

OCTOBER 2013 ### N° 24

Donnons un sens à l'innovation

# Interactions

## FROM THE PRESIDENT'S DESK

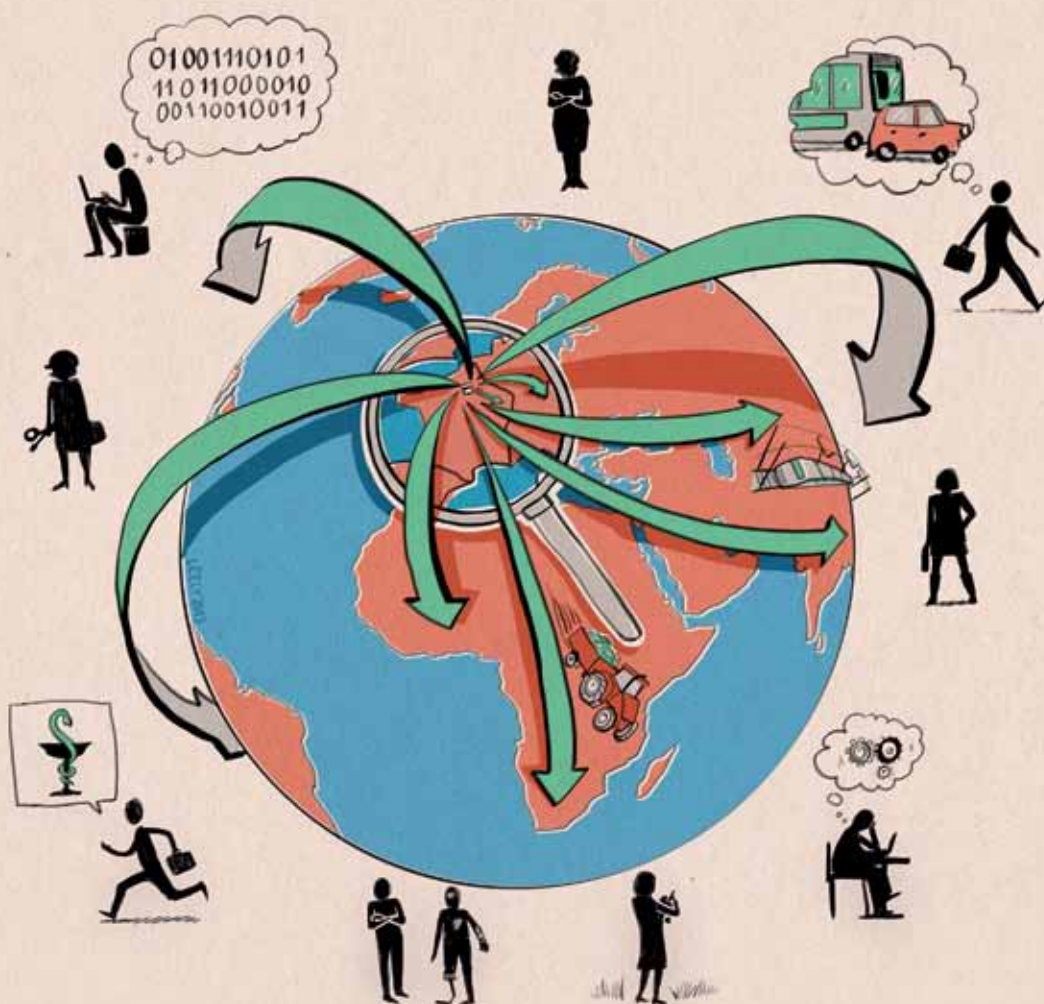
**Innovation :**  
has the concept worn thin  
or is the transformation still  
underway?



Innovation : 113.000.000 pages referenced on Google, far more than Invention (34.800.000) and only a fraction less than Training (137.000.000). How can we explain such interest in the concept, or the process (lat. innovare – to renew), or the shift

in paradigm that started 10 years back and which have led to numerous reports, proposals, recommendations – the latest in France being the Lauvergeon report “Innovation France 2030” – to the drafting of a National Strategy for research and Innovation, or to the explicit recognition of entrepreneurship as one of the objectives of training efforts in the recent Higher Education and Research Law (minister Fioraso) ... The question now arises, has Innovation itself become the magic potion that will heal all Society's ailments? Is it now the life-belt to which we desperately cling in these troubled times of economic crisis, ecological and ecological disasters, of loss of moral guidelines and aims? Has control of innovation become the sole, necessary ingredient to ensure our competitiveness and sustainable growth? The agitation surrounding the innovation concept is all the more relevant in our choice to convene an international conference on “Innovating Innovation”, admittedly with a slightly provocative title, organised at the Sorbonne October 29, 2013 in context of the celebrations of the 40th anniversary of UTC ; it justifies that the ‘fundamentals’ underpinning the concept of Innovation be revisited, concept which, I feel, has probably been worn thin with so many appropriations, so many promises... and so much delusion. ■

**Prof. Alain Storck**  
President and Vice-Chancellor, UTC



## 40 years 'on the job'

### Experience gained in innovation

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## The 40th anniversary of UTC

Follow the **International Conference Innovating Innovation**  
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## The UTC Business Club Prize

UTC's Business Club Tremplin met on Sept.23 at the French Parliament and during the evening event, on the theme "Engineers, entrepreneurs-actors in reindustrialisation", 5 honorific prizes were announced for UTC alumni who had created their own businesses.

- The Enterprise Creation Project Prize went to: Aspic (acronym for Improved Immersion in Virtual Environments) a company created by Marc Muller and Quentin George, undergraduates in UTC-GI (computer sciences);
- The Seedling Company Prize went to: Entreaute (novelties and innovative products), founded by Christophe Tincelin (UTC-GM 2004 (mechanical engineering)) and Bertrand Vignau-Lous (idem);
- The Industrial Innovation Prize went to: Virtualsensitive (tactile furniture), founded by Fabien Château (UTC- GSM 2012);
- The Global Aim Prize went to: Stratoz (Catalytic Synthesis of Bio-molecules), founded by Jacques Biton (UTC-GB 1982);
- The Coup de Cœur Prize went to: Getmaker (inter-connected demand for 3-D projects and makers round the world), founded Claude-Emmanuel Serre (UTC-GM 2008). ■

## A Google research award was awarded to Antoine Bordes (UTC-Heudiasyc)

Antoine Bordes, Junior CNRS research scientist at the UTC-Heudiasyc laboratory has been awarded Google Research Award, for a research project conducted in connection with ANR EVEREST. The project consists of defining new ways to represent multi-relational data, with a special focus on knowledge bases (graphs where each node represents a concept and each link a relationship). The principal aim of the project is to model data when the dimensions have become extremely large, with a view to optimising their interpretation/utilisation. ■

## The annual Science Fête and the UTC-Roberval Prize



As every year, UTC organised open days, Thursday October 10 – Sunday 13 Oct. This was the 22nd edition, on the theme "From the infinitely large to the infinitesimally small", to which the Picardie Region added "Arts and Science" and "Water". ►

## SCIENTIFIC DAY

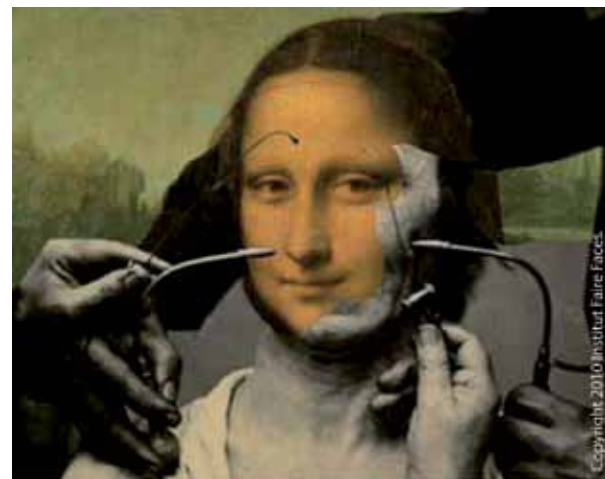
# Disfigurement, a lifetime's research

The Institute Faire Faces (IFF), created by surgeon Professor Bernard Devauchelle in 2009, organised its first scientific day September 28, 2013. It provided an opportunity for the scientists and practitioners party to the first research centre dedicated to disfigurement, to present their work and the progress achieved thus far. 'Interactions' spoke with Prof. Devauchelle and with members of two UTC teams in the UTC-BMBI Laboratory, headed by Cécile Legallais and Marie-Christine Ho Ba Tho.

**"The Faire Faces" Institute builds up forms of collaboration in research on the theme of disfigurement", explains Prof Devauchelle.**

"Our first Scientific Day enabled my colleagues to present the 6 main themes that we are investigating currently". The themes are as varied as this problem of disfigurement is transversal. From the history of disfigured French WWI troops, known as the "les gueules cassées", to psychology of grafted patients, and not forgetting all the associate technological research needed, the Faire Face Institute is an interdisciplinary platform. "We are working, for example, with Sylvain Bouchigny from the CEA on teaching/learning robot-controlled surgical acts. Prof Devauchelle adds that "a second project is underway and aims at training protocols using an interactive table". The European INTERREG project serves to demonstrate the influence of WWI on art, literature, law and leads on to specific pedagogical actions in the secondary schools and lycées of our Region, making use of the interactive training kits designed and assembled by the CEA. Another theme is that of re-innervating the larynx and thereby recovering a speech capacity, i.e., restoring voice-box nerves – a subject on which Christophe Egles, a research scientist at UTC is working in the framework of his project on the 'Silk Nerve'.

The Faire Faces Institute acts as a go-between but exclusively: it leads to an identification and organisation of synergies between various actors doing research on organ transplants, which constitutes an extremely complex subject at the cross-roads between ethics, philosophy and science. The ambition of the Institute is to combine research, teaching and communication, in such a way that Society will change its viewpoint on disfigured members. A child suffering from a harelip can have an adverse effect on schooling and the child's sociability. "Disfigurement generates a degree of fascination/repulsion and these



factors must be taken into account in a philosophical, artistic and social science approach" recalls Bernard Devauchelle. In 2009, the Institute presented its objectives to the UTC research teams to identify possible projects for collaboration with the various UTC laboratories. Today, UTC's BMBI Laboratory is the coordinator for research activities carried out jointly with UTC on the FIGURES excellence equipment, supported by Amien's teaching hospital (CHU), related to consequences of disfigurement following maxillo-facial surgery. During this first Scientific Day of the Institute, Marie-Christine Ho Ba Tho and Cécile Legallais presented the progress of their teams in their respective areas of research (cf. p3), viz., biomechanical modelling of facial movements (SIMOVI project) and tissue engineering to rebuild bone structures (projects VASCOS and INGETISSOS). "We are continuing to develop strong links with UTC and shall also be lodging applications with the ANR [France's national research assessment agency] and with the national cancer institute. In all likelihood, we shall be recruiting a research scientist soon", notes Bernard Devauchelle, for whom the Institut Faire face

The  
Institute Faire  
Faces allow the actors  
to identify and organise  
synergies among research  
workers all of whom are  
specialists in transplant surgery,  
an extremely complex subject  
at the crossroads of ethics,  
philosophy and  
science.



represents the responsibility of a lifetime. It is not sufficient to be under the sun-lights, thanks to a surgical “first”; the try must be converted, beyond our media success and ask ourselves seriously how disfigurement can fit in with research policies and programmes. IFF represents a ‘space of liberty’ to build up connections in France and elsewhere, with research scientists of our own choosing. I must add that I have every reason to be satisfied with the scientists at UTC – a research nursery with whom we really can collaborate”. ■

plus  [www.institute-facing-faces.eu/fr/](http://www.institute-facing-faces.eu/fr/)



## Will we soon be able to grow new bones?

The question is how to rebuild cell tissues outside a patient's body and implant them later, optimising the chances of the tissues surviving? Over the past 5 years, Cecile Legallais and her team of scientists have developed a unique approach, in the framework of a programme called INGETISSOS, supported by the Collegium CNRS-UTC and by the Picardie Regional authorities.

Tissue engineering has been around for 20 years now and is a common practice in the scientific community. However, it is much more unusual to find teams that explore tissues systemically – looking closely at the clinical, applications rather than a given cell behaviour. Cecile Legallais explains this “In order to rebuild bone tissue, we adopt the hypothesis that a set of cells in contact with a biomaterial in a

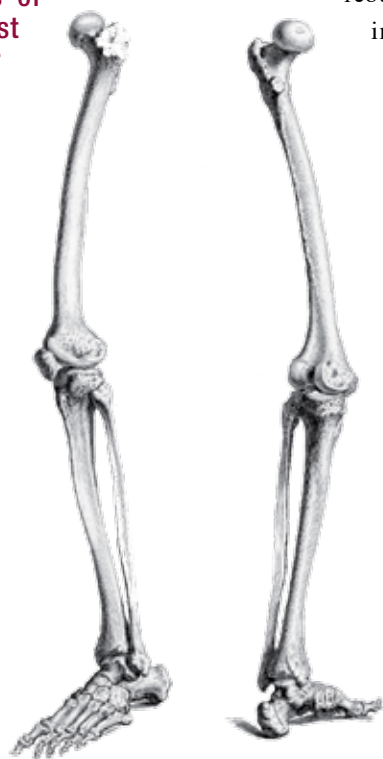
To rebuild bone tissue, we adopt the hypothesis that a set of cells in contact with a biomaterial in a bio-reactor will build up a 3-D structure and behave in a manner almost identical to that of natural living tissues.

bio-reactor will build up a 3-D structure and behave in a manner almost identical to that of natural living tissues. These dynamic criteria seem best adapted inasmuch as they are close to the in vivo conditions.”

Growing cells in a 3-D frame also requires you to have excellent biomaterials, such that the products can indeed be used by surgeons. “The original feature of our work and approach is that we mechanically characterise of the tissues we are rebuilding”. Do they or don't they comply with the clinical specifications established by Prof.

