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# Interactions

Donnons un sens à l'innovation

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**CULTIVATE YOUR TALENTS !**  
VALÉRIE GUÉNON  
GODMOTHER OF THE GRADUATION  
CEREMONY FOR THE CLASS OF 2022

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#### FROM THE PRESIDENT'S DESK

**F**aced with the climate change emergency and the energy crisis that is hitting European countries largely due to the war in Ukraine, France is stepping up its pace in the field of renewable energy. Moving on from fossil fuel sources has become both an imperative for a more sober society while ensuring energy procurement sovereignty. Europe has set itself a target of reducing net greenhouse gas emissions by at least 55% by 2030 and wants to achieve carbon neutrality by 2050. This is an ambitious challenge that requires profound changes. Among the biggest emitters are the energy and transport sectors, particularly private cars, housing and agriculture. It is true that France has a relatively low-carbon economy compared to its neighbours thanks to its nuclear power plants. However, the urgency of the energy transition means that we must act swiftly. Car manufacturers say they are ready to take up the challenge. Today, 12% of all new vehicle sales are electric and this percentage is growing, even though they currently represent only 1% of the total vehicle fleet on the roads. There is therefore enormous scope for progress, especially as the European Union has decided to bring an end to installation of new combustion engines by 2035. Thus, it is highly important to multiply the number of recharging stations, significantly low in numbers and distribution at present. The UTC - in particular, its research scientist and engineers working at its the Avenues Laboratory -- is engaged on two fronts. Firstly, on what could be qualified as sustainable electro-mobility, working on intelligent charging stations powered by photovoltaic arrays but also on the optimisation of their geographical location. Finally, following the Government's service sector decree requiring the owners and occupants of service-intensive buildings, both private and public, to significantly reduce their energy consumption compared to 2010, the reference year, UTC-Compiègne has decided to develop, wherever possible, parking lot shades fitted with photovoltaic panels. This is the case of the those planned in the first instance on the car park of UTC's Daniel Thomas innovation centre. We must all collaborate in our research activities and on our campus to demonstrate our full and firm commitment to attaining a more sober society and a world of life more respectful of the planet Earth.

**Prof. Claire Rossi,**  
Interim executive administrator

#### GRADUATION CEREMONY 2022

# Cultivate your talents !

Valérie Guéron graduated from UTC, majoring in Mechanical engineering (elective specialty-Materials and technological innovation) and is Vice-President Environment Policy at Safran Aircraft Engines products. She is also a member of UTC's Scientific Advisory Council and the Godmother of the graduation ceremony for the class of 2022, which will take place on November 26.



**H**ow does she feel about the choice of UTC? «I am honoured and moved by this choice. It takes me back 40 years. I see the 18-year-old girl who was admitted to this engineering school, and I see the people who entered it five years ago and who are today in a world of upheaval,» she says.

How do you see your role as a mentor? «During the graduation ceremony, we deliver their diplomas which I hope will be of some use to them in the future and will enable them to cultivate their talents to the full», she assures.

All the more so since «in recent years we have witnessed fundamental upheavals that are revolutionising the way we look at the world, shaking up our base values and questioning the way our companies and societies function», adds Valérie Guéron.

Among these upheavals? «There is, among others, the digital revolution, Societal upheaval, the climate change emergency, etc.,» she says.

The digital revolution? «It has provided extraordinary tools and possibilities for communication, information, design, manufacturing... that did not exist when you were born. Unfortunately, these tools also encourage the propagation of false truths, the questioning

of scientifically established facts, and sets of behaviour that are not always exemplary. This forces us to be vigilant,» she says.

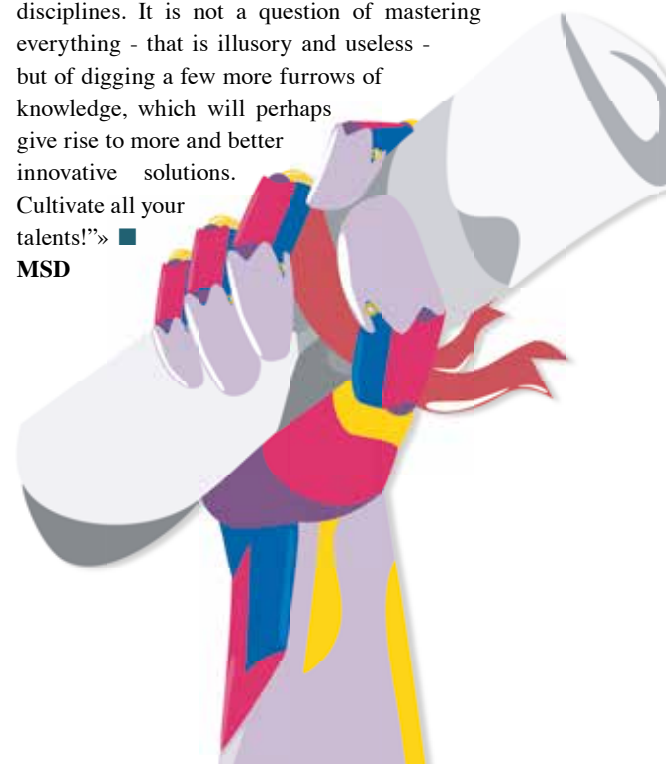
Societal upheaval? «One of the great advances in the world of work has been the recognition of discrimination mechanisms - of all kinds -, the identification of phenomena such as harassment or suffering at work, and their consideration in corporate functioning. These phenomena have certainly not disappeared, but they are named, identified and fought. It is up to you to develop a culture of inclusion and benevolence, which is essential for the performance of companies and, above all, for an acceptable functioning of Society,» she stresses.

The climate change emergency? «We are sure that we must take up the challenge of the climate change threat with its predictable geopolitical, economic, social and human repercussions», she urges.

And Valérie Guéron concludes: «Be open to cultures other than your own, be interested in communication, economics, sociology, arts, politics, languages... whatever you want, as long as it interests you. Do not forget ecology, which has become a requirement that cuts across all disciplines. It is not a question of mastering everything - that is illusory and useless - but of digging a few more furrows of knowledge, which will perhaps give rise to more and better innovative solutions.

Cultivate all your talents!» ■

**MSD**





## INAUGURAL LECTURE

# Dare, Share, Care!



**Danièle Bigey graduated in 1994, majoring in Computer Engineering at UTC-Compïegne, and immediately joined the Renault Automobile Group where she held various positions. On August 30, 2022, she was invited to give an inaugural lecture at the UTC.**

**W**hat, we ask, was the main theme of her lecture? «Dare, Share, Care», she said. A mantra that her professional and personal career illustrates perfectly. It was during the presidency of Nicolae Ceausescu that she was able to come to France. As her father was a political refugee, the doors to university in Romania were closed to her. «For nearly three years, my mother and I lived meagrely on what my father sent us and on the odd jobs we could find here and there. It was a hard time, but it gave me a form of willpower and resistance. So, as I couldn't go to university and in order not to lose what I had learnt, I forced myself to do a daily programme of work in maths, physics, learning French...», she explains.

In 1989, she was finally “freed” and arrived in France where she enrolled at the University of Rouen. «It was a culture shock on all levels. Whether it was the way of life, the abundance or the kindness of the people. With my strength of character, I managed to overcome past difficulties like those experienced in France. I remember this period with a lot of emotion because it was, for me, a second birth, a second chance at life that I didn't want to waste», she asserts.

With a degree in Science, Danièle applied for admission to UTC, and was admitted on the high quality of her application dossier, registering for Computer Engineering.

It was after her end-of-studies project with Volvo that her adventure at Renault began. It lasted more than twenty years. «At Renault, I first had very operational experiences in project management because I like to bring people together but also to have a vision. During those years, I worked for business customers, as the direct proximity allowed us to see how the customer would use our product,» she emphasises.

Might we hear about some specific projects? «For example, for the Renault Group's engineering department, we developed the first internal messaging system, which replaced paper distribution. For each project review, the vehicle projects required a lot of



DANIÈLE ILIESCU BIGEY

reports, about ten pages each, to be printed out for a number of recipients, which meant wasting paper. With e-mail, we brought ease of use and considerable paper savings. We also worked on a project in the Sales department. In this case, it is a question of sharing information and working together. We have developed a portal that brings information from the various marketing entities to everyone's attention,» says Danièle.

Can she cite a character trait that emerged during the implementation of all these projects? «I like to get people to work together and to make the most of each other's work. Most of the time, people tend to stay isolated, out of habit or technological limitations. For example, the marketing department received the video ads but didn't know how to share them with all their international colleagues. The introduction of the portal solved the problem and with one click people could access all the ads, without geographical limitations. We first had to solve the problem of the network, which was not originally designed to support such large files,» she says. After ten years in operations, the need to get some perspective became apparent. «I needed to have a better vision and a better

understanding and knowledge of the businesses I was working for,» she says.

She then decided to take a year and a half of General Management MBA training, in the «strategy» field, at HEC. «Renault offered me to do it part-time, but I needed to live this experience to the full and I declined the proposal. Consequently, I took a leave of absence and immersed myself in this full-time international course, bilingual in French and English. An environment with diverse profiles, both culturally and professionally. It was a joy for me, and the friendships I made during this period are unbounded» she says.

At the end of the training, she returned to Renault for a purely strategic IT mission. «I was responsible, at CIO (Chief Information Officer) level, for coordinating synergy plans between the information systems of Renault and Nissan. This involved identifying all the opportunities for IS (information system) convergence, cost reduction, sharing and implementing best practices, etc.,» says Danièle.

*I like to get people to work together and to make the most of each other's work.*

She then left the IT department to join the Quality & Customer Satisfaction business line, where she piloted the digital and data transformation of the new group.

