

Donnons un sens à l'innovation



En route to 2050:
cutting-edge engineering professions
 that forge our future Page 5

FROM THE PRESIDENT'S DESK

Thank you, Christian

From 2005 to March 21, 2013, Christian ESTEVE has chaired of the UTC Academic Board of Administration. He will be standing down this March and I cannot find it in me to pen these words from the President's desk without paying homage to his tremendous contributions, defining UTC's forward strategies in an undoubtedly a turbulent period of unrest, which saw two Government laws on Higher Education in France, 2006 and 2007; UTC being invested with more responsibilities and a wider competence, with the launching of the Government's Investments for the Future plan and finally the preparation stages for a new HE law... Christian's industrial background, notably in his capacity as VP for the Renault-Nissan Alliance, plus experience gained with Ronan STEPHAN at the Directorate General for Research and Innovation (DGR) in the intricacies of ministerial administration of higher education and research establishments, and his personal deep-rooted humanism, allowed Christian to pilot UTC's development, which he tackled with 'realism' faced with the constraints of public administration such as slow processing yet with a modern, dynamic and international vision of what the University should be, notably in terms of innovation, social and societal responsibilities, instilling an entrepreneurial culture. With his leadership and initiative in the Chair, the UTC Academic Board made some significant decisions about major strategic options, not always with a consensus but where Christian clearly organised the debates in a dignified manner in total respect for adverse opinions: let us mention UTseuS in Shanghai, China, access to the Regional Centres of Expertise* (RCEs), participation in France's Sorbonne Universities Pole of HE and Research (PRES), high level commitments for the Investments for the Future plan, especially the PIVERT project in Picardie, the launching of apprenticeships at University, the opening of a new course entitled Humanities and Technology (HuTech), enhanced dynamics for the UT Group of universities of technology... Christian's list of achievements is long and, with a little hindsight we now realise just how relevant his decisions were and are. It pleases me no end that Christian has accepted to pursue his personal engagement with UTC, helping our new UTC Foundation for Innovation to progress; his assistance here will be all the more precious that his eagle eye on innovation (cf. intra) and his rich experience constitute a powerful driving forces for the Foundation's development.

With renewed and heartfelt thanks, Christian. ■

Alain Storck

President and Vice-Chancellor, UTC Compiègne



A refreshing look at **innovation**

Five questions to Christian Estève Page 9



Doc'Matinales January 22, 2013

The first Doc'Matinales were held Tuesday January 22, 2013 at UTC Compiègne. Their objective is to encourage regular exchanges between doctoral PhD students at UTC and economic partners in and around the City of Compiègne. The following companies - Span Diagnostic, Reviattech and Montupet gave talks about the positions PhDs have (and can have) with them, especially in innovating SMEs. The next edition will take place in March 2013. ■

plus d'infos   <http://interactions.utc.fr>

Project Mare Nostrum wins 2nd Prize at the Poseidon Trophy awards



Two students, Louis WILMOTTE, UTC Compiègne and Douglas COUET, doing a master's degree in oceanography at University Pierre & Marie Curie, Paris (part of the same Government supported Pole for Research and Teaching PRES Sorbonne, as UTC Compiègne) won 2nd prize at the Poseidon Trophy awards, February 6 and 7, 2013. This competition is organised by the National Naval Construction Consortium (DCNS), specialised in high technology for ships and associate energy questions. The Trophy rewards associations who present projects that relate to the sea. In the framework of their project, these two students will paddle a sea-going kayak from the straits of Gibraltar to Istanbul, some 10 000km and will take a year to do this. As they progress round the Mediterranean, they will conduct a series of scientific missions and organise public awareness events for the protection of the marine environment. When they return to France they will host some photographic exhibitions and debates on environmental issues. ■

plus d'infos   <http://interactions.utc.fr>

UTC Compiègne comes second in the French Digital Ranking

In January, UTC Compiègne confirmed its second place ranking, due notably to an increasing presence on the social networks. The Ranking (Classement) looks at the digital strategies of the engineering schools, analysing three criteria; social, web and mobile. The social ranking, for instance, measures the presence or otherwise of the schools in social networks. The Web ranking records the public news posted on the school web-sites and the dynamics. Lastly, the mobile ranking compares presence of the schools on Google Play Store, iTunes and the App Store. The question of web-TV's is now being addressed and UTC Compiègne is a pioneer in this area. ■

plus d'infos <http://www.ingenieurs.com/classement-ecoles-ingenieurs-2013.php>

PARTNERSHIP

Golden Silence

How can you hope to sell an electric car supposedly totally "silent" when it makes an audible whistling sound? Renault encountered this problem and approached the UTC Electro-Mechanical Engineering Laboratory (LEC) to help them solve the issue. This became the core business of the AVELEC Commission (Electric Vehicle Acoustics), which started in 2010. Here are some of the initial findings.

The whistling noises originate in power electronics, where 'rogue' frequencies can randomly generate vibrations and hence become a noise source.

"The very low noise level of an electric motor, compared with an internal combustion engine, in fact allows the driver to hear just about everything! To solve these phenomena from design stage, we had to bring together various skills that were somewhat removed from the core business of our Renault Divisions: vibrations, acoustics, magnetism and electronics. Renault did not have this combination of skills in its in-house teams," explains Vincent LANFRANCHI, senior lecturer at UTC who had some previous experience in the area when he worked with ALSTOM on a similar set of problems. It was doubtless for this reason that the LEC laboratory was chosen to design and develop vibro-acoustic engineering solutions for Renault's electric motors and to pass on this knowledge and new skills to the Renault teams. According to the specifications of the study, LEC was invited to study one electric motor from almost every possible angle and to ensure reproducibility of the modelling and experimental protocols, given that each motor has its own specific parameters. "We adopted a novel scientific approach to study motor-generated harmonics, coupling digital and analytic models" adds Vincent. "We had in essence to break some barriers between various skills and tools used to draft the design specification recommendations. I was personally impressed by the way Renault implemented the means needed to do this. It now remains for us to



Z.E. CONCEPT

synthesise our findings, which we feel are quite satisfactory, to define the case limits and to draw up some prospects for future developments." With a budget of 2.6 Meuros, AVELEC combines contributions from three innovative SMEs - Vibratex, Adetel Equipement and Cedrat Technologies. The contract will end in 2013. A thesis by Pierre PELLERREY on "Noise and vibrations in electric motors designed for use in automobiles" was also successfully defended during the same time; Pierre was indeed recruited by the British Dyson company, founded by inventor James Dyson. "AVELEC will be a clear benchmark for UTC's LEC notoriety in Europe", concludes Vincent LANFRANCHI. ■

 www.webtv.utc.fr - "acoustique des moteurs électriques"

PARTNERSHIP



PETALE, An EDF-UTC pedagogical project making a robot

Now is the time to throw some light on a highly rewarding collaborative project PETALE [acronym in French for "EDF-UTC Automatic Helium Underwater Testing"]. The pioneer on the EDF side is a certain Patrick LEFEBVRE, an environmental engineering specialist is about to retire.

The original idea behind PETALE project was to optimise electricity production at one of France's nuclear power stations (Gravelines, on the English Channel coast).

The current practice - when an inspection is launched on the sea-water coolant circuit - calls for a reactor power-down and outage. This circuit is used to cool the secondary circuit which in turn cools the primary circuit that draws heat from the reactor core. Outage can last for up to a week! The question arose - can we avoid this period of loss of production? Engineer Patrick LEFEBVRE raised this question with some UTC students in 2005. Once they had examined the circuits, there were no secrets left to discover - the interface between the sea-water and the secondary circuit is in fact a large 'box' condenser device, measuring 4m x 6m and containing over 1 100 tubes. The leakage-test consists of injecting helium into each tube and detecting possible leaks of this gas in the condenser vessel. The process can now be carried out during production using a robot designed and developed by 26 student engineers (mechanical engineering systems) between 2005 and 2007. "You can imagine this robot as a sort of 4-legged spider,

which tests each condenser tube for leakage without having to stop production" says Emmanuel DORE, the research scientist heading the project work with his students. "And it was a real challenge - we had to design a remotely controlled system in the severely controlled environment of a nuclear power station, co-ordinating knowhow of three UTC Departments. It turned out to be an excellent case study for UTC, managed by the EDF engineers in the framework of a teaching contract between the institutions." Since 2007, when the PETALE Unit was set up at Gravelines Power Station by Patrick LEFEBVRE, EDF has had 35 student engineers working there on placement from UTC. "I just love working with young people, who share a very high level of motivation and a desire to move things forward. This project offers them a rare opportunity to co-ordinate their individual skills. Their robot will be commissioned in a couple of years". On March 25, Patrick will come to Compiègne to give an overview lecture on PETALE, it being noteworthy and commendable that 6 of these students were recruited by EDF when they graduated. ■

 www.webtv.utc.fr

“My vision is *to build a worldwide University of technology*”

What lies ahead in 2013 for UTC Compiègne? President Professor Alain STORCK gives his answers.