Devauchelle and his colleagues. Will they or won't they be sufficiently adaptable to ensure a recovery of facial features through surgery? “We now are able to build a ‘manipulatable’ tissue, a few square centimetres at a time, from cell lineages”, adds Cécile Legallais. The INGETISSOS project therefore has the objective to establish various bone recipes (cells, biomaterials and the bioreactor vessel) to build bone tissues to order. The “mechanical” aspects are investigated by Fahmi Bedoui at the UTC- Roberval Laboratory. And more recently, stem cells have turned up at the lab. – and we know the promise they hold when it comes to rebuilding bones. These cells must be identified, isolated and made to differentiate into bone cells – all of which steps call for patience but they avoid problems of immunity response. The work is conducted in close collaboration with Prof. Jean-Pierre Marolleau's team (at UPIV-CHU Amiens) who, in the framework of VASCOS, has the objective to grow stem cells from the bone marrow and ‘marry’ them with blood cells from the umbilical cord. These cells have the capacity to form “neo-

blood-vessels” that allow the surgeon to re-vascularise the bone implant. “Today, rebuilt tissues die once they are implanted. What we have to do is to vascularise them before implanting, by cultivating stems cells and endothelial cells together”, explains Cécile Legallais. It is a long-range target but we hope to be able to create and grow transferrable vascularised bone implants between 5 to 10 years from now. The future, as we see it in the field of maxilla-facial surgery lies in growing and modelling bones specifically for a given patient's needs.



## Modelling face muscle activities

What muscles do we use when we smile and what are those involved in face mimics? Here we have topics for Marie-Christine Ho Ba Tho and her research team in conjunction with clinical experts at the Institute, in the framework of the SIMOVI project (simulation of facial movements).



The medical imaging techniques used by Marie-Christine Ho Ba Tho allow the scientists to model the geometric and mechanical properties of a patient's face, in a personalised format. This sort of expertise provides the surgeons and the physiotherapists with objective criteria to understand the role of muscles in facial mimics. “Clinical applications requires personalised models for each patient. We are now able to characterise in vivo the mechanical properties of the muscles involved from the medical imaging data” adds Marie-Christine Ho Ba Tho. “We are currently developing digital models to simulate various facial expressions and to better understand those movements that are most used (in terms of function rehabilitation protocols)”. Today, our digital models concentrate on 4 different facial situations: the face's neutral position, the smile position, the mouth voicing a rounded “pou” and a projected “O”. “Many muscles move in a voluntary or involuntary manner? After a transplant operation, the patient must regain the facial mimics that have disappeared in the process. He/she can think of smiling, but the person opposite does not perceive this. What we must do is to model the complete muscle action involved in smiling, or to translate an utterance (sound) and be as close as we can to reality (un-operated persons). Criteria such as we are identifying/quantifying help the surgeon and the physiotherapist to aid the patient in re-discovering his/her facial expressions”, detail Marie-Christine Ho Ba Tho. We must bear in mind that there are 26 muscles involved and they interact in a highly complex manner. Consequently the research focuses in priority on the main face muscles that lead to a short-list of expressions, among which the Zygomaticus major muscle - Wikipedia, quote “The zygomatic major is a muscle of the human body. It is a muscle of facial expression which draws the angle of the mouth superiorly and posteriorly (smile).” ■



Understanding the role of muscles in facial mimics.

The ceremonies for the 26th edition of the UTC Roberval Prize – rewarding books, AV or multimedia supports explaining technologies to the public at large or specific to the needs of Higher Education, was held at Compiègne's Théâtre Impérial, Saturday Oct. 12, 2013. ■

plus d'infos ► <http://interactions.utc.fr/26e-edition-du-Prix-ROBERVAL>

## Harbin's HIT visits Compiègne's UTC

In the framework of the agreement between PRES and the Harbin Institute of Technology (HIT), Chin, a HIT delegation visited UTC's laboratories on Sept. 17, to identify possible areas of mutual interest for both establishments. ■



## A-V. Salsac laureate of the Biomechanical Engineering (Learned) Society's Prize

At the 38th Conference of the Biomechanical Engineering Society, convened in Marseilles Sept. 4-6 September, 2013, Anne-Virginie Salsac, research scientist at the UTC-BMBI Bio-Mechanical Engineering lab., received the Prize for a Promising Young Scientist. A-V Salsac presented work on digital simulation of fluid interactions in an artero-vein fistula (a surgical pathway between an artery and a vein created for kidney diseases in terminal phase providing an access to allow blood in adequate quantities to feed a haemodialysis), carried out by Iolanda Decorato for her doctoral degree. ■

plus d'infos ► [http://webtv.utc.fr/watch\\_video.php?v=04GNM3NXNNMN](http://webtv.utc.fr/watch_video.php?v=04GNM3NXNNMN)

## Palmares: Compiègne in the avant garde for student dynamics



The City of Compiègne ranked first in the "business friendly" rating for education, compared with other 70 000 to 100 000 inhabitant cities in France, in a 'hit parade' palmares established by the review Expansion-Entreprise and Coface-Services (financiers); 120 cities (each over 70 000 inhabitants) were reviewed and ranked in three categories according to 16 criteria in 3 domains: urban infrastructures, education and local eco-systems. ■

## LABEX MS2T

# Mini-drones and systems of systems: UTC leads the way



Imagine a mini-drone actually flying round the Le Bourget halls: this was the challenge accepted in 2013 by the research scientists at the UTC-Heudiasyc Laboratory on the Picardie Region's stand. "In two years' time, hopefully, we shall be presenting our new mini-drone models in the framework of the Robotex excellence programme, promises Professor Ali Charara, Director of the UTC-Heudiasyc laboratory. These mini-drones also serve to illustrate work in progress so to speak in the laboratory "Control for Technological Systems of Systems", Labex MS2T, co-ordinated by UTC.

**M**aking a mini-drone fly round inside a building is far more complicated than meets the eye, if only because of the numerous possible sources of interference with flight control. Guillaume Sanahuja, who is a research engineer with Heudiasyc and in the Equipex Robotex teams, has successfully programmed the drone to follow a white line and land at a predetermined spot on the floor.

## Keep the right heading!

Flight disturbances were modelled to check the capability of the drone to keep to its heading in any prevailing weather condition. "What we did was design a unique methodology, relying on tailor-made algorithms and a technique to analyse optical data flow, so that the drone always positions itself correctly with respect to the designated target", adds Prof. Charara. In the Robotex programme context we are now developing at UTC a small squadron, around a dozen drones? A flight circuit is being built in the UTC Innovation Centre". This is because UTYC was chosen to pilot one of the 5 excellence equipment aspects of Robotex, mobile air and land robotics, coordinated by Prof. Philippe Bonnifait from the Heudiasyc Lab. The objective is to achieve synchronised flight with 4 mini-drones, each with a single task in an overall mission assigned to the squadron. "It would prove interesting when monitoring a major site, or a railroad complex, or monitoring for fire risk and seeking out persons lost in a forest", adds Prof. Charara

## A generic methodology for systems of systems

Synchronised group movements illustrate what we call systems of systems, such as inter-communicating vehicles on the road, a multimodal platform, a remote Medicare monitoring unit or a multi-source energy production system. So, how do we organise the interactions and optimise how the systems as a whole operate? This is the question addressed by Labex MS2T. "This concept of 'systems of systems' has its origins in military thinking, to co-ordinate various armed forces, but it has spread over into the industrial world now, in sectors such as transportation, environment energy. However, academic research in France has not thus far looked closely at the topic: each industrialist or each socio-economic actor applies his own methods to his own area of interests or products and, consequently, there is no generic methodology that they could adapt to their specific tasks. In order to build such 'generic solution, we have started working on a unique,

interdisciplinary approach, association the UTC labs, viz. Heudiasyc, BMBI, Roberval and the CNRS. The MS2T Labex is a sort of melting pot for exchanging ideas among the scientists and the industrialists to face up to the scientific and technological challenges involved. We shall soon be extending the concept and approach to incorporate social sciences and thereby take human factors into account," details Ali Charara. The scientific hurdles relate mainly to three subjects: management of uncertainty, system to system co-operation and resilience of the system of systems concept. There are 10 theses under way, 2 of which are co-financed with the military research establishment DGA (Direction Générale de l'Armement) and the Picardie Regional Council; and 8 post-docs studying the same issues, one of which is supported financially by Alstom working on optimisation of a control & command system in a so-called "smart" network. The challenge here is to manage as well as possible the matching between production and energy consumption at a time when there are now decentralised sources of renewable energy and associate problems of energy efficiency. Applications could be forthcoming in e-medicine, smart cities, etc. The MS2T Labex unit also hosts foreign high-level research scientists who would come to Compiègne and also finances excellence grants to attract then best student candidates in the framework of the new master's degree launched in September 2013.

## First international workshop: strategically positioning the MS2T Labex

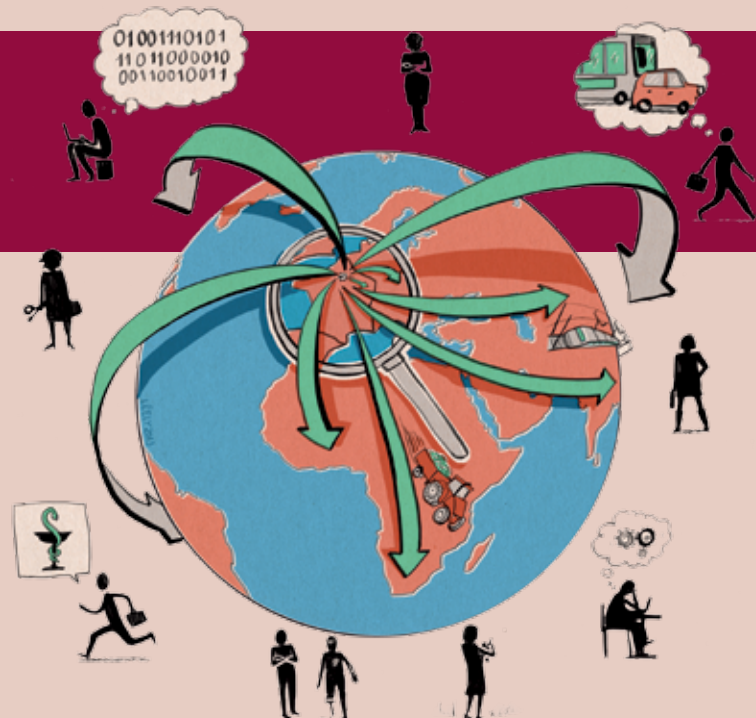
The progress and the prospects before the MS2T Labex – with budget of 6.7 M€ over 9 years – were presented early September in an international workshop and at the meeting of the international scientific steering advisory committee (with its 7 experts from the USA, from Europe and from Australia), with representatives of the management of UTC, of the CNRS, of the ANR, of the PRES (Pôle de recherche et d'enseignement supérieur Sorbonne Universités). More than 100 persons attended this first international workshop organised by Professor Marie-Christine Ho Ba Tho, Director of the UTC- BMBI Laboratory. «For this first workshop, the objective was to position strategically the MS2T Labex at European and internal level, notably on the context and framework of the REU's Horizon 2020 Programme. We had some excellent feed-back from the attendees." Each year, alternately, the MS2T Labex will organise a summer school and an international workshop. With one overarching aim: To become the benchmark laboratory in systems of technology intensive systems within the decade to come!" ■

plus d'infos ► [www.utc.fr/labexms2t](http://www.utc.fr/labexms2t)





# 40 years 'on the job' Experience gained in innovation



The Dossier today, on the occasion of the 40th anniversary of UTC, presents the portraits of 9 the first class graduates. What we want to show is how their jobs constantly evolved during their professional careers. The advent and the now pervasiveness of digital technologies, the changes in major sectors such as energy or health where 'decentralisation' is the name of the game along with personalization, open attitudes to the international scene in a globalised world: all of these are marked and lasting trends and they enable us to make some projections in terms of professions and the link with innovation. Referring to the experience of our 9 graduates, of the findings of the Report "Innovation 2030", handed to the Prime Minister by author Anne Lauvergeon, of the articles in the Dossier on Future Jobs published in 'Interactions' February 2013, we present again what could turn out to be promising future employment paths.

**The French Innovation 2030 Commission, chaired by Anne Lauvergeon, identified as its first priority 'storing energy'.** Quote – "the development of renewable energies most of which are intermittent, optimised electricity production and development of portability call for innovative breakthroughs in storage systems. This is vital to the success of any energy transition policy". The Lauvergeon Report precedes a draft bill that will be debated, amended and normally voted in Parliament in 2014.

## Target n°1: energy storage

The Report indicates that "France has its specific advantages thanks to its large corporations and SMEs in good marketing positions in this area and there is excellent public research too". Graduates from the first UTC class, Eric Verbrugghe (GDF Suez), Gérard Lefranc (SICAE Oise), Patrick Delahaye (Areva) and Philippe Chappuis (ITER) have carried out most of their careers in the energy arena. As they see it, the major changes will be decentralised production, free markets, growing impact of social acceptability issues and emergence of smart networks in a geopolitical context where continuously rising prices for fossil energies are the order of the day. Progress in energy storage, deployment of renewable energy procurement facilities will prove strong sectors in the future. Taken together these sources form a meta-system or system of systems, close to the concept of smart networks: the UTC Heudiasyc Lab. is working on this topical problem area, presented by Ali Charara, page xx.

One  
day biomass  
fuels will replace  
kerosene for  
aircraft engines

Energy transition can be gauged also in terms of observable climate change, due to greenhouse gas emissions from fossil fuel burning. In this light, among the 20 "future jobs" identified by the Fast Future agency in "The shape of jobs to come", 2 relate to climate. When shall we see a training course for climate change specialists (useful when designing a nuclear power station ...), or climate gendarmes, authorised to indict States who shift clouds from their normal route to secure rainwater? If we want nuclear fission to become viable and produce its first kilowatt-hours by 2050, then we shall have to train battalions of task-force engineers capable of both understanding the physics involved in nuclear fission processes and able to work in a totally international context.

