiments carried out and the methodological construction of research were a revelation for me. So I looked for a thesis subject in France and found one at UTC with Professor Joël Chopineau, who announced six months later that he was going to set up a lab in the South. There were two alternatives: either I followed him but the lab didn't exist yet, admittedly a bit risky. Or I could do it from a distance. Having the experience of autonomy and supported by the UTC-GEC team and Prof. Daniel Thomas, its director, I made the latter choice," she explains.

Her thesis focused on 'the interaction of a toxin from the pertussis bacterium with cells to determine how the toxin interacted with cell membranes and the different modes of insertion of this toxin', she indicates.

After a post-doc at the Max Planck Institute for Polymer Research in Germany, Claire Rossi first came to UTC-Compiegne as a lecturer in 2007 and rose to the rank of university professor in 2016.



She has been a member of the UTC's Board of directors since 2017, and from August 2020 was the interim Director of the university in the midst of a pandemic and lock-down. A period when the life of the institution was slowing down, as was the case in most other institutions, but "the machine did not stop for all that", she says. When the new Director arrived in January 2021, she was asked to be his deputy, as she knew the university so well. When Christopher Guy left in August 2022, she once again naturally took over the duties of interim Administrator. The skills and vision she has shown during these two years have made her decide to take the plunge and run for the university's top management post. ■ **MSD**

Restoring agility to UTC

Fully aware of her responsibilities, Claire Rossi details the projects she intends to undertake at UTC.

What is her vision of the UTC? " UTC-Compiegne was created 50 years ago to bridge the link between society, companies, science and technology in order to meet the challenges of the day. It has developed several aspects: the adaptability of the students through modular training, high-level research in connection with the industry, territorial anchoring but also the international vista. In this respect, UTC was a pioneer establishment,' she says.

In her opinion, this dynamic has somewhat run out of steam in recent years. Why? "There are, among other things, certain specificities of our school that have inspired and been copied by other establishments, but also the mode of growth that we have experienced. A layered growth which means that the agility of the early days has given way to more cumbersome processes which slow down innovation and creativity. We have to restore agility to UTC", Claire Rossi advocates.

Faced with major challenges such as ecological and energy transitions but also the health issues of the near future, what role can UTC play? "To manage the coming crises, we will have to find solutions which do not exist yet. UTC, with its adaptive, modular training model, plus its agile and interdisciplinary research is, in my opinion, well equipped to answer these challenges. In fact, the fundamentals of the creation of UTC are still relevant. They just need to be updated so that we become a leading school in the creation of technological solutions by considering all approaches, and more specifically those that are sober, eco-responsible and sustainable, and that we do so in connection with the territory and the Nation's priorities in the sector of green industries,' she emphasises.

At a time when science and technology are more and more questioned, Claire Rossi wishes that the UTC reaffirms several aspects linked to its original values: a more interdisciplinary research at the service of a more sustainable future, an evolutionary training of the students, and to reopen itself more to companies.

More interdisciplinary research? "It will be a question of defining, with the laboratories and departments, strong cross-cutting strategic themes such as sustainable cities and mobility, the health of the future or digital transition and developing, beyond the disciplinary excellence that is already ours, a higher level of interdisciplinarity," she asserts.

What about student training? "We need to strengthen the modularity and project-based training in which we are already excellent, in particular by encouraging the development and experimentation of new concepts by students over a longer period of time - one or even two years - during which they work on and test their concepts, the associate prototypes and underlying ideas. In a word: they should be actors in their own approach. Some of them will probably "break their teeth". So they will have to learn to cope with failure but, above all, to bounce back," she says.

A greater openness towards companies? "It will be a question of facilitating the interactions of research laboratories with companies so that companies take ownership of these strategic cross-cutting themes on which we will display our positioning. Thus, we must be able to propose innovative solutions to a company that submits a seemingly unfeasible project to us thanks to our new interdisciplinary vision," Claire Rossi explains.

Other projects await her. "Among other things, we must display and make rapid progress on the institution's commitment to sustainable development and social responsibility, further develop our international relations and partnerships in Europe, further strengthen our action within the Sorbonne University Alliance, our links with other universities of technology and work closely with local institutions," she concludes. ■ **MSD**

UTC IN THE WORLD RANKING OF UNIVERSITIES (QS) 2022 AND TIMES HIGHER EDUCATION (THE) 2023

UTC ranked 336th in the QS * 2022 in the "Engineering & Technology" category; between 201st and 250th in the "Engineering - Mechanical" category; and between 351st and 400th in the "Computer Science and Information Systems" category. This ranking is published annually by Quacquarelli Symonds*. It is one of the three most reputable university rankings, along with the Times Higher Education ranking and the Shanghai ranking. It is based on six main criteria: academic reputation, citations (research), faculty/student ratio, reputation with employers, international student/student ratio and international faculty/staff ratio. UTC is also ranked between 1201st and 1500th in the Times Higher Education 2023 international ranking. It is also ranked as the 6th French university in the "international outlook" category and 24th French university in the "industry income" category.

A UTECEEN WINNER OF THE BNP PARIBAS-UFA SCHOLARSHIP

On Thursday January 26, 2023, the "Bourses BNP Paribas-UFA" scholarship grants were awarded at the French Embassy in Berlin. Léon Lüer received the BNP Paris-UFA Scholarship for his brilliant results during his double degree in systems engineering at the UTC and the University of Braunschweig.
*** QS Quacquarelli Symonds is the world's leading provider of services, analytics, and insight to the global higher education sector.**

APPLICATION FOR RENEWAL OF THE HUMAN RESOURCES STRATEGY FOR RESEARCHERS' LABEL FOR UTC TO 2024

Last January, UTC received the visit of experts from the European Commission in order to evaluate the renewal of the HRS4R (Human Resources Strategy for Researchers) label, which was initially withdrawn in 2016. UTC was then the 1st engineering school among the first 5 French institutions to win it. The objective of the label is to apply the European charter and the code of conduct for the recruitment of research staff by focusing on 4 aspects: ethical and professional aspects, recruitment, working conditions, training and career development.

EDUCATION

Low-technicisation
at the core of a new CC at UTC

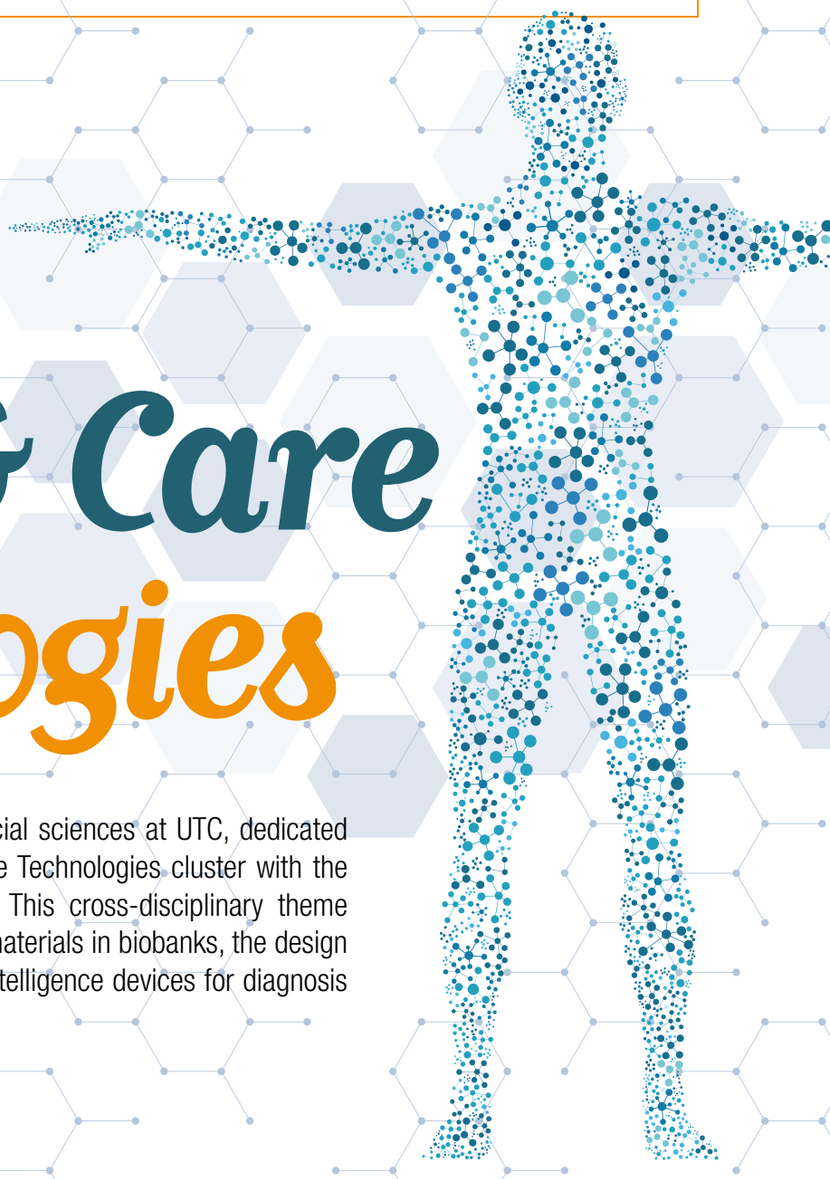
Next semester, a new CC will open at UTC: IS03 - Low-technicisation and digital practice. This CC was created in the context of the label 'Sustainable Engineering' at UTC. The objective is to provide students with tools on current environmental and social issues in order to have input keys to better understand the ecological situation and to be able to take action in their profession.