When Prof. Alain STORCK was confirmed as President of UTC in 2012, he introduced a tremendous, novel idea, to set up a local eco-system for innovation and creativity. It will become reality at the end of 2013 and Alain STORCK comments “In order to make UTC Compiègne a European-scale university institution, building on opportunities to innovate and create, we had to establish such an eco-system in our Region of Picardie. Inasmuch as the ecosystem is rooted in the regional context, it accompanies the international thrust of UTC, thanks to partnerships signed between the University, the Regional Authorities and industrial entrepreneurial partners”, stresses Prof. STORCK. The key feature, the UTV Innovation Centre will be delivered and commissioned end-2013; its purpose is to optimise the main links between the system’s actors, and to promote and enhance innovation wherever possible: with technological upgrades, in marketing protocols and practice, in organisation and management and in pedagogy, etc. This local eco-system will also be placed under shared governance, UTC and the Picardie Region, the city of Compiègne and its suburbs and local enterprises. “I did not want UTC Compiègne to be the only driving force of this local network, which improves the attractiveness of the area to favour the installation of new research centres, branches for foreign universities, foreign companies and leading

proponents of our specialities”, adds the President of UTC Compiègne.

Does this herald in a new vision for UTC’s training cursus?

“Well, without going as far breaking with tradition and the initial ambition to see engineers and engineering at the heart of innovation processes, we see the new local ecosystem and the new cursus Humanities and Technology, not forgetting our joint teaching venture with China, UTSeuS, as an answer via an evolution in our pedagogy and courses to better meet the demands of a changing world”, explains Alain STORCK. UTSeuS which is a training and research branch of UTC within the University of Shanghai will soon be followed by a second similar unit in Chile, located in the French Lycée at Viña del Mar. There is an overarching vision for these ongoing developments: to “build a worldwide University of technology” based on complementary branch nodes all digitally inter-connected. “The point is that new ICT communication technologies are integral components of the new vision, but the contact teacher-student will not disappear” adds Prof. STORCK. The new UTC Humanities and Technology course is a real challenge, consisting of matriculating student from the L (literary) and ES (economics) baccalaureate streams. Its inception corresponds to a wish expressed both by the students and by enterprise at large; the aim is to enable recruitment of engineers who will gain from both the technical and the general culture training modules. “The ambition of UTC Compiègne is to reconcile science, technologies, humanities and social sciences, and thereby produce graduate engineers capable of thinking in technical terms and also on the social and environmental consequences of

the technologies implemented. For example, notions such as “the zero and infinity” are taught from various angles: mathematics, philosophy and technologies,” details Alain STORCK.

“Engineers for the 21st Century must be more humanist”

These ongoing changes correspond to a new kind of engineer, who will be faced with the societal expectations arising through economic, social and environmental crises. “Engineers for the 21st century must be more humanist, more creative, more innovative and more open to the world around them” feels Alain STORCK, who also is a believer in mixed formats, such as “engineer-doctor” with the visible development of “e-medicine”. Thanks to its Department of Bio-Engineering, UTC will be in a position to answer this need. “It is also within the remit of UTC, besides producing new knowledge and know-how, transmitting them and transforming them into innovative products, processes ... to train entrepreneurs. UTC graduates, we can note, have set up some 110 new companies over the past 10 years. To go beyond this level, we now have planned for what we call an ‘entrepreneurship pole’, based in our Innovation Centre”, he recalls.

A priority concern: increasing and diversifying financial sources

The fear that Prof. STORCK entertains is that the French State may not be in a position to honour its commitments, financially speaking, to support the ambitious development project at UTC Compiègne and to allow the “future infrastructure schemes” to become reality. “First and foremost among my concerns at the moment is how to increase and diversify UTC’s funding. There are several ways to achieve this : firstly, through development of the UTC Foundation, where the next funding raising campaign aims at securing 10 Meuros over 5 years; the second is to reinforce links with the economic/industrial tissue in terms of partnership research agreements and the “apprenticeship” tax, viz., on local professional activities that accrues to teaching establishments in France; thirdly, to proceed with a possible rise in student matriculation fees for non-French nationals in our student population and at the same time setting up a grant system, etc., for those in need”, adds prof STORCK. Moreover, the various alliances signed by UTC Compiègne are gaining in impetus: the network of French universities of Technology (UTC,UTMB and UTT) to produce an enhanced level of attractiveness; our alliance with the University Jules Verne – Picardie which is compliant with territorial logic, embodied in a Regional conference of higher education a research establishments and our complementary choice of thematics in the framework of the PRES Sorbonne (Government supported Pole for research and higher education). 2013 indeed holds some highly promising prospects! ■

Prof. Yann MOULIER-BOUTANG delivers his first set of lectures at the University of British Columbia

February 14, 2013, Prof. Yann MOULIER-BOUTANG, chair of economics at UTC Compiegne gave a lecture on "the cognitive capital resource", first in a programme called the French Scholars Lecture Series, created by the French Consul General in post at Vancouver, the Peter Wall Institute for Advanced Studies (establishment specialised in interdisciplinary development and exchanges among confirmed research scientists) and the University of British Columbia, Canada. The aim is to encourage and enhance exchanges between French and Canadian research scientists. Six French lecturers were chosen for this first series, each staying for a week on the UBC Campus. Apart from delivering a public lecture, there were seminar commitments and informal get-togethers and this multiplies the level of exchanges and contacts; the French Scholars Lecture Series will be programmed between February and November 2013. ■

plus d'infos ► <http://www.pwias.ubc.ca/>

UTC at the "top table" for the Compiegne Regional Association New Year's greetings

Saturday January 19, 2013, was the occasion for the Mayor of Compiegne, Senator Philippe MARINI, President of the Compiegne Regional Association, to recall that UTC was celebrating its 40th birthday (throughout the year 2013). Prof. Alain STORCK, President of UTC Compiegne and Dominique BARTHES-BIESEL, Prof. emeritus at the BMBI (Bio engineering) laboratory delivered some recollections of the 40 year long adventure. Senator MARINI reminded the guests of the strong links between the University and the City of Compiegne ever since it was created [in 1982]. He decorated Prof STORCK with the medal for 'Personality of the year' 2013. A number of UTC scientists made presentations of their research work and the undergraduates also displayed ongoing innovative projects. ■

plus d'infos ► www.webtv.utc.fr

Next Open Day, March 9 following suit to the successful January 19 edition

Saturday January 19, 2013 – Compiegne was under 10cm snow! – the University welcomed school-leavers, students and their parents and friends to its Open Day (local code name "JPO"). During the day, there were lectures that presented the various educational paths offered in a UTC cursus as well as the opportunities abroad included in the education package. Visitors were able to ask questions to the numerous research scientists and lecturers present at the admissions stands as well as the APB (post baccalaureate) process. Information was to hand about the courses and international placements. The new course on Humanities and Technology – open to S (science), ES (economics) and L (literary) Baccalaureates enjoyed a full house and a field day! ■

plus d'infos ► www.webtv.utc.fr

AN INNOVATIVE PROJECT

Building JellyNote after a pre-labelled project at the UTC Innovation Centre

Every musician knows that, for the moment, there are no self-explicit, complete web-sites for musical scores, videos, tablatures, etc. Now, thanks to JellyNote, a special social platform created by 3 friends, including Arthur LENOIR and Adrien COGNEE, UTC graduates in Computer Sciences and Applications is offering an on-line solution.

Arthur is a pianist, Adrien plays the guitar but the third man, Baptiste POIRIER, is not a musician.

Arthur adds, with a smile "We shall probably test new beginner solutions on him!" The story goes back a couple of years when, in a web data mining course, Arthur developed a research engine to find musical scores automatically generated from MIDI files on the Internet. The project was then called Dionysus and received a pre-label qualification from UTC's Innovation Centre. "That project gave me a clear vision of errors and gaps in the web offer for musicians. And as Adrien and I discussed matters, it transpired that there was a real opportunity here to set up an efficient web site to do the job" says Arthur. JellyNote brings together and lists scores, videos and tablatures as posted by Internauts that help simplify practice with musical instruments. Pay-as-you-go applications will soon allow JellyNote to earn some income, as the team prepares the next versions of JellyNote, including sponsored

links, to outlets for concert seats, new albums, new tools, etc. "We are currently developing interactive scores that are synchronised in real time with the partition played by the on-line musician. JellyNote will be able to detect wrong notes, record and store parts played and approved by the musician on line, etc. This way we think we can come up with some interesting tools for music teachers", explains Arthur. The project convinced the selection jury of the start-up accelerator "Le Camping", in Paris. JellyNote was accompanied for a six-month period that is proving decisive to their future. So far JellyNote has registered 30 000 "web clicks" in January, the target being 500 000 for year 2013; hopefully, JellyNote will become the Deezer of musical scores. The selection committee of UTC's Innovation Centre showed that they had an excellent intuition when they prelabelled Dionysus. ■

plus d'infos ► www.jellynote.com

THE UTC INNOVATION CENTRE

Focal point for exchange and emulation

The construction phase of UTC's Innovation Centre will be completed in 2013. The question now arises 'what will front-line innovation actors find there? The Centre's Director, Bruno RAMOND, describes the installations and some of the future possibilities.