## Green growth and circular economics

Consumption of Earth's limited raw materials, progressing ever since the start of the industrial era and the increase dependence of France in terms of material procurement have led to adopting policies, for example, for rare metal recovery and recycling, as identified in the second target of the Innovation 2030 Report quote "France has its specific advantages in a favourable European context. Innovation and appropriate regulations could allow leaders to emerge in this field". Interactions, in its February issue, underlines the importance of eco-designing, which is a prerequisite for any efficient form of recycling, as Jérôme Favergeon, Head of the Mechanical Engineering Department (UTC-GM),

notes. In the UTC Roberval Laboratory research is being focussed on innovative materials to comply with the performance/cost criteria set by industrialists, such as materials with 3D or vegetable reinforcement strengtheners which open up new horizons. In what we might call a "circular economy", seen as probable in 2020 in the report "The shape of jobs to come", every product will either be recycled or re-used, from packaging wrappers to complete automobiles, from textiles to electronics goods, with better attention to use and recovery of rare earths, use of which is going to grow as green economies grow. In more general terms, underlines Patrick Delahaye (Areva Group), the recent, so-called corporate societal responsibility (CSR) and sustainable development are becoming increasing important. Future engineers will have to take these factors into account, whatever their field of activity.

## The seas, a new horizon for energy procurement and access to water

Recycling massively will certainly not be enough to meet our Society's needs tomorrow. For this reason, inter alia, the Innovation 2030 report also looks at the possibilities of value adding to marine resources, starting with metal deposits on the ocean floors. Sea-water desalination also figures among the targets, but the process would have to be made less energy-intensive. The Report says "France possesses one of the world's largest marine exclusive zones and also has highly competent companies and research workers studying this theme". As Daniel Thomas (president of

"Water  
access  
engineer" will be  
a job for the  
future



PRES UFECAP) puts it, the “water access engineer” will be a job for the future. “Accessing drinking water is a challenge on the same scale at least as that for energy procurement”. Eric Verbrugghe, who works at GDF Suez, reminds us that his Group is investing deeply in hydro-power generators, a marine renewable energy in its prototype phase. Energy from the seas – almost a call for interest for our engineers today!

## Biomass at the heart of future resources

Assuring an access to food is rapidly going to be the 3rd target and it is a formidable. In 2050, viz. less than 40 years ahead, there will be some 9 billion inhabitants on Earth. So, how are we supposed to feed them all? The Report Innovation 2030 points to “the combined forces” of agriculture, the agro-food industrial sectors and France’s culinary traditions and suggests that research be carried out in the area of plant proteins to meet the needs of a world-scale food supply. “Moreover, our agricultural wealth could also lead to the development of new materials”, underlines the Report. In our Interactions #20, Daniel Thomas had earlier set out that “Numerous professional openings will be made possible through biomass research. Costs must still be brought down, but one day biomass fuels will replace kerosene for aircraft engines. The long-range aim is to introduce industrial agroforestry; we shall produce GM (genetically modified) trees that will release cellulose more readily and this is the plant part that is most attractive to then produce 2nd generation bio-fuels”. With the ‘excellence’ Institute for carbon-free Energy (IEED), the PIVERT platform and programme, which also collaborates with the competitive cluster Industry and Agro-resources and the local company Sofiprotéol, UTC is at the forefront of plant-added value research and is pre-designing tomorrow’s bio-refineries. In Fast Future, it is self-evident: there will be a need for engineers with the know-how to create seeds and GM animals, to produce increasingly improved foodstuffs, fuels as well as engineers to design and assemble alternate energy vehicles – as seen in the need to build less fuel greedy cars in China, where Peugeot (PSA) is building a platform for small-sized vehicles, as UTC graduate Christian Béhague reminds us.

## Health issues: personalisation and the “silver” economy

Target ambitions #5 and #6 of the Innovation 2030 Commission relate to health issues, insisting on personalised medicine and longevity care via innovation, or what the report calls “the silver economy”. “Development of various new sciences ending in “-omics” such as genomics, proteomics, etc.” says the Report, “increased links between medical devices and therapies as well as development of digital processing of health data are going to lead to increasing personalised treatments ... our

senior citizens, 15 years from now, will account for the majority of medical expenditure in France. A new economy will develop, offsetting their gradual loss of autonomy”. In respect to ‘personalisation’, progress in bio-mechanical engineering is focusing on artificial organs and tissues, predicts Pierre-François Bernard, an expert in orthopaedic surgery. Fast Future also sees the same developments: engineers will soon be designing complete body organs, and nano-medicinal drugs will yet again push the personalisation of treatments.

Already, in the UTC-BMBI (bio-engineering) laboratory, headed by Marie-Christine Ho Ba Tho, the research scientists are developing tools and protocols to enable disfigured patients to recover their face (cf. p. xx). We shall also have to train engineers capable of handling problems related to elderly persons. UTC-graduate Thierry Leclercq (with GE Healthcare) offers his opinions: faced with economic constraints and the looming Papy Boom, intensive home care will develop and become general practice. Technology will have to be brought to the patient rather than the reverse. “Miniaturised devices and data mobility are now available. What remains to be done is the relevant training of health workers to integrate these changes”. Thierry Leclercq sees a massive arrival and implementation of sensors to collect the personal data of the patients. “We then have to interpret the data, to forward, as needed, appropriate information to the practitioners”. This challenge the advent of big data and its utilisation, constitutes the 7th final target ambition of the Innovation 2030 Report.

## Big data: the digital future

“The observed multiplication of data generated by private persons, enterprises and public authorities will bring new utilisations and new productivity gains” states the Innovation 2030 Report. The digital revolution still under way has ‘rocked’ the world over the past two decades – from punched card readers, recalls Philippe Chappuis in charge of designing one of the most sensitive components for the nuclear fusion experimental reactor, and EDF’s supercomputers that Eric Verbrugghe remembers totally occupying buildings to house them. The big data approach will have many varied applications, from management of smart grids (pointed out by Gérard Lefranc (SICAE Oise) and even into archaeology, notes Patrick Méniel who introduced large-scale statistics into this area of work at the CNRS. Christine Roizard (University of Lorraine) places her bets on pedagogical innovation. In a wider frame, the digital revolution may well lead on to new professional positions, such as virtual lecturers, or head of IT waste disposal ... if we follow Fast Future’s visions. Johan Mathe and Mathieu Bastian, respectively employed by Google and LinkedIn are already using big data (cf. pp. xx), Johan providing Internet connections to the world via stratospheric balloons and Mathieu linking the world’s professionals

Taken together these sources form a meta-system or system of systems, close to the concept of smart networks

all round the world on a virtual network. Such work also brings with it the ethics debate, and UTC’s Technology and Social Science Department is looking at these issues. Philosopher Bernard Stiegler – a lecturer research scientist and a member of the French national Council for Digital Applications – sees the digital world as both poison and a remedy faced with today’s consumerist attitudes, inasmuch as it will generate a re-appropriation of knowledge. The question remains – how do you innovate in today’s transition towards a new economy, a ‘contributive’ economy? This is the question that will be addressed by UTC and its guest speakers in the conference “Innovating Innovation” at the Sorbonne, October 29, 2013. ■

## “Innovating Innovation”: philosopher Bernard Stiegler’s point of view

The way UTC was originally designed, embodying the objective to train engineers that would implement the dynamics of continuous innovation processes – as demanded by the world’s growth pattern – was profoundly marked by the concept Joseph Schumpeter offered, that of ‘creative destruction’, which became the base-line for all industry in the 20th Century. Now we are in the early decades of the 21st Century – following the major crisis in 2008, but also 20 years after Internet and the world-wide-web (www) were introduced and at a point where the Schumpeterian model, in regard to innovation, seems to have reached its limits. Technological innovation has revealed new ways to innovate, based not on top-down, linear organisations for research, development and socialisation of the results of innovations, but more now into network-intensive, decentralised structures where bottom-up processes are prevalent and decisive. Our universities are among the first to be concerned by these questions: if the digital world proves excellent, especially as a support for knowledge, it is the very structure of the knowledge content itself which is changing as digitisation progresses, just as are our methods in research and experimentation are increasingly turning into exercises in modelling and simulation. Pedagogical models are strongly called into question and with (probably before) the editorial industries whose vocation it is to shape knowledge in all sorts of format and frameworks. Questions like these are of interest to UTC, more so than for other universities: an innovation culture is the base-line, common knowledge and its technological culture provides for specific capacities for initiative in the newer forms of knowledge production, new tools to shape knowledge which the other universities, generally speaking, do not possess. To project its perspectives and roll back the horizon that underpin such questions, UTC will be celebrating its 40th anniversary by inviting world-famous personalities to debate with UTC students at its conference “Innovating Innovation”, organised at the Sorbonne, October 29, 2013.

[www.utc.fr/utc-40-ans/news002a0095.php](http://www.utc.fr/utc-40-ans/news002a0095.php)

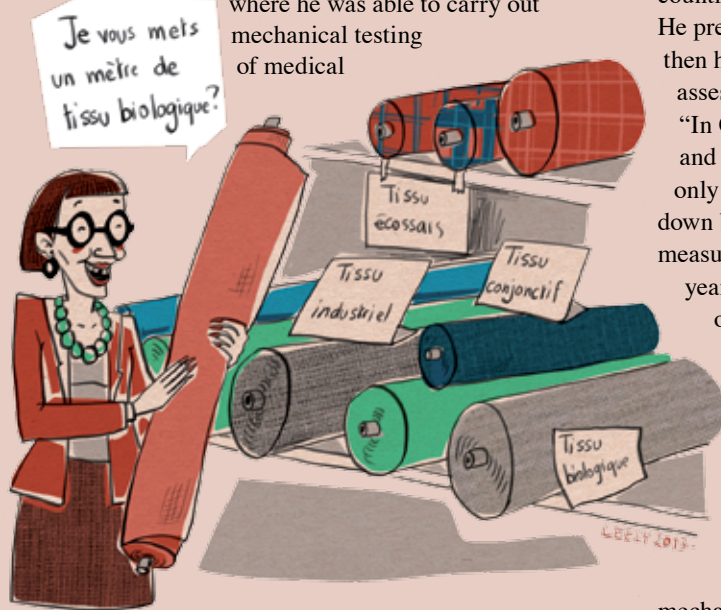


## 40 years *progress in Bio-mechanical engineering*

Applied bio-mechanical engineering has been his professional guide-line, stretching from UTC to Greece, where Pierre-François Bernard has set up his consultancy business in orthopaedic bio-

**A**fter gaining his UTC engineering diploma, Pierre-François Bernard defended a thesis in bio-mechanical engineering at the University Paris 7 and then did a post-doc year at Ecole Polytechnique Montreal, Canada. When he came back to France, he was recruited by a prosthetics manufacturer before taking up an appointment as Head of the Certification Procedures at the national hospital equipment centre (CNEH), an establishment reporting to the Minister in charge of Health. The experience here led to another move into the private sector and then to the national standards laboratory (LNE)

where he was able to carry out mechanical testing of medical



devices, from the prosthetic implants to the surgeon's operating table itself. "This new posting gave me experience in almost every area of bio-mechanical engineering, running from industrial manufacturing to the test protocols and certification".

### Bio-mechanical engineering and the crisis in Greece

In 2001, for family reasons, Pierre-François Bernard moves to Greece where he was recruited by the country's only manufacturer of orthopaedic equipment. He prepared the audits needed for EU certification, and then he set up his own business selling his time for assessment operations in bio-mechanical equipment. "In Greece, independent workers are common-place and it is relatively easy to set up a business". The only set-back was the economic crisis that slowed down business everywhere in Greece and the harsh measures that in a word "killed the economy". "For 5 years now, surgeons and manufacturers have been ordering less and less tests. Even, the university laboratories are short of funds to work."

Moreover, the tissue industrial sector is very limited here and we often have to call in other European sub-contractors if we want to carry an idea from the drawing board to the prototype phase", explains Pierre-François Bernard, who obviously has been keeping up with the extraordinary progress observed in bio-mechanical engineering.

### More security, less innovation

"Over the past 40 years, the proportion of implants that have failed has fallen considerably, this being mainly due to progress in terms of stress/strain assessment and improved materials, notably with the arrival and use of new plastics. Computer sciences have provided for better models of mechanical behaviours, better implant design and better life-expectancy predictions for the implants themselves. This stops us from indulging in trial and error approaches", adds Pierre-François Bernard. "On the other hand, the regulatory framework and the costs to develop new bio-materials have limited scope for innovation. We have moved on, so to speak, from a world of 'amateur' but specialist artistry to one with the major companies and a blanket or standards to be adhered to". It is Pierre-François Bernard's opinion, the training delivered at UTC, forearms the students to adapt to such changes, thanks to basic courses in anatomy, physiology, mechanical engineering and chemistry. "Nonetheless, we must constantly call our skills and knowledge into question, updating both and for this purpose, the Internet is a magnificent tool". Pierre-François Bernard conjugates the future of bio-mechanical engineering with 'robotisation' and bio-materials. "Robotisation in surgery brings with it higher levels of accuracy and in orthopaedics, we can benefit from progress recorded in design and use of artificial organs. Orthopaedic surgery will not be able to avoid metallic implants, but reconstruction work of biological tissues as and where they interface with the implants will be an area where we shall note breakthrough progress in the future." ■

## STATISTICS

## When *statisticians meet archaeologists*

Even if we think there is no chance events in life, nonetheless, it was a sort of a toss of a coin decision that brought the Compiègne citizen Patrice Méniel to UTC. While in his lycée year and thereafter, Patrice was totally enthralled by archaeology and he had the opportunity to meet the UTC metallurgists who were studying the Celtic arms discovered by the Compiègne Archaeological Society.