The pandemic arrived and, like many people, she wondered what to do next. She first joined Capgemini, as Director of Engagement Insights & Data, and then recently Egis, a world leader in civil engineering, transport and construction, which is tackling the major challenges of our time: climate emergency, digital revolution and demographic growth. As Group Applications & Data Director, Danièle hopes to make her modest contribution to a better world for future generations. ■ MSD



# *Sustainable electro-mobility*

Faced with the climate change problem and the energy crisis that is looming following the war in Ukraine, France has decided to accelerate its pace advancing into the field of renewable energies. In this area, UTC and particularly the UTC-Avenues laboratory team are involved on two fronts. That of electro-mobility with research work on the optimisation of recharging stations covered with photovoltaic (PV) panels but also that of energy production from PV installed on the university premises. A movement that the service sector decree - published in the French Official Journal in 2019, requiring owners and occupants of both private and public service intensive buildings to significantly reduce their energy consumption compared to 2010, the reference year - has accelerated.

## *Smart recharging stations for low-carbon mobility*

**Manuela Sechilariu is a full university professor and Director of UTC's Avenues research laboratory since 2016.** Her research interests include microgrids and, more recently, electro-mobility in general. More specifically, recharging stations covered with photovoltaic panels and equipped with intelligent control systems.

**These are research areas which, in view of the ongoing climate change crisis, have stimulated a large number of projects, both nationally and internationally.** The proof? Projects at the national level that are part of the search for greater electric mobility. Thus, "Mobel"\_City was

launched in 2017 and PV2E\_Mobility in 2020, both financed by the French Agency for Ecological Transition (ADEME), while in July 2021, it was the turn of Smart\_PV4EV specific to UTC within the framework of a State-Regional Planning contract (CPER) «Electric Energy 4.0» (EE4.0).

«The first call, where we were the winner, in 2017, following a call for projects is also supported by an industrial partner, SYSTRA, specialised in transport-related issues on a national scale, but also by the Agglomération de la Région de Compiègne (Greater Compiègne ARC). One of



the objectives of the project? To find the best way to deploy recharging stations for electric vehicles (EVs) powered by photovoltaic (PV) panels. This project illustrates both the skills accumulated at Avenues and the interdisciplinarity that reigns there, since it is at the crossroads of the fields of transport - electric mobility, renewable energies, urban planning and sustainable territory, but also social sciences,” explains Manuela Sechilariu.

The second project, in the same vein, has attracted a number of partners, including the CEA, Enedis, Tecsol, a company specialised in solar energy, and SAP, who specialize in software and intelligent or “smart” management of recharging stations. The project focuses on on-board and stationary PV energy and power for (and in) transportation, with Avenues being in charge of studies on systems and infrastructures equipped with stationary PV sources to used for EV recharging.

Pursuing on the same Smart\_PV4EV issue. «This time, the aim is to show the advantage of PV in EV charging and to look at the societal impact and social acceptability,» she adds.

Finally, on an international level, the PVPS scientific programme of the International Energy Agency (IEA). «This project, which terminates end 2024, represents the French contribution to Task 17<sup>1</sup> of the IEA programme dedicated to PV and transportation,» she says.

What exactly is the role of Avenues research scientists in these projects? «We are the project

leaders and coordinators of Mobil\_City and PV2E\_Mobility. As for the international project involving the IEA, I am Task Manager with a Japanese colleague and leader of subtask 2. The latter subtask addresses the feasibility conditions and requirements for the best use of EV recharging stations with PV panels. Finally, Smart\_PV4EV, for which I am responsible, is part of a large CPER project involving most of the electrical engineering laboratories in the Hauts de France region,» says Manuela Sechilariu.

All these projects aim at optimizing the use of PV for both mobility and buildings. This is a goal that calls for numerous theoretical studies upstream. «It is a question of designing and testing a set of methodologies and tools, both for implementation and sizing and for regulation and smart system control. Indeed, the recharging station is based on a microgrid made up of stationary storage, PV panels, a connection to the national grid and has loads such as buildings or EVs. In order to maximise user satisfaction and the use of PV energy, algorithms are being developed that allow both off-line optimisation, i.e., outside real-time operation, and on-line optimisation for real-time operation control. We are showing that an EV can be recharged, even in December in Compiègne, with more than 75% PV energy, enabling the vehicle to travel 40 km,» she explains.

However, in this type of project, the theoretical studies are not limited to the scientific and technical aspects but also involve other fields of knowledge,



MANUELA SECHILARIU

since the aim is to develop more widely the uses of PV. «For example, we are calling on urban planners to develop methodologies and decision-making tools for territorial actors concerning the most judicious deployment of recharging stations. We are also working with UTC-Costech, a social science laboratory at UTC, to study the societal impact and acceptability of the project”. ■ MSD

>> **\*Photovoltaic Power Programme Systems Task 17** (<https://iea-pvps.org/research-tasks/pv-for-transport/>)

## A Living Lab called STELLA

Fabrice Locment is a university professor and research scientist in the UTC-Avenues research unit. He is also Director of the university's Urban Engineering Department (GU). His research on electro-mobility has led to the setting up of STELLA, which will be transformed into a Living Lab in the autumn of 2022.



**W**ithin AVENUES, the idea of the STELLA or ‘Smart’ Transport and Energy Living Lab technology platform is a long-standing project. MBut it was in 2016, thanks to funding via a State/Region Planing contract (CPER), that it was launched and became operational at the beginning of 2017 and finally transformed into a Living Lab.

Concretely? «It is an experimental set-up that allows the validation of concepts related to technology, but not only with technological objects, since it also introduces human beings in interaction with these objects. Hence the name «Living Lab». So in STELLA, there are photovoltaic panels (PV), electric vehicles (EV), back-up power storage and a connection to the national grid, but it is the human beings who are at the heart of the Lab,» he explains.

What made it happen? «When we saw the large, uncovered car park at the university's Innovation Centre, the idea took hold in 2010. We thought it would be interesting to install PV arrays on these unused surfaces. Of course, at first it was the research ideas that guided us. At that time, we were working with Sunvie, a company specialised in PV technology, but we didn't have the funding to go further. And it was in 2016, thanks to the CPER, that the project came to fruition,» he explains.

This was a natural development for Avenues, which historically housed the PLER platform, an acronym for Local Renewable Energy Production. «With PLER, we are still in a multi-source, multi-load system, but the aim is to power a building. PLER still exists and works very well. Special



features? It's a real research platform with cables everywhere, but it's a bit limited as soon as you increase the power level. But with the problem of electro-mobility, the power supply for EVs is needed. And with STELLA, we change the format. It was no longer the same power ratings or the same operation. Above all, STELLA allows for both building and EV applications.» Fabrice Locment points out.

The transformation of STELLA into a Living Lab? «Until now, with STELLA, we emulated EVs, i.e., we carried out tests on the UTC's own fleet of EVs, looking in particular at their energy consumption pattern, in order to emulate them on systems physically present at STELLA and thus be able to repeat the tests. At this stage, the human aspect was not taken into account. With the Living Lab, we will go further and put the human factor at the heart of the work. For example, the PV shade house, which covers 9 parking spaces, 3 of which are reserved for EVs dedicated to research at the Avenues laboratory, will be going fully electric. We have already installed three two-headed recharging stations for UTC staff,» he says.

A development that will make it possible to analyse the behaviour of real users with real constraints. «Our goal is to have the Living Lab up and running by September. At that time, we will contact the staff to find out who has an EV, who would be interested in recharging. They will then be able to use the system in return for their permission to retrieve all the data. That is, the charge when they arrive, the charge when they leave, the duration of the charge, the type of recharge - slow or fast, etc. Data that will allow us to set up control laws to intelligently recharge the vehicles,» he adds.

This project is in line with their research and its main objective is to minimise the imbalance in the national electricity network. «The energy reservoir of a battery in an EV such as Renault's Zoé or Peugeot's e208 is around 50 kWh. However, the current shading system only produces 29 kW even under almost optimal conditions. Hence the project to build 10 additional shading systems in the Innovation Centre car park,» concludes Fabrice Locment. ■ **MSD**



## Photovoltaic energy production at UTC

Professor Fabien Lamarque is a senior lecturer, responsible for the «Urban Engineering» major and an associate member of the UTC AVENUES research unit. He leads the workshop-project «Photovoltaic energy production at UTC». Julien Sautjeau, a 5th year UTC student in the «Building» speciality, is also part of it.



*The aim is to study ways of reducing the energy consumption of buildings and to develop a digital model of existing sites.*

their energy consumption compared to 2010, the reference year - has accelerated. This reduction can be achieved through two main solutions: improving the energy insulation envelope of buildings and/or the production of renewable energy (RE).

«In the context of the GU urban engineering course, we have a very professional teaching format which involves both lecturers and students in project-workshops responsible for responding to orders placed by various, differing clients. For the project-workshop on photovoltaic (PV) energy production, the order came from the UTC's Property Management Department (DPI),» explains Fabien Lamarque.

It is a mission that requires three main skills. The first concerns the entire energy conversion process, the second involves modelling and calculation to measure the sunshine potential at the various buildings and the third concerns the interface between RE production and the buildings. The latter involves general knowledge of the building, technical constraints, regulations, etc. «Hence our decision to set up a group of students and lecturer-cum-research scientist possessing all three skills,» he adds.

What are the objectives of this project-workshop? «The aim is to study ways of reducing the energy consumption of buildings and to develop a digital model of existing sites in order to define those most suitable for the installation of PV and thus ensure the best possible energy optimisation,» emphasises Julien Sautjeau.

A project that makes sense with buildings that, for the most part, were built in the 1970s and whose thermal envelope is poor, to say the least. A project which, of course, has a cost. «During our investigation, we evaluated the return on investment of the PV panels, which have a certain

**T**his is a project-workshop part of the sustainable development policy initiated by the university. UA policy that the service sector government decree - published in the French Official Journal in 2019, requiring owners and occupants of both private and public service-intensive buildings to significantly reduce





lifespan but also an environmental impact. The energy gain is obvious, but we went further and evaluated the environmental gain generated by the PV panels compared to the French energy mix,» explains Fabien Lamarque.

«The French energy mix, which is largely made up of nuclear power, emits little CO<sub>2</sub>. For PV,

we carried out a life cycle analysis, i.e., from the extraction of raw materials to installation/operation and up to the end of life and subsequent recycling. So far, PV has had difficulty competing with nuclear power in terms of its carbon footprint,» adds Julien Sautjeau.