As we approach the inauguration of the 5 000 m², we can clearly see the overall scheme. The UTC

Innovation Centre will definitely be project-intensive, evolving round 3 major poles: research, innovation and entrepreneurship. How will the poles operate and what are their objectives? The Centre has been designed to attract students, student-engineers, enterprises, financiers, lecturers and research scientists, thereby building up a locus or focal point to exchange, to enhance creativity, to gain in efficiency ... The Centre will be equipped with some interesting "structural" set-ups, e.g., the virtual reality (VR) room that enables visual immersion in a predefined world. "We shall be able to propose VR visits to new buildings or to analyse in slow motion, for example, how car components react in a crash situation", details the Director RAMOND. A railroad network simulator will also be available as well as a prototyping workshop. The first few projects of the Centre are progressing well, while awaiting the delivery of the Centre facilities. "We are currently testing project typologies that will, when vetted, be admitted to the centre. Several start-ups are also in the pipeline", adds Bruno RAMOND, with obvious satisfaction. As far as the

economic actors are concerned, this operational mode will offer an opportunity to collaborate with pluridisciplinary teams in the work-conducive spaces of the Centre, designed as they are to enhance exchanges and mature projects, from blue-print design stages to product or service marketing. "What we do not aim to do is compete with existing industrial laboratories, but rather bring together various skills to help make innovation progress", stresses Bruno RAMOND. The industrial group Dassault Aviation is a partner, as are the two French Regions of Picardie and Haute-Normandie, supporting the Glass Vallée project that started 2 years ago. Students will be able to propose innovative bottling solutions for the SMEs that work in this luxury market sector, based in the Bresle Valley and currently faced with stiff competition from Asian countries. When the Centre opens officially, more activities will be launched. "Each project will integrate course credit possibilities – in this way the UTC undergraduates can meet and exchange with the Centre residents", underscores Bruno RAMOND. "We shall also offer special rooms that guarantee confidentiality of private conversations, plus office-space that we feel will stimulate creativity and intellectual emulation!" ■





En route to 2050

cutting-edge engineering professions



The 21st Century will be an era of transition and challenges. By year 2050, planet Earth will have to feed 9 billion inhabitants. China will have by-passed the USA, becoming the world's first economy. Global interconnection will have grown, as will the world's mean temperature. The oil crisis (depletion) will occur and there will be an accelerated demand for alternate energy sources (as energy need continue to grow). Progress in medicine and biology will open up wide ranging ethical debates on 'augmented man' and virtual reality, in a context of ageing populations. Robots and nanotechnologies will become common-place, as will 3D printers, but questions of poverty and climatic refugees will be rife. But above all, innovation will no longer be able to sidestep questions of social acceptability, just as engineers will need to take account of economic, social and environmental assessment of their work, given that science and technology combined will provide the answers to the challenges noted here. In this context the NAE (USA) report on "the Engineer in 2020" saw engineers at the heart of future societies. The report in question sets as 14 the number of challenges ahead, quote **make solar energy economical; provide energy from fusion; develop carbon sequestration methods; manage the nitrogen cycle; provide access to clean water; restore and improve urban infrastructure; advance health informatics; engineer better medicines; reverse-engineer the brain; prevent nuclear terror; secure cyberspace; enhance virtual reality; advance personalized learning and engineer the tools of scientific discovery.** These major trends will entail destruction/creation modes for new jobs, calling for new skills for engineers. So, in the light of this, how do undergraduates, departmental staff and alumni of UTC Compiègne view their future? How do they see engineering in yr. 2050? All those we interviewed stressed that they were not using crystal ball theory. Below is their vision of the pathways to the future.



The demand is *now for higher levels of skills*

We may wonder, will the engineer of 2050 have a nano-screwdriver in one hand, a communicating computer in the other and a boarding pass for Mars in his pocket? Our interviewees take a wide look at those skills expected of future engineers in 2050, necessarily seeing themselves as cross-roads and acting as an interface between various technological specialities and Society.

Nathalie ALVITRE, manpower resource director for Snecma feels that **“Enterprises will definitely need more engineer-integrators than any other skill”**. In a context where the advanced level of intrication of technical problems and where there is a constant search for optimisation, engineers will no longer be able to see their contribution as independent of others. **“Such an organisation can no longer be envisaged, if only in terms of costs and delivery dates. For example, a mechanical engineer (specialist in systems engineering) cannot ignore manufacturing/assembly processes! Two view-points are needed: that of the specialist and that of the generalist. The aim is to achieve a ‘perfect’ design first time round”**, explains Nathalie ALVITRE. Thus, without denying the need for specialist knowledge and profiles, as needed to make innovation progress, the systems engineer will be wooed by enterprise, inasmuch as he/she will bring that additional added value that is primordial in a highly competitive world.

Engineers at the heart of the system

This is the opinion held by Jerome FAVERGEON, Director of UTC’s Department of Mechanical Engineering and a former UTC graduate, Gilles BOUVIER now Head of manpower Resources with Bombardier. “Project engineering is gaining ground compared with proof of expertise and yet it is the latter that distinguished two competitors. We note, for example, that there are only a few specialists of braking systems for rolling stock or vehicles and an overall comprehension is necessary here to optimise this function. It is a field of knowledge and know-how that can only be acquired through experience; UTC Compiègne, we note, has a lead position with its Department of Mechanical Engineering Systems. Moreover, companies tend to recruit more IT engineers because of the increasing amount of ICT electronics in many areas, including transportation. Data must be processed to be useful, must be delivered to the right user, the interfaces must be defined appropriately, etc.” Thus, in the

Enterprises will definitely need more engineer-integrators

views of Maurice NONUS, Director of the Department of Chemical Engineering, engineers in 2050 must have both specialist knowledge and a widespread cultural experience if they are to understand the needs of small geographic locations and entities. “What we call local counter-forces will oppose more strongly the effects of extreme globalisation,” predicts Maurice NONUS. “The role of the engineers will be to translate technological solutions to comply better with local expectations. In their capacity as experts, they will be able to draw on relevant information and data in the foreseeable, announced ‘universal library’”.

Expertise distinguishes two competitors.

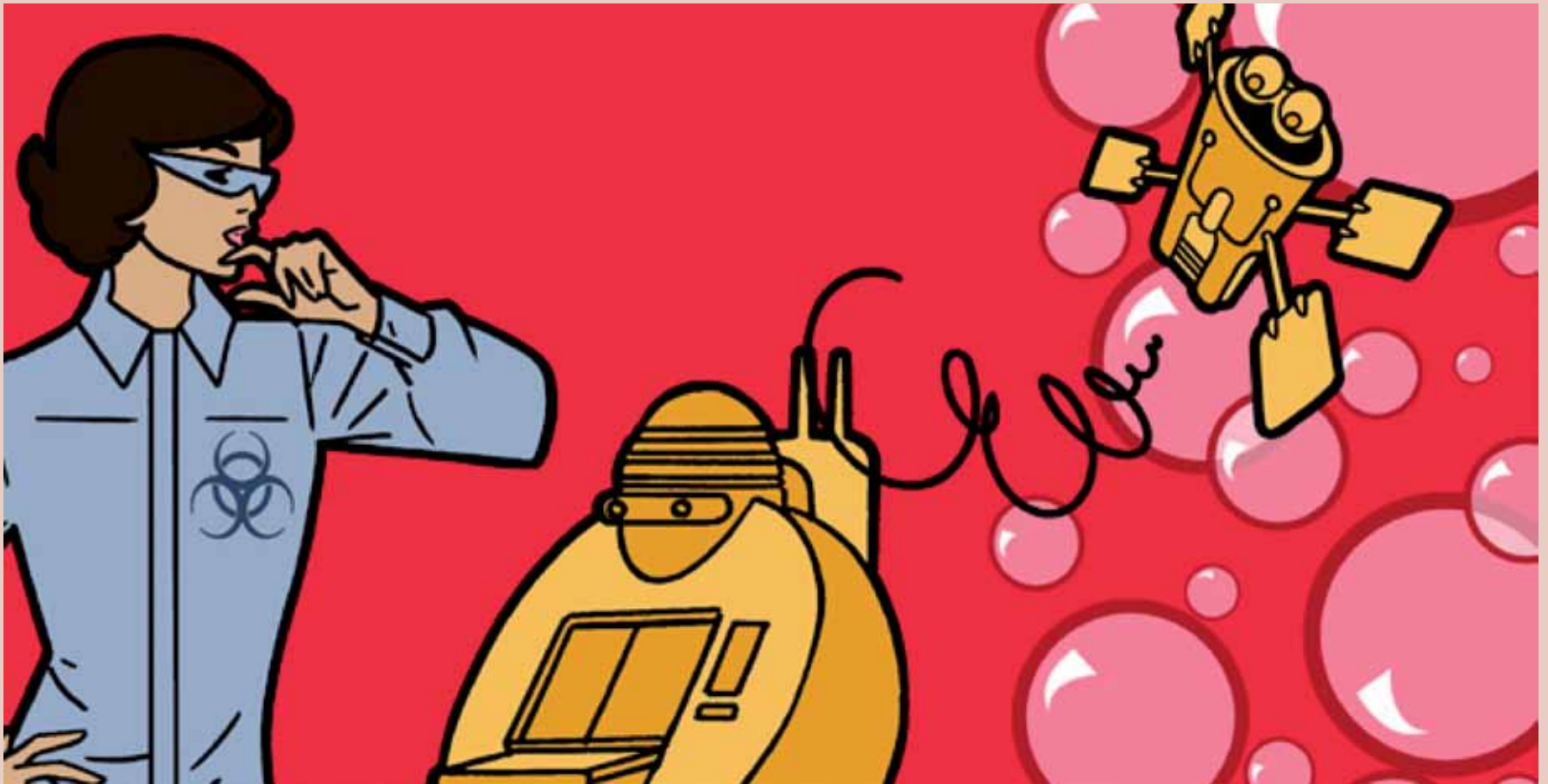
Risk analysis in a context of growing globalisation