**“U**TC had set up a metal restoration laboratory, which later on became an independent unit. At the time, I was preparing two theses in parallel, one about corrosion of stainless steel under stress/strain conditions and the second on the history of livestock breeding in Picardie", recalls Patrice who began his archaeological career with teams excavating the Louvre museum courtyard, before the Pi Pyramid was built there. He then came archaeo-zoologist with the CNRS studying the remains of domestic and wild animals in Celtic sites, in France and elsewhere in West Europe. "Thanks to my UTC training," adds the now Director, "I was the able to introduce a necessary degree of formalism (via statistics) to test the various hypotheses in a realistic manner – I appeared here as a free electron in a sector generally reserved for research scientists with a literary background". With the micro-computers now at the UTC and in the research centre, he was able to become familiar with 'analysis by correspondence', a pioneer

technique he used and helped spread. "For example, without the aid of statistics it was impossible to map the 50 000 bones remains found in a hundred or so pits round a Celtic village in since the French government has issued the law on preventive archaeology, there are now hundreds of sites round the country where diagnosis and excavations are carried out prior to any civil engineering, building or otherwise or operations? But due to a lack of means, colossal amounts of data cannot be appropriately processed, at least not in the manner they call for".

### How the job became professional

Over the past 40 years, the national network of amateur archaeologists has become a professional body, feels Patrice Méniel. Site procedures are now standardised and regulated. "This brought about a revolution in work methods. The polyvalent archaeologists were replaced by specialists but who had lost their connections with the overarching geography. In contradistinction among

the amateur archaeologists, some work more for their personal pleasure than for research per se." Prospection campaigns have evolved, with magnetic, electric, and even airborne equipment and isotope analyses, to identify sites without removing the soil covering them. "Progressing rapidly, the methodology employed gives us the possibility, for example, to see if a given animal had been imported to the site area or whether it was raised in situ (using dental sampling), or to identify the age of a veal leaving the cud and therefore to deduce whether or not there was a source of milk for the village". Will DNA analyses one day tell us where domestic dogs came from, apart from knowing that they are descendants of the wild wolf at the time of the stone-age hunter-scavengers, or cats who came to Europe from Egypt at the end of the iron-age? There are now technologies that will prove interesting for engineers: "Archaeology has become a sector with real job openings and this is no luxury given the prevailing context!" ■



## INTERNATIONAL

# The international itch

UTC was exactly what the doctor ordered for Christian Béhague: no competitive entrance exam, plenty of training placements, an international policy focus and an optional course on Quality ... the ideal formula for a Christian who loved to work hard and who already was fluent in English. He only just missed out on a possible one year study period possibility in the USA. But not to worry, a 'stitch in time', as they say; he has been involved since the on the international ventures of PSA in Brazil and China.

**B**efore joining the automobile manufacturing sector, Christian Béhague spent 10 years in aeronautics, with Aérospatiale – the latter becoming EADS. With his initial training and background, he was put in charge of Quality Assurance of the suppliers and this led him to setting up the first data base for a PC use. "The first micro-computer we had had a 512 kO RAM! The system rapidly proved inadequate to meet the demands of the various branches, who all wanted to have their own data bases", he recalls. We had had primer courses in computer science while studying at UTC, so I could clearly see the potential of these tools.

## How I became the corporate computer scientist!

Christian Béhague received an assignment to install a "central" corporate computer service to be shared by the Supply Quality and the Procurements Divisions. "As far as they were concerned, I was their computer scientist!" At the time of the Airbus programme, the members of the European consortium were approaching the same suppliers throughout the continent. Would it not be beneficial, we thought, to mutualise or share our data? This was how Christian became involved in setting up a share system long before Internet has arrived, based on the physical exchange of diskettes. The system was in fact slowed down by the sheer inertia and complexity of these exchanges. As the 1990s drew to a close, Christian had the opportunity to move to the automobile sector, more precisely to the computer department of PSA to design applications dedicated to quality assessment issues, including the core system for detection and correction of errors. After declining a mission in China – too complicated with my three children – he moved to the central management echelon top produce quality in design programmes, notably in the area

of project control. This took him – in 2000 – to change job profile yet again: it was now his job to draft the development schemes, i.e., the forward planning and scheduling of activities and the critical nodes in automobile project progress for the company's new models or derived models (C5, 407, 508, ...)

## Serving projects in Latin America then China

The urge Christian had to move and work abroad - a feeling he has nourished ever since his lecture hall days at UTC - came to fruition. In 2007, he shifted his home base to Sao Paulo where he organised the life series of the 206 between Brazil and Argentina and he completed the launch phases for the 207SW at the Resende (Rio State) assembly site. No sooner had he returned to France, than he was off again to China, in 2010 to install what PSA called "platform 1 (small vehicles)". "We in fact designed this platform for our Wuhan (capital of the Hubei Province) factory; the first cars will be rolled out by the end of the year". In the meantime, PSA set up another joint venture located in Shenzhen that will assemble the DS model and it was Christian Béhague's responsibility to validate the Project and Factory Schedules. "The first car came off the line recently!" adds Christian proudly. PSA hopes to attain 4% of the domestic Chinese automobile market, which continues to grow.

"For the moment we are still Tom Thumbs here but we must continue. PSA has located a design and style bureau in Shanghai to adapt PSA's models in situ to Chinese taste and preferences and therefore better meet the local demand", notes an enthusiastic Christian who has now settled in Shanghai and speaks Chinese reasonably well. PSA Shanghai has 800 personnel (50 of whom are French) with English as the working language). "Over and above the 6 to 7 hours' time lag between the HQ in France and Shanghai, it is not always easy to work with the Chinese, even if to be fair to them, they are generally very friendly. The cultural difference with a different time management system, limited initiative on their part, a high turnover in a bubbling labour market, do not make the job any easier; nevertheless, it still is a very exciting assignment" concludes Christian Béhague. ■





## SOCIETAL RESPONSIBILITY AND SUSTAINABLE PERFORMANCE

# Quality assurance, vital for the nuclear energy sector

So, what did Guy Deniérou actually say to the first student he interviewed for admission to UTC? Patrick Delahaye, today in charge of assessment and follow-up of Areva Group's suppliers, will probably remember it all his life: "You're first. I'm not sure if it is a good or a bad thing, but we shall soon see!"

**O**ur memories build our lives. You should have seen us, 18 years old, in the Maison de l'Europe, a real youth hostel where we slept upstairs and went to class downstairs, in the kitchens!", recalls Patrick Delahaye, not without emotion. It was in a classroom in his earlier Lycée at Amiens that Patrick saw the announcement and applied.

### "Mud and dreams"

"When I got to the place indicated, I at first thought I had made a mistake on the address. On the wall, there was however a name-plate – and that was the only thing that made this house different from the all in the street. I was surprised but it was true that UTC was different from all the other places where I had gone for an interview. I enjoyed an exceptional encounter with the team of colleagues around Guy Deniérou; they obviously were looking for candidates with 'strong human factors' rather than good class records and high marks. This was weird in the context of that time. It was some time later that I realized the full meaning and extent of that interview. In his questioning, Guy Deniérou was hinting that an adventure was about to begin, whatever the doubts we or they might have had. He quoted an expression he had heard on a visit to a US campus, "Mud and dreams". If the students were able to walk in mud, then they would be preserved from having doubts, thinks Patrick Delahaye. His recollections were of high quality teaching served by high-flying lecturers in an environment that was really conducive to making strong links between the undergraduates and the teaching staff. "We trusted them. Not a single student ever entertained the idea that his or her training at UTC could fail".

### Quality assessment: a cross-the-board job that opens many doors

Patrick Delahaye followed classes in mechanical engineering, quality assessment and control, a course that was highly appreciated in the French nuclear industry sector. In a Picardie region SME, he was responsible for quality assessment for 2 years, then of a quality control team of 110 in an Alstom factory for 5 years. He then became responsible in the same factory for the production line of stainless steel heat exchangers for the nuclear sector. This opened the doors to the Areva Group where his appointment was as Head of Quality Assessment then of Nuclear Safety and finally Quality Assurance Director at La Hague (retreatment site). After a spell (7 years) as Quality Manager for the subsidiary in charge of nuclear power plant round the world, he went back to La Hague to assume his current post as Assessor and Executive liaison officer of and with the Areva Group's suppliers. "Quality assurance is a very transverse domain and it opened lots of doors for me, both in my career and on the various functions and responsibilities I have held in parallel", details this former member of the Quality Performance committee that reports to the French Minister for Industry; indeed Patrick teaches this subject among others to the Master's degree students. Patrick Delahaye is also Head of the auditing consultancy company he created.

### From the workshop to ROE

"In a span of 40 years, Quality Assurance has gone from a highly technical approach to a management approach. Heads of Quality is no longer to be found in the production workshops- they have moved to

corporate directorate level". In the nuclear field, for example, quality assessment goes hand in hand with safety control, so that the operators can have an overall mastery of risks in a sector that is constantly under fire in terms of social acceptability. On top of this integrated system, implemented in the nuclear industrial sector 15 years ago, a new approach was brought in: Lean management. "That is why my own son, doing his master's degree in biotechnology and quality assurance at UTC has a more 'operations-orient' performance training than a strictly technique-technology cursus. In today's world with the prevailing, strong economic pressures, quality assurance is now better taken into account, along with other performance objectives; it covers, for example, purchasing. The aim is to identify the best suppliers and avoid as far as possible, any dysfunction. The gains come in terms of productivity and efficiency. You must realise that the job is changing all the time and the quality assurance managers have set up their own trade & professional networks. This allows them to continuously re-examine the profession and call it into question, with continuous training add-ons". Among the latest changes observed: suppliers can now be assisted, to adapt their management practice to the expectations of the buyers and the extension of the Quality Assurance systems by including Sustainable Development considerations and Social Corporate Responsibility (SCR). "The nuclear sector must be clean and exemplary and Anne Lauvergeon, 10 years ago, had expressed the wish that Areva would become a world leader in terms of retunes on experience (ROE). The operational performance level and the societal responsibilities are now the corner stones for sustainable performance ratings and we intend to use this dynamic factor to support our future development". ■

## EDUCATIONAL INNOVATION

# From UTC, Compiègne to Lorraine, a mobile career

Today, Christine Roizard is Vice-President of the University of Lorraine, in charge of the finance and manpower resources, but she never really left the world of research ever since she arrived at UTC, 40 years ago. She was one of the undergraduates to benefit from the first exchange programme with Penn University (USA).

**"A**nd what a welcome we had at Penn! At the time, it was really rare to have an opportunity to do a full year abroad. It was very enriching and enables us to discover the good and bad sides of American culture", she recalls. "Just as an anecdote, when we returned to UTC, we had to learn in French all the technical terms we had picked up in Pennsylvania. Christine, who hails from Compiègne, graduated with the Chemical Engineering elective specialty and remembers well the first year lab sessions organised in 'prefab' buildings. Her end of studies assignment was at the Elf-Aquitaine research centre, who proposed a thesis subject in their chemical engineering laboratory at Nancy, the subject being

heat storage. "Just after the oil crisis, there were lots of studies in solar energy technologies and which we are re-discovering today. The underlying principles have not changed".

### Pedagogical Innovation and the University reform programme

Christine Roizard did a detour via the Group Saint-Gobain's industrial research activities, but she found the experience frustrating inasmuch as she could not explore the topics in depth. Consequently, she returned to the public research sector, as a chargée de

recherche (junior research scientist) at the CNRS. She studied gaseous effluents. In 1995, she experienced an urge to teach so she accepted an appointment as lecturer – research scientist at the Ecole Nationale Supérieure des Industries Chimiques, Nancy, where she had the possibility to implement her inclinations and thoughts about pedagogical innovation. "What I did was to set up some skill related bench-marks, the know-how and behaviour that an engineer should possess by the end of his/her course to qualify for the diploma, instead of using the classic marking system. For one of my courses, I set up what today is known as integrated pedagogy, replacing lecture hall courses by problem-based learning: the idea here is that the



undergraduate learns the specific difficulties of a given sector as they progress with their learning". Christine also rapidly took on administrative responsibilities. When the government introduced the University reform law in France, the 4 Lorraine universities agreed to merge together: a huge dossier for the Vice-President in charge of the finance and manpower resources! "It's a challenge I accept and enjoy, even although it is no small affair, especially in the delicate economic context faced by many HE establishments today." The objective is to set in motion a structure with 53 000 students and 6 800 staff, 3 600 of whom are research scientists-lecturers, and at the same time enhance its

level of international attractiveness. But Christine's own engineering training is a source of efficiency and pragmatism, and helps her a lot. "Had I not gone to UTC, I might not have acquired this work ethos ; in parallel to the Vice-Presidency, I keep my foot in the door of the laboratories so as not to lose the spirit of discovery and the dynamics of a career in research work".