"It is not enough to green wash our common ways of thinking about and doing things to solve the major problems of habitability that we face right now. This is one of the motivations of Stéphane Crozat, qualified engineer and PhD in computer science and several lecturer-researcher scientists from UTC involved in the creation of the CC IS03: Low-technicisation and digital practice. Low-technicisation has been introduced as one of the three structuring axes of the label Sustainable Engineering at the UTC. "Furthermore, the Ademe Agency has published a document entitled "Transitions 2050" which proposes four scenarios for France's transition policies. And we have to admit that almost all of our courses are oriented towards the fourth scenario, known as 'the repair gamble'. Hence the idea to propose something such that future engineers could orient themselves towards the other 3 scenarios, and in particular the first one, "The Frugal Generation". With other colleagues from several university departments, with students and with working engineers, we met regularly to see what educational content we could structure for the students," explains Stéphane Crozat. This lecturer-cum-research scientist who has taught at UTC since 2002 collaborated on this project with several people, including Pierre La Rocca, a student at the time, a young qualified engineer today, Sylvain Spinelli, technical director of the Kelis company in Thourotte and the lecturers Hugues Choplin, Benjamin Lussier, Guillaume Carnino and Matthieu Bricogne. They quickly experimented a short format as part of the inter-semester teaching activities. "The participation of IT in the ecological footprint of humans (CO2, rare earths, biodiversity, water, etc.) is now proven valid, even if the forms taken are quite diverse and complex," he continues. In the IS03 course, we will study how to accompany the production of more sustainable and user-friendly objects or services.

We will study how to accompany the production of more sustainable and user-friendly objects or services.

A CC adapted to the UTC model

Students who take the IS03 course will continue to follow other more traditional courses and they will therefore have an additional feather in their hats. However, they will retain the possibility of choosing the sector and the approach which will suit them in fine. UTC's a la carte course format allows for this kind of evolution. "Indeed, we can introduce new courses as we go along, without necessarily suddenly calling into question what already exists. The CC will be based on conferences leaving an important place to exchanges. We will meet with colleagues from several branches to talk about methodology, technology, history or philosophy,' says Stéphane Crozat. IS03 will then be based on a large group project that will last the whole semester. Among the subjects envisaged are "Eight billion Internet users", which will aim to enable Internet users to assess the environmental footprint of the web services they use. There is also EcoCAD to embed rules, tools and methods to facilitate the integration of environmental issues into a design tool. IS03 is open to all UTC students, regardless of the major branch they are aiming for next. ■ **KD**



Health & Care Technologies

Costech is an interdisciplinary laboratory of human and social sciences at UTC, dedicated to the study of the technical fact, part of the Health & Care Technologies cluster with the Biomechanics and Bioengineering (UTC-BMBI) Laboratory. This cross-disciplinary theme covers various fields such as the conservation of biological materials in biobanks, the design of bioartificial organs, perceptive substitution and artificial intelligence devices for diagnosis (cancers, Lyme's disease).

Costech
a strong multidisciplinary approach

Xavier Guchet, a professor of philosophy of technology, has been Director of Costech since 2019. With a staff of nearly 60 lecturer-cum-research scientists, PhD students, post-doctoral students, not counting associate research scientists - Costech is organised around three research teams.

Created in 1993, essentially by philosophers and cognitive science specialists, Costech was initially built around the following problem: the technically constituted dimension of human cognitive faculties. In other words, the fact that our cognitive abilities are only exercised through technical supplementation. A human and social science laboratory, it has since opened up to new disciplines. "Today, there are more than ten different specialist disciplines. They range from the philosophy of technology and cognitive sciences to epistemology, the history of technology, design, psychology, sociology, information and communication sciences, language sciences, political science, computer science and economics and management," says Xavier Guchet. This makes it the most interdisciplinary laboratory dedicated to the study of technology in France. "Our aim is to study technology through the prism of all such disciplines," he says.

Costech is structured around three research teams: the CRED team (Cognitive Research and Enactive Design), the EPIN team (Writing, Practice and digital Interactions) and last but not least the CRI team (Complexities, Networks and Innovation).

The first team, more oriented towards the humanities and cognitive sciences, includes philosophers, psychologists, historians of technology, researchers in cognitive sciences and language sciences, as well as epistemologists and computer scientists.

Among the CRED's areas of research? "It is a team with different disciplinary profiles, but our work lies at the intersection of two major questions. The first concerns the study of technology from a historical, philosophical and epistemological point of view. We explore the thesis that technology is constitutive of the human being in the sense that it makes possible our way of being in the world. We are

also interested in contemporary technologies and their ethical and social issues. The second concerns cognition and unfolds through experimental and theoretical research on perception, thought, language and the role of technical mediation. These two major questions end up crystallising in the issue of design, and in particular the design of perceptual support devices, which lies at at the heart of the technological research carried out by the team," explains Vincenzo Raimondi, head of the CRED.

The second question, more oriented towards information and communication sciences and political science, is particularly interested in two issues: digital literacy and political transformations in the digital age.

Can you be more explicit? "We are working on digital issues in two main areas. On the one hand, a sociology of digital practices and uses, and on the other, the specificity of digital writing and literature. In the first case, we will study how digital technologies transform social dynamics and political practices with work that will focus, for example, on digital democracy or the regulation of Internet platforms and social media. In the second case, we will study how digital technology opens the door to new ways of creating or interacting with online creations. In this way, we observe that digital technology modifies the language and the medium of certain artistic practices. Some of the researchers in our team will thus combine research and creation by producing content that aims to show how digital technology allows us to create differently," explains Anne Bellon, co-leader of the EPIN research team.

These issues under investigation have led to a number of projects, including one on “discoverability”, funded by the French Ministry of Culture. "The aim is to develop tools to study our online cultural practices and to see to what extent they are guided by the recommendation algorithms of cultural platforms, for example," she adds.

To round up, the CRI team, with its 27 highly multidisciplinary research scientists, embraces various fields including sociology, economics and management, philosophy and mathematics. "The team size and disciplinary diversity allows us to explore various fields of research all linked to the study of technology in its socio-economic, organisational and collective dimensions. We are interested in three areas in particular. The first area concerns the ongoing digital transition, artificial intelligence and big data. The second area is concerned with the theme of organisation, innovation via collectives bodies and the governance of innovation, and the third explores ecological transition," explains Hadrien Coutant, co-director of the CRI team.

Tell us about the projects linked to these themes? "We have several, including one on so-called “industry 4.0” and the digitalisation of industrial processes, and another on data intelligence and Lyme’s disease. For my part, I am conducting work on the regulation of public companies and their relations with the State authorities, while technological research on the uses of digital technology is conducted with the platform at our “Halle numérique”. Finally, we are conducting work on ecological thinking and the ecological commitment of engineers, photovoltaic charging stations and decentralised industrial models and their role in the ecological transition," he concludes. ■ **MSD**

"Health and Care Technologies" pole

As an example of a cross-cutting theme, the "Health and Care Technologies" (H&CT) cluster is linked to Costech's "Care Technologies" axis and is co-piloted by Costech and BMBI.

What initiated this multidisciplinary and cross-disciplinary project? "When I arrived at UTC, I took responsibility for the "Health Care Technologies" axis within Costech. Today, it is by getting involved in the H&CT cluster that I am contributing to the existence of this laboratory axis", explains Xavier Guchet.

For Costech researchers, technology is a total fact. Can you expand in this? "The devices designed by engineers are intrinsically carriers of social, moral and political issues. The technical object aggregates, at a very early stage in the conception and design choices, issues that go far beyond it. In fact, society, ethics and politics are materialised in the choices that govern the design of objects," he stresses.
Technology is therefore not neutral, as the human and social sciences (SHS) have amply demonstrated over the past 50 years. However, there is a gap between the theoretical knowledge accumulated

on technology and the world of technological design. "If we wanted to draw the logical conclusion of these social studies of technology, any process of designing a technology should be deemed multidisciplinary. Professional engineers should be equipped with a culture of social sciences and humanities, just as the philosopher or anthropologist should be familiar with the constraints of conception or design, among other things. But it is not so easy to get these different communities to work together,' he says.
Historically, UTC has always had the ambition to create spaces for interdisciplinary dialogue and to train, according to Professsor Guy Daniélou, founder of the university, what we can designate as 'philosophical engineers'. That is to say, engineers with technical skills but also in social sciences (SHS). The H&CT cluster is designed to contribute to this objective.

A cross-disciplinary centre

CCan you expand a bit, in concrete terms? "The idea is to defend the idea that technological design in bioengineering benefits from the contribution of philosophy and social and human sciences. The aim is not to provide engineers with an 'extra soul', a bit of ethics covering the engineer's activity like a layer of varnish: the vocation of the H&CT cluster is to demonstrate the fruitfulness of engineering/SHS collaboration from the initial process of design, tackling the guiding concepts that orient engineers' work, or by demonstrating the interest for engineers in replacing their activities in its history," insists Xavier Guchet.