Globalisation is increasingly making incursions into the engineering world. Firstly, in terms of recruitment: “Competition to secure the services of top-notch engineers will become international, but will also cover recruitment of standard engineers”, surmises Maurice NONUS. “On the other hand, global mobility will be slowed down by questions of retirement, social security, ‘medicare’, etc. Maybe we could envision some universal system, or at least one organised in terms of major geographic zones – this would encourage mobility of our graduates”. Engineers must learn more about the international context of their personal field of activities – if only to better select among potential suppliers. “Every country will soon possess high-quality know-how” proffers Nathalie ALVITRE. In a global panorama, engineers will be able to identify possible suppliers in terms of risk analysis in a way that would prove much more accurate than it is today. The notion of risk analysis will be capital to selection choices: quality assessment, costs, delivery dates and product performance will be more relevant than just “feeling” and will require a keen critical mind, to the extent that the answers to future challenges will not necessarily “inside answers”. Over and above learning about a global context for their activities, engineers will need to specialise locally. Nicolas SOURAQUI, General Manager for Oxyane, based in Shanghai, adds “companies demand a high level of local relevance. Many suffer because their subsidiaries are not adapted when located elsewhere round the world. It is impossible to enter the Chinese market using just

Engineers in 2050 will be "agile"

Why, might we wonder, will agility be the key feature of engineers in 2050? Some answers are to be found in **“Today’s engineers, a mix of philosophers and scientists”**, by Hughes CHOPIN, himself a philosopher and research scientist at the UC Costech laboratory. [French title **“L’ingénieur contemporain, le philosophe et le scientifique”**.]

In his book, Hughes CHOPIN analyses three corporate situations. “The words that engineers use to describe their professions are strong: whirlwind, chaos, etc. The enterprise is seen as a white water river. How then is it possible to ‘think’ straight about an engineer’s profession is this sort of ‘mess’ to put it politely?” Hugues CHOPIN brings his philosopher’s training to bear: with the Badiou event, the Deleuze organisation and the future according to Bergson. Each concept can be used in given situations of disorder that engineers face. “When faced with disorder, engineers suffer. If, on the other hand they mobilise ‘agile’ methods, then they will be able to manage and control the situations as they arise” underlines the philosopher. Let’s take an example here: out of, say, 150 functions described in the upstream stages of a software design schedule, a customer may want to change 100 functions as the programme progresses. In order not to unduly suffer, the Head of the project organised twice-monthly meetings (in order to be constructive) with the customer. “Should a project be abandoned, this failure may be explained because the original idea was not called into question. In the third case study, the project manager invents a role, as needed to manage the new production line or unit”. This book takes its place in technology intensive philosophical writings and in this field UTC delivers an innovate contribution. Elsewhere, the world of engineers and technology is ignored by the field of philosophy. The challenge nonetheless is enormous when it comes to training programmes: “We must move on [in France] from the current selection by skills and performance in mathematics and by admission to the major engineering schools [grandes écoles]. Our educational systems must open themselves more to international criteria, to the corporate world, to innovation and research. Engineers have never been “applied scientists” but must be seen rather as DIY proponents for the science content of their work. The quality of the “do-it-yourself” is where intelligence come in. If e can design this sort of training approach, then we shall be able to train engineers for 2050”.



customised French culture; you also have to “think China”, create local autonomous units. Engineers must be able to provide an added value that relates to their intimate knowledge of a local geographic and cultural context.”

Would a freelance status better suit the Y generation?

Maybe engineers in 2050 will be free-lance professionals, working less for a given enterprise than for a project, in a general context of flexible work. “Even now, the young people I recruit do not see themselves with a mid-term future in the company; they prefer to jump at opportunities and when they arrive, without any fears or misgivings”, says Nicolas SOURAQUI. We get the same message at Snecma [French aircraft engine consortium]: “the missions we assign to engineers

will get shorter and shorter in time, if only because they want to change position regularly and because companies cannot afford to spend 10 years on development of a product”, opines Nathalie ALVITRE. “Engineers will be required to successfully finish a project in 2 to 3 years. This kind of organisation calls for transmission of knowledge and know-how.

The model where by an engineer’s job was to solve a well-framed problem is now on the wane.

What we call the y-generation has not yet integrated this work dimension, related as it is to memory transfer functions”. The key word is therefore efficiency, to which we must add good manpower resource management. “Companies in the near future will call on the services of specialists to recruit the right man/woman for the right project, and will doubtless focus on intermediate recruiting cabinets who possess an excellent knowledge of local skill availability. Professional activities will be more participative, better rooted in the local context”, feels Nicolas SOURAQUI. Maurice NONUS is of the same opinion “I believe less and less in life-long careers

Over and above learning about a global context for their activities, engineers will need to specialise locally.

with the same group: behind the apparent safety factor, there are very strong constraints. Engineers will be independent artisans hiring their specialist skills to a proximity network and working with a constant concern about saving raw materials.”

Trend detectors

If we consider impending rarity of raw materials, the global warming challenge, the difficulties for many to access drinking water, we realize that the very bases of the past century are being shaken. In a world rife with uncertainty, engineers will no longer be able to disconnect professionally from the economic and social context. François SEBBAH, Director of Social Sciences and Humanities recalls that “the model where by an engineer’s job was to solve a well-framed problem, to produce and improve products or devices is now on the wane. A new relationship to Society is beginning to take shape: on one hand engineers must think in terms of social acceptability for their inventions and innovations and on the other they must detect those ideas, expectations and demands that will lead to innovation.” In this manner, engineers will endeavour to understand forces at work in Society and to measure the effects of their production lines on the social and economic environment. François SEBBAH assures us that this sort of change is already underway in three notable sectors: biotechnologies, digital innovations and urban engineering; all three being closely tied to social, political and ethical issues.

It combines what we might term the clear-cut, geometric mind and the precision that “Pascal advocated!”

The training challenge: to surpass the single criterion of technological success

“Our training schemes today prepare the senior engineers for year 2050. The capacity counties will have to train skilled, productive engineers will be one of the keys to retaining jobs and innovation”, says Charles-Henry DUROYEN, VP for Manpower Management in the Atos Group. “We need to keep control of training, we need to preserve our know-how built up over decades and we must continuously spark new vocations to become engineers”. Placements in industry and services and training abroad are now seen as primordial factors: they provide maturity, self-reliance and a critical mind, none of which is taught at school today: integrating social science dimensions and humanities is essential as François SEBBAH sees it. “UTC offered a new university course for L (literary) and ES (economics) baccalaureates as of 2012-2013. “Humanities and Technology” (the course name) is deemed highly attractive by students and by the entrepreneurial environment. It combines what we might term the clear-cut, geometric mind and the precision that “Pascal advocated!” The aim is to

train minds capable of making judgements. In this area, we can question: is the Internet neutral? What balance must be struck between acceptability, innovation and well-being? “We must provide the engineers of 2050 with tools that will enable them to surpass the sole criterion of technological success”, says François SEBBAH. “Engineers

must become forward thinking nit-pickers, in a world which even today sees the logics of growth and progress replaced by those of a more complex universe. What the will be the price for progress? What areas for downsizing must be included in a growth package? This is no easy situation by it provides highly stimulating, provocative room for thought!” ■

The 28 jobs of the future

as seen from UTC's local eco-system

Here is the line-up of 28 future jobs, sector by sector, where engineers will be at the heart of tomorrow's Society. The views are provided by a panel from the UTC eco-system: first, 3 undergraduates Elsa RESCAN (GSU), Etienne DEPARIS (GI) and Vincent DELAGE (GSM); 4 lecturer-research scientists and professors, Daniel THOMAS (Vice-President of the University's Scientific Steering Committee), Christophe EGLES (Head of Material and Biomechanical Engineering), Maurice NONUS (Director of the Process Engineering Department) and Jerome FAVERGEON (Director of the Mechanical Engineering Department), as well as 2 senior Manpower Resource managers who graduated from UTC Compiègne, Nicolas SOURAQUI (with Oxyane) and Gilles BOUVIER (Bombardier). The list could have been miles longer!