### Know how to disconnect

Over a 40 year period, Christine Roizard has noted the increased numbers of industrial companies seeking

to optimise their processes, and this is concomitant with the requirement to comply with environmental constraints and the impact of increasing raw materials costs on production. Another fantastic change in research is that provided by today's computer power. "When I did my thesis, our computer was in a cool room and had a 64 kO RAM memory!" she recalls. "We, the students, were better than the machine at solving mathematical equations! But this leads to another point: if we want these computers to help us gain time in protocols, then we must also learn how to disconnect from e-mails and 150 paper mails per day, they are now swamping our offices!" ■

## COMPLEX SYSTEM

# Energy : from distribution to 'smart' grids

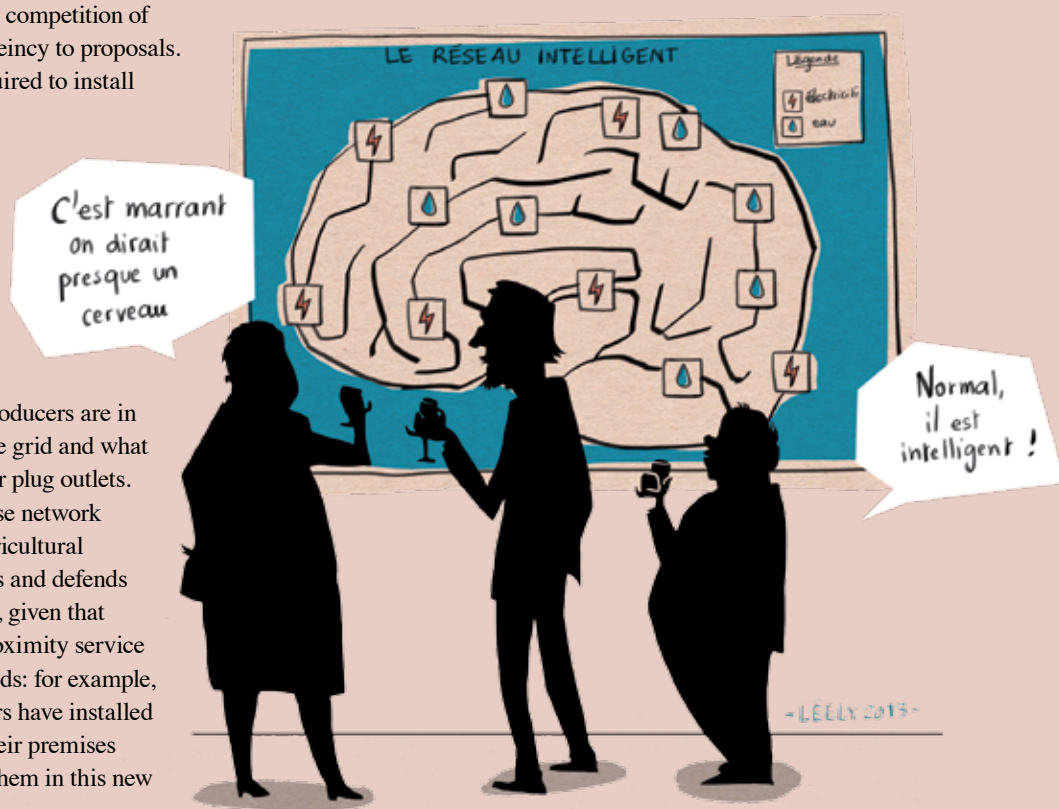
The question is what really pleased Gérard Lefranc, today Executive Director General of SICAE Oise, a concessionary company work offering services in the electricity distribution field. The answer was an innovative project far from the beaten paths of classic teaching. "A school without walls" stresses Gérard Lefranc who, in his final year at UTC, chose the elective option Electromechanical energy conversion. "There were 10 of us! I have excellent memories of the option"

**G**érard found a first job two weeks after graduating, then he joined SICAE Somme to make the most of the training and skills he had acquired at UTC. The acronym SICA stands for "A collective electricity company in the agricultural world". It is a private co-operative company with a public service assignment, to supply electricity and to manage the local grid on a given piece of territory. Initially Gérard started as Operations Engineer, then he was appointed Chief Engineer and finally Director General, which in this sort of structure is equivalent to CEO. SICAE Oise has 150 staff and its networks supply some 110 000 customers in 185 towns. "Here I was back in Compiègne – I had wanted to work in an SME and in the countryside, since this seemed more appropriate in terms of activities and human relationships. And personally I attach a great deal to my quality of life"; Gérard Lefranc is also President of the Professional Trade Union Uneleg (acronym for Union Nationale des Entreprises d'Electricité et de Gaz, Vice-President of the fédération nationale des SICAE and titular member of the Conseil supérieur de l'énergie [National Advisory Energy Council].

### SICAE Oise's public service and proximity mission

Over the past 20 years, the energy supply, distribution sectors have been impacted by a deep-reaching evolution, changing from a monopolistic to an open economy market. "My job has therefore evolved consequently:

from concerns about procurement to quality of distribution, today I am handling problems that anticipate changes in the regulations and to the opening of the market place to competition of offers, to energy efficiency to proposals. Soon we shall be required to install peak power shaving equipment, with a view to obtaining energy savings and making use of smart grids and networks. We shall soon be in a position to ascertain what decentralised producers are in fact injecting into the grid and what consumers use at their plug outlets. This will help optimise network management. The agricultural world clearly supports and defends the SICAE structures, given that they offer a public proximity service and meet specific needs: for example, many of our customers have installed solar PV panels on their premises and we are assisting them in this new activity." ■





## DEREGULATION AND COMPETITION

# A career in industrial research

When he was a UTC undergraduate, Eric Verbrugghe sat on the Academic Board and he recalls the fights Guy Deniélou put up to secure finance, to build the university's infrastructures, to defend his vision against the attacks launched by his detractors. "The way UTC was run was quite novel and I was able to find an elective speciality that attracted me: acoustics".

**"The staff-student ration was excellent (one teacher for two students) and the scientific level was excellent.** The computer science facilities allowed us to programme our software, ... with punched cards!" What Eric Verbrugghe appreciated was both the diversity and the flexibility of the courses. Apart from choosing the acoustics elective, in the Mechanical Engineering Department (UTC-GM), he followed courses in Russian, design, etc. He began his career in Quebec, in an industrial research centre working on a project to reduce noise levels in a saw-mill. When he came back to France, he took up a job at the EDF (national electricity utility) research centre to develop monitoring and situation diagnosis methodology, introducing acoustics means. Among the main applications, there was that of leak detection in nuclear power stations. "For example, using helium which is a gas that diffuses easily in the heat exchanger tubes, and, more interesting, it transmits sound waves three times faster

than air does". Eric Verbrugghe worked on these questions for 15 years.

## Marketing and supercomputers

In parallel, Eric followed training in marketing at ESSEC, sharing his course time between the computer and the applied mathematics departments. His mission was to identify and quantify needs of clients requesting time on EDF's two super-computers. "At that time, 3 000 people were working on strategic equipment and we could even sit ON the computer – it filled a whole building! In the 1990s, when engineers and technicians were in 'pole position', so to speak, the aim was to understand better the computer users by submitting them to marketing enquiries, and to better identify the applications that needed to be developed as a function of their real needs and not as a function of our own desiderata", details Eric, who, following this period, moved to GDF Suez (the national gas utility). "My new job consisted of implementing intellectual property (IP) rights tools (trade-marks, patents, etc.) in the area of our research findings and to negotiate the user licences with third parties interested". Just before retiring, recently, he was in charge of IP for the GDF Group. As both an actor and observer of the energy world, he witnessed the opening up of an era for deregulation and globalisation that in essence multiplied the number of actors and intermediaries, between the energy producer upstream and the consumers downstream. "Those equilibrium patterns



we had knew up till then were upset: each intermediate agent must draw profit for his activities, while operating in a competitive environment. The question is: has deregulation lowered the cost of energy or not? Another change to bear in mind: then arrival of new energy sources, such as wind-power or water power (e.g., tidal machines), where GDF Suez has invested a lot." As we see the arrival of smart grid technologies, the research side of the Group has been expanded to help develop new software packages capable of simulating the operation of the various energy production units and the networks. Eric Verbrugghe thus spent his career in research but in highly differing sectors: "The broad, generalist engineer training delivered by UTC gives its graduates the option to be able to change jobs easily. That is what makes a full and varied career very rewarding!" ■

## BIOMEDICAL

# Biomedical equipment : the quality factor seen from the USA

The long years required for medical studies put him off but Thierry Leclercq really wanted to work in the health sector. As it turned out, UTC at that time had a biomedical option among its course offer, and this corresponded perfectly with the expectations of the future President & CEO, GE Healthcare Life Care Solutions.

**Thierry recalls, "We were all pioneers at the time but thanks to my enterprise placements, I found myself rapidly immersed in the biomedical industries".** After completing his biomedical and bio-hospital engineer training at Rennes, Thierry Leclercq was given the responsibility of the biomedical engineering service and also the equipment procurement assignment for a new 500 bed hospital in the city of Le Havre. "I was able to apply what I had learned at UTC. Hospital engineers act as go-betweens for the administration and the practitioners, and in this role they must make the right choices in terms of technologies and price, without jeopardising the quality of the care provided for patients" underlines Thierry Leclercq. In 1987, he was recruited by the



Compagnie générale de radiologie (CGR), acquired just one week later by General Electric (GE). This opened up international horizons for Thierry and, as of 1993, he went to Asia, 6 years spread between Singapore, Hong Kong and Tokyo, as Head of Global Products, then as Executive Director General for Sales and Marketing for a single line of products. "My positions were in marketing and sales responsibilities, to which I applied my technical background and know-how but also drew a lot from one key feature of our initial training at UTC: 'being smart and making do'. In Japan, my market share figures rose from 5% to 20%; we had to adapt our products to their spatial constraints and lack of floor space, by combining, for example, several tools in a single radiological equipment."

## Encouraging access to health services in developing countries

When he returned to France, Thierry Leclercq was appointed Executive Director General of Services Division, with its 2 000 staff. The early 2000s saw the arrival of remote-maintenance – a real revolution for the technician squads who were worried that their jobs might disappear. "I had to explain, convince and accompany the operational changes by proposing specific training packages. I then fully recognised the strength of the Guy Deniélou's vision – capable as he was of federating so many people to the cause of creating UTC". Remote maintenance became standard practice: up to 30% of system/machine failure are now repaired by the clients themselves. Thierry then became the boss of Lifecare



Solutions, a branch dedicated specifically to biomedical hospital equipment, and the most important branch in the GE Healthcare Group. “The sort of job opportunity you dream about! Exactly what I wanted to do when I started studying at UTC”, notes Thierry enthusiastically.

“It is our role to design, develop, produce and sell all the equipment you find in hospitals today, excepting imaging equipment.” Today, Thierry lives in Milwaukee (Wisconsin) and directs some 3 000 colleagues. He is pursuing two strategies: in developed countries, the overall health service offer must be improved, and in developing countries efforts need to be undertaken to facilitate access to health services. “For African

countries, in India and China, we are designing products that cost 10 to 20 less than in developed countries. This alone is highly motivating”, stresses Thierry Leclerc, travelling between a centre for emergency care for premature babies (Europe) and a five-baby incubator (Africa). “Today, in Africa,



doctors still have to anaesthetise their patients manually during surgery! Our technologies will help them in their professional practice. We are working hand-in-hand with the NGOs to train personnel, the worst sort of outcome being when you sell equipment and see later that it is not properly used or only to a small extent”.

## Bringing medical care to the patient and not the reverse

So, how has biomedical practice evolved over the past three decades?

“Imaging techniques have progressed with technologies that are less and less invasive, consequently lowering the pain factor. Development of ultra-sonic equipment has improved diagnosis and detection programmes. Sensors have become far better, opening the way to complete body echography analysis. We now have to learn how to interpret the flow of data, to give the practitioners the right information and thus improve predictions as to evolution of a given patient’s case, wherever the patient



might be, physically”. Information like this becomes essential faced with economic constraints and the growing pressure of the Papy boom leading to home care becoming the general rule. You therefore have to bring the technology to the patient’s home rather than the reverse. “Miniaturised equipment and enhanced data flow are now available and satisfactory. We still have to train personnel to integrate the ongoing home-care change.” On a more

personal level, Thierry Leclercq has noted that his professional environment has changed very rapidly:

he first flew when he was 27 years old, now he spends about 40% of his time in flight and has reached the point where he can count the countries he has not yet visited! Being Cartesian by nature and in his braining years, he has also been able to adapt to the marketing world and accepts readily that there may be several solutions to a given problem. “In France, we are always seeking perfection. In the USA, we first go for action and return on experience (ROE), and the Americans are not afraid of making mistakes”. ■



## LARGE-SCALE PROJECTS

# When life-long training pays

« One of the key features of UTC is that it teaches the students how to adapt to situations », recalls Philippe Chappuis and he pursues “we followed our lectures in pre-fabs, and nobody was surprised at the time. Today, I’m still working in a pre-fab! “says Philippe smiling, all the more that he is, now in charge of designing and assembling a vital component for ITER, the experimental fusion reactor at Cadarache, South France.

**P**hilippe’s Father studied in the USA and had heard of the creation in France of UTC, inspired as it was by North American models. “I was

attracted by the novelty of the project, marrying so to speak a university and an engineering school. And the fact that students could do two semesters in internships in industrial placements did not exist anywhere else,” recalls Philippe Chappuis, who in his undergrad years at UTC was elected President of the UTC students’ union (BDE) in his second year – this leading to doubling up the year. His first professional appointment after graduation was with the French Atomic Energy Agency (CEA); he carried out safety and quality assurance studies for the Superphenix [breeder] reactor and was then appointed Head of Safety Assessment for the physical metallurgy sector and structural computation.

## From punched card readers to a totally digital world

“In those days, we did our huge equations by hand and our calculations on slide-rules. We had machines to punch i.e., perforate, cards and this led to the punch-card readers. We used to wander around with shoe boxes jam-full with hundreds of punched cards, the order of which was essential to the computation to follow. One of the local pranks was to pretend that the box had overturned and spilled its cards!” recalls Philippe. “We then obtained hand-held calculators marking the beginning of science-oriented computer science. “Today we use scientific computation in much the same way as we used slide-rules and this had led to changing the way we work. Younger engineers tend to think that digital modelling is a black box tool that carries out the calculations and calls for less upstream thinking and problem solving. Phenomenal computer power has partly been substituted the need for analytic efforts and team-work – this consequently has generated a lot of line loss”. The senior research workers

– those who had effectively known the punched card era – are still able to orient and optimise the computations, used more now more as “statistical bases” to converge on the right solution rather than confirm the scientific reasoning. As Philippe Chappuis sees it, the gain in time in design work is practically nil. After working on safety assurance issues, Philippe joined the tokamak Tore Supra research programme at the CEA centre at Cadarache.

## Living and working with nuclear fusion

Philippe Chappuis is now in charge of designing various components for the Tore Supra machine, the aim of which is to explore the possibility of creating and controlling sustainable a nuclear fusion process. Some of these components will be integrated in the ITER prototype. “The components are required to protect the surrounding reactor vessel structures from the effects of nuclear fusion as it takes place in a plasma”, adds Philippe Chappuis. He had teams reporting to him, and he was the youngest manager there. “The challenge and it was a real challenge, with hindsight, was that to have them obey instructions, I first had to convince them!” adds Philippe. In 2005, he was given the responsibility to set up a design bureau at the CEA to prepare the ITER project and remembers the emotion when the official agreement to proceed with ITER was signed at the Elysée Palace, in 2006. Philippe Chappuis joined ITER 5 years ago as the Principal Scientific Officer responsible for “the blanket” a vital liner placed between the plasma and the reactor walls, with its 600 m<sup>2</sup> of stainless steel blocks!