The idea is to defend the idea that technological design in bioengineering benefits from the contribution of philosophy and human and social sciences.

The idea caught on and, in 2016, the two laboratories launched a joint Annual Study Day on a wide range of themes. "Among other things, we organised a day dedicated to organ replacement using bioartificial devices, and another on 3D bioprinting, again in connection with organ replacement. Prof. Cécile Legallais and I are also co-directing a thesis on the history and epistemology of artificial organs. Manon Guillet, one of our PhD students, has also set up an ethical meeting within BMBI. And the underlying idea? To convince engineers of the importance of knowing the history of their own field, i.e., the history of the concepts and tools they use on a daily basis, but also to encourage them to reflect on their own practice from an ethical point of view," he explains.

Since January 2023, these spaces for interdisciplinary dialogue have been enhanced by a monthly seminar.

The H&CT cluster's cross-disciplinary approach has taken concrete form in three projects coordinated by Xavier Guchet.

Biobanks

The first project (acronym BiobanquePerso), launched in 2017 and financed by the Hauts de France Region (formerly Picardy) and the European Regional Fund (Feder), concerns biobanks, or Biological Resource Centres. "These infrastructures, mainly hospital-based in France, aim to support biomedical research by providing research teams with biological samples such as blood, tumour tissues, cell cultures, associated with the health data of the donors concerned, having received their informed consent beforehand. The collection, preparation and storage of these biological resources follow a very precise and standardized protocol to ensure their quality. Indeed, numerous studies have shown that the non-reproducibility of research results from one laboratory to another was often linked to the lack of homogeneity and quality of the samples made available to research scientists,' he explains.

This shows the fundamental role of biobanks for biomedical research.
What are the cluster's objectives in this area? "It seemed to me that, compared with the existing literature dominated by ethical, legal and sociological studies, two aspects were missing. Firstly, the historical aspect. Namely, how was this activity of biobanking – born as it was with the 20th century - made possible, what were its trajectories? The other aspect is strictly epistemological: how do these infrastructures and their evolution transform the way knowledge is produced in biology and medicine? The project involved the Picardie Biobank, one of the first in France, with historians of technology and philosophers of technology. I would add that we practice a philosophy of 'fieldwork', in the sense that we develop our analyses by feeding them with empirical investigation, in situ, by observing the activity of the actors as well as the objects they handle and produce, in order to understand the issues at stake," he emphasises.

Le projet « Organes »

Launched in 2021, this second project is financed by the National Biomedical Agency, whose main field of competence concerns organ transplants and all related issues. This ranges from organ donation to organ graft assignment.

The characteristics of this project (acronym ITEGOREC)? "At UTC, our BMBI colleagues are working on the design of bioartificial organs, the aim of which is to design external or implantable devices capable of ensuring the functions of failing organs and/or of replacing them. These devices are one of the areas investigated by the project. It also explores two other organ technologies: firstly, perfusion technologies, the function of which is to ensure that organs are well preserved between the time they are removed from a donor and the time they are transplanted into a patient. These machines also allow the graft to be tested to assess its quality – all of which represents valuable information for the transplant surgeon. Secondly, the project is also interested in 'organoids' and organ-on-chips, i.e., 3D cell cultures that are designed to reproduce certain metabolisms and even functions of the target organ. These highly simplified versions of organs are the subject of much hope, particularly in clinical and toxicological research and potentially in regenerative medicine,' explains Xavier Guchet. These new objects are thus at the crossroads of the field of cell culture, which dates back to the early 20th century, that of biomaterials and that

of modelling. The idea is to understand when, how and why these different fields came together, giving rise to these new bioengineering sectors.

The project also aims to address the touchy ethical and regulatory issues raised by these organ technologies.

Artificial intelligence in oncology

Launched in 2022 and financed by the French National Cancer Institute, this project (acronym MaLO), which focuses on breast cancer, aims to shed multidisciplinary light on AI devices being developed in the field of cancerology.

More concretely? "As with the "Organs" project, it is first of all a question of placing these devices in a historic context. Indeed, history can be constructive in order to shed light on the present since it can teach us about the mistakes made earlier, plus some dead ends that were reached, for example by linking today's devices to the history of expert systems in the 1970s/1980s which, on the whole, did not keep up their promises. It is also a question of understanding the extent to which these systems are transforming the manufacture of knowledge about cancer. Thus, 20 years ago, the rise of genomics changed the way we produce knowledge about cancer, define what cancer is, understand its mechanisms and ultimately how we treat it. Will AI have a similar impact on cancer classification and patient management? The project also intends to address the ethical and regulatory issues raised by these AIs when they are developed in medicine. Our approach is based on a conviction: these devices only make sense in context, it is not relevant to hold a general and off-the-wall discourse on medical AI. Finally, in a more exploratory approach, we want to experiment with partners - university hospitals, research centres - a process of co-design of devices, encouraging multidisciplinary reflection on the problems of AI in cancerology," explains Xavier Guchet.

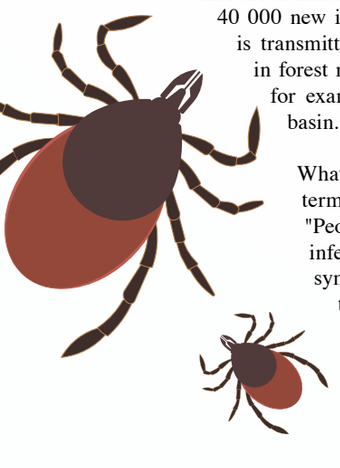
Today, the H&CT cluster appears as a successful example of interdisciplinary engineering/SHS research. "The ambition is to provide the cluster with a visibility going beyond the institution, especially through the special Study Days. At UTC, we want to be identified as important players in the reflection on the role of engineers in the evolution of medicine at the level of regional policy," he concludes. ■ **MSD**

Num4Lyme a diagnostic tool

Marc Shawky is a university professor in computer engineering and is attached to the CRI team at Costech. He works, in particular, on two transversal axes "Care" and "Digital tools" including the Num4Lyme project.

Research that focuses on the analysis of massive data and automatic learning. This involves artificial intelligence. "I am particularly interested in health data and especially in long-term infectious diseases, including Lyme disease. Hence the Num4Lyme project," he says.

Lyme disease is the most common infectious disease in France - 30 000 to 40 000 new infections per year - and is transmitted by tick bites, mainly in forest regions. This is the case, for example, in the Compiègne basin.



What is special about long-term infectious diseases? "People with a single infection may not have symptoms requiring treatment. On the other hand, those with several infections detected by serological tests and PCRs may have symptoms similar to auto-immune diseases and in some cases show no symptoms at all. The clinical signs of the first group are very few and far between - short memory loss, joint pain, etc. - often confusing general practitioners, causing patients to wander around trying to make the right diagnosis,' he explains.

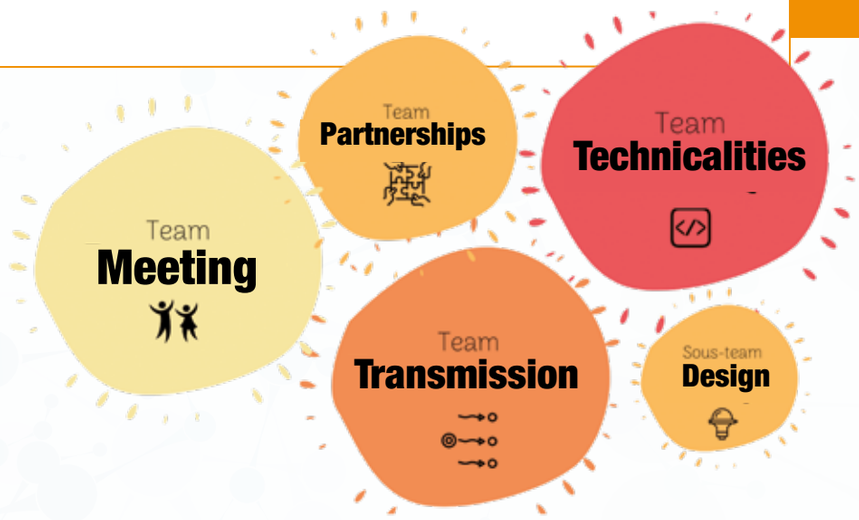
What can be done about it? "We need other diagnostic tools, particularly data analysis," adds Marc Shawky.

What does this imply in practice? "We will start with the clinical signs and complaints as expressed by the patient, such as the frequency of a particular symptom, its intensity and also its evolution over time. The data collected includes the forms filled in by the patients under the supervision of hospital doctors, medical analyses, medical imaging reports, etc. We are working on 300 to 400 parameters per patient," he says.

Partners for this project? "There are three centres of expertise on Lyme disease in France. We are going to sign an agreement with Dr Ahed Zedan of the Saint Côme clinic, one of the three centres, and discussions are underway with the one in Nantes and the one in Metz," he says.