Energy and agro-resources

The impending so-called energy transition will be the major challenge of the 21st Century. What will be our energy source mix in year 2050, taking into account the carbon print of our activities, the prices, the risks, the availability and social acceptability of each source?



Decentralised energy procurement engineering : “In process engineering, we are currently at the beginning of a radical change: energy production will become more local and decentralised with development of renewables”, says Maurice NONUS. Engineers will have to discuss their business with decentralised and authorities, in places where energy and cultural autonomy will be the name of the game, so to say, faced with globalisation.



Lean engineering : whatever the final choice of energy source made, the question of lean, ‘sobriety’ in terms of energy consumption will be at the heart of process engineering and management. “This trend will involve all mechatronics engineers”, asserts Jerome FAVERGEON. Clearly energy conversion outputs will have to be optimised and all reductions of energy use must be made.



The biomass engineer: by 2050, biomass sources will replace conventional petroleum products (mainly oil) as the primary source for carbon raw material, but will only amount to a small fraction of future energy procurement mix. “Numerous jobs connected with biomass will be created” says Daniel THOMAS. “Costs must be brought down, but there is no doubt bio-fuels will replace kerosene inasmuch as planes will never be able to take off using electricity or solar power. Genetically modified trees will produce cellulose more profusely, this being the raw material from which 2nd generation bio-fuels can be produced. This, in essence, would lead to a new industrial agro-forestry sector”. Third generation bio-fuels, based on micro-algae will come in later, at which point there will be a market takeoff in

neutraceuticals, cosmetics and fine chemistry. “We need to improve production by combining, as we indeed imagined it, heterotrophy and autotrophy”, stresses Daniel THOMAS



Energy challenge engineers: a growth trend in use of electric motors leads to another question, future use of supraconducting materials, to improve efficiency. “Such supraconductors can currently only be used at very low temperatures, around -120°C”, recalls Jerome FAVERGEON. “We must now seek ways and means to have them operate at ambient temperatures”. Fuel cells will be developed: in order to achieve this, we must overcome the stumbling blocks in hydrogen production processes that take place at very high temperatures and its subsequent storage before use.




Energy storage engineers: absence or lack of storage facilities slows down the development of alternate energy provisions. “We must therefore now invent ingenious relay-systems, as buffer zones for energy management”, stresses Jerome FAVERGEON.




Artisan engineers: every household in the future will produce energy. “Equipment installers tomorrow will still be artisan workers, but the maintenance and system overview questions, intrinsically more complex and more technological than even today will require the services of highly qualified heating-plumbing engineers”, predicts Maurice NONUS. ■


Matter and products

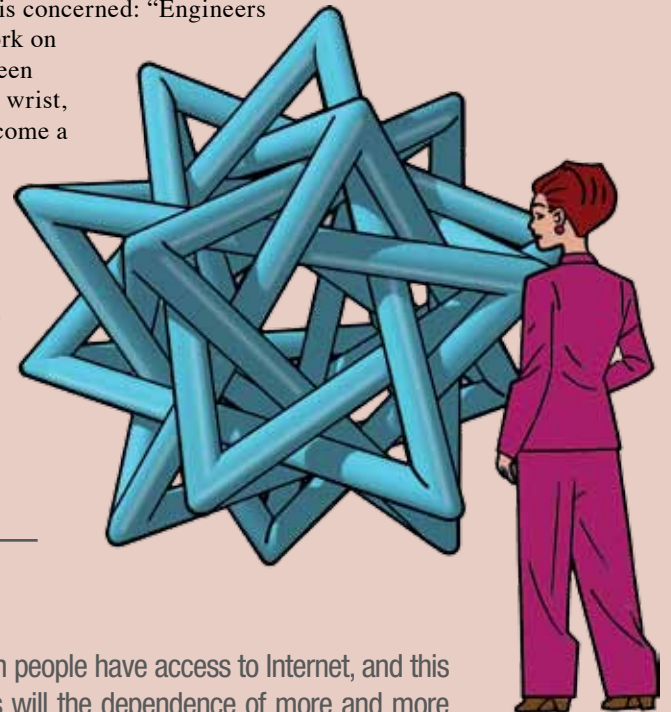
If Mankind pursues the observed trend, in 2050, 3 times more raw materials will be consumed than today, i.e., 16 tonnes of mineral and hydrocarbon resources per year and per inhabitant. This will no longer be a sustainable. We must therefore learn to do more and achieve more with less.

 **The "smart materials" engineer:** what we call "smart materials" are those that change properties as a function of external stimuli (temperature, pH, humidity, etc.). "Shape memory materials can change their structure (hence their properties) as a function of a change in temperature. Thus, we can find them in bra underwires and stays as we can also find them in aircraft wings!" says Jerome FAVERGEON, by way of examples. "When a plane takes off or lands, the wing can be designed to adapt according to outside temperature, speed, airport altitude... this making it become close to bird-flight". Nano-materials are also becoming familiar, day by day.

 **The eco-designer engineer :** "Eco-designing will become commonplace practice", feels Jerome FAVERGEON. "Repair jobs being those that leave the lowest environmental print, engineers will have to learn how to design and produce economically viable and repairable products". The raw materials used will also have to be recycled locally. "From design stage forward, engineers will also have to think in terms of local recycling", adds Maurice NONUS. For undergraduate Elsa RESCAN, engineers in life-cycle analysis (LCA) will hold key positions in the future; lastly, chemical scams and scandals and general scarcity of raw materials will demand that we find substitutes for a growing number of components. "The question is, how do we replace them and at the


same time keep the product's initial properties?" wonders Gilles BOUVIER. "Substitution engineers will be essential when it comes to defining and drafting new standards".


 **Designer-engineer :** There can be no doubt here, as far as Jerome FAVERGEON is concerned: "Engineers will have to work on communications between men and objects". The wrist, for example, could become a watch, the ear and mouth a telephone ... adapting an object will be based more on design considerations and the value of the interface with men than on the technical content and functionalities. ■




The Internet


By year 2014, there will be more mobile phone contracts than Earth's inhabitants. Today, some 2.3 billion people have access to Internet, and this figure has doubled up over the past 5 years. The observable exponential growth here will continue, as will the dependence of more and more industrial/commercial/service sectors to requirements of a digital world.