## A human, more than a scientific, challenge

To update readers, on the Cadarache site, the excavations

have progressed and the first full-scale heavy-load convoy was tested successfully. The ITER programme employs around 1 500 persons and some 6 000 are expected on site when we start to assemble the reactor’s components, the first of which should be delivered over the next 3 years. The first energy production experiments are planned to take place before 2027, but the grid-connection of a fusion reactor (to be built) is not planned for 2050. As Philippe Chappuis sees it, the first challenge for ITER is that the programme is the result of one of the largest international co-operation programmes ever signed, between China, South Korea, the USA, India, Japan, Russia and the European Union; in short a programme that transcends the States party to the Agreement. “It is essential for us as human beings to agree on large-scale joint projects; they require really open minds and efforts to understand each other given the different cultures and ways we think and reason. It is therefore a human, more than a scientific challenge, inasmuch as we must give due consideration to every contribution before we make the smallest decision, within a framework of precise, concrete programme objectives.” You really need to be enthusiastic about this sort of large-scale work, ready to work 12 hours a day, re-train continuously and transmit your knowledge to others as you approach your personal career-end. Indeed you have to think about preparing your departure and after-career. ITER is a life-long project. “Contrary to what happens in Germany, France does not organise life-long training and literally wastes the acquired know-how of its senior citizens. Today we have the Internet, but at the same time we must keep and enhance our human contacts, our physical face-to-face exchanges, all of which I see as small turbulent areas that are vital to gaining better, mutual understanding!” ■





## Henri Verdier views the Open Data scene

H. Verdier is Director of Etalab, a special French government service reporting to the Prime Minister on questions related to Open Data. He graduated from Ecole Normale Supérieure (ENS), was appointed Director General of Odile Jacob Multimedia and then Director of Innovation at Lagardère Active. He then created 'Futur numérique', a think tank at the Institut des Télécommunications. He was among the Founder members of the competitiveness cluster Cap Digital which he chaired from 2008 to 2013. He has authored, inter alia "L'Age de la Multitude. Entreprendre et gouverner après la révolution [The Age of the Masses. Entrepreneurship and governance after the digital revolution] (Ed. A. Colin, Paris).

### What are the challenges Etalab faces?

Etalab reports to the French Prime Minister and is an ad hoc but institutionalised team in charge of sharing on line public data. The mission reports via the Secretary General for the modernisation of public action. It accompanies the various administration sectors to open, develop and feed the national portal [www.data.gouv.fr](http://www.data.gouv.fr) and to overview re-utilisation and innovation of public data downloaded or transferred.

### As you see it, could information delivered by Etalab be a vector for innovation?

There are 3 dimensions to your questions and all 3 are very important. On one hand, public data can of course mask in-depth treasures that only become apparent when innovators use them. The lists of the laureates of the Dataconnexion completion (see insert), for example, show just how creative the innovators can be. On the other hand, and even if we do not speak too much about the trend, the administration in France is moving towards a real "open innovation" approach. In meeting these innovators the administration gains by examining and taking on board their talents and intuitions and thus progresses. The simple fact that for a large-scale structure, getting organised and being accountable and accept occasional criticism leads to organisation changes that enable the administration as a whole to fully enter the digital modern era.

### Who today are the utilizers of the portal [data.gouv.fr](http://data.gouv.fr), and how do you see near future developments?

[www.data.gouv.fr](http://www.data.gouv.fr) serves the administration sectors directly. It is a national portal that enables access to 355 000 pieces of free, public, re-utilisable data, or as lists of state-owned property. The purpose is to be accountable to the public at large as to state operations with a higher level of transparency. We are also aware that here are a lot of start-ups that integrate public data into their products and services. A small community of journalists is being built up round the public data and we have a very active civilian follower community, that is very active, demanding ... We are currently working on a revamped site that will, we hope, interest an even

larger fraction of the public; our aim is that open data will become part of the Nation's heritage.

### What role could a University of technology play in the process and what interest would it find in participating?

In my opinion, the universities, like any other public institutions, should join in the process and have everything to win by doing so. It's a process that leads on to open innovation, open education, etc. I personally think that open data is going to require new skills, in computer science, data sciences, data display, etc., It will also require control of action oriented strategies, such as so-called 'data-driven strategies', 'behavioural politics', etc. A university such as UTC must prepare its students to enter this new era. That alone is a huge challenge... ■

### Dataconnexions, the Open Data competitions

Initiated in February 2012, the 'Data-connexions' Competitions reward noteworthy re-use of public, "open data". The common objective is to stimulate innovation, to encourage development of a digital economy in France and to aid the emergence of innovative projects that use public data as a strategy to create added value, to enrich existing services and applications. The first three editions rewarded and supported some twenty projects selected by a jury of digital and economic sector professionals (health services, housing, data display, politics, transportation, culture, publicity, tourism, etc.). The 4th edition, organised in collaboration with the Groupe La Poste focuses on "proximity services". Over and above the classic awards, for the best Public-at-large candidates, for private companies or public utility services, this edition includes a new category 'the local and territorial dimension. The competitions are open for the first time for international projects from other French-speaking countries.

To participate in the competition, please register before Oct. 28, 2013:

[www.etalab.gouv.fr/article-le-4eme-concours-dataconnexions-est-ouvert-119924591.html](http://www.etalab.gouv.fr/article-le-4eme-concours-dataconnexions-est-ouvert-119924591.html)

### DID YOU KNOW THIS?

France come 3rd ex æquo with Japan in terms of providing basic public statistics in an open data format. Their rank, given by the British association Open Knowledge Foundation, covers the G8 countries and relies on 10 criteria: public transport timetables, government budget, public expenditure, election results, national statistics, pollutant emission levels ... France obtained a mark of 46/60 compared with 51/60 for UK and 54/60 for the USA.

More at :  
<http://census.okfn.org>

AN INNOVATIVE APPROACH

# Google : heads in the clouds

Following his academic exchange placement in Canada, Johan Mahe announced his discovery: it is not at all impossible to work for Google! As a student in UTC-GI Computer science, he presented an application, was given an internship job and now works at Google X, the in-house laboratory that produces the most avant-gardists projects, such as Google Glass or the Google Car. Johan is working on a project called Loon, a diminutive for Balloon, which means crazy, mad, cracked, ... nuts!

Google X laboratory, directed by Sergueï Brin, one of Google's co-founders is located at Mountain View, Goggle's HQ town. Johan Mathe has been working there for a year now, after London and Dublin. "Google X is so secretive that I did not even know for what project I was being selected during the interviews" recalls Johan.

## (Wifi) balloons aloft !

Today, Johan is free to tell us more: the objective of Loon is to provide connection possibilities to the 4.7 billion who do not yet have an access, thanks to weather balloons equipped with wifi antennae. "Our balloons would float in the stratosphere, 20 km high and would provide a 3G connection to developing countries, to devastated areas where the construction of land-based infrastructures would cost far too much", explains Johan Mathe. After two years development at Google X, a first experimental phase was tested in June 2013 in New Zealand, where 30 balloons brought Internet to 50 inhabitants in Christchurch when the city was struck by an earthquake in 2011. In the team that

has received the assignment to develop and implement this project on a global scale, Johan is in charge of analysing stratospheric winds and elaborating the algorithms to 'pilot' the balloons that resemble giant floating jellyfish. "It is in fact only possible to even envisage balloon piloting on the basis of meteorological conditions because we can avail of the nigh-infinite computing power possessed by Google. The process consists of adjusting the ratio air/helium in the balloon to catch the useful winds and to maintain the network of connections between balloons in flight" explains an enthusiastic Johan. The balloon's equipment is fed via photovoltaic solar panels and can remain in flight and autonomous for a period of 100 days". Beyond the 3 month mark the weather conditions in the stratosphere are such that the balloon fabric weakens and the balloon must be brought down for revision.

## Fail once and succeed better next time

"What we have here is a unique company, Google, with a unique project, Loon," explains our UTC engineer, who not only followed courses in applied maths at UCLA-Stanford but is currently gaining his private pilot's license. "Apart from the largely media-relayed features of Google such as the free cafeterias, etc.,

the company sets aside 20 of the personnel's time to discover the work of other teams and the corporate projects. Indeed this is similar to what I appreciated at UTC: autonomy, flexibility, responsibility and mutual trust. Another unusual feature is that, in the lab, we try to prove that the project will not work." "It is a real token of freedom to be able to explore different paths for possible developments. The team is composed of very talented, smart, impressive people, all of them totally free and highly creative. To illustrate this, I can tell you that I work alongside the man who designed the special effects for the film Matrix! Technical skills are recognised and rewarded accordingly. I enjoyed the feeling of almost playing more than I was working; I also enjoy contributing to projects that carry a meaning." As he sees it, Loon contributes to wealth by providing Internet access: "For 10% of the inhabitants it guarantees 1.4% additional GDP". Google is currently working in New Zealand with a local telecoms partner to develop the wifi network. The next test sites for Loon balloons will be at the same latitude as New Zealand, to avoid problems with adverse winds. ■

plus ► [www.google.com/loon](http://www.google.com/loon)

## MAPPING THE WEB "MADE IN" UTC

# LinkedIn : a UTC data scientist at the network core

It all began with the UTC course UV IC5 (exploratory data analysis) given by Franck Ghittala. Mathieu Bastian found the data display facilities very exciting and devoted a lot of his spare time to creating GEPHI an open source software package that has now become the benchmark in this field. In order to adapt the tool to his needs, LinkedIn® approached the software creator who now lives and works in California.

"Gephi has been downloaded more than 500 000 users. As an open source developer, I felt it was my duty to debug the programme and thereby assure an optimal operation. I set out to solve the problems encountered by LinkedIn® to use Gephi for their application Inmaps® which allows the users to visualise their personal network", explains Mathieu Bastian. He started working on this project and mission when he

settled in the Silicon Valley.

## "Where we measure just about everything"

Mathieu discovered a world that is constantly looking for new talents, in a company that doubles up every year. "LinkedIn® was created in 2003 and its growth accelerated rapidly as of 2007. 3 years ago there were 1 000 on the pay-roll, today we have 5 000!", notes our 'Data scientist'. "A data scientist, as I see it, is both a developer and a statistician. His/her work

relies on using 'big data' to create smart algorithms for the recommendations and personalisation pop-ups. For LinkedIn® we have to analyse millions of 'clicks' to optimise the site as a function of users' search patterns, to provide recommendations for other contacts, interest groups, articles that appear most relevant to the cases studied", explains Mathieu. The personalisation parameter comes from past site visit behaviour, from the user's profile: from this LinkedIn® can deduce that probability that an internaut is looking for a job and by analysing the behaviour of other internauts looking for a job can present certain filtered professional openings rather than others. "We know

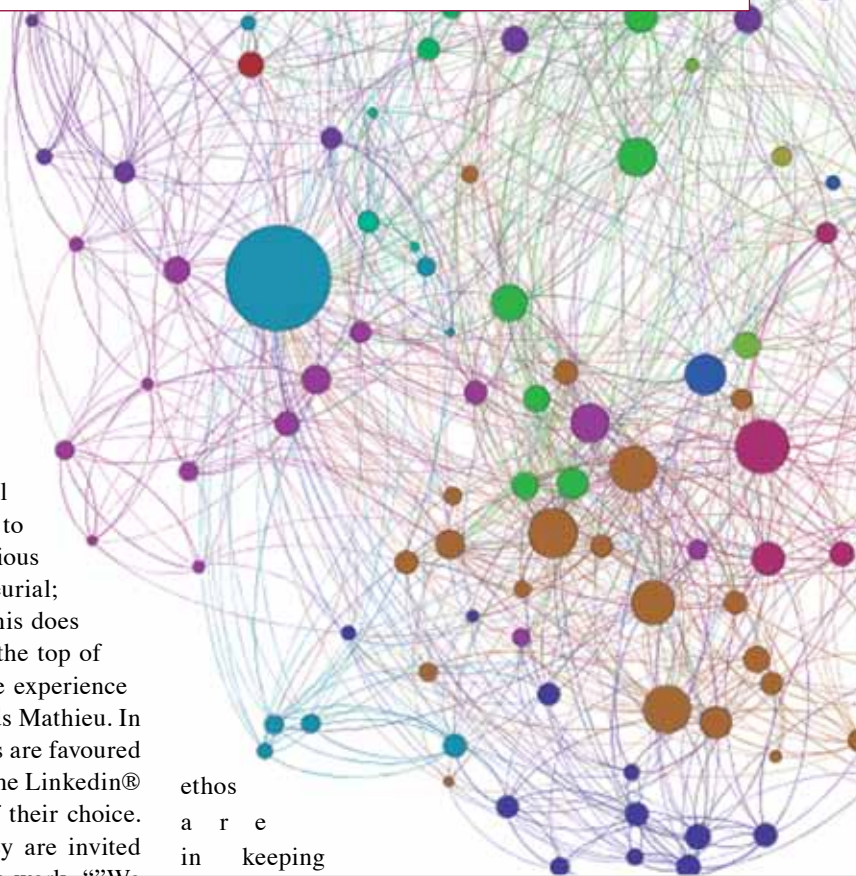


what we would like to optimise, e.g., the number of e-mails sent out by recruiting agents, or the number of invitations among users. If the personalisation allows us to improve overall efficiency, then we shall have attained our objective. The final aim is to improve user experience, whatever his/her profile – recruiter, student, employee, job seekers or just looking for contacts”, adds Mathieu Bastian.