The conclusions of the project? «In the course

of the study, we worked out different scenarios for installing PV panels. We acted as project management assistants. We detailed both the potential gains and the risks associated with each installation, whether it be on the roofs of buildings, on the ground, or on car park shades. It's a kind of diagnosis that we carried out for the DPI,» concludes Fabien Lamarque. ■ **MSD**

# Planning and optimisation of PV charging stations

**Nathalie Molines** has been a lecturer in geography at UTC since 2006. She is attached to the UTC-AVENUES research unit and works on decision support issues for territorial transition.

**In order to comply with its international commitments to reduce greenhouse gas emissions (GHG), France must drastically reduce its emissions from transportation, and in particular from individual transport vehicles.** UOne of the ways of reducing these emissions is through electromobility. However, this implies, upstream, an optimised deployment of recharging stations.

Reducing transport-related GHGs? «In the Compiègne conurbation, for example, individual transportation accounts for 16% of GHG emissions, which is the third largest source of emissions after housing and agriculture. There are several ways to reduce GHGs. It is a question of transforming people's habits by encouraging them to use public transport or bicycles, for example. To do this, we need to work on urban forms by densifying areas served by public transport rather than opting for urban sprawl, but also to develop soft mobility by building cycle paths and, finally, to switch a significant proportion of the existing internal combustion engine car fleet to electric vehicles. The financial incentives for the purchase of a

bicycle or an electric vehicle are there to facilitate this transition,» she assures.

These measures, if they succeed, will probably increase the number of electric vehicles on the road. Between 2018 and 2021, the number of electric car registrations increased by more than 400% (source: Avere France)! The number of recharging points is struggling to keep up. «In 2018, there was one recharging point for just under seven vehicles. That's less than one per township. As a result, it is mainly people living in individual houses who acquire an electric vehicle,» observes Nathalie Molines.

Hence the desire of France and other European countries to increase the network of electric recharging points, but also to optimise their territorial location.

As a geographer, Nathalie Molines has mainly worked on the issues of planning and optimising recharging stations at the urban level.

The underlying idea? «The idea is to think about the location of the recharging stations beforehand in order to define the places where they will be the most useful and the most used. Indeed, during a study day with the various trades involved in this theme, we realised that some of the recharging points installed, for example in the Hauts de France region, were never used, or used very little. It is also a question of thinking about the right type of terminals to be installed since,



depending on the model, recharging can be more or less rapid. Finally, it is a question of anticipating their impact on the electricity network. This is the work of Manuela Sechilariu and Fabrice Locment,» she explains.

A methodology for analysing the territorial potential has been developed as part of the MOBEL\_CITY project and tested in the city of Compiègne. A tool for searching for potential locations for recharging stations, which can be used throughout France, has also been developed. It is free and available online.

What about the state of the art in urban planning and optimisation? «Several methods exist for planning and optimising these networks. Firstly, it is a question of analysing the capacity of the existing network to absorb additional demand, knowing the location of typical users for the location of recharging stations and finally observing the uses of a territory in order to define the type of charging to be deployed,» concludes Nathalie Molines. ■ **MSD**





# Optimization of energy management



As a PhD student at UTC since 2019, Saleh Cheikh Mohamad presented his thesis in October 2022, focussing on the optimization of energy flows in PV (photovoltaic) powered charging stations dedicated to all-electric vehicles (EVs).

**I**t was during his internship at UTC's Avenues laboratory that he became interested in these topics. «The idea was to develop a graphical interface allowing interaction between the user and the microgrid or recharging station used for electric vehicles»; he says.

As an active participant in the PV2E\_Mobility and IEA PVPS Task 17 projects, Saleh Cheikh Mohamad explored different issues related to the optimisation of energy management for recharging stations in the framework of his thesis. «First, we had to understand the energy system of a recharging station powered by photovoltaic (PV) panels, equipped with a storage system, a connection to the national grid and dedicated to powering EVs.

Secondly, we had to optimise the flow of energy between the different power sources - PV, storage, grid - in order to minimise the energy cost for the user. Consequently, depending on whether you are in off-peak or peak hours, the energy cost of the grid is different. It is obviously lower in the first case than in the second. The interface offers three recharging thresholds - slow, medium or fast. A multi-criteria interface is provided to help the user. Finally, the optimisation is launched in real time each time an EVs arrives and another departs,» he explains.

An interface that allows the user to indicate his/her charging rate preferences and thanks to an intelligent algorithm that includes hourly solar radiation forecasts from Météo France, the

optimisation is carried out in real time. «Depending on the choice made by the user, recharging will be done directly by PV, by storage or by the national grid, or even a mix of the three based on the results of the optimisation calculations,» he notes.

Other areas of research? «We have the V2G (Vehicle to Grid) issue. In this case, it is the electric vehicles that can supply the national grid in the event of a consumption peak. This has the enormous advantage of sending energy instantly to the grid rather than restarting a coal-fired power station, for example. Of course, the purely environmental aspects of electric vehicles, such as the lifespan or recycling of batteries, require further in-depth studies,» concludes Saleh Cheikh Mohamad. ■ MSD

## Pre-sizing power recharging stations

Amalie Alchami joined the UTC-Avenues laboratory as a Research engineer, after carrying out an internship at the UTC Roberval Laboratory. She works on PV2E\_Mobility but also on the International Energy Agency's (IEA) PVPS Task 17 programme.

**H**er precise role on the STELLA platform? «I work with Saleh on the experimental part of the charging stations. I carry out tests to study various recharging profiles, based on different criteria, with the aim of sizing the recharging stations in an optimal manner, so as to best meet demand. The criteria include the number of electric vehicles (EVs) connected at any one time, the energy flow and demand, and the discharge of EVs to feed the grid during peak demand. This is called Vehicle-to-Grid (V2G),» she says.

Her mission does not end there, however, as Amalie Alchami is also involved in the PV2E\_Mobility project and Task 17 of the international

IEA PVPS programme. «In the framework of the latter, I have developed a tool for the pre-sizing power recharging stations powered by photovoltaic (PV) panels, taking into account

Life Cycle Assessment. In other words, we have to analyse the performance of a recharging station over its entire expected lifespan, which in our case is 30 years,» she says.

What variables are included in the tool? «We include the location of the charging stations, the level of solar radiation and geographical

constraints, but also the cost issue. There is the cost of the panels, batteries and terminals, the cost of maintenance - cleaning the PVs, replacing

batteries and converters for example - and finally the operating costs. So we need to be able to calculate the total balance, taking into account the income forecast over the 30 years,» she says. Environmental aspects, and in particular the carbon footprint of such charging stations, are naturally also taken into account. «We must reduce this footprint as much as possible in all the elements used, but also integrate the footprint linked to the installation and maintenance of the station components,» adds Amalie Alchami. Among the avenues of reduction envisaged? «We can use PV or new generation batteries with a relatively low carbon impact; we can also use recycled materials. With this in mind, we have built several scenarios and we have come up with a charging station model that has a lower carbon impact than the national network. The latter, based essentially on nuclear power, is already significantly decarbonised compared to other national networks,» she concludes. ■ MSD





# Electric buses in question

Nathanael Dougier graduated from IMT Atlantique (Nantes) with an engineering degree in energy and the environment and went on to defend a PhD thesis at Arts et Métiers in Aix-en-Provence. He is now interested in the question of future all-electric buses.

**What was the core theme of his thesis?** «I worked on microgrids and more particularly on the dimensioning of the various technologies involved and the associated control strategies while integrating environmental, technical and economic objectives. Let me illustrate with the case of a city. In concrete terms, the latter may have objectives of autonomy, cost reduction or emission reduction. This means choosing the relevant technologies to achieve the right trade-offs between the targeted objectives,» he explains.

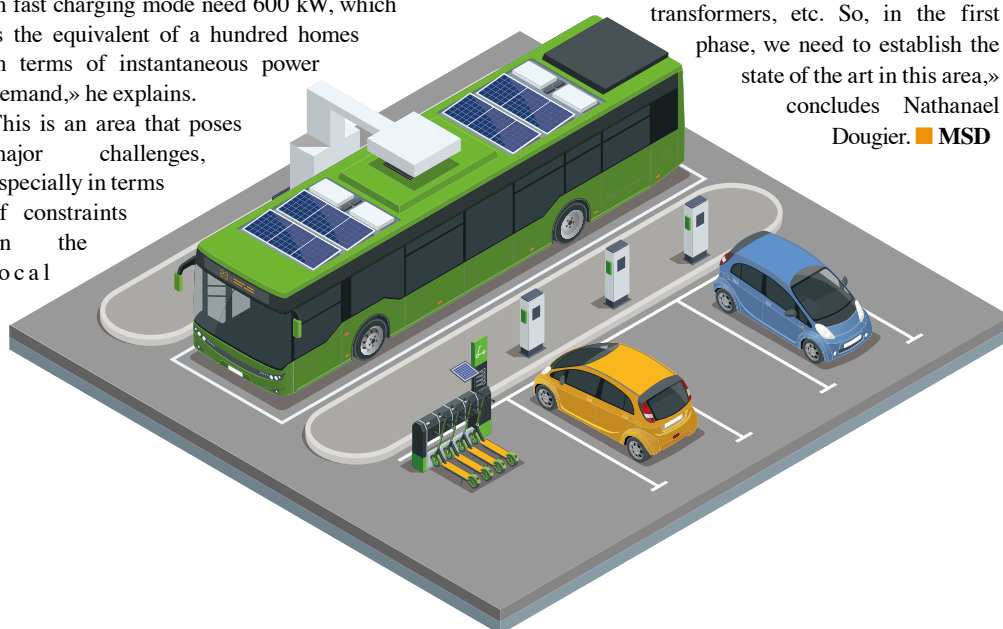
His thesis led to a post-doctoral research position at the UTC-Avenues laboratory. There he works on the IEA's PVPS Task 17 scientific programme and its French contribution PV2E\_Mobility, funded by ADEME.