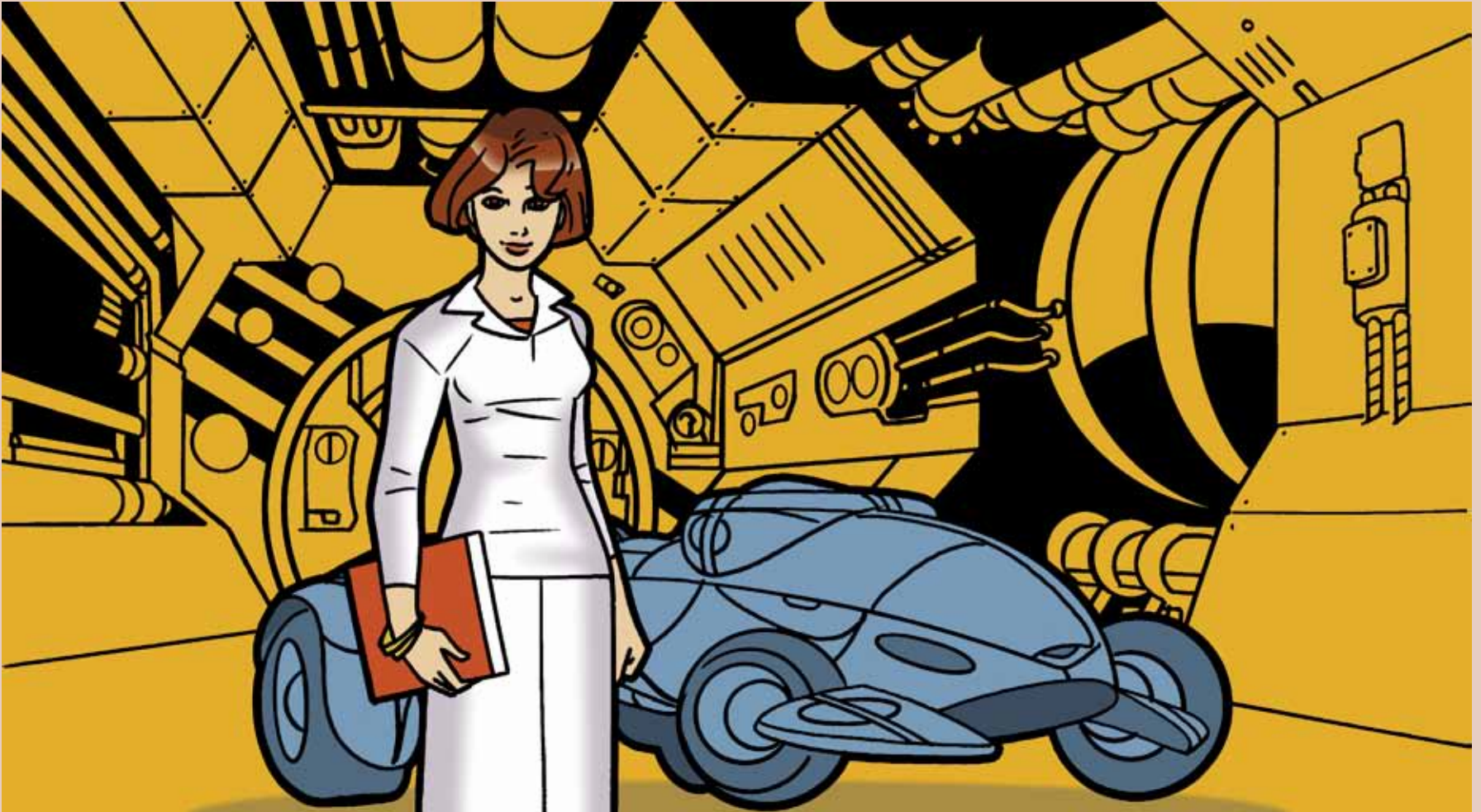
 **Anticipatory engineering :** for Etienne DEPARIS, the challenge for Internet and Internauts is how to anticipate on uses. "Democracy might take the Internet on board, with on-line petitioning and on-line administration? What form will new economic relationships take: barter, sales, development of free services, micro-finance offers, new forms of money independent of central bank authorities such as Bitcoins ?" Engineers will have to manage and make safe the servers used, to design software to guarantee confidentiality in exchanges, non-volatility of virtual money, etc. The requirements for safety and open access to interfaces must be reconciled. "Internet will be accessible via mobile phones. The mouse will be replaced by tactile moves, but not the keyboard. We then have to start thinking about the absolute convergence between the phone, the desktop and new modes for man-machine communications" feels Etienne DEPARIS.

 **Internet protection engineers :** "It is little known that petroleum products are present in 90% of all parts in a computer. Could foreseeable scarcity of resources be a draw-back for future digital development?" asks Etienne DEPARIS. So-called data centres are consuming more and more energy just to cool their servers. On YouTube® for example, the number of hours of video posted daily has risen from a factor 8 to factor 48 between 2007 and 2011 will 3 billion connections per day! Soon, our standard high disks will be overtaken by SSD storage both in storage capacity and in price. Life expectancy for new systems will be 5 to 10 times longer; "On one hand, Google® and Facebook® are continuously replacing their data bases; on the other the NASA are looking for computer replacement parts going back to the 1970-80s. There is a job here for engineer-recycling specialists for computer

components: what are these reusable parts? How can we reintegrate them in less "hectic" uses than Google® and/or Facebook®?"

 **Cyber-crime expert engineers:** cyber-attacks will become more frequent. "Countries will equip themselves to the point where they can remotely destroy the electronic networks of enemy countries, as was done to the uranium enrichment sites in Iran, for instance" says Vincent DELAGE. In this new battlefield, the 13 Internet server roots represent primordial nodes and a breakdown here could adversely and globally degrade the Internet. "Several cyber-attacks have been signalled over the past few years" underlines Etienne DEPARIS. As far as engineers are concerned, the fight against cyber-crime opens up employment and business prospects in terms of network safety assurance, digital spying, anti-virus package design, etc.

 **Robotics engineers :** in a global context where salaries are being levelled out, robots and automats will more frequently take their place on the assembly production lines, and likewise in the area of services for individual persons, notably among the elders, or in contaminated areas. Robotics and automation science open up a vast range of possible new jobs. "We can already imagine forms of artificial intelligence (AI) specifically designed for special purposes: selling airline tickets, ordering in a fast-food outlet, optimising the number of moves a plough must make to cover a field, register a delivery request over Twitter®, etc. By 2050, voice recognition software will no longer make mistakes" feels Etienne DEPARIS. The changeover to AI will require us to encode the use for which it will be designed and to ensure that the system still benefits from human surveillance. ■



Urban development and transportation

In year 2050, 70% of the world's populations will live in cities. We therefore must set up acceptable life-styles for the future polycentric megapoles.



Urban mobility engineering: How are we supposed to reconcile the growing trend towards polycentric travel and reducing emission of pollutants? Gilles BOUVIER illustrates this, with an example “The Grand Paris Plan (Greater Paris) raises questions about mobility management, with the sub-questions related to traffic fluidity and reliability. How can we avoid traffic jams and encourage mixed mode travel, whilst reducing CO2 emission levels?” The answers lie in policies in favour of mass transport systems and renewable energy powered vehicles. “Another promising area is to automate the driving function, up to and including driverless vehicles, with ecological applications. An electric lorry could haul, i.e., ‘pull’ lines of coupled cars, with better aerodynamics and reduced fuel consumption”, imagines Vincent DELAGE. “Likewise, with some imagination, lines of aircraft! Artificial Intelligence (AI) could be used to programme the journeys, much the way that drones today can fly in formation”. Etienne DEPARIS envisions the gradual disappearance of driver/pilots (in trams, buses, metros and even planes); they would be replaced by computer scientist-engineers.



Local charm engineers: “Now that we are in a world of major works and absolute urban, planning, we see that more participative actions are in order. Engineers must act as go-betweens for technical, social, aesthetic issues, etc. and must be able to explain clearly the urban projects to the citizens concerned by them. The challenge is to assure as best as possible the happiness of all. They will need to integrate parameters such as feelings, the local spirit and charm that simply are not dealt with by purely functional approaches,” says Elsa RESCAN.



Urban density engineering: urban spread will crystallise oppositions because agricultural land and natural unspoilt countryside will inexorably disappear. “Engineers will address the question of designing compact homes that remain pleasant places to stay”, underlines Elsa RESCAN. New rights such as access to daylight will arise. Certain towns are already enforcing local legislation to specify the amount of sky than can be seen from any home”.



Engineer-artists: How are we supposed to avoid 7 billion inhabitants suffering from stress and falling into depression? “Engineers will need to work with architects and artists, the first-named offering a novel, different viewpoint, and new experience with urban situations” surmises Elsa RESCAN. “Engineers will invite citizen to co-construct their designs, to make the most of available space, using renewable ephemeral materials, such as wood, for intense usage. Not only must they comply with a given framework, but also with numerous standards using their imagination to do so.”





Silence engineers: on a densely inhabited Earth, noise will become a sensitive issue. “Technologies are being developed with a lack of consideration for the noise parameter”, feels Jerome FAVERGEON. “In our countryside, people who live near wind-farms are beginning to complain about the adverse effects of inaudible frequencies that nonetheless disturb their auditory system. In urban areas, noise emissions from transport system sources must also be limited”. ■


- Ingénieur en migration environnementale • Ingénieur en densité urbaine • Ingénieur-designer • Ingénieur en sobriété • Ingénieur artistique
- Ingénieur en "smart materials" • Ingénieur contre le gaspi alimentaire • Ingénieur en biologie 3D • Ingénieur en protection d'Internet
- Ingénieur en accès à l'eau • Ingénieur en stockage • Ingénieur en silence • Ingénieur en création du vivant • Ingénieur en robotique...

Climate change, global warming and biodiversity

By year 2050, the Earth's mean surface temperature will have increased by between 1.4 and 3°C, with serious consequences on nature's balance factors. Accelerated degradation of present biodiversity is already hampering our capacity to adapt and access to drinking water will become more and more a danger fraught issue.