## And this decade's most sexy job is ... the Statistician

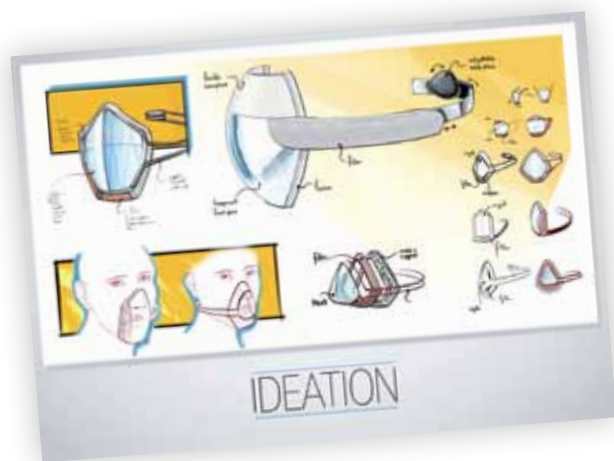
LinkedIn® has 238 M profiles (compared with 1 billion on Facebook). For data scientists, the profiles represent a phenomenal field to explore and analyse. “It procures a real pleasure when you initiate a data query on data bases of this size. Big data is a field that literally has exploded and offers new opportunities in every sector, to the extent that they provide ways to optimise existing processes”, explains Mathieu. LinkedIn® is a pioneer in big data analysis but it will be noted that there is a growing need in various sectors to work with huge, rapidly expanding data banks (in health, transportation, energy, finance) even in France. It has reached the point where the statistician's job had been qualified as the “most sexy of the decade”, by emeritus Prof. Hal Varian (economics) at UC-Berkeley and chief economist at Google. “Tomorrow I'll be in a position to make use of the experience I have gained at LinkedIn® in a very wide range of other sectors”, confirms Mathieu. “Big

data are one of the keys to correctly analysing complex systems, and today we can witness a shift in the paradigm” To better understand complex systems, cf. intra p.4, the article on the laboratory “Control of technological systems of systems” directed by UTC. The paradigm favoured at LinkedIn® currently is ‘youth’. The average age is between 30-35 and many young people are appointed rapidly to managerial positions. “There is a real meritocracy here and a clear desire to succeed. My collaborators are ambitious and all are driven by an entrepreneurial fibre. Everyone has personal aims but this does not lead to malevolent competition. At the top of the company, the leaders want us to see experience here as a jump stage in their career”, adds Mathieu. In keeping with American culture, charities are favoured every month with an “InDay” whereby the LinkedIn® workers can spend time on a charity of their choice. And when it comes to “HackDay”, they are invited to produce and present innovative team-work. ““We all have a keen sense of hierarchy and admiration for our company – the purpose of which is to connect professionals the world over with new opportunities of career and personal development; we all understand and share these aims and this itself leads to a high level of personal commitment. LinkedIn® management and



ethos  
a r e  
in keeping

with the company's growth rate” adds Mathieu Bastian. Each team sets its own objectives, and the latter must be realistic and ambitious. If an objective is 100% attained, then obviously, there was a lack of ambition in the beginning! ... ■



“Design something that solves a problem”. The subject was so vast that Victor Cheung and Vincent Bihler spent several weeks beforehand, concentrating on designing a hygienic mask to enter the competition for a James Dyson Award. Both students are matriculated in Industrial engineering design at UTC, and as winners of the national competition are now set up for the international prize deliberations!

**We can observe increasing numbers of people wearing face masks when outside, to filter pollutants in the air or to avoid contaminating other people when they themselves harbour infectious germs.** Professionals also use masks in large numbers

## STUDENT PROJECT

# 1<sup>st</sup> Prize at the James Dyson Awards

(in health services, the military, etc.). The problem is that these masks hide the mouth and facial expressions, muffle sound viz., there is a communication problem”, explains Victor Cheung. “The challenge was to find a way to filter the air without isolation the masked person from the surrounding world”. The answer proposed by the two UTC students may more in the area of design than in pure technological optimisation. By positioning the air-filter in the branch that holds the mask in place at the back of the head, in which case the opaque part of classic masks can be replaced by a transparent material. Very clever! And the students had through the project and its variants: a slider to adapt mask to various head shapes, an articulation so as not to hamper the users' movements, flexible membranes at the nose and chin to ensure air-tightness and a hands-free kit to use the phone ... in a word, a practical, aesthetic mask, that can be manufactured with a perfect product presentation. We can note that the two students continue their proposals – their project Eole, an economic,

good-looking home heating unit was also singled out by the jury! The best ten projects from each country are forwarded to an international jury, who select 50 and among the 50 Sir James chooses 3 finalists: First Prize 30 000£ for the laureate and 10 000 £ for his/her school; 2nd and 3rd Prizes, 10 000 £ each fr.wikipedia.org/wiki/James\_Dyson. Early November, Victor and Vincent's projects will be exposed in Dyson's Paris showroom. “This recognition will be a definite plus on our CVs, at a time when we shall be looking out for future job opportunities”, thinks Victor Cheung who also envisages launching a commercial venture with the mask; his conclusion “We have proved we can be engineers and win design competitions!” ■

**plus** ▶ INHALE : [www.jamesdysonaward.org/Projects/Project.aspx?ID=3570&RegionId=8&Winindex=3](http://www.jamesdysonaward.org/Projects/Project.aspx?ID=3570&RegionId=8&Winindex=3)

**EOLE**: [www.jamesdysonaward.org/Projects/Project.aspx?ID=3573&RegionId=8&Winindex=0](http://www.jamesdysonaward.org/Projects/Project.aspx?ID=3573&RegionId=8&Winindex=0)



### Inauguration of the exhibition "Portraits of our research scientists" - Upcoming event

To celebrate its 40th anniversary, UTC and the Picardie Region Authorities have joined forces to prepare a standing exhibition Portraits of our research scientists that the inhabitants of Compiègne will discover along UTC's railings. Forty UTC research scientists from have agreed to display their personal and professional research passion, illustrating yet gain the open approach of UTC as an institution and fostering the town and gown concept of the University in the City.

### The diploma awards ceremonies and the UTC Gala night November 30, 2013

The diploma awards ceremonies will take place November 30, 2013 at the Espace Legendre and at the Imperial Theatre in Compiègne and can be viewed via UTC's stream webcam, for alumni all round the world. In the evening, the UTC graduates, friend et al will meet up at Chantilly at the Hippodrome for an exceptional Gala evening.

plus d'infos ► <http://assos.utc.fr/etuville/pages/gala-8>

### World Innovation Summit: "Sustainable, innovative transformation in land planning" November 14-15, Liege (Belgium)

This year's edition of the World Innovation Summit will be organised in Liege, by the University of Liege, UTC and the Ecole de technologie supérieure (ETS), Montreal. The theme chosen for this year is "Innovative city districts: sustainable, innovative transformation in land planning: technological, social, organisation and cultural innovation related challenges. The Summit will bring together a hundred actors engaged in land planning, creative city precincts, academic working in the field and specialist consultants.

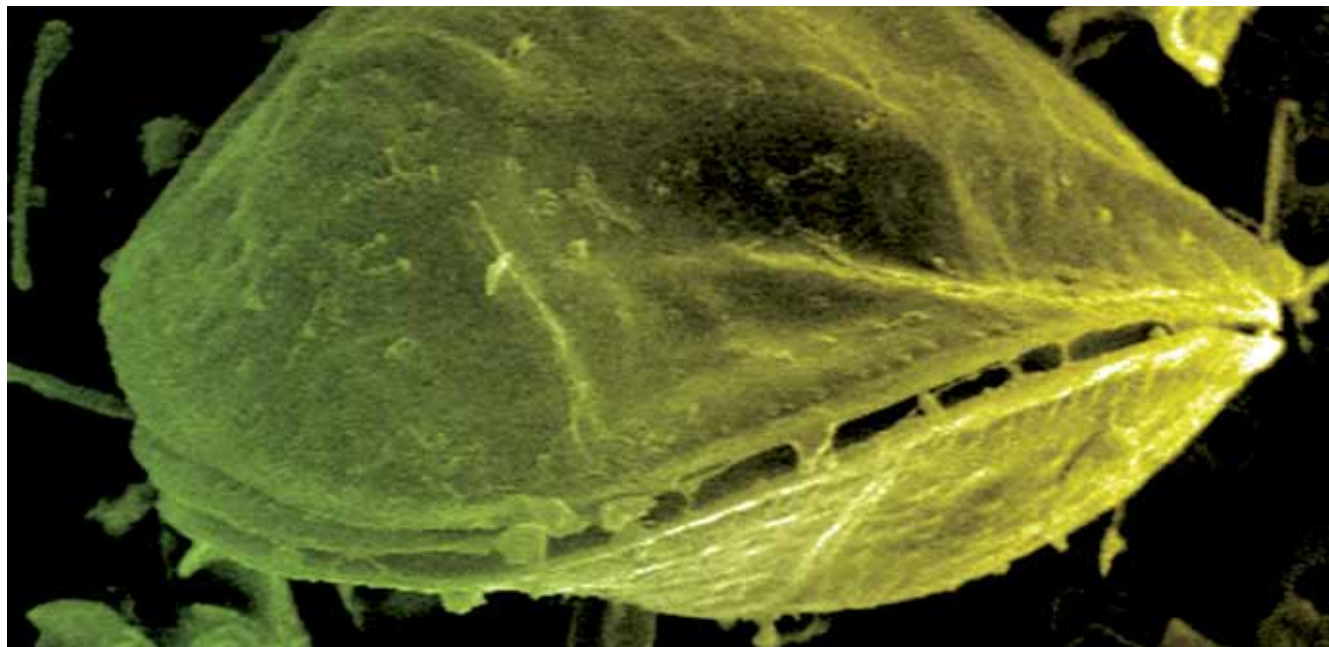
### Research and Innovation Week in Picardie November 26-29

The 7th edition of the Research and Innovation Week, organised by the Picardie Region Authorities will take place this year, Nov. 26-29, 2013 in the town of Creil. The event is designed to enhance meetings and exchanges between the universities, engineering schools, the technical, technology transfer centres and enterprise.

plus d'infos ► <http://www.picardie.fr/-Recherche-et-innovation->

### CLOSE-UP

Ostreopsis, a green algae, under the electron beam microscope.



### STUDENTS PROJECT

## Mare Nostrum

One of the reasons for our undertaking this trip was that the Mediterranean is a marine biodiversity "hot spot", a rich 'world' that needs to be protected. Despite its small size, the Mediterranean Sea possesses a very impressive level of biodiversity. There are many different species here, some 10% of the world's as yet known total. And 25% of these Mediterranean species are endemic, i.e., they only live in this zone. As a basin where numerous human civilisations emerged, the Mediterranean has nonetheless fallen victim to strong anthropic pressures (the impacts of Mankind on Nature), given that hundreds of millions of inhabitants live round its shores.

**O**ver the past few decades, observed on Spanish, French and Italian coastlines there has been an algae bloom, i.e., a very rapid proliferation that had never been observed before in this Sea. Related to the bloom, there have been cases of human intoxication and high mortality rates in marine invertebrates.

Following analysis and identification, we are faced here with an invasive algae of tropical origin: dinoflagellates (micro-organisms with flagella) of the Ostreopsis family. This is a microscopic species that develops on a substrate (benthic), other sea-plants or sea-weed in general and in the summer time when the local water conditions are favourable. Development is such that the algae create patches visible on the water surface [NR-there is practically no tide in the Mediterranean]. As is the case for many other tropical algae, Ostreopsis is toxic: the toxins are released into the surrounding water and can take the form of gas clouds drifting over the nearby beaches. The species is not in fact fatal for mankind but the impact of Ostreopsis on the environment does call for studies if only to better understand the mechanisms. When a species invades a given zone, it implies a change in the local eco-system, all the more striking if the invader uses toxic molecules to gain territories. This rapid development of Ostreopsis has led to a drop in water quality and in occasionally to large-scale mortality of marine organisms, such as sea-urchins and mussels. Moreover, the toxins can accumulate in the food chain. Our trip along the Mediterranean coastline and the fact that we chose to do it in the summertime turned out perfect for us to participate in a study

of these algae in collaboration with the Villefranche-sur-Mer Oceanological Observatory Laboratory (LOV) cf. [www.obs-vlfr.fr/LOV/](http://www.obs-vlfr.fr/LOV/) [in English]. As soon as possible, we shall take samples of the substrates, for later study at the Observatory. The samples will reveal the presence or not of Ostreopsis and will contribute to understanding the dynamic nature of propagation, e.g., will the extension continue geographically or will it be restricted to certain specific zones? Moreover, we shall photograph the substrates to see if Ostreopsis develops preferentially on certain sea-weeds rather than others. With our collection of cells, a DNA analysis will enable comparison of sources and this again will teach us more about the dynamics of the species. ■

plus d'infos ► [www.marenostrum-project.com](http://www.marenostrum-project.com)





## COMPETITION TIME

# When the GIS leads to *San Diego*

“Our project was finalised and complied with the prerequisites of the competition organised by ESRI France at the end of the semester: we just couldn’t let an opportunity like this slip away”, explains Tom Thenon who had motivated his team to register their application. A promising initiative, given that two months later, ESRI France told them the good news – they had won!

**ESRI is an American software editing company, world leader in the field of geographic information systems (GIS).** In the context of the UTC credit course ‘Geomatics’ taught by Nathalie Molines, students in UTC-GSU (urban system engineering) learn how to use

these tools and are required to co-produce an assignment at the end of the semester. By choosing to analyse the risk of flooding in Compiègne, the team comprising Fanny Saffroy, Flore Cailloux, Quentin Boufassa and Tom Thenon had no inkling that they were going to win the ESRI competition. First Prize: a week in San Diego, Ca. at the ESRI Headquarters to attend the annual GSI conference and present the work they had done at UTC. As it turned out, however, Tom Thenon was the only student able to make the trip. “It was very exciting. Through the various ROE (returns on experience) I heard, I realized the potential of GIS in a multitude of countries and sectors, from protection of forests in Germany to missions conducted by the US federal police services. Maps represent a very powerful tool to decision taking” says Tom, who hopes to take up a career in land planning. “GIS tools can prove very useful when it comes to carrying out

studies, they lend more meaning to the data”. The Founder and CEO of ESRI, Jack Dangermond was awarded the United Nations Environment Programme (UNEP) “Earth Champion 2013” in the category “Powerful monitoring tools to assess the state of the environment”. This was indeed the feature of GIS that Tom Thenon and his team demonstrated in their project about the risk of flooding in Compiègne, modelled from a centennial flood event in the 1900s. The data was collected from the Townhall’s technical services and processed in a rigorous analytic programme enabling the students to identify the weak points in the territory as a function of population densities, transportation networks, position of public establishments, historic monuments, etc. “It would prove useful, we feel, to continue the studies that could be of assistance to the Town’s technical services”, suggests Tom, currently doing a placement in a sports and cultural design bureau. ■



## EUROPEAN PROJECT

# The usefull monitoring to *silver economy*

Have you done your 30 minutes work-out? Have you done your heart training exercises? With movement sensors, you could not procrastinate and your doctor could monitor your progress day-by-day. Frédéric Marin and his research team recently completed their European project PAMAP the purpose of which is to develop tool for gerontology to monitor the physical activities of our senior citizens. Here are some of the team's research subjects, ranging from nerve ending regeneration to virtual reality (VR).