Among his main tasks? «In addition to my research work, I am assisting Manuela Sechilariu in the project dedicated to Task 17 of the International Energy Agency's (IEA) international programme. In particular, this involves participating in the preparation of the final report which will compile the state of research of the various international teams collaborating on this programme,» he points out.

However, his role does not end there, as Nathanael Dougier is also interested in another mobility-related issue, that of electric buses. «With buses, we are facing very different problems from those of electric cars. Indeed, there are major constraints on bus transportation, particularly in terms of continuity of service for users, but also in recharging. It is estimated, for example, that an electric car needs a power supply rated at 7 kW for slow charging and 50 kW for fast charging. By comparison, buses in fast charging mode need 600 kW, which is the equivalent of a hundred homes in terms of instantaneous power demand,» he explains.

This is an area that poses major challenges, especially in terms of constraints on the local

electricity grid. «For buses, there can be different ways of charging. For example, they can be recharged at night at the depot. But this requires them to be equipped with very large batteries. They can also recharge for a few seconds/minutes during the day when they reach the end of the line or at certain bus-stops. However, this has an impact on passenger transportation and the electricity network in the event of a high power demand. This would require the installation of new cables, transformers, etc. So, in the first phase, we need to establish the state of the art in this area,» concludes Nathanael Dougier. ■ MSD



## Social acceptability and societal impact

Mathilde Boesch is a final year student in Urban Engineering, specialising in Building, at UTC. She is in charge of a workshop-project dedicated to the social acceptability and societal impact of PV (photovoltaic) powered charging stations.

**It was pursuant to a call for projects from ADEME that this 6-month project-workshop - (an "AP"), in which 12 students participate - was set up.** SHis role as project-workshop leader?

«I update our progress at each session for the project to the supervisors and set the agenda for the session. Then, with the group, we subdivide up the tasks to be carried out during the day,» she says.

This study follows suit to a similar study carried out in 2018. The aim this time is to check whether the mind-set of the French has changed in regard to the concept of electro-mobility and the use of PV energy, especially as we have seen strong growth

in all electric vehicle (EV) sales since 2019. It is also a question of verifying the acceptability of charging stations with intelligent energy management allowing a two-way exchange. In other words, an EV can receive stored energy from PVs but also supply its own home, for example, or the national grid in the event of a consumption peak,» she believes.

The various stages of the study? «We started with a qualitative survey during semi-directive interviews with users of EVs but also of other types of transport. From the sixty or so responses, we came up with a number of hypotheses to be verified during a quantitative survey with the

implementation of a questionnaire. We wanted a larger sample that was representative of the French population, and to date nearly 800 people have responded,» she explains.

And concerning the analysis of the responses? «A question-by-question analysis and then an overall analysis were carried out, followed by a comparison with the 2018 study to see if and how mentalities have changed. In a way, we are trying to find out the state of mind of the French with regard to electro-mobility in order to target the obstacles and expectations relevant to this technology development,» concludes Mathilde Boesch. ■ MSD



PEDAGOGICAL INNOVATION

# Hybrid training: educational innovation

The ET-LIOS project, an acronym for «Enseignements Technologiques de niveau Licence Ouverts pour une industrie du futur compétitive et Soutenable» [First Degree level Technology-intensive training for competitive & sustainable industry] is a project of 'hybridization' of higher education courses dedicated to 'Industry of the Future'.

**T**he ET-LIOS project develops «hybrid» pedagogical contents, designed to be used in engineering and industrial training courses, on subjects related to so-called «4.0 technologies», with a focus on competitiveness and sustainability. The project is carried out by an academic group of 14 partner universities, led by UTC-Compiègne, a member of the S.mart scientific interest group and winner of the «PIA3 New University Courses» programme. Funded by the ANR (Agence Nationale de la Recherche) under the Government incentive Programme called «Investissements d'Avenir» (PIA), the project was launched in November 2020, in connection with the COVID-19 pandemic crisis and to meet the need to ensure the pedagogical continuity of HE teaching. Indeed, the 14 partner universities of the project pooled their experiences acquired

during the COVID-19 period, in terms of distance learning and continuity of training. They designed and developed various hybrid teaching modules that also meet the needs of «autonomous learning», «flipped classroom» and other innovative training

methods. The project is aimed at learners and teachers of SPI, EEA, Pro Licences in the theme, BUT GMP, GEII, GIM, QLIO, MP, SGM, PEC, integrated preparatory cycles of INSA, Polytech, UT, and also first year of the engineering cycle. .

## 3 QUESTIONS TO...

**Maxime Blampain, 21 years old, who studied for his bachelor's degree at UTT, majoring in Design & Material Shaping Processes last year and is currently doing a Master's degree in Digital mechanics and design at INSSET, Saint-Quentin.**

**How did the ET-LIOS project contribute to your personal learning?** I was a student assistant engineer at the UTC within the ET-LIOS project and my role was to take part in the creation of contents and to bring my student vision to the various proposed contents, to ensure that the courses and statements were clear. This training allowed me to develop my knowledge, particularly in the field of materials. This work-study period within the ET-LIOS project has given me a lot of knowledge on the IT aspect, as I come from a background that is more focused on mechanical design. These two fields are complementary in my opinion.

**How did you experience this period of on-line remote learning?**

This period was quite complicated I must say.

Staying behind a screen with headphones on so as not to disturb the rest of the house was not pleasant. Interaction with colleagues and teachers was complicated. The practical classes were difficult to follow as we did not have the machines at our disposal and reading dozens of pages of PDFs on how to use the machines was a 'pain in the neck'. So hybridisation of courses is a good formula when the support is well-structured and the contents are adapted. Yes, it's a good formula when you can't come on site, which is the case today with the fuel shortage, refinery strikes, etc.

**What are the virtues of this teaching method?**

The positive aspects of this formula are obviously: a better flexibility of work, the possibility of managing personal problems and unforeseen events while continuing to work. For example, the car won't start so I have to stay at home, but I can give an on-line course by video. Since the beginning of this year, I'm delivering a work-study programme at Cetim in Senlis and my professional project is to evolve within a design office in the field of motor sports or aeronautics.





## Active pedagogy...

«Active teaching is favoured. Remote students can use these simulation software programs like a video game, in a fun environment. The tools made available facilitate learning, in particular the online checks as to the validity of the actions undertaken by the learner. The platforms are accessible, controllable and remotely usable. They make it possible to generate ‘real data’ to illustrate all the trades through their maintenance aspects,» stresses Benoit Eynard, teacher-researcher in industrial engineering, Scientific Manager of ET-LIOS AIP (Uni Lorraine). It is based on six teaching modules: Design-simulation-3D prototyping, Advanced manufacturing and metrology, E-maintenance of cyber-physical production systems, Digital twin and virtual commissioning of automated production systems, Sustainable and responsible engineering and Intelligent systems and multiphysical modelling.

## ... and innovative

The latter, for example, aims to train future technicians and engineers to design from the perspective of integrating mechanical, electrical, electronic and software functions. In the context of the design of connected, “smart” and adaptive systems, the engineer integrates structural, sensory and motor functions linked by intelligence. The design and production of these complex, light and resistant components, equipped with a form of autonomy, capable of carrying out measurements and movements or behavioural adaptations, requires the implementation of new skills. «After an introduction presenting the

### FOUR SUB-PROJECTS IN SUPPORT OF PEDAGOGICAL HYBRIDISATION

- Development of the digital infrastructure for “virtualising” software solutions and hosting educational content.
- Structuring, development and deployment of educational content.
- Measuring the project's performance and impact on the target training courses.
- Dissemination and availability of educational content.

main trends linked to product developments, particularly in the context of the development of mechatronic systems, cyber-physical systems and smart products, several topics are addressed, such as systems thinking, systems engineering, requirements engineering, Model Based System Engineering associated with the SysML language and an awareness of the verification/validation logic. A case study, based on a land-based “climbing” drone for structural inspection, serves as an illustration throughout the course. The example of the drone is also used in a recurrent manner in the tutorials for the application of knowledge and know-how. Classroom time is devoted to a project of design, simulation and realization up to the physical prototyping of a remotely controllable, semi-autonomous device”, explains Matthieu Bricogne, lecturer-cum-research scientist at UTC and responsible for the



BENOÎT EYNARD



MATTHIEU BRICOGNE



MANUEL MAJADA

module E. Innovative teaching methods such as peer-to-peer model reviews were also devised and associated digital solutions were developed in partnership with the university research group of the Jean-François Champollion institution.

## For a sustainable society

The Sustainable and Responsible Engineering module aims at providing open-source teaching materials and to train higher education teachers so that they can integrate socio-ecological issues into their teaching. «Whether we are talking about ecological transition, energy-climate issues or sustainable development, the challenge is the same, namely the transformation of our Society and economy into resilient systems. Integrating socio-ecological issues into our training, our professions and our lives means recognising the need for change. The engineering profession wears two hats. They are both the source of the environmental problem through their involvement in the use of resources and energy and the production of waste, but they are also the ones best placed to find solutions for these problems. The engineer therefore plays a pivotal role between technology and society,» explains Tatiana Reyes-Carillo, a lecturer-cum-research scientist at UTT-Troyes (the Université de Technologie de Troyes) and head of module F. The aim of the Sustainable and Responsible Engineering module is to question and reposition the engineer of tomorrow within our Society.

## Providing knowledge to lecturers-cum-research scientists to feed their thinking

Collaboration with different institutions and the involvement of lecturers from the targeted courses (BUT, bachelor's degrees) encourage the homogenisation of training modules as well as the tools to be developed and shared. «Of course, we must not forget the technical and pedagogical support for the project, based as it is on a triple challenge: 1° building a collaborative tool with several contributors: 2° structuring of the contents, their formatting and 3° ensuring the sustainability of the resources. We work at the UTC in editorial chains developed internally to manage these three dimensions,» emphasises Manuel Majada, head of the UTC's pedagogical

*«Active teaching is favoured. Remote students can use these simulation software programs like a video game, in a fun environment. The tools made available facilitate learning, in particular the online checks as to the validity of the actions undertaken by the learner. The platforms are accessible, controllable and remotely usable.»*

support unit. The results: a real added value for documents that are more structured, more complete, more comfortable and more interactive for the students. What comes next? To continue to work around the communities created for the production of even more easily reused documents and to continue the reflection on attractive usage scenarios. ■ KD

### OBJECTIVES AND EDUCATIONAL RESOURCES OFFERED BY THE ET-LIOS PROJECT

- To develop new scientific and technological teaching contents, by encouraging the autonomy of learners.
- To experiment these contents with teachers and learners at undergraduate level.
- To make this shared educational content, made available to S.mart members and, more broadly, to academic actors at the national level.
- To develop platforms and resources compatible with the hybridisation of teaching and other forms of innovative teaching, and to make them available to the educational community.
- Measure the performance of the project and the impact on the target courses, with students and teachers.