 **Environmental migration engineers:** environment-induced migration (over 150 M people displaced by 2050) will become a huge challenge. "Engineers everywhere will be mobilised to solve logistics problems to provide aid to climatic and other environmental refugees, in UN, State or association aid structures," asserts Vincent DELAGE.

 **Climate change engineers :** engineers, without going as far as geo-engineering, will be called upon to participate in rehabilitation programmes for zones that, for example, have become deserts, or in creation of a quality of life that is seen as acceptable for those who live in extreme condition areas. "How can we induce rainfall? How can we re-plant a vegetable cover? Engineers will naturally be working with biologists, with climate experts, etc".

 **Biodiversity rehab. engineers:** in order to combat degradation of biodiversity and to better understand the links among

species, modelling and cartography of eco-systems are essential. "We must also make artificial habitats, that will be co-designed by engineers and biologists", feels Vincent DELAGE.



 **Water access engineering:** "Access to clean water will be an issue every bit as vital as questions of energy procurement", says Daniel THOMAS. The professions of water treatment and sanitising will become primordial and there will be a return to solutions that were seen as out-of-date, such as lagoon construction, in a "systems" logic approach. "The major companies Veolia and Suez have excellent market positions and innovative engineering know-how. Veolia, moreover, is a party to the UTC PIVERT programme, designed to valorise by-products of bio-polymer sanitising with an industrial approach to metabolism", recalls Daniel THOMAS. Dealing with medicinal drug residues, nanoparticles, endocrinal disturbance agents, antibiotics will also be major challenges. ■



110 future professions

The list according to the UK foresight cabinet Fast Future, contains some future jobs from which 20 are selected as being the most representative. In order, we have, quote: 1. Body part maker; Nano-medic; Pharmar of genetically engineered crops and livestock; 4. Old age wellness manager/consultant; 5. Memory augmentation surgeon; 6. 'New science' ethicist; 7. Space pilots, tour guides and architects; 8. Vertical farmers; 9. Climate change reversal specialist; 10. Quarantine enforcer; 11. Weather modification police; 12. Virtual lawyer; 13. Avatar manager / devotees; 14. Alternative vehicle developers; 15. Narrowcasters; 16. Waste data handler; 17. Virtual clutter organiser; 18. Time broker / Time bank trader; 19. Social 'networking' worker and 20. Personal branders.

plus d'infos ► <http://fastfuture.com/?p=129>



Demography and health issues

Certain global factors of balance will totally changed when the Earth's population reaches 9 billion, 2 of whom live in Africa, 5 in Asia and less than 660 million live in Europe.



Old age engineering: somewhere between 2000 and 2050, the proportion of elderly persons will rise from 10% (yr 2000) to 22%. Medical support devices, prostheses, bio-engineering and bio-mechanical engineering will help assure autonomy for these seniors at home. "Prostheses will become increasing complex and will be adapted to each specific case", predicts Christophe EGLES. "Ceramics and polymers will replace metals". Engineers in 2050 will have to adapt to constant renewal of materials, techniques and technologies in this domain. They will also have to invent all sorts of new materials and techniques, so that the elderly can continue to stay at home, if they so wish.



Food waste engineers: How are we going to able to feed 9 billion inhabitants on Earth in year 2050, when already 1 billion today are suffering from hunger? "Engineers will be require to invent new consumption modes that help reduce waste, discarded food", says Maurice NONUS. Between one third and one half of the foodstuffs produced today in the world end up in the garbage bin. Moreover, production of agricultural foodstuffs must be optimised, rationalized. "The question is, are GMBs an opportunity or should they be relegated as potential risks?", asks Vincent DELAGE.

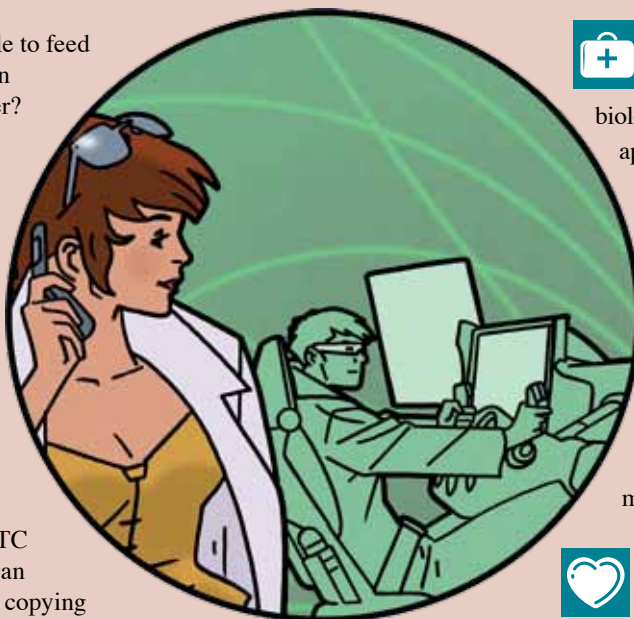


Regeneration engineers: "Stem cells will be used for a large number of repair applications for the human body, or to fight against new illnesses or epidemics, etc. feels Vincent DELAGE. "UTC Compiègne is already studying the issue of external organ replacement: for example, a liver can function correctly copying kidney dialysis processes. On the contrary, it is still a highly complex question when we want to reintegrate the organs in the receiver body, mainly because of immune system rejection following the transplant operation", explains Christophe EGLES. Nanotechnologies will also be called on to assure certain body functions, and will be able to target designated cells and destroy them.



Engineers in creation of living materials : according to the OECD definition, from <http://syntheticbiology.org/>, "Synthetic biology is: (1) the design and construction of new biological parts, devices, and systems, and (2) the

re-design of existing, natural biological systems for useful purposes". "Synthetic biology mobilises almost all engineering sciences to invent new combinations of living matter", notes Daniel THOMAS. Application areas are vast: agro-food, bio-chemistry, health, environment, cosmetics, etc. A recently established 'observatory' tries to anticipate the possible ethical issues which allow us, for the time being, to modify only marginally certain reactions of the micro-organisms. "By 2050, we shall be able to create totally new plant functions", predicts Daniel THOMAS.



The bio-system engineer: Daniel THOMAS deciphers the change as follows "reductionist approaches in biology will give way to more systemic visions". A systems approach enables you to study "rugged systems", such as occur with cancer and these can be destabilised. "In cancer, the functions that programme cellular death, known as apoptosis simply disappear. By studying cancers systems, we might learn how to reprogramme apoptosis and this could be far more efficient than chemotherapy!" explains Daniel THOMAS. "A systemic approach allows you to better understand the mechanisms behind certain biotechnologies and in synthetic biology. We could thereby develop GMBs in a more accurate and specific way."



3D biology engineering: the advent and development of 3D printers, coupled with stem cell culture and engineering opens up a field to create cellular tissues: skins, functional organs, etc. "By programming their compatibility with the receiver's immune system, the printers will be able to create new technology-intensive implants: eyes to see further, more agile hands, stronger arms, etc.," surmises Vincent DELAGE. "Of course there are ethical questions in parallel: should we compensate for lack of functions, should we address vital life-sustaining needs, or contribute to certain desires to avail of higher levels of technological or military power?" ■

What other jobs do you foresee ? React on Facebook, Twitter and www.interactions.utc.fr

Seen on the Internet

Work and employment in 20 years' time : 5 questions, 2 scenarios and 4 proposals [Le travail et l'emploi dans 20 ans, 5 questions, 2 scénarios et 4 propositions] Centre d'analyse stratégique, July 2011.
www.strategie.gouv.fr/content/le-travail-et-lemploi-dans-vingt-ans-5-questions-2-scenarios-4-propositions-note-de-synthese

Mid-term job-creating sectors [Les secteurs créateurs d'emploi à moyen terme] Centre d'analyse stratégique, January 2012.
www.strategie.gouv.fr/content/les-secteurs-createurs-demploi-moyen-terme-note-danalyse-258-janvier-2012

Will the ecological (re)conversion of the economy provide more jobs? [La (re)conversion écologique de l'économie sera-t-elle source d'emplois ? Green Forum 2011, organised by WWF. www.lepublicsystemepco.com/files/modules/documents/synth-se-green-forum-2011.pdf

The internet site "Raise the Bar for engineering", under the heading "The future engineer" by the National Academy of Engineering (NAE-USA) about Engineering in America from 2020 to 2025.

www.raisethebarforengineering.org/future-engineer

"The shape of jobs to come 2010-2030" [a study carried out by the foresight cabinet Fast Future <http://fastfuture.com/?p=129>

A refreshing look at Innovation

Christian Estève, has chaired UTC's Academic Board since 2005. He was Vice-President for the Renault-Nissan Alliance and was party to the start of the Government programme Investments for the Future (Ministry for Higher Education and Research). Before stepping down from the Academic Board in March 2013 and becoming Chair of the UTC Foundation campaign committee, Christian ESTÈVE gives Interactions his dual vision of how the engineering profession is changing and in innovation.