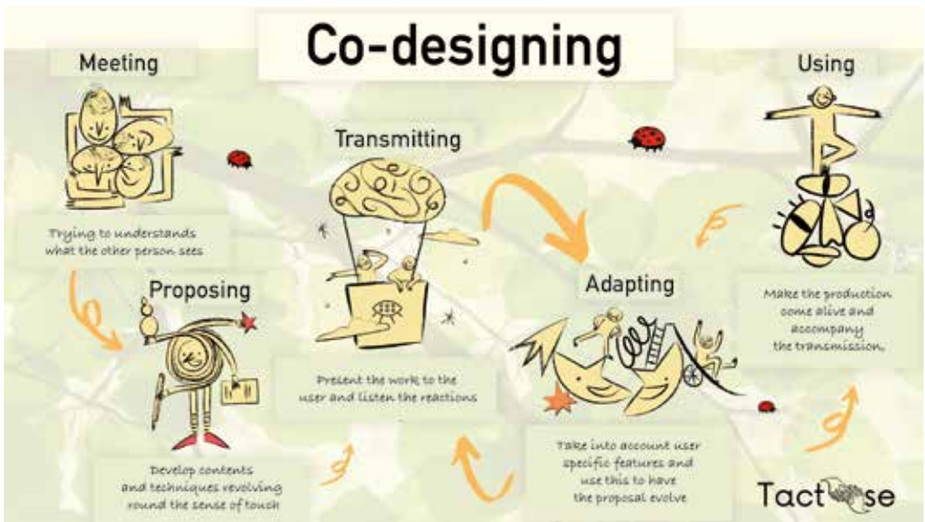
What is the role of Marc Shawky's team in setting up these new tools? We are developing algorithms that will analyse the data using classification techniques. There are several of them, but we'll start with the simplest ones. We're building a learning database with patients we're sure have Lyme disease, and then using this database we shall classify data from patients we don't know. So we acquire data that has never been previously learned. The algorithms will then match each of the new patients with this learning set. Let's not forget that we have almost 400 parameters per person and that all the data is not yet standardised. This is a real challenge in the analysis of massive data, anonymised data that comes, essentially, from our partners," explains Marc Shawky.

A cross-disciplinary project that involves, in addition to Costech, the LMAC (with Ghislaine Gayraud and Miraine Davila-Felipe) and the UTC-GEC Laboratory (with Séverine Padiolleau and Irene Maffucci) as well as the Saint Côme clinic. ■ **MSD**



TactOse for participatory research

Amandine Legry, a student in the Hutech course, is doing her end-of-engineering diploma course internship at UTC-Costech. She is working with Charles Lenay, a professor of philosophy and cognitive sciences, whose research focuses on perceptual substitution and on assistive devices for people with blindness.



What is her role precisely? "It's a question of perpetuating our links with the blind and visually impaired people living in the Compiègne region. Hence the idea of founding a tripartite association between UTC students, Costech's teacher-researchers who work on these issues and the visually impaired or blind people of Compiègne and beyond," explains Amandine Legry.

An idea that Charles Lenay found very appealing. "I have been working for years on projects related to perception and the creation of assistive devices, but I was frustrated to see that, as soon as the project was completed, the blind people with whom we had established human contacts were left, so to speak, out in the cold. We thought that we should remedy this by creating an association that could perpetuate the links but above all mobilise the UTC students.

This is how TactOse - the name found by Ombeline Lheureux -, in other words "Dare to touch", was born in September 2022, out of a need for continuity between research projects and the human links forged with the blind. Why TactOse? "It's an allusion to the interfaces with which subjects are equipped. These are tactile interfaces that give them access to digital environments. So, when the subject scans the screen with his cursor and encounters this or that shape, he gets such tactile feedback that he has the impression of touching the shapes," he adds.
This initiative is entirely in line with the approach within the 'Health Care' axis. "It is not a question of imposing technology on people and forcing them to accept it, but of setting up the conditions for participatory research with blind people, young people and researchers in order to carry out meaningful actions together," he stresses.

This initiative has also attracted the attention of the National Institute for Young Blind People and the apiDV association (Accompagner, Promouvoir, Intégrer les Déficients Visuels). Among the objectives of these associations? "They work, among other things, to encourage and assist the integration of adults into the world of work and young people into the education system and create mechanisms to help young blind people access higher education, for example," says Amandine. Beyond the research carried out, Charles Lenay and Amandine Legry add a dream: "To make the UTC a "Blind Friendly" place".

In concrete terms? "It is a question of working on two main axes. The first one concerns the sensitization of both teachers and administrative staff who would have to work with blind or visually impaired students. Even if, when we talk about digital accessibility for example, it certainly does not only concern the blind but also people with other disorders such as language disorders, etc. Hence the importance of creating specific content to facilitate their integration into the school. The second is the training of engineers. We are taught how to handle lots of tools and develop technology, but there is no teaching on the laws governing disability," concludes Amandine Legry. ■ **MSD**

UTC CHAIR

Tomorrow's glass invented at UTC

The UTC Chair "Smart and Transparent Surfaces for the Automobile of the Future (SITAF)", launched in November 2019, is the first such chair to be funded by the UTC Innovation Foundation. It is an industrial-intensive chair devoted to "smart" glass surfaces conducted in close relationship with the company Saint-Gobain Sekurit based in Compiègne.

The SITAF chair deals with various issues related to the development of the automotive cockpit of the future and more specifically with the role of glazing in it. "When we talk about the car of the future, we imagine an autonomous vehicle with innovative glazing. The technological innovations implemented within this Chair are produced by Saint-Gobain. Through these innovations, new questions arise and will lead us, as research scientists and engineers, to framing new problems and proposing new tools to solve them. It is our role to translate the problems posed by industry into scientific questions", explains Delphine Brancherie, a lecturer-cum-research scientist at UTC's Roberval laboratory, who has been in charge of scientific coordination since 2020. The research work was carried out through two theses by PhD students supervised by lecturer-cum-research scientists from the Roberval and Heudiasyc laboratories. In the Roberval mechanical engineering laboratory, an acoustic thesis is being conducted by Alexandre Berthet, aged 27; it relates to the development of super-elements for the dynamic simulation of viscoelastic multilayer structures. "The aim is to respond to an important problem raised by industry, namely confidentiality. The subsystem we are interested in here is the windscreen, made up of an assembly of glass layers and an intermediate polymer layer, the viscoelastic behaviour of which must remain confidential in order to be able to exchange numerical models with car manufacturers", he explains. "Within the framework of the Chair, the development of super-elements for the windscreen was the subject of my thesis work, which began in November 2019 and was defended last December, the main objective being to enable the exchange of glazing models while ensuring the non-disclosure of confidential information."

Deciphering encoded data

Antoine Montesinos' internship dealt with the optimisation of a method aimed at reducing the numerical model of a car windscreen. The post-doc of Christophe Langlois, 29, is entitled "Experimental identification of the dynamic behaviour of a car

IN THE BEGINNING, THERE IS THE UTC FOUNDATION FOR INNOVATION

The UTC Foundation was the catalyst that allowed to bring together industrialists and UTC academic skills in a partnership approach favourable to build projects and explore tomorrow's technological solutions alongside the actors of innovation. The Foundation, created in 2018, finances and supports this Chair. "The Chair on intelligent glass surfaces was the first programme supported by the Foundation. It is a strong marker of a privileged and lasting partnership with the Saint-Gobain group, a historical player in the region for its glass activities. It is also a world actor in innovation, essential both in research to advance on the technological stakes of tomorrow, and in training: many student-engineers of the UTC carry out their internship there, and many graduates join the group", underlines Sylvie Lemonnier-Morel, General Secretary of the UTC Foundation for Innovation. The vocation of the Foundation is indeed to raise funds, to promote by its actions the development of the UTC and to support innovative projects which are meaningful for the society.

windscreen and reverse engineering process from a reduced model". It was conducted from February 2022 to February 2023. "My work consisted of detecting what is hidden, in finding the mechanical properties of the encrypted windscreen model. This is called reverse engineering. The purpose here is to evaluate the possibility of identifying the mechanical characteristics of confidential materials from the supply of the windscreen model alone. For the industrialist, contributing to the generation of a state of the art on reverse engineering methods applied to laminated structures containing a viscoelastic material, but also of experimental results from the vibratory analysis of a laminated structure and comparing them with numerical results is very interesting. "We are very demanding on the performance of our glazing. They must be the best to ensure the safety of the occupants and provide them with optimum comfort in the car. To achieve this, we want to co-develop innovative solutions with car manufacturers while retaining control of the materials and technologies used in the glazing. Within the framework of the chair with the UTC, we have therefore chosen to develop an encryption method that will enable us to make the essential properties of our glazing available to car manufacturers. The research work on deciphering data aims at verifying the robustness of this encryption method and thus of our technological mastery. The chair with the UTC is very important for us beyond the scientific work, as it puts us in touch with a pool of talent and a whole ecosystem of skills. This provides a great opportunity for Saint-Gobain," says Jérôme Gilles, deputy director of Saint-Gobain Recherche Compiègne. The UTC Roberval laboratory had already forged links with the Saint-Gobain Group on other projects involving glass and metal.