## # CELEBRATING THE 40TH ANNIVERSARY OF THE UTC-HEUDIASYC LABORATORY



On October 7, Heudiasyc celebrated its 40 years of existence with the CNRS, at UTC-Compiègne. It was a day highlighted by presentations and a round table of «cross-views on the future stakes of research in complex technological systems» animated by Paul de Brem, scientific journalist, together with:

- Patrick Bastard, Director of Research, Renault
- Yves Nicolas, Deputy Director of Technology, SopraSteria
- Adam Ouorou, Director of Trust and Security Research, Orange Innovation
- Philippe Baptiste, President of the Centre national d'études spatiales (CNES)
- Antoine Bordes, Director of the FAIR (Facebook Artificial Intelligence Research) laboratory, Meta AI
- Catherine Grandhomme, Head of the Strategic Industries Department, CNRS.

The 150 participants present were also able to discover the latest research carried out on the laboratory's technological platforms.

## # ROMAIN BEL, UTC STUDENT AND FENCER, WINS SECOND PLACE AT THE SENIOR SATELLITE WORLD CUP IN BUCHAREST



Congratulations to Romain Bel, a UTC student majoring in Mechanical engineering and "elite branch" athlete, who just won the second place at the

Senior Satellite World Cup in Bucharest. This great result also sees him climb to 152nd place in the international fencing ranking.

## # A UTC STUDENT WINS 3 PRIZES AT THE ALTAIR GLOBAL CONTEST FOR STUDENTS



Sergio Octavio Esparza Martínez, a student in the Simulation for Mechanical Engineering (SIM) elective specialty in the Mechanical

Engineering department, won 3 prizes at the Altair Global Contest for Students.

1st prize overall Americas + EMEA + Asia-Pacific, 1st prize EMEA (Europe, the Middle East and Africa) and the prize for the most creative presentation EMEA. Sergio Octavio Esparza Martínez won his awards for his work in mechanics, data and artificial intelligence. You can discover his project on the UTC's YouTube channel.

## # UTC OBTAINS THE ERASMUS+ GOOD PRACTICE LABEL

For the first time in 10 years, the UTC has obtained the «Good Practice» label from the Erasmus+ Agency. This label reflects the excellent evaluation received for UTC (86÷100) for its administrative and financial management, as well as for the quality of the proposed improvement projects. ■ PS



## INTERNATIONAL

# From Malaysia to UTC, an exceptional journey

Welcoming foreign students has always been part of the UTC's DNA and the links with Asia have always been strong, since the first twelve Chinese students were welcomed here in February 1979, through the creation of UTSEUS in 2006. Today, about 20% of UTC's matriculated students are foreigners, of which a significant part comes from the Asian continent. Students with impressive academic backgrounds, such as Dhivenya Rajarathinam, a Malaysian student who is currently finishing her studies, majoring in Mechanical engineering!

**B**ehind every application to UTC, we find an excellent academic record. Dhivenya is no exception to the rule, as her brilliant record offered her the opportunity, after her Malaysian baccalaureate, to study engineering abroad. "I had the choice between Germany, France, Japan and Korea," she explains. "As I wanted to go to Europe and I preferred the French language and culture, I didn't hesitate long between these destinations!"

So Dhivenya flew to France in 2017, more precisely to the city of Tours. There, she took intensive French courses for a year (to reach the B2 EU language skill level), as well as a refresher course, to acquire the same basics as the French scientific baccalaureates. In 2018, a change of scenery, she moved to Le Havre to obtain a DUT (University Technology Diploma), at the IUT of Le Havre. "It went very well for me, the teachers were very attentive, and as I worked hard I finished second in my class!"

Excellent results which pushed the director of her IUT to talk about UTC, at the beginning of his second year. «The director of my IUT spoke to me about the UTC and encouraged me to apply after my first semester results. It was not an option I had considered before. So I looked at the programmes offered by UTC, and the student life, and I was convinced!

## LINKS BETWEEN UTC AND MALAYSIA

Gaëlle Dacqmine, deputy director of the International Relations Department, UTC

The Malaysian students we welcome at UTC come within the framework of specific programmes, managed by a French organisation in collaboration with the Malaysian Government. This is the case of Dhivenya, a student of the SFERE (Société Française d'Exportation des Ressources Educatives) Malaysia programme. Since 2016, we have been receiving a few Malaysian students (usually 2 - 3) from SFERE every year. These students choose a major at UTC after two years of studies in France (generally for a DUT or at a IUT). They have a very good general level and an excellent level of French and integrate the institution following the same admission procedure as all UTC student-candidates. They then follow their engineering curriculum at UTC until graduation. The second specific programme, in Malaysia, is managed by Campus France. It works in the same way and has also existed since 2016.

## «WELCOME TO FRANCE», THE LABEL WHICH REWARDS THE WELCOME OF THE UTC

UTC has been awarded the label «Bienvenue en France» 2 star level for the quality of its welcome of international students, for the period 2020-2024. This label distinguishes French Higher Education institutions that have developed and implemented reception facilities for these non-French students. The indicators particularly recognised for UTC are those of the quality and accessibility of information, the quality and accessibility of reception facilities, the quality and accessibility of the training package offers and teaching support, accommodation, and the quality of life on campus, and the quality of post-graduation follow-up for international students.



Other Malaysian students who also joined UTC were also very encouraging". More motivated than ever, Dhivenya is working hard: «I did my best to get a good ranking in the third

semester. To do this, I took up a sports activity and started to learn a third foreign language, as this added bonus points to my overall average."

With her excellent results and impeccable French, admission to UTC is only a formality. And the third move in 2020 for Dhivenya, who this time settles in Compiègne. She enters UTC in Mechanical engineering, with already in mind the idea to follow the elective specialty course on Industrial Design Engineering. But there is no question of her giving up her hectic lifestyle: she regularly posts videos about her student life and advice for other students on her YouTube channel, and also makes videos for the UTC. In 2022, she did her first internship, for the brand La Roche-Posay, at L'Oréal:

«I had the opportunity to do my internship in the industrial development team," she adds. "This rewarding internship gave me my first glimpse into the field of product development, in which I flourished.»

Dhivenya is now finishing her studies at UTC, and is looking for a final year internship in the field of product development. No doubt she will find it quickly ! ■ MB





# From BMBI to the stage of "Ma thèse en 180 secondes"

Nicolas Rivoallan, a doctoral student at UTC-Compiègne and under coPhD supervision with Leibniz Universität of Hanover, in biomechanics and bioengineering, was unanimously acclaimed by the jury during the Sorbonne University final of the «My thesis in 180 seconds» contest, last March. His challenging topic: «Repairing your broken tendon, using a material to reconstruct a bioartificial bone/tendon/muscle».



NICOLAS RIVOALLAN

**A**fter obtaining a scientific BAC in SVT (life sciences...) with a maths speciality option and a European maths-English section, Nicolas Rivoallan entered a IUT in Mechanical and Production Engineering. To get a little closer to the field of life, he entered the ENSMM in Besançon in the «Microtechniques and Health» speciality. He did his three years of engineering school through an apprenticeship at ADHEX Technologies near Dijon. «This

company specialises in adhesive products for the automotive, industrial and health sectors, but it was also a very good school for me to learn the engineering profession in very different sectors. Once I got my engineering degree, I looked for a thesis subject, and that's where I discovered the research activities of UTC, in particular the Biomechanics and Bioengineering Laboratory (BMBI). Unfortunately, my profile lacked a bit of «bio» aspect to answer the research challenges of the laboratory. This is how Cécile Legallais advised me to join the Master 2 Biomechanics and Bioengineering of the UTC,' he explains. His objective has always been around teaching in higher education, which is why he wanted to enter a thesis to reach positions such as lecturer. «I have the opportunity to see the profession of lecturer-research scientist through the supervision of practical work at UTC and my research activities in the laboratory. Today, the world of scientific mediation and popularisation also interests me a lot, always with the pleasure of sharing knowledge. My thesis in 180 seconds or the science festival are events that challenge me in scientific popularisation».

## A thesis in 180 seconds

«My thesis aims to reconstruct the junction between bone, tendon and muscle using tissue engineering. The idea is to create a material

composed of biocompatible polymeric nanoscopic threads, and then to deposit cells that will attach themselves to these threads and grow into bone, tendon or muscle depending on how the threads are arranged. Indeed, by assembling the threads in a honeycomb shape (hexagons), we encourage differentiation of cells into bone,» explains Nicolas Rivoallan, for whom the «My thesis in 180 seconds» adventure began in January 2022 with a training course on public speaking organised by Sorbonne University and relayed by the doctoral school. It was following this day that the criteria for the pre-selection were given: 90 seconds only to speak about your subject and interest the jury via zoom. The results were given the same evening and only sixteen candidates were retained out of the forty or so who had registered. «This is where the great adventure began! We again had more specific training for the competition until the big day. It was certainly a stressful evening for all of us, but it was also a joy to see us in person after the regular zoom training sessions I had organised while I was still in Germany, in my other thesis laboratory,» he recalls. Following our performances and the jury's deliberation, I was awarded first prize by the jury and thus selected for the national semi-final. » ■ **KD**

## POPULARISING SCIENCE :

### WHAT A CHALLENGE!

Each year in October, the «Fête de la Science» takes place throughout France. It is an opportunity for laboratories to present their activities to the public at large. This year, during the CNRS festival, the UTC-BMBI laboratory was invited to hold a stand at the media library of the city of Cambrai, in addition to Compiègne at UTC. «Pascale Vigneron, Jean-François Grosset and myself had the pleasure of presenting the laboratory's activities to classes of secondary school students as well as to the general public. It was also an opportunity to meet other laboratories in Hauts-de-France as well as the team in charge of this

event and of the scientific mediation activities of the CNRS in a more global way,' says Nicolas Rivoallan, who also held a stand at UTC with Cécile Legallais, director of the laboratory, on the subject of artificial organs such as the liver or the bioartificial tendon, flagship projects of one of the teams of the BMBI laboratory. From September 6 to 10, the 48th congress of the European Society for Artificial Organs (ESAO) was held in Krems, Austria. The UTC-BMBI laboratory is actively participating in this congress as it brings together many researchers



working on technologies and applications close to its research work.