How do you see the engineering profession change?

The main change will encompass a more operational stance. Freshly graduated engineers must be operational as soon as they are recruited, since the companies they join will not have any spare time to pursue training. The graduates will also be part of an accelerating world, with its cortege of rapidly created and equally rapidly destroyed professions and whole business sectors. The business environment is undergoing constant change. Today's engineers must adapt and question themselves constantly. At Renault, our management teams began asking questions whenever any part of the corporate organisation did not change. Globalisation forces us to adapt and neutralises any desire to hide behind a bush, so to speak. In the automobile sector, in Europe, we have run into a major period of disequilibrium, mainly due to basic production over-capacity. But this, in turn, opens up opportunities for new technical solutions and the launching of new models such as the Bluecar by Bolloré that will soon be market ready. In this context, priority must be given to orienting our engineers to engaging in more innovative areas. It is one of the strong features of UTC Compiègne to open paths like this and placing research and innovation at the very heart of the teaching curricula.

Could innovation be the solution to today's economic doldrums?

Innovation is a prerequisite. But then you still have to turn promising ideas into economic winners. The concept of the entrepreneur is every bit as important as that of the qualified engineer. Our engineering schools (les grandes écoles) should not limit themselves to turning out management level engineers for the major industrial groups or for French Administration. They must also teach young people how to face risk intensive situations and help them assume and accept taking risks. The whole field of teaching entrepreneurship in France is wide open. Tomorrow's wealth will depend largely on today's next generation entrepreneurs. Indeed, we can see UTC's new Innovation Centre as a concrete translation of this guiding spirit at UTC insofar as it will accompany young creators of start-ups. The UTC local innovative ecosystem, largely due to the initiative of Prof Alain STORCK, is totally in phase with the logic exposed here. We must do everything we can to encourage innovation and entrepreneurship.

How do you explain the typical French fears faced with entrepreneurship?

Well, one answer is that the question of 'enterprises' is nowhere central in school programmes in France. On top of this, there is a paralysing premonition faced with possible business failure. Going bankrupt is seen in France as a terrible, stymieing set-back whereas in other countries going into receivership three times is often seen as the best guarantee that the fourth time round will be a profit-making bonanza! We must also change our attitude to science per se – there is a high degree of a priori distrust. If we fail to do this, France will become a 'living museum'. When I negotiated the buy-out of Dacia by Renault and started the assembly lines that produce the Logan, I realised that intelligence was totally pervasive, everywhere. Rumanians can produce just as well as we can (or even better) because they adopt a more pragmatic vision than we do to automobile assembly. In France, we tend to prefer well marked tracks rather than going down the albeit more risky roads opened by research and innovation.

Has the Government 'Investments for the Future' funding provided new impetus to innovation when creating value?

After I left Renault, I simply thought it was important that in a world where access to knowledge was becoming "open shop", we needed to upgrade innovation and value it as a national priority

including it in an overarching process that will hopefully save our children from difficult times ahead. And that was why I got involved in the Government Investments for the Future programme. This Government funding programme represents a powerful leverage even through I regret when I see how it is slowed down by administrative hurdles that lower the competitiveness of the projects designated as worthy of support. Some projects advance well; others get bogged down just because of these admin. brakes. We must be aware that the rest of the world is not going to slow down just for us!

What memories will you cherish after 8 years' office as Chair of the UTC Governing Board?

I personally took great pleasure in co-setting the heading for our University, along with all our research scientists. UTC Compiègne now has an internationally recognised status and is a magnificent tool that the university corps of research scientists must defend and see flourish. ■

DID YOU KNOW THIS ?

The Government programme Investments for the Future (IF) was launched end-2009 with an earmarked 35 billion euros, to bring France to the forefront of innovation in 5 domains: higher education and training, research, industrial sectors and SMEs and sustainable, digital development.

All current calls to tender in the IF Programme are at:

<http://investissement-avenir.gouvernement.fr/content/action-projets/tous-les-appels-%C3%A0-projets>

QUALITA 2013

March 19-22 mars 2013

UTC and RUFEREQ co-organise the 10th International Conference on Quality Assurance and Safety, in Compiègne. It is a forum for academics and industrialists on safety measures and associate research in quality assurance and operational safety. www.qualita2013.sciencesconf.org

Art and Technology

March 19, 2013

For the 16th time, the Composites Festival organises a national conference in Compiègne, with UTC, to address the challenges at the interface of art and technologies; this year's thematic is the relationship Virtual vs Real worlds. Several UTC lecturers and researchers will be participating. www.utc.fr

Springtime in Industry

March 14 - April 7, 2013

The theme chosen for the 7th edition of Springtime in Industry will be "Design and new firms of production/ consumption serving competitiveness and employment". Emmanuel CORBASSON will be organising several workshops at UTC Compiègne. www.utc.fr

UTC present at the 2013 RUE

March 27-28, 2013

UTC Compiègne, with the other French UTs and the pole known as Sorbonne Universities, will be present at the annual r/v of the universities/ economic and institutional actors, at the Paris Palais des Congrès; presentations will be made for the UTC Innovation Centre and the training and research branch unit at the University of Shanghai (UTSeuS). www.utc.fr

Picard'IT Days

March 28, 2013

UTC Compiègne will take part in the Picard'IT Days at the Megacity-Amiens. On the agenda: ITC technologies and challenges, ITC in enterprise and local authorities, as used to modernise their IT systems. UTC Compiègne will present IT innovations by both students and research staff. www.utc.fr

SÉMINAIRE

"We must build up warmer technologies"

"Now that was what I call a terrific seminar!" says Charles LENAY, who headed the Phiteco Seminal Conference, held January 21-25, 2013 under the banner "Perceptive meetings and technical supports to thought processes".

Since 1989, the Phiteco Seminal Conference has provided an opportunity to weave a balanced dialogue between scientific research, philosophy and technological development. "We are investigating phenomena that relate to perceptive interaction such as the meeting of two similar perceptive activities, e.g., caresses or glances" adds Charles LENAY. Just how do technical supports interact with personal and social development? This is a huge question area under study here, addressed by many experts from round the world: Bernard Stiegler (IRI), Ezequiel Di Paolo Ikerbasque), Anne Guénand (UTC Compiègne), Vasudevi Reddy (Portsmouth), Caroline Hummels (Eindhoven), Bernard Devauchelle (Faire Faces), Tom Froese (Mexico), etc. "Design functions – directly involved in this approach – are under the limelight this year", continues Charles LENAY. Designers, on a par with a more technical viewpoint, identify the support bases of social interaction and explore new forms of interaction that become both the subject and the means for research. Speakers at the conference also addressed

the thematic of perception of others via available technologies. An example is the interactive mat, a realistic meeting through a tactile phone, or a simple lighting up of a luminous signal on the screen of someone we miss. "The impression of the presence of another person is in fact the perception that the other person is perceiving. We must now develop warmer technologies that induce meetings rather than isolation, while enhancing our autonomy", explains Charles LENAY. This is the research called perceptual replacement, for persons with sensory deficiencies. "UTC Compiègne is at the cutting edge in terms of aids for the blind". For the first time, the Picardie Region has supported the conference, providing 6 000 €. "We hope to be able to answer European calls for projects to help make this enactive approach, specific to UTC Compiègne, better known outside France, inasmuch as it underscores the importance played by technical supports in cognitive interaction." ■

 www.webtv.utc.fr

CHAIRE

Better bio-predictions for better health

The UTC University Chair for Mathematical Modelling and Systemic Biology applied to Predictive Toxicology, created in a partnership with INERIS 4 years ago, has now gained an international recognition in bio-computer sciences. Those most interested in this is venture are in the pharmaceuticals sector.

"Our expertise is sought in the context of European projects and we are engaged in discussions with a major French laboratory to create novel bio-computer science tools that will allow us to predict much farther in advance the degree of toxicity of given medicinal drugs", explains Frédéric Y. BOIS, who currently holds the Chair. What active principles are promising and what are those that have dangerous side effects? What answers can genomics bring to these questions? "Mathematical modelling helps out biology to list and rank a multitude of transcriptomic, proteomic and metabolic data that we gather", details F.BOIS. Recent scandals involving fatal side effects are there to remind us of the intrinsic challenges that these issues raise for the pharmaceutical sector – also called upon to abandon in vivo animal tests for their molecules and products, for economic, ethical and scientific reasons. Hence the move to testing with human cells. In the European project PREDICT-IV that has been under way for 4 years now with INERIS aims at predicting in vivo toxic levels of medicinal drugs on an in vitro lab bench. A thesis in this area will soon be defended to analyse and predict cell response to oxidising stress. The Chair was also selected for another European project, StemBANCC, where studies started in October 2012. The work here relates to the setting up of a pluripotential induced stem cell bank, i.