"The research work is bearing fruit. We know the Saint-Gobain company well. For doctoral students, a thesis is also training, for example in numerical modelling," concludes Jean-Daniel Chazot, head of the acoustics and vibration for engineers in the mechanical engineering department of the Roberval laboratory. ■ **KD**

AN "AUGMENTED REALITY" THESIS AT HEUDIASYC

In March 2023, Baptiste Wojtkowski, 26 years old, will submit his thesis entitled "Validation of multimodal feedback for the multisensory cockpit in an immersive virtual environment in the case of driver inattention." He was supervised by Indira Thouvenin, a lecturer-research scientist from the UTC-Heudiasyc laboratory and Veronica Teichrieb from the Voxar Labs in Brazil, but also by Pauline Merveilleux with the Saint-Gobain Group. "Industrialists have realised that fully autonomous vehicles will not be possible in the near future. These vehicles still need to be taught how to handle complex situations such as a lack of road markings, faulty vehicle sensors, how to accelerate and slow down and, above all, how to inform the driver of the reason for taking back control, in short, to ensure that the driver understands," summarises the computer engineering student. It was mainly these last two aspects that interested us. I have really enjoyed working on this subject for the past three years in a laboratory with a high quality scientific team. The Region co-financed this thesis, via Feder funds, as did Alexandre Berthet's acoustics-based thesis.

The Heudiasyc laboratory and the multisensory cockpit

Three questions to Indira Thouvenin, a teacher-researcher from the Heudiasyc laboratory who co-supervised with Veronica Teichrieb from the Voxar Labs in Brazil, a thesis entitled "Validation of multimodal feedback for the multi-sensory cockpit in an immersive virtual environment in the case of driver inattention".

What is the research context that led to this thesis?

It is known today that the autonomous vehicle presents too great a risk, and that the presence of the driver is required in certain complex or ambiguous situations. This is known as the highly automated vehicle (HAV), which allows the driver to take back control of the vehicle. Regaining control is a complex cognitive task involving a transfer of knowledge from the automat back to the driver. We therefore propose aids with augmented reality displayed on the windscreen. These aids must adapt to the situation but also to the driver's attention (or inattention), otherwise the driver will no longer look at them or will be disturbed by these permanent displays. We therefore need to describe the driver's state, with sensors but also a model that takes into account his state, his actions and his gaze in order to generate feedback at the right time and in the right place on the windscreen. Our semi-autonomous driving simulator allows us to test scenarios, to display adaptive feedback in a virtual environment and to check that this feedback helps to regain control, on a motorway for example.

So what is your scientific contribution to the industrial reality of the Saint-Gobain Group?

Our scientific contribution is to propose a model that will be useful for intelligent glazing because the surface of the windscreen becomes an augmented reality interface. Many projects already exist on this theme and are industrialised. But what we are providing are descriptors of the driver's state, for the motorway driving situation. We are also providing proof that the model is useful, because we are testing it in a simulator and we have results on the interest of our approach. Heudiasyc is a joint research unit - between the CNRS and the UTC. This project is part of the "Autonomy of mobile robots in interaction with humans" theme. The objective is to control and navigate an autonomous system in an open and complex environment and to study how the robot can gain autonomy in the presence of the human operator.

How is the thesis "Validation of multimodal feedback for the multisensory cockpit in an immersive virtual environment in the case of driver inattention" relevant to the automobile of the future?

The VHA becomes a multi-sensory cockpit, a sort of cabin equipped with sensors, visual and audio displays, or even allowing the driver to feel the touch of the system. This can be compared to the cabin of an aircraft in which the autopilot is in control. But the pilot has to stay alert and intervene quickly in case of a problem. Humans cannot quickly check all the sensors, and need so-called adaptive interfaces, i.e., they adapt to their state at a given moment. These are multimodal interfaces because they are also in visual mode, sound mode and haptic mode, which is the sense of touch. ■ **KD**

TALENT

He plays the piano... at UTC

Lucien Oisel, 22 years old, student in urban engineering, also enjoys his passion for music while at UTC. His favourite instrument is the piano, which he plays at least twice a week in one of the music rooms of the UTC.

Originally from Lille, Lucien Oisel is a sound and music lover. At UTC, he found the ideal place to study his two favourite subjects: engineering sciences and music. The urban engineering student has been playing the piano since he was 9 years old. At UTC, he has access to two weekly practice sessions of this instrument that he really likes more than the others, even if he admits to a certain attraction for the double bass. "Yes, this instrument has a low frequency range that I really like. In fact, I have a real sensitivity to sounds, to the pitch of sounds, to frequencies. Quite naturally, noise also appeals to me," confides Lucien Oisel, who is very interested in the noise of the city, transport, traffic, and the acoustics of our daily lives. This is the reason why he foresees continuing his studies and specialising in this field of sound. "A lot of research is already being carried out on this subject. I would also like to think about regional planning from the point of view of acoustics. To see how a sound in a specific area of the city can be perceived, to think about how to attenuate a noise with the use of such or such material. Studying the different sound atmospheres of the city inspires me a lot,' says the pianist who, following a very nice meeting with some UTC students who love gypsy jazz, also admits to appreciating the soft sound of the guitar.

UTC and music on the same wavelength: freedom

Lucien Oisel followed in the footsteps of his father, who himself attended UTC in the 80s. After a scientific baccalaureate and a preparatory class, he discovered the richness of the teaching at this engineering school. "And above all, the fact of learning in a free manner, of choosing and developing one's own path. Not forgetting the openness to the arts and therefore to music, which I can practice regularly. The piano allows me to enjoy and experience superb encounters here at UTC, to make beautiful contacts which will last beyond the school, for sure," assures the pianist who has two music rooms with a piano at UTC. This allows him to carry out jam sessions and to perform with confidence during concerts at the Cloître Saint-Corneille in Compiègne. "Improvisation also brings joy and a lot of freedom," says the future engineer, who is a fan of jazz from the 1930s and is currently rehearsing for an international music festival next May in Strasbourg. ■ **KD**

CHANGING MINDSETS

A group of students led the project entitled "more responsible practice objective for the Jubilee of UTC". It will start in March with a dedicated website and a programme of challenges over six months with a monthly theme around sustainable development issues such as mobility or sustainable food. Conferences will also be proposed in connection with the student associations of the UTC. "For example, there will be a conference on the impact of technologies with Clément Mabi, lecturer and researcher in information and communication sciences at UTC, on the theme of the eco-responsible web with the participation of students. We will also propose quizzes to inform in a playful way and a monthly challenge by theme," says Paula de Pina Borges, 21, a student in computer engineering. It's really exciting to reach as many people as possible with this action, both students, teachers and outsiders," she says. This approach will benefit everyone, that's for sure! The working group has been working on this project for a year and has come up with everything to attract as many participants as possible. "It has taught us to start and develop a concept from scratch. And this we did with complete freedom. We exchanged a lot with the communication department of the UTC. This allowed us to question our role as students and to change mentalities via simple action levers within the engineering school. And this in order to change the practices of students and professors on a daily basis via very accessible challenges," promises Lou Riedel, 23, a student in biological engineering, biomechanics and biomaterials department.

CITIZEN

"Into The Tribes"

Hugo Paul's exploration for an ecological and social society

Freshly graduated from UTC in the elective specialty MPI (Management of Innovative Projects), Hugo Paul, decided to explore the best methods of collective learning to accelerate the ecological and social transition.

Since January, Hugo Paul has been travelling around Europe to meet a variety of learning communities. By immersing himself in ancestral tribes, religious communities or learning companies, his objective is to share how we can learn together to cultivate an ecological society. Convinced that education is essential to accelerate the ecological transition, Hugo has been committed for five years, in parallel to his studies at the UTC, to educating as many people as possible on social and environmental issues. "After coordinating various initiatives on a national scale, I founded Into the Tribes in order to equip transition actors to develop their own learning communities. The project started in August 2021 while I was still a student at UTC. Looking back on my last years of ecological engagement, I remain convinced that communities are a powerful lever for personal and societal transformation. It is only by bringing citizens together, by helping them to work hand in hand, that we will be able to meet the challenges of tomorrow," says Hugo Paul, who is passionate about management in general and project management in particular.

Taking the time to be and the time to do

Hugo Paul was able to acquire theoretical knowledge thanks to the MPI course of studies at UTC and then to put it into practice within the rich ecosystem of associations in UTC. "For me, taking the time to explore means and taking the time to be inspired by the pioneers of education and learning communities, to move away from the beaten track by opening myself to worlds that are still unknown. As I am extremely concerned by the deep fragmentation of our society, I want to meet people who are far from ecological or social issues to learn from their way of being and doing things. But above all, I hope to be able to create bridges between these different worlds to lead us collectively towards a just, ecological and social society." After spending a month immersed in the Lérins Abbey in one of the oldest monastic communities in France, he is now leaving to meet the Sami, one of the last indigenous peoples of Europe. ■ **KD**

https://www.intothetribes.org/

ON THE UTC CAMPUS

The participatory budget leads to some excellent ideas

At the end of 2021, the students elected to the Conseil des Études et de la Vie Universitaire (CEVU), with the help of the Bureau de la Vie Etudiante (BVE), implemented the "participatory budget" project resulting from the Contribution de Vie Etudiante et de Campus (CVEC). With a budget of 15 000 euros, the projects selected were submitted to the students' vote in December.