«This was my first scientific conference, and not the least. During the «my research for dummies» session, I had the opportunity to present my thesis again in 3 minutes and to be awarded the first prize». The BMBI laboratory was able to shine with its two presentations on artificial liver and tissue engineering of the bone/mother junction, led respectively by Cécile Legallais and Nathália Oderich Muniz, a post-doctoral fellow in the team.



## INNOVATION

# Innovation objective

Arnaud Duval, graduate of Arts et Métiers in Angers and holder of a DEA in acoustics from the University of Le Mans, was appointed the Acoustics and Innovation Director of the Trèves group in 2016. A group that adheres to the United Nations Global Compact project.

**N**ot wishing to continue with a thesis, he chose to work in industry and more particularly for the automotive sector. The role of the acoustician? «Our job is to reduce noise. Either by acting directly at the source or, if we can't, by preventing the noise from being transferred to the area of the occupants or users of any noisy machine. Finally, the tools used in the automobile industry can be transposed to the railways or the aeronautics industry, for example. However, we do not have the same constraints concerning fire, etc.,» he explains.

So, after several years with an automotive supplier, he arrived at Trèves with a precise roadmap. «One of my missions was to manage both the acoustic and thermomechanical expertise and the innovation plan. It was a question of structuring innovation by setting up processes, called 'Technology Readiness Level', similar to those of the aeronautics industry,» he says.

But his role does not end there. He contributes to the group's external influence, notably through international conferences, and is in charge of research collaborations with academic institutions, including UTC. «We set up funded research programmes, in particular with Cifre doctoral theses. We have two permanent PhD theses, one of which is currently with UTC, and two post-doctoral theses at the moment. With the Cifre theses, we are working, for example, on the problem of encapsulating engines with the aim of reducing noise. Indeed, by 2024, the standard for external noise, which is 70 dBA today, will be reduced to 68 dBA, knowing that we have already reduced it by two dB over the last three

*We set up funded research programmes, in particular with Cifre doctoral theses. We have two permanent PhD theses, one of which is currently with UTC, and two post-doctoral theses at the moment*

years. This is considerable,» he explains. Noise reduction can be achieved in two ways. «The manufacturers ask us to reduce the noise at the source. So by acting directly on the engine. This has an impact on the noise generated both inside and outside. But also to find solutions to reduce rolling noise, since this type of noise is becoming more and more preponderant with the development of electric vehicles,» adds Arnaud Duval.

Indeed, all manufacturers are faced with the same equation. «Among their priorities, interior acoustic comfort comes first as a differentiating element, but it is also a question of reducing exterior noise for the well-being of local residents, especially since the «Pass By» standards are becoming stricter. Studies are currently being conducted on the link between these standards and

the reality of noise in cities. However, Bruitparif, which maps the sources and locations of noise pollution in the Paris region, points the finger mainly at vehicle horns, two-wheelers, lorries and only after that at private vehicles, particularly road contact rolling noise,» he explains.

Hence the major challenges of innovation in the materials used by the various players working on the noise problem, including the Trèves group. There are two main areas of focus. «The first, which we are working on, concerns the transition from plastic technologies to recycled and recyclable textile technologies for underbody panels, mudguards, etc. in order to reduce rolling noise with a potential of 0.7 to 1 dBA. Admittedly, this may seem like a small brick, but we hope to go further. The second concerns the issue of road surfaces. Bruitparif works a lot with road surface manufacturers. And we have observed that certain surfaces can generate a reduction in rolling noise of up to 6 dB, or even 8 dB! And if we only take

the low range, on a ring road such as the Parisian periphery, this is gigantic!

Among the constraints weighing on the automotive sector? «The main challenge for the automotive industry today is to reduce emissions, particularly CO<sub>2</sub>, but also the overall environmental impact through life cycle analyses. This, at our level at Trèves, implies considerably increasing the proportion of recycled materials in our products but also ensuring their recyclability at the end of their life,» he explains.

Which materials will ultimately be used in the car of the future? «In the framework of Global Compact, a United Nations programme to which Trier is a member, the group has set itself the objective of achieving 80% recycled materials and 80% recyclable materials by 2027. This is ambitious but achievable, especially as we already have know-how in the use of recycled cotton or polyester fibres, for example. We are also increasingly moving towards the use of natural fibres such as linen or hemp. Most of our products already contain around 70% recycled material. Reaching 80% is therefore a major challenge,» concludes Arnaud Duval. ■ MSD







SAMUEL VEILLERETTE

## UTeam : the link between UTC and its partners

**UTeam, a valorisation subsidiary 100% owned by UTC-Compiègne, is the gateway to access the competences and the means of UTC.** It is the result of the will of the professors-researcher scientists to favour applied research, innovation and collaboration with the industry.

**C**reated in 1987, UTeam has the status of a PLC (public limited company) with a Management Board and a Supervisory Board, and is a subsidiary of UTC for the management of its partnership research. UTeam was created to offer companies of all sizes, from large groups to start-ups, the skills of its network of experts composed of UTC professors-research scientists, external consultants and engineers, thus covering many scientific and technical fields. «UTeam offers specific support for its clients, project holders or company founders. This ranges from activity support to training, including research, engineering, consulting, auditing and educational projects. Our mission, through an agreement with the UTC, is to contribute to the promotion of the know-how of the units and laboratories of the research centre, the technological platforms and the innovation centre, through the development of the partnership activity, and thus to contribute to the enhancement of the image and the reputation of the UTC,» explains Samuel Veillerette, a former development officer on a CNRS contract for the UTC-Heudiasyc laboratory, who became the

third President of the Board of directors of the UTeam company in 2015 at the age of 32.

### UTeam, the commercial arm of the UTC ecosystem

The company relies on a team of about ten permanent employees to assist about a hundred consultants per year in the setting up and management of business deals from a legal, administrative and financial point of view. UTeam handles an average of 300 projects per year with a turnover of €3.5 million. «To sum up, UTeam is the commercial arm of UTC. We offer different types of contracts such as research collaborations (Cifre theses, for example), research or services, or educational projects (including project workshops). The pedagogical contracts are particularly appreciated by the companies, but also by town halls, the public authorities and the ministries, because they allow the UTC's partners to become familiar with the thematic and organisational diversity of the UTC, too often ignored, before setting up more ambitious research or innovation programmes», indicates Samuel Veillerette, himself a graduate from UTC in 2007. UTeam set up an engineering cluster in 2016 in order to extend the ecosystem's and laboratories' offer in terms of development and prototyping, particularly in the digital field. The UTeam engineering division is thus conducting IT developments around the first French quantum computer developed by the start-up Pasqal. UTeam was also behind the structuring of the national network of subsidiaries and related structures, «RENAFI», which organises meetings several times a year to discuss their practices, as well as with the French Ministry of Higher Education, Research and Innovation. UTeam is

working on several development axes such as the enlargement of its offers, the development of territorialized thematic aggregates of the Oise metropolitan pole, or the creation of a restaurant for the lecturer-research scientists, the consultants and the partners on the UTC campus. ■ KD



#### PROJECT WORKSHOPS

#### ANCHORED IN THE TERRITORY

Among the numerous Project Workshops managed by UTeam, on behalf of the UTC, is the one of the Compiègne station area with the ARC (Greater Compiègne). Several UTC students worked in 2019 on a set of issues and innovations in the field of digital (smart cities, smart urban districts and building), environment (biodiversity, natural risks, nuisances) and socio-economy (circular economy, citizen participation, mobility...); fields that should be articulated within the framework of the future multimodal exchange hub and in particular the renovation of the Compiègne railway station, according to an integrated approach of development and mobility. Six months of work with two groups of about fifteen students each, supervised by several lecturer-research scientists of UTC, led to the creation of three scenarios for the development of the future eco-district of the station. «This Project Workshop was a great opportunity for us to participate in a development project aiming to build the future of an eco-neighbourhood by imagining and studying the constraints and feasibility. It was a rich work in acquiring know-how and skills. The integration of feedback from the consultation with the citizens allowed us to support the anchoring of our proposals on the ground, by selecting the most relevant innovations for the Compiègne territory», the students stated in their report.



### 3 QUESTIONS FOR...

**ZADIYÉ BLANC**  
DEPUTY MAYORESS OF  
COMPIÈGNE, IN CHARGE OF  
URBAN PLANNING AND  
ECONOMIC DEVELOPMENT FOR  
MARGNY-LÈS-COMPIÈGNE  
AND COUNCILLOR FOR GREATER  
COMPIÈGNE (ARC).

#### What are the main urban planning projects in Margny-Lès-Compiègne?

In Margny-lès-Compiègne, we can begin by mentioning the future "Eco district" of the Railway station and the Zone d'Aménagement Concerté de la Prairie, a future district located on the border between the townships of Magny and Venette. The "Eco-district" of the Compiègne/Margny-lès-Compiègne railway station is a flagship project for our Region with the dual objective of transforming the station into a Multimodal Interchange Pole (PEM), a gateway to the conurbation, with the creation of a two-sided railway station designed for all modes of transport, and also to develop urban renewal/renovation schemes (housing, offices, services) in the heart of the conurbation. With a key challenge for the years to come, the project scale will rise to a district level that will be both an active district: with 16 000 m<sup>2</sup> of offices-space, 3,500 m<sup>2</sup> for shops and services, and also a district to live in with 400 diversified housing units, a park, shared gardens, landscaped riverbanks, and cultural and leisure areas.