**With the currently observable “Papy boom” and the associate “Silver economy”, the UTC-BMBI laboratory is preparing tools for tomorrow.**

“This monitoring system allows you to personalise and to follow re-education programmes accurately. In the framework of the PAMAP project, in a Franco-German-Greek consortium, our lab is responsible for elaborating the biomechanical models to quantify the senior’s activities”, adds Frédéric Marin. “The clinical tests we have conducted at the CHU hospital in Rennes were encouraging. We now have to find new forms of finance to improve the monitoring tools and then to extend, i.e., democratise the process, the system and their medical uses. Given the population graphs and the pressure that is already exerted on hospital accommodation possibilities, we need to create tools that make life easier for the families, friends – aids – of these seniors.” This project also fits in with then aims of the regional programme VESTA, that received a distinction from the banking Foundation of the Caisse d’Epargne in collaboration with the Picardie Region’s University Jules-Verne and the medical rehabilitation centre ay Corbie to assess the physical capacity for patients afflicted with multiple sclerosis. To continue in this vein, Frédéric Marin has registered a project “Ageing in the City”, accepted by the research laboratory ComplexCity which conjugates the efforts of the UT Group (France’s Universities of Technology) and the University of Shanghai; the thematic is framed as ‘Ascertaining how to integrate gerontological tools specific to cases of Parkinson’s disease when designing urban spaces?

## Prevention and personalisation

More generally speaking, the fact that we can record

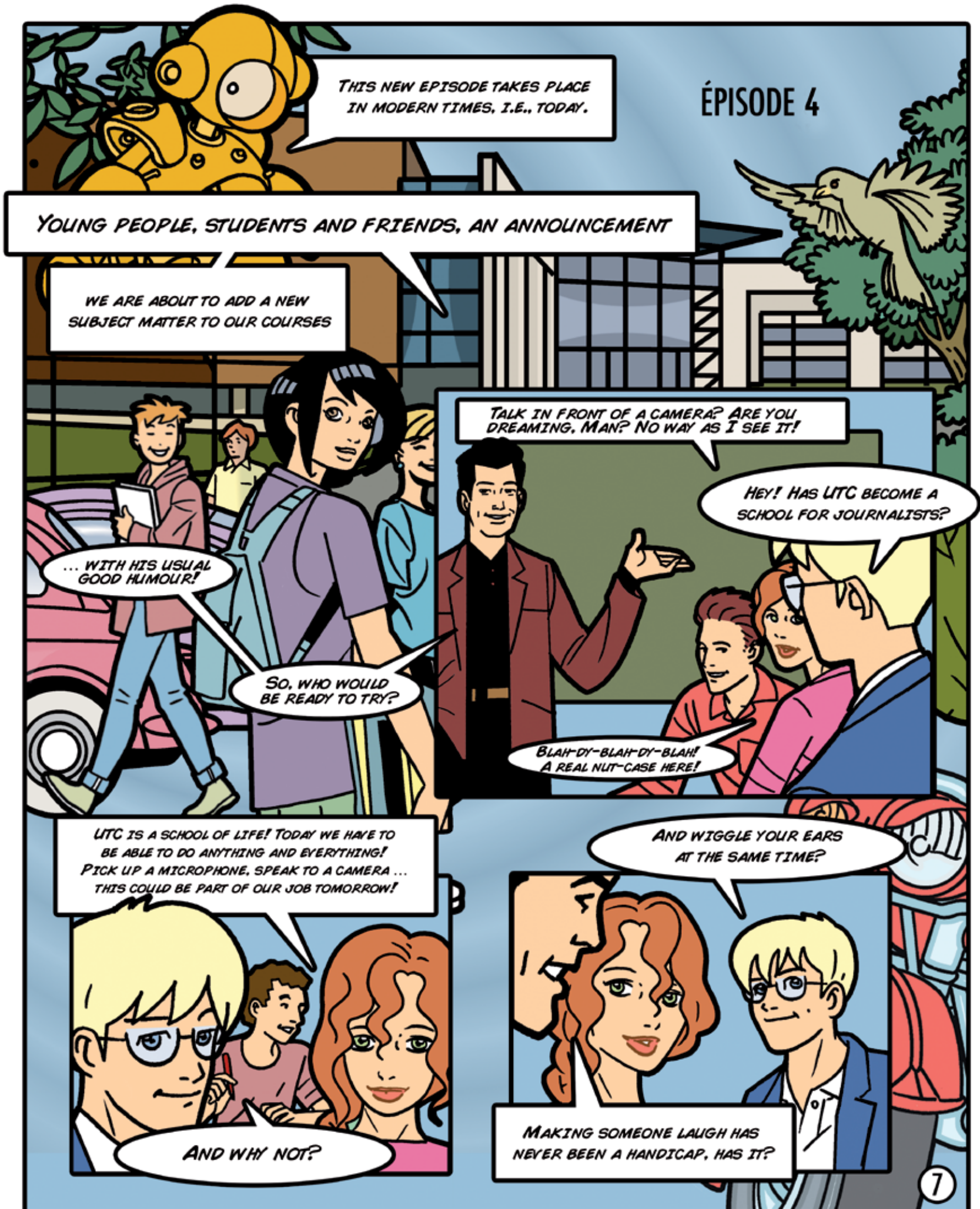
movements enables us to engage in prevention policies and personalise the monitoring process, which are two emerging notions. “Each of us moves in different ways, as a function of our genetic make-up, previous traumatic history, life hygiene, etc. Recording movement allows the treatment to be adapted to the patient’s capacities”. Thus, with the Institute Faire face, Frédéric Marin is working on the quantification of facial movement to study the dynamics of a face after muscles have been regrafted, to better programme and adapt the rehabilitation of the patient. In the area of prevention, what we must understand is that above 35 years of age, our muscle-skeleton system is being degraded. “Ageing management is a new field of studies before us: 150 years back, average life expectancy was 40 years compared with 80 today! Without falling into the trap of hypochondria, we can use movement sensors to follow the ageing process and the compensation that we use to accompany the changes, such as the way we stand when we have a sore back or weak knees, and to organise prevention procedures – such as changing one’s sports activity for another without hurting or damaging oneself, viz., avoiding having to seek remedial cures”. There are some technological hurdles to be crossed before these inertial sensors become commonplace in medicinal practice, starting with the question of their energy consumption. They are now relatively cheap, the price tag dropping from 2 000€ to 10€ a unit in a lapse of 10 years, hence their existence now in a number of devices such as Smart-phones, Wii, sports devices, etc.), but they must be recharged every 8 hours. Frédéric Marin’s team is working on this subject with Professor Abdelmadjid Bouabdallah from the UTC-Heudiasyc laboratory, in the framework of the Labex MS2T.

## The hand, muscle-skeleton disorders and virtual reality (VR)

The UTC-BMBI team who are specialised in the hand’s bio-mechanical properties, have just completed another European project called COGNITO. The objective of the project is to propose tools to record and analyse hand movements in industrial environments, with the aim to assess the degree of difficulty for the operators and the risks to either muscles or the skeleton. “We should bear in mind”, adds Frédéric Marin that “the hands are the first victim of muscle-skeleton disorders, coming before the back and the knees” ». Inertial sensors for the hand could also lead to other futuristic applications, such as the ANR’s (national research assessment agency) project Mandarin involving the CEA (atomic energy), Inria (automation and computer sciences) and the companies Renault and Haption. UTC’s expertise will be applied to producing a return effort-reproducing glove. This is a project carrying a budget in excess of 700 000 €, beginning in June 2012 for a period of 42 months. “The research work features are now mature”, underscores Frédéric Marin, extending his gratitude to his collaborators past and present, viz., Pierre Devos, Laëtitia Fradet, Sofiane Fouaz, Clint Hansen, Khalil Ben Mansour, Lydie Edward, Tifenn Raoult, Tony Dinis, Taysir Rezgui and Nicolas Vignais. “In 2014, part of our know-how and in particular the platform CinDyAH, a real showroom for movement sensing, recording and analysis will be located in the UTC Innovation Centre to obtain an optimised valorisation of previous research work in the field”. ■

**Plus ► PAMAP : [www.pamap.org](http://www.pamap.org) - COGNITO : [www.ict-cognito.org](http://www.ict-cognito.org) - MANDARIN : [www.agence-nationale-recherche.fr/projet-anr/?tx\\_lwmsuivibilan\\_pi2%5BCODE%5D=ANR-12-CORD-001](http://www.agence-nationale-recherche.fr/projet-anr/?tx_lwmsuivibilan_pi2%5BCODE%5D=ANR-12-CORD-001) 1**

For its 40th anniversary, UTC tells its (hi)story in a Comic Strip: **In the Heart of the Future.**











# The open mind, hard driving CEO

BI-SAM was ranked 23rd 'most beautiful' independent SME in France by the magazine 'Entreprise'. This annual rating rewards "the French champions in profitability and growth". Here 'Interactions' offers a portrait of one of the Founders of BI-SAM, Alexandre Harkous, who initially graduated from UTC with the Computer Science elective speciality.

**So, what is the most important key to achieving recognition at this high level? "First you must have a good idea",** says

Alexandre Harkous, co-founder of BI-SAM in 2000, 8 years after graduating from UTC with the elective speciality Computer Science, "and you must really believe it will work". BI-Sam is a software editor specialised in management of financial assets. Bi-Sam currently has 100 employees, and generates 20 Meuros annual turnover. The company specialises in analysis of performance ratings for asset portfolio managers, as a function of the risks they tend to take as the markets evolve and fluctuate. Before creating Bi-Sam, Alexandre Harkous worked in financial spheres. "The first key step consists of identifying and carefully validating market needs, leading on to the signing of a contract with the first customer" he explains. "It is the first customer who generates the dynamics for the early development phases of the company. Our first contract came 4 months after the firm was set up". The second key to success is to build a good team "capable of believing in the product and committing themselves to succeeding". "The success of BI-SAM relies enormously on the team. We are a young company and we can count on the UTC network to start the staff recruitment. 3 co-founders, 2 are graduates from UTC and one from a commercial college. We were able to attract talent thanks to our own level of motivation and the intrinsic value of our innovative product", details Alexandre Harkous. Witness the first solution provided by BI-SAM for which the research took two years to mature fully and the company continues to invest 3 Meuros annually in R&D.

## "So, what's next?"

The third key feature is to go look for contracts. After 3 years as a start up in Compiègne, Alexandre Harkous was able to leave Compiègne with its ideal scientific and technological environment, and move down to the capital Paris, where the potential customers were. "UTC helps us a lot. The university offered the bases of our first team, and our first office space – 15m<sup>2</sup> in the Technology Transfer Centre, plus the encouragement of President Francis Peccoud and Mr Joseph Orlinski, UTech Entrepreneur and Head of Placements. The

decision to leave Compiègne was a hard one, and we also had to take development costs into our stride and the much level of competition that we would face in Paris. But, it was a risk and we took it", he recalls. After Paris, he moved the business to London in 2005, then to the USA in 2009 and Hong Kong in 2012. BI-SAM now has 80% of its business in international contracts. "London represented a decisive stage and the company took on a new dimension there. Setting up shop in the USA – at that time in the midst of the financial crisis – was in itself risky and frankly our shareholders didn't believe we would pull through? In the end, they did choose to follow us and today some 35% of our turnover is in US contracts. Each stage called for a risky decision, a new large step forward. And each time, we returned to the question: 'So, what's next?', without losing from sight our overarching vision". For BI-SAM, the next stage consists of creating 'a service solution that will enable companies to implement corporate software without having to install it on their servers'. "To do this, we shall move into a cloud configuration thereby enlarging our customers' range of action", summarises Alexandre Harkous. "We are also envisioning a move to South-West Asia and South Africa."

## Twenty job positions to fill

Seeing his company ranked #23 in the list of the 100 'most beautiful'

French SMEs, was an extra source of pride. "It was a great surprise, an additional shot of adrenaline! But our best successes lie in our customers' satisfaction and the faithfulness of our collaborators, 20% of whom are the BI-SAM shareholders". The other surprise is the difficulty Alexandre had to recruit 20 computer science engineers! The prime requisite is to be able to speak fluent English. So what makes a good entrepreneur – Alexandre Harkous sees 3 other necessary qualities: "an open, international mind; a know-how for managing and motivating a team; to be tenaciously hard-driving when the going gets tough, to get back on your feet and believe in the next steps". ■

plus ▶ [http://webtv.utc.fr/watch\\_video.php?v=S96RRRU27S24](http://webtv.utc.fr/watch_video.php?v=S96RRRU27S24)

## BIO EXPRESS

**1992**

Graduated from UTC with the elective speciality Computer Science; head of computing service, successively at Mitsubishi Bank then Demachy Worms.

**1995**

Special Missions then Director of the Customer Management Department at SIP (Misys Group).

**1998**

Deloitte Consulting, where he developed the Asset Management pole, while working on various missions, notably for ABN Amro AM, Banque du Louvre, CIC Group, Dresdner RCM Global Investors, HSBC and Merrill Lynch.

**2000**

Co-founded BI-SAM.



## Interactions

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