After studying their eligibility and feasibility, according to the CVEC themes (reception, social and health support, culture, sport, prevention and health education), 9 projects were chosen within the framework of the 2022 participatory budget. All of them will be implemented during 2023. "For example, we have validated the UTSafe project, which offers first aid training in mental health. Another action consists of installing vegetable bins and composters in the student house and potted plants in the Benjamin Franklin building. Another idea is based on raising awareness as to water issues and another is to install a glass board, known as a light board, at UTC to create and present videos for educational purposes," begins Sacha Benarroch-Lelong, 22, student representative at the CEVU since November 2021 and a student in computer engineering, artificial intelligence and data sciences. Another winning project is that of the UTC association, Veloc, which wants to provide students with a cargo bike to transport goods and also with safety equipment to improve the mobility of everyone by bike. It is very pleasant to realise the real power of decision of the students in their student life through an approach such as the participatory budget," says Sacha Benarroch-Lelong. It puts us on an equal footing with the students, the lecturers and the administration of our engineering school. It is also interesting to understand how UTC works beyond its teaching/research aspects. For the next edition of the participatory budget, we will have to wait until next November 2023. By then, some new and hopefully excellent ideas will germinate. ■ **KD**

TECHNOLOGY-INTENSIVE RESEARCH

FuseMetal joint laboratory, a breeding ground of skills

The FuseMetal joint laboratory was born from the combined will of actors of the UTC Roberval Laboratory and the Montataire research centre of Arcelor-Mittal to join their forces in order to tackle some well identified technological research themes.

Research scientists from Roberval's Materials and Surface and Digital Mechanics teams have been working with the ArcelorMittal Global R&D research centre in Montataire, which specialises in automotive applications, for nearly 30 years on rather ad hoc projects, through theses, post-doctorates and internships. "We wished to perpetuate this collaboration by structuring it further, around current themes for the industrial partner but also stimulating for the academic and technological research carried out at UTC. The FuseMetal joint laboratory was therefore officially created in April 2019, an opportunity having arisen in 2018 to respond jointly to a call for a Joint Research Team project launched by the Hauts-de-France region," explains professor Marion Risbet, Director of the joint laboratory. The projects developed in the FuseMetal laboratory are based on two themes. Firstly, there is the opportunity represented by the introduction of very high strength steels known as "3rd generation", i.e., sheet steel that is much thinner and therefore lighter, but just as strong as current steels, in an automotive sector that is forced to reduce its CO2 emissions. These steels have very elaborate chemical compositions and microstructures, which complicate their weldability and the mechanical strength of assemblies. There is also the potential of using additive manufacturing techniques for steels and their applications. "We are endeavouring to understand the multiphysical phenomena that occur when steel powders are heated to very high temperatures to make parts, in order to improve the quality of the finished products. We are also studying the possibility of replacing certain very massive parts, used in shaping means, by 3D steel parts with a completely revised design. These two themes require the combination of skills in terms of both materials experimentation and digital simulation, skills that are brought together in the joint laboratory," continues Marion Risbet.

Off-site laboratory

This is a 'hors-murs' (off site) laboratory, meaning that the members of the joint laboratory meet at the premises of one or other partner, but do not have a specially dedicated rooms. The doctoral students often have an office at both partners' premises, and their supervisory team is always made up of research staff from both entities. "We currently have 35 members in this joint laboratory, about 70% of researchers and technical support staff from the UTC and 30% of researchers and technicians from ArcelorMittal, with six PhD students and two research engineers. It is worth noting the high rate of women in the joint laboratory (40%), which is notable in the field of metallurgy and mechanics, and is an important indicator for the European funds from which we benefit. Thanks to the financial support of the various partners, the FuseMetal laboratory has been able to invest in the scientific equipment and digital simulation software needed to carry out its studies, develop practical applications and participate in various scientific events (study days, conferences, etc.). Not forgetting the recruitment of 6 PhD students with 4 PhD students recruited by ArcelorMittal France on a CIFRE contract, 2 by UTC on a ministerial support allocation and 2 research engineers financed by the European FEDER funds (see pages 16 and 17). This makes up a young, dynamic, multi-skilled and multi-cultural team from countries such as Brazil, China, Tunisia, India and France. ■ **KD**

FUSEMETAL : NUMEROUS POINTS IN COMMON

For the UTC, the joint laboratory allows first of all to bring to the UTC researchers original themes in the field of the technological research, the DNA of UTC, in a direct link with the concerns of the socio-economic world. The scientific topics are globally related to the definition of steel structures for automotive applications which are safer and more durable, which resonates with the current preoccupations in terms of sustainable development and societal responsibility pervading the world of higher education and research. This joint laboratory also allows the Roberval laboratory of the UTC to attract good profiles of PhD students, by the proximity with the industrial group ArcelorMittal. The researchers of the Montataire centre are also invited to intervene directly in the UTC courses for engineers of the mechanical engineering department (UTC-ME), for courses targeted on industrial themes. Six-month internship subjects are also offered to mechanical engineering students on subjects related to the joint laboratory.

A look at high-strength steel at ArcelorMittal

FRANCIS SCHMIT

The collaboration between the ArcelorMittal laboratory and the Roberval laboratory goes back a long way. Initially, they mainly concerned the numerical simulation of flat steel forming and metallurgy. They then developed towards the problems of welding high-strength steels.

The impetus given by the Hauts-de-France region to the creation of joint university/industry laboratories led ArcelorMittal to reconsider the form of this partnership. "We thought it would be interesting to broaden the subjects of our collaboration with UTC's Roberval Laboratory and to make it a long-term project in order to take full advantage of the laboratory's specialist skills. We wanted to have a powerful force at our disposal to further develop key technical points relating to the welding of third-generation high-strength steels and to additive manufacturing through research work, PhD theses and post-doctorates. The industrial stakes are high, hence this human and financial commitment on the part of ArcelorMittal," emphasises Francis Schmit, head of the Assembly & Multi-Materials department within ArcelorMittal Global R&D in Montataire and co-director of Fusemetal. The research staff at the Montataire laboratory are fully involved in defining the research topics and monitoring the work, in conjunction with the PhD thesis director. They regularly intervene to provide tools or skills from the research centre, when necessary. The company is also the employer of the PhD students who benefit from a CIFRE contract from the ANRT. The research axes are co-directed by professors from the UTC (Mohamed Rachik, Pierre Feissel) and by engineers from the Montataire laboratory (Sadok Gaied, Patrick Duroux and Gilles Brun). The involvement of the company is also financial.

Advocating a circular economy

One thesis has already been completed. Five others are still in progress. The thesis was presented in July. "This work is clearly a success and the results are already being used by our organisation. The doctoral student, Héléna Lejault, has been hired and works in the assembly department of our laboratory. We can therefore fully benefit from the skills and knowledge acquired by Héléna during her thesis," announces Francis Schmit at ArcelorMittal, where UTC students are appreciated for their multidisciplinary technical training and their ability to tackle new subjects and the problems of human and project management. "Indeed, in the laboratory of Montataire, the hiring of UTC graduates is regular, but we regret that it is too rare, for lack of candidates, with regard to the numerous possibilities offered by the research centre of Montataire and more generally within the ArcelorMittal group, he concludes. The specialities sought by the group are very diverse: in manufacturing, in commercial development, in product research, processes and application of steels. A key issue for the group is the decarbonisation of steelmaking. It is important to bear in mind that steel is easily recyclable and is therefore an ideal material for a circular economy. So, to the students reading this article, "don't hesitate to contact us for an internship or a job." ■ **KD**

UT'CLOCK WORKSHOP : FULL HOUSE FOR THIS NEW ASSOCIATION

Passionate about watchmaking, UT'Clock was created in the autumn semester of 2022 with the determination to help students discover the watchmaking world in general, through various activities and study topics (TX). Thanks to a partnership with the Paris-Diderot vocational high school, UT'Clock was able to organise two workshops to build one's own watch over two days that were 'sold out'. During this workshop, the thirty or so participants had access to a watchmaker's workbench, the tools needed to assemble the watch and individual coaching from professional watchmakers, all for the sum of 280€ At the end of these days of assembly, everyone left with a watch personalised with their name and assembled by themselves!

UT'AFRICA : FROM ENGINEERING TO HUMANITARIAN AID, THE CONCRETISATION OF THE PROJECT

On Monday January 30, the members of the UT'Africa team left to carry out their humanitarian operation in Bamendou in Cameroon to build toilets in the Ngoui public school.After a six-month period full of fundraising events (sale of cakes/pancakes/waffles, tote-bag making workshop), a collection of school equipment and hygiene products and the creation of an online kitty, the association succeeded in obtaining the 5 000€needed to carry out their operation. For 3 weeks, they will carry out this work camp while alternating moments of activities, the preparation of traditional meals and the realization of tasks necessary to the life in community with the children and the support of Solidarité sans frontières Cameroun. ■ **PS**

PORTRAITS

Highly involved research workers

As long-time partners, the ArcelorMittal Global R&D research centre in Montataire, which specialises in automotive applications, and UTC have created this joint laboratory in 2019, which is supported by the Hauts-de-France Region and partly funded by the ERDF (also calle Enedis- power grid management). The work carried out within the framework of FuseMetal focuses on the welding of 3rd generation high strength steels and the modelling of additive manufacturing processes. The 6 PhD students, Elise, Daoming, Héléna, Marcia, Ghassen and Ana Julia present their research work in the laboratory.