#### Does an engineering school like UTC have a role to play in the transformation of the city?

Of course! Several partnerships have been signed with the Urban Engineering Department of the University. In particular, let me pinpoint three «project workshops» commissioned by the ARC. Two in the spring of 2019 with the common theme «The Railway Station district: both sustainable and 'smart'». One was dedicated to consultation, with implementation of consultation campaigns run directly by the group of students, and the other devoted to the innovation component. And a second project in spring 2021 to conduct a study of the "centrality of Margny-lès-Compiègne in connection with the Eco district of the station mobilized sixteen UTC students, supervised by two lecturers. This work generated some ambitious scenarios which serve as excellent bases for our urban projects. Many elected officials and agents of ARC (Greater Compiègne) and Margny-Lès-Compiègne were invited to attend the oral presentation of the project results in the UTC premises.

#### How do you reconcile urban planning and economic development for your territory?

Since the creation of our so-called "intermunicipality", the strategy has focused on the development of business parks; this is how the Hauts de Margny development centre was created in 2012. It now hosts 31 companies and 240 jobs for a surface area of 60 hectares, numerous small industry and craft activities, services and soon logistics operators. Economic development must also adapt to the challenges of environmental preservation. That is why we have to strike a balance between supporting our businesses and jobs, and preserving our agricultural and natural areas. This quality of life is a factor of attractiveness for our companies, who can thereby attract a workforce that is keen to benefit from a high-quality environment in which to flourish. High quality of life is therefore one of our assets to encourage the installation and development of companies but also the personal development of employees. ■ KD

### TERRITOIRE

## When engineers participate in the transformation of the city

UTC is a partner of the development, notably economic, of the local community. It has been an initiator and/or stakeholder in major projects linked to the attractiveness of the territory for many years. **Emmanuel Pascual, Municipal and Community Councillor, Delegate for Innovation and Relations with Higher Education, explains.**

#### In its work, the local community, whether it is the City Council of Compiègne or the Greater Compiègne authority (ARC), calls upon UTC to be accompanied.

In this case, this work is done by the means of academic CCs or project workshops. This was the case on a large-scale project, such as the Eco-district of the Compiègne/Margny-lès-Compiègne station. On this subject alone, three project workshops were mobilised. Two workshops were organised in spring 2019, with a common theme of the «Railway station district: sustainable and intelligent district», each dealing with a specific aspect: one on consultation with an survey onboard and online about train transportation and urban

the teams and elected representatives with a different vision, which feeds the reflections for the construction of the territorial projects. As you can see, we rely of course on the skills of UTC in urban engineering, which are a real asset for our territory, but we also look for skills in innovation and project management. It should be added that most of the students and lecturers are inhabitants of the territory,» underlines Emmanuel Pascual, Municipal and Community Councillor, Delegate for Innovation and Relations with Higher Education since 2020, but also an INSA architect, from the École Nationale Supérieure des Arts et Industries de Strasbourg.

#### A territory as a place for experimentation

The proximity of the links between the community and UTC-Compiègne makes multiple collaborations possible. Indeed, it is a question of facilitating the implementation, in real conditions, of work that has passed several stages in laboratory. This was the case for a project which consisted in equipping certain bus lines with fixed and mobile sensors to test a new communication architecture. «More recently, we worked alongside Manuela Sechilariu, at the Urban Engineering Department, and the company Systra, to develop a tool for sizing individual vehicle recharging infrastructures. ARC's participation made it possible to take into account the constraints of a typical territory, such as the number of surface and underground parking spaces, flood zones, and the perimeter protected by the architect of the buildings of France. Our participation has also made it possible to draw up documents for local authorities, a sort of decision-making tool,» continues Emmanuel Pascual, for whom urban development also acts as a lever of attractiveness with more than 8 600 active establishments and 41 200 jobs. Industry is very present here, representing more than 15% of total jobs, and the number of research scientists in the area is also constantly growing. We are pleased to welcome many projects to the region. Very recently, Plastic Omnium announced the construction of a hydrogen tank manufacturing plant in Compiègne. This future site will have a production capacity of 80 000 tanks per year and will produce its first line products by 2025. It will be the largest in Europe. ■ KD



*They provided an opportunity for the students to present the results of the consultation at a public meeting.*

pathways and a consultation workshop with the project's stakeholders, while the second one was devoted to the innovation aspect. «The results were very positive. They provided an opportunity for the students to present the results of the consultation at a public meeting convened in December 2019. Of course, the CRA departments in charge of the Geographic Information System (GIS) or Urban Planning and Development sometimes welcome UTC Urban Engineering (GU) trainees into their teams. These different ways of working provide

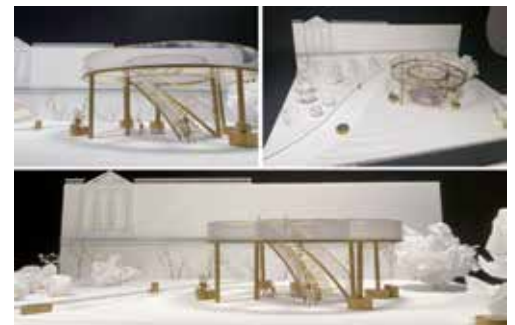
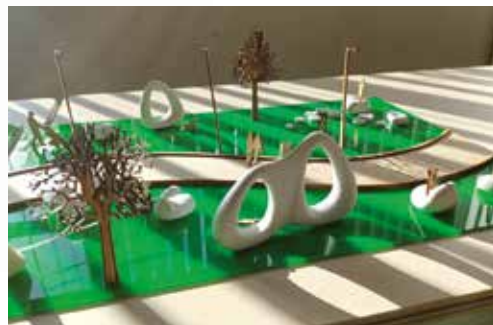






# Urban furniture that stands the test of time and blends in with the landscape

Last spring, as part of UTC's IDI-Di03 CC, (industrial design workshop), Victor Lherm-Soulas, a student in urban engineering, together with Lucas David, a student majoring in mechanical engineering, designed a space for the city of Compiègne. The result is a scenography that resonates with the place to form a meaningful whole.



*The history of the engineering profession is also closely linked to design and the craft that preceded industry*

**A**s part of the IDI course, Industrial Design Engineering, Mechanical Engineering Specialty, Victor Lherm-Soulas imagined and designed a terrace for a specific public place on the banks of the river Oise, integrating a reflection on its aesthetics, its materials, its functions and its associated uses. The project consists of a large wooden deck terrace with a diameter of 30m, structured in two circular spaces marked by different decking: a space in the centre for music and dancing, and around it, a space with tables of different sizes. And a "centrality" around a kiosk which is the support of all the life brought by this project. «It was carried out as a commission from the ARC, the agglomeration of the Greater Compiègne region, which wanted to communicate, make visible and tangible the dynamism of the agglomeration on the economic, cultural and environmental levels. This is a fictitious project. The aim is that the result should go pass the test of time and blend in with the surrounding landscape,» explains Anne Meuleau, a lecturer in industrial design at UTC, accompanied in the project by the BLAM workshop. This company in the urban furniture sector explores the designers' ability to see the world and imagine the world of tomorrow. «Aurélien Meyer, co-founder of the BLAM workshop, accompanied us by building

the brief with me, giving his expert opinion to the students, as much on the aesthetic, semantic, poetic and symbolic aspect, as on the pragmatic aspect of the projects, the use, the manufacturing and the implementation.»

## Creativity as a lever

According to Victor Lherm-Soulas, today the engineers are given an advisory, even limiting role. He/she knows the technical aspects, so he is consulted to find out if it will work or not. He/she writes technical specifications, translates architectural intentions into technical plans, checks compliance with the regulatory framework, and produces technical studies. «It is terribly sad to see that the creative role of the engineer has been largely lost, the most striking testimony to which in history is undoubtedly Leonardo da Vinci, who forgot that the first engineering school, Les Ponts et Chaussées, was founded on the model of a school of architecture. The history of the engineering profession is also closely linked to design and the craft that preceded industry,» continues Victor. «For me, it is a question of reviving this heritage and considering technical and regulatory constraints no longer as obstacles but as creative levers. This is what should guide our way of making the city».

## Imagining attractive urban furniture

The students came up with targeted, unique and unexpected answers. 3D modelling enabled them to develop an idea by pushing it to the limit, in terms of details and finish, by integrating some manufacturing constraints, while producing realistic images of the projects, with integration of the furniture in its context. «The objective is to re-enchant public places, by creating a collective, by bringing conviviality and interaction. To offer beauty, positivity, wonder, pleasure and emotion. If possible, integrate the eco-responsible dimension,» assures Anne Meleau. «We are hoping for a positive response from the Compiègne town hall to exhibit the models there and show the projects to the members of the Arc. Through their ability to understand and analyse, to think about the meaning of what they are doing, to integrate all types of constraints and tools, to be creative, but above all to put the human being who uses the devices at the centre, engineers have their place at all levels to participate in the creation of the city of the future». ■ KD



HUMANITIES AND TECHNOLOGY

# Research scientist - cum - artist

Ninon Lizé Masclef is the first artist “in residence” as we say, at the 3DEXPERIENCE Lab, the innovation centre of Dassault Systèmes France. She is simultaneously in charge of scientific research with the UK start-up Ontbo. Her research is specialised in the analysis of emotions and music to develop brain-computer interfaces.

**A**ged 25, Ninon Lizé Masclef has already designed an emotion sensor mask with CATIA XGenerative Design, using a 3D scan of her head to integrate an EEG sensor and fibre optics. She had never used this software & hardware before. She was trained and assisted by the 3DEXPERIENCE Lab team and Sébastien Rosel - Technical Director at Dassault Systèmes. The mask was printed using powder sintering (aka ‘SLS’ an acronym for Selective Laser Sintering). The EEG sensor is integrated into the mask, with an electrode targeting the human frontal lobe. «The signal is analysed to derive peaks in the gamma, beta, alpha, theta, delta bands, as well as attention and relaxation levels. The colours of the optical fibres change according to these peaks of activity and light animations occur, such as flickers or ripples when the person is very attentive or meditating,» explains the research scientist. She certainly has a very original background. She followed the Humanities and Technology (Hutech) course at UTC-Compiegne, and pursued majoring in Computer Engineering branch, with Data Mining as her elective specialty. «I was interested above all in the interdisciplinary nature of Hutech. I saw it as an effective way of reconciling my attraction for the humanities, in particular philosophy, and the sciences. Indeed, as I had done a Baccalaureate L specialising in visual arts and music. In fact, I changed my final lycée year, going from “première S” to “terminale L” in visual arts,» she says. It was my high school philosophy teacher who advised me to do the Humanities and Technology course at UTC. What interests me in engineering is being able to think about the worlds that are possible with technology, to imagine technologies that transform society”. »

## Developing research and art

This mask was her final project for the «Fabricademy: Textile and Technology Academy» programme at the Fablab of the University of Paris-Saclay. An intensive programme that mixes



*I got the idea for the shape of the mask from the electrical fields from the brain found at the surface of the head. In a way, I am trying to amplify, to increase our emotions, and at the same time, I amplify the electrical activity to capture those same emotions*

art and science and where she learned to use 3D printing, laser cutting, milling and designing of printed circuit boards (PCB) on textile and skin, soft robots, biomaterials. «I have wanted to create a brain-computer interface for a long time. During the programme, I made a first interface from a Star Wars toy that contains an EEG sensor used to make a hologram move with thought. I developed a script to “hijack” in essence, the function of this toy to compose music with my brainwaves. Then I tried to build my own sensor circuit,» she adds. “When I was designing the circuit, I realised

that an EEG is based on a mechanism used to for amplify the brain’s electrical activity, and I found a kind of poetry in that area. I got the idea for the shape of the mask from the electrical fields from the brain found at the surface of the head. In a way, I am trying to amplify, to increase our emotions, and at the same time, I amplify the electrical activity to capture those same emotions”.

Ninon Lizé Masclef has imagined a series of masks based on the principle of biofeedback, for example with the heartbeat and facial muscles. In this way, she could have a finer characterisation of emotions. During her year-long residency at Dassault Systèmes’ 3DEXPERIENCE Lab, she planned work on several art projects, including one on dreams. «I set up a protocol to record my EEG signal during sleep and annotate my dreams when I wake up in order to train a model to recognise objects in the dream content. The ultimate goal is to use artificial intelligence models to generate 3D scenes from dreams,» concludes the research scientist, who would like to defend a PhD thesis in computer science combining deep learning with neuroscience or art. And why not, create her own AI and Art research studio. ■ KD

>> <https://3dexperienclab.3ds.com/en/>





## CHALLENGE

# UTC in the Top Ten rating of the European Innovation Academy

Accompanied by the Innovation and Territorial Sustainable Development Department (DIDDT) of UTC, several students take part each year in the European Innovation Academy which takes place in Porto (Portugal) in summer. We meet one of them. Baptiste Viera, currently majoring in Computer Engineering, with the elective speciality Artificial Intelligence and Data Science, who is wearing the colours of UTC at this event.

**T**he beginning of the journey for Baptiste Viera started in October 2021 with the Créathon, with 48 hours to develop a start-up idea, organised by the DIDDT. UTC

students worked in groups with a mentor from the business world. Then, he took part in the innovative project competition, of which he was one of the winners. «That's when the idea of creating an application at the intersection of a traditional fitness application and a video game experience was born. At the end of December 2021, I applied for the National Student Entrepreneur Status (SN2E), which I obtained. This allows me to follow training courses and activities on entrepreneurship, to obtain ECTS credits for my project and gives me the possibility, if I wish, to replace my end-of-study internship with my entrepreneurial project,» stresses the company creator who, last January, decided to take part in the Sport Business Challenge competition organised by EDHEC French Business School. After several months' work, and after passing the various selection stages, he won the competition. «Baptiste is one of the many students who has developed a maturity for entrepreneurship very early on. The DIDDT exists to open doors for them and to provide numerous opportunities to discover the workings of innovation,» recalls Virginie Lamarche, head of the Entrepreneurship Pole of the DIDDT at UTC, which finances access to the European Innovation Academy, as well as the innovative entrepreneurial projects.

### The EIA adventure

In the summer of 2022, he joined the European Innovation Academy and made it to the Top Ten projects out of 450 students. «The EIA took me through the three major stages of life. Childhood during the first week which was intense and

challenging as it involved team building, problem identification and client validation. Adolescence during week 2, which was dedicated to prototyping, the marketing campaign and the Demo Day. Finally, adulthood during the final week focused on the business model, intellectual property and pitching the project, to investors, all accompanied by exceptional mentors. The EIA also allowed me to make new friends from all over the world, a truly fantastic

adventure made possible thanks to UTC, which financed our participation,» relates Baptiste Viera, is registered for in a double degree at the Ecole de Technologie Supérieure in Montreal (ETS-Montreal) in Information Technology. This training allows him to acquire a double set of skills in computer development and in digital project management. Today, his project is at the advanced prototype stage. It is an application that works on a smartphone. Very soon, he will fly to the «Global Conference» in Chicago where he will be able to present/pitch his project and acquire more skills in business, marketing and leadership. Since the end of September, Baptiste has been participating in the online Pitch Competition organised by the Collegiate Entrepreneurs' Organization. He is one of the top 100 projects among 600 candidates. Will he make it to the top 20? Stay tuned - the answer will come in November. ■ KD

*A truly fantastic adventure made possible thanks to UTC, which financed our participation !*





NABIL HADJAZ



# A Frenchman in the stars

**Nabil Hadjaz, who graduated from UTC in 2011, majoring in Mechanical Engineering, used to dream about becoming an astronaut.** Today, he works with them, after succeeded in joining the world's elite in space exploration. He is an engineer for the Canadian Space Agency (CSA) and works with NASA on the ISS (International Space Station) programme.

«**N**ever give up and always move forward.» These are the words with which Nabil sums up his journey and track-record. His personal story is proof that determination leads to success. Born in the Val de Marne Department, 5th child in a family of 6, he grew up in a modest but rich value-added environment. His interest in science quickly focused on aerospace questions. His father, a worker, worked on the runways at Orly. It was here that the boy found himself attracted drawn to engineering: «I wanted to understand how planes flew». His mother took him to the library where he read scientific magazines. A dream came true: to become an astronaut!

After his baccalaureate S, he went to a preparatory class at a lycée. «I didn't know how to become an engineer; I was the first in the family to do this kind of study. I stopped the preparatory class after six months, because it didn't suit me». Nabil did a DUT and discovered vibro-acoustics through an internship that he loved. As N°1 of his class, he was admitted to UTC in the Mechanical engineering branch and then took the elective specialty the acoustics and vibration branch for the engineer. In 2009, Nabil successfully applied his mantra: «Pure luck does not exist, you have to create your own opportunities». He obtained a scholarship to do a double degree at the University of Sherbrooke in Canada, following the meeting of a Canadian professor visiting UTC.

Nabil returned to France in 2011 and worked at Safran designing an engine for Airbus, before flying to Montreal in 2013, with his determination as his only luggage. This

was followed by an exemplary career at Lockheed Martin and then at the Canadian Standards Association. A new challenge came in 2019: «At NAV Canada, I was trained as an air traffic controller, as director of operations, I decided how many planes would land at Montreal airport. A strategic job worthy of a movie: I coordinated NORAD missions to protect North American airspace by directing the fighters that took off in case of a threat. Not bad for a «Frenchy»!

In 2022, Nabil is now a Canadian citizen, and has fulfilled his dream by joining the prestigious Canadian Space Agency after a long process of interviews and security investigations: «I work as a systems engineer. Canada is in charge of the robotics part of the ISS: the arm, the mobile base and the mini robots. I liaise with international partners such as NASA and Space X. I manage the projects of MDA, the contractor that develops the Canadian hardware for the ISS. My mission is to ensure the functionality of the hardware for the safety of the astronauts and the mission. My favourite part is managing the emergency measures to protect the station!"

Nabil dreamt as he watched the space shuttle on TV, now he finds himself in a meeting with those who worked on its design. «It was super intimidating at first! But in meetings at the Space Agency, everyone respects each other and is allowed to offer their opinion or propose ideas. It's really a fantastic working atmosphere, and it's very exciting to work with NASA.» Nothing is impossible for those who know how to give themselves the means! ■ MB

## BIO NOTE

- 2007 : admitted to UTC after gaining a DUT
- 2011 : obtained a double degree UTC - University of Sherbrooke (Canada)
- 2011-2019 : engineer at Safran, Lockheed Martin and the Canadian Standards Association
- 2019 : Director of Operations, NAV Canada (air traffic control)
- 2022 : Canadian Space Agency - Senior Systems Engineer - ISS (International Space Station, NASA)



## Interactions interactions.utc.fr

Director of publication  
**Christophe GUY**

Editor-in-chief  
**Odile Wachter**

Editors  
**Marilyne Berthaud**  
**Kaitoume Dourouri**  
**Pauline Seban**  
**Meriem Sidhoum Delahaye**  
Design/Realization  
**Dorothee Tombini-Prot**  
**Antonella Vaudru**  
Assistant  
**Corinne Delair**  
Translation by  
**Alan Rodney, BABEL TWO**  
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## AGENDA

### UTC-COMPIEGNE OPEN DAYS

**December 10, 2022 and January 21, 2023**  
Centre Pierre-Guillaumat- UTC

[www.utc.fr](http://www.utc.fr)

### UTC'S BIOMED ANNUAL RENDEZ-VOUS

**Friday, January 27, 2023**  
Centre d'innovation - UTC

[www.utc.fr](http://www.utc.fr)

### LIGHTUP CITY SPOTLIGHTS ON COMPIÈGNE

**Friday, March 3, 2023**  
Parc Songeons et centre Benjamin-Franklin

[assos.utc.fr/lightupcity](http://assos.utc.fr/lightupcity)