Ghassen Dali, a 3rd year PhD student, is conducting a thesis on the modelling and simulation of metal additive manufacturing for metallurgical and process optimisation.

"My thesis project started on October 1, 2020, and is part of the laboratory's strategy to develop and strengthen its skills in the field of additive manufacturing (3D printing), which is a focal point of the FuseMetal joint laboratory. Indeed, this technology has a promising potential because it allows the production of complex and non-traditional geometries, thus bypassing the design/manufacturing constraints imposed by conventional processes, shortening development cycles and reducing costs. On the other hand, additive manufacturing processes can lead to defects during and after manufacturing (instability of the liquid bath, porosities, delamination between layers, heterogeneous properties). To remedy these drawbacks, the use of simulation software is recommended in order to reduce the number of tests required to produce a part that complies with the technical specifications in 3D printing.) I am therefore working on the simulation and modelling of 3D printing of steels. The aim is to develop so-called predictive digital models. The model will be able to better describe the relationships between the operating parameters, the properties of the material and the manufacturing state of the final part."

Marcia Meireles, a 3rd year PhD student, is conducting a thesis on the experimental identification of the links between process parameters, thermal cycles and metallurgical transformations during the additive manufacturing of steels.

"My thesis work concerns the study of an additive manufacturing process for parts (3D printing).

Thanks to the high mechanical properties obtained, it is possible to reduce the thickness of the parts, which makes it possible to reduce vehicle weights. Ultimately, fuel consumption and CO_2 emissions will be reduced.

This consists of manufacturing 3D parts by adding successive layers of molten material. This process is very promising in the industrial sector because it allows the manufacture of parts with very complex geometries, while avoiding additional assembly phases and produces very little waste. Thus, 3D printing is a process that combines remarkable and unique capabilities. The material I am studying is a type of steel developed by ArcelorMittal specifically for 3D printing. Indeed, to obtain parts that meet the requirements of their application, it is essential to understand the effect of the chosen printing parameters on the quality of the parts. This is why, in my thesis, I study the physical phenomena that take place during 3D printing and evaluate their effects on the final characteristics of the parts. Thus, the goal of my studies is to be able to manufacture 3D parts in an optimal way."

Daoming Yu, a 3rd year PhD student, is conducting his thesis on the optimisation of 3D printed hot stamping tools.

"My research project focuses on the topological optimisation of hot stamping tools obtained by metal additive manufacturing. Hot stamping is a forming process in which a metal sheet is first heated in an oven to a temperature of approximately 900°C. The sheet is then shaped at high temperature in a press and, thanks to intense cooling (in contact with cold tools), metallurgical transformations allow the final part to have high

Highly involved research workers

mechanical characteristics (the final part is case-hardened). Thanks to the high mechanical properties thus obtained, it is possible to reduce the thickness of the parts, which makes it possible to lighten the vehicles. Ultimately, fuel consumption and CO2 emissions will be reduced. In addition, this process has several other advantages: it allows complex geometries to be formed, requires less press pressure, the parts do not show springback, etc. Because of these advantages, hot forming is a widely used forming process for the manufacture of automotive parts. In the hot forming process, the tool is particularly complex, as it incorporates a cooling circuit. It seemed important to us to evaluate the potential of additive manufacturing to produce these stamping tools. In particular, this technique can be used to optimise the cooling circuit and thus improve the efficiency of the hot stamping process. The objective is to develop a unified procedure for designing forming lines, including the design of tools by combining modelling of the forming process and topological optimisation, freeing the constraints imposed by machining and taking into account the constraints imposed by additive manufacturing. This procedure is tested on prototype tools to validate the viability of the proposed solutions in terms of conformity and tooling performance.

Laser welding technology enables the design of automotive parts with specific properties where they are needed.

Élise Champolivier, a 2nd year PhD student, is conducting a thesis with experimental and numerical studies on modelling and scale transition for the prediction of the shaping of laser assembled structures.

"For several years now, car manufacturers have been constantly challenged to reduce the consumption of their vehicles while maintaining their performance in terms of safety. ArcelorMittal is developing new solutions to meet these objectives by combining two technologies: Laser-Flattened Blanks and 3rd generation ultra-high strength steels. The Laser Flap Blank technology consists of joining steel sheets of different grades, thicknesses or coatings by laser welding. The assembled sheets are then shaped to obtain the shape of the automotive part: this is the stamping stage. Coupled with the use of very high strength steels, this technology makes it possible to lighten automotive parts with the same performance while maintaining their strength properties. My PhD thesis focuses on the study of the formability of Laser-Flattened Blanks made of 3rd generation steels. My work consists of studying the mechanical behaviour of the welds of these assemblies during the forming stage in order to define recommendations and failure criteria that manufacturers can apply to the design of their parts. The study is based on experiments that allow the feeding of models The study is based on experiments that feed into numerical models with the aim of developing predictive models for the behaviour of laser welded assemblies.

Ana Julia Vasconcelos de Moreira, 3rd year PhD student, is carrying out a PhD thesis on the evolution of local microstructures of 3rd generation steels in the presence of strong thermal and chemical gradients.

"My thesis focuses on the study of the joining of two identical or different 3rd generation steel sheets by laser welding for the manufacture of automotive parts. In order to meet the requirements of the automotive industry regarding weight reduction and improved mechanical performance. In addition to meeting these requirements, laser welding technology makes it possible to design automotive parts with specific properties where they are needed. The challenge lies in the change in the characteristics and behaviour of the steels around the weld seam, due to the high temperatures reached during laser welding followed by rapid cooling. Consequently, I am studying the different areas of the different steel assemblies designed by ArcelorMittal, in order to identify and understand the origin of the mechanical and metallurgical defects and thus be able to optimise the laser welding process. ■ **KD**

GRADUATION PORTRAITS

Two former students recruited at the Montataire research centre following their work at FuseMetal.

Héléna Lejault, a 2018 UTC graduate in mechanical engineering and former FuseMetal PhD student with a thesis defended in July 2022, has been an ArcelorMittal research engineer since September 2022. Her thesis dealt with the assessment of liquid metal embrittlement (LME) risks of advanced 3rd generation high strength steels (AHSS) during resistance spot welding (RSW).

"Resistance spot welding is the main process for joining steel sheets in the automotive industry. My PhD thesis involved numerical modelling of the resistance spot welding process in order to develop a criterion for evaluating the LME phenomenon during welding. The use of the numerical model, associated with the criterion, aims to give welders the most suitable process parameters to avoid LME cracking during resistance spot welding."

Vincent Lafilé, a 2013 UTC graduate in mechanical engineering, spent two years as a research engineer in the FuseMetal laboratory on the development of experimental means, after a PhD thesis in mechanical engineering carried out at the Dupuy de Lôme Research Institute (Lorient). He is currently working at the Global R&D research centre in Montataire as a research engineer, since February 2022.

"My work in the FuseMetal laboratory has consisted of assisting the doctoral students in their experimental activities by developing new techniques or new means. In particular, I designed a biaxial laser traction device for Héléna Lejault's thesis. During this test, the steel studied is subjected to constant mechanical loading applied in two perpendicular directions. The area of interest is then heated with a laser and reaches a temperature of about 1 000°C in less than a second, which causes the material to deform. These deformations are then measured using the digital image stereo-correlation technique. This original method has made it possible to experimentally simulate certain thermomechanical phenomena that occur during the formation of a welded point."

STARTUP UTC

PolarSea
sailing without polluting

Is pollution-free travel a utopia? Christophe Brière, a UTC graduate and Sophie Galvagnon have decided to take up this challenge. Their solution: to produce an ultra-efficient sailboat equipped with measuring equipment, to combine tourism and scientific research. In 2025, they will head for the far North!

"There is always a frustration among passengers regarding their carbon footprint, and more and more people are aware of the fact that they can travel less but better. These are the words of Christophe Brière, who graduated from UTC, majoring in mechanical engineering in 2010 and who has just created the startup Polar Sea with Sophie Galvagnon. The ambition of this startup is to offer low-carbon tourist and scientific cruises in the Arctic Circle by 2025.

Although the project really started last year, the idea of associating boats and sustainable development is not new for Christophe: "I have been sailing ever since I was a child, and I went to engineering school to work in the nautical and sailing sector. Failing to be good at racing boats, I chose to be good at building boats!" At UTC, he chose to follow CCs in entrepreneurship and project management. "I had a project, called 'Boat'A Green', which consisted of developing an eco-designed pleasure boat," he explains. I therefore chose the relevant CCs, which helped me to structure myself, because they offer a "box of knowledge" that I can use to help me develop my project. But in entrepreneurship, you have to find not only the right project, but also the right timing and the right team.

And for Christophe, the timing was not yet right for creating a company: "I started working in ocean racing, as a mechanical and composite engineer within the GROUPAMA sailing team. I did my end-of-study internship there, and I was hired directly afterwards to work on the construction of the carbon fibre boat. For a young engineer from UTC, it was a childhood dream! It was also very responsible, because the parts we were designing were going to go around the world, and if they were to break, it would compromise the whole race.

After this first experience, Christophe decided to change his life and did a VIE (voluntary programme) at the French Polar Institute, spending a year in Svalbard. I fell in love with the polar regions," he says. I changed direction after this VIE, but I continued to go on cruises as a polar guide. It was on one of these cruises that I met Sophie in 2018. At the time an employee of Total, Christophe began working with Sophie on their startup project: "We started it as a side-project, evenings and weekends, then I moved to 80% for a year, until we made the concept viable and had enough positive signs to launch ourselves full-time, which has been the case since May 2022."

The first objective of the two partners is to have a boat built to meet their very specific requirements. Our boat will be a small liner 70 metres water-line, with sail propulsion, for 36 passengers and about 20 crew members," explains Christophe. The sails will probably be rigid (similar to an aeroplane wing set vertically), 5 for the size of our boat, and covered with solar panels. This is because when we cruise in the Arctic Circle, it will be daylight all the time, so the solar panels will be very efficient.

Our boat will be a small liner 70 metres water-line, with sail propulsion, for 36 passengers and about 20 crew members [...] This is because when we cruise in the Arctic Circle, it will be daylight all the time, so the solar panels will be very efficient.

Construction of the first boat is expected to begin in the summer of 2023, with the first cruise two years later, departing from a location that could be reached by a low-carbon means. Limiting carbon emissions as much as possible is indeed Christophe and Sophie's main objective. My first piece of green advice is to stay in France," says Christophe. But we know that people will always continue to travel, so we might as well offer them services that will allow them to travel better. We would have 80 to 90% less impact than a traditional cruise. After that, we must be honest, a cruise will always have an impact, so the aim is to be transparent about what we manage to do in terms of reducing our carbon footprint.

To further limit the environmental impact of their cruises, Christophe and Sophie had the idea of coupling them with scientific campaigns:
"The acceptability of this type of cruise can only be achieved if you have a purpose other than tourism. Part of the ticket price will therefore be used to finance scientific missions on board the boat. The aim is to bring science with us, with 4 places reserved for scientists, but also with automated scientific instrumentation, to take a considerable number of measurements in open source. It is a good idea that requires a lot of specific arrangements in the boat: plankton nets, winches, space for measuring equipment, a dry lab, a freezer for the samples...

It's a large-scale job that requires a lot of personal sacrifice, as Christophe confirms: "My personal life is taking a big bang, more than I imagined. But it's really exciting and I still have time to sail, fortunately! We wish him good luck ! ■ **MB**

Catalyst of projects

The UTC Foundation for Innovation is a link between the UTC and the Society to build the world of tomorrow. To make sense and enrich its training model, such is the vocation of this partnership foundation of the university of technology of Compiègne around its founders: UTC, UTC Alumni, Saint-Gobain Glass and Sopra Stéria since 2020.


PATRICK DUPIN

The Foundation therefore supports and finances some of the innovation and entrepreneurship projects. It gives the means to explore and support locally, or in international paths. And all this within the framework of the most satisfying value of the UTC model, that of reconciling technologies and human beings.

The UTC Foundation for Innovation aims at supporting, enhancing, financing and promoting actions for the development of innovation in the service of education and campus life. It is based on a shared project, a strong institutional alliance in order to take up the technological and human challenges of tomorrow and to federate all the actors around this project of common public utility. Created in 2018, this partnership foundation accompanies "the university in a different way" and contributes to placing the UTC at the heart of a network of sponsors and donors from multiple horizons. "The Foundation therefore supports and finances some of the innovation and entrepreneurship projects. It gives the means to explore and support locally, or in international paths. And all this within the framework of the most satisfying value of the UTC model, that of reconciling technologies and human beings. It has existed for nearly four years and already counts some beautiful achievements alongside the actors of the UTC, " underlines Patrick Dupin, President of the UTC Foundation for Innovation and Deputy General Manager of the Saint-Gobain Group.

Linking industry and teaching

To make the excellence of the students shine brightly and to promote the research of the UTC, to accompany the development of the missions of public service of the higher education and particularly that of UTC in its mission of innovation are part of its flagship actions. "Close to the teams of the laboratories of UTC, in connection with the stakeholders and the patrons, the Foundation proposes specific programmes in support of the development of the UTC in the framework of the patronage. These programmes are developed directly by the Foundation or co-constructed with the project teams and the sponsors. They are supported by the sponsor companies who also have the opportunity, in the framework of some of these programmes, to engage their employees," adds Sylvie Lemonnier-Morel, Secretary General of the UTC Foundation for Innovation.

Working in synergy

Through these scientific and academic collaborations, the students and research staff of UTC can, thus, be actors on large-scale projects with renowned industrialists, such as Saint-Gobain Sekurit which works in particular, within the SITAF chair, on high quality glazings designed to provide the transparent and intelligent surfaces of the future. They are constantly evolving in shape, design and functionality. The Foundation also supports the industrial chair in artificial intelligence (AI) of trust held by CNRS researcher Sébastien Destercke, in partnership with Sopra Steria and the Sorbonne Centre for Artificial Intelligence (SCAI). And also the Hydraulics and Mechatronics chair held by Eric Noppe, with CETIM, a patron partner.

A fund to support student entrepreneurship

The UTC Fondation, moreover, supports the young graduate students entrepreneurs, by granting to the best projects a helping hand towards the achievement of their prototypes, of their experiments, grants of excellence for the certain carriers who carry out their end-of-studies project on their startup project, in connection with the Pepite device. Beautiful startups such as Ontbo, AtmosGear, TechOs and Bikespin have all benefited financially from this. The Foundation finances spontaneous projects and supports student participation in competitions, with a total of ten projects. "We have also supported the academic career of about 20 engineering students within the framework of scholarships for excellence and international influence in 2022 at British, Canadian and American universities, all strategic partners of UTC. In 2023, we are going to continue to support he UTC community, to create even more interactions between the lecturer-research scientists and to increase tenfold our means to continue the support of the international courses", concludes Patrick Dupin. Another important issue is the extension and renewal of our funding beyond the existing founding members. We want to finance chairs and new projects, and this requires resources, particularly from the private sector. ■ **KD**

More about the
UTC Foundation for Innovation

MARILIA DE SOUZA

Dreaming about a PhD and France

After graduating in industrial design in Brazil, Marilia de Souza was admitted to UTC in 1996 for a DEA. She went on to obtain her PhD in 2001. Here is the portrait of a determined young woman.

Marilia de Souza was born in the state of Minas Gerais, Brazil, second last of 7 children. What do you remember most about your childhood?

Determined, Marilia de Souza joined the University of Industrial Design and it was in her 5th year, in 1993, that her luck changed. A young PhD graduate, Jairo Drummond Câmara, who had graduated in France, arrived at the university and offered to help her fulfil her wish to do a PhD thesis in France. "He introduced me to Pierre-Henri Dejean, who had come to Brazil for an international conference and agreed, after an interview, to become my future thesis director," she says.

Faced with an obstacle course to obtain a grant, she never doubted that she would succeed and, anticipating her departure to France, she began to learn French. "I started my classes at 6 am before going to work. I was lucky that a French teacher agreed to take me at such an early hour," she adds.

In 1995, after two years of proceedings, the sky cleared for Marilia with the award of a scholarship to study abroad. "During those two years, I took part in various competitions, won prizes, published scientific articles and worked at the university as an assistant professor. All this must have counted in the examination of my file by CAPES, the institution in charge of scholarships. I managed to get one of the only two grants awarded that year in design in Brazil. Funding was granted on condition that I returned to Brazil after my studies to do a service period for the country," she says.

This is how she found herself, in 1996, at UTC in the TSH (Technology & Humanities) department, first for a DEA whose thesis was on "the cultural differences between France and Brazil" followed by a thesis.

The theme of the thesis? "It dealt with the problems of interculturality, design and globalisation. We wanted to understand the role of culture in the development of products in a globalised world," she says.

During this period, luck smiled on her again. " UTC, which has long-standing links with Brazil, provided technical missions for Brazilian partners. That's how, during one of these missions, I met Sergio Asinelli, Director of the Elvaldo Lodi Institute, in the national confederation of industries of Brazil based in Brasilia, who hired me at the end of my PhD in 2001", explains Marilia de Souza.

There she was, in February 2001, in the capital of Brazil with the ambition "to work on the technological development of the country", she says. She was never to leave the world of industry.

In 2004, she joined the Federation of Industries of the State of Paraná, whose role is to support the development of industry in the territory. Marilia's role? It was to create the Industry Observatory dedicated to strategic forecasting and economic intelligence of national and international markets," she says.

Marilia, who is in charge of this unit, which has 70 staff including 50 researchers, is proud of this institutional innovation, which has since spread to many states in Brazil. ■ **MSD**

BIO EXPRESS

1996 : arrival in France for a DEA at UTC

2000 : defended her PhD thesis in the department of mechanical systems engineering

2004 : creation of the Industry Observatory within the Federation of Industries of the State of Paraná, Brazil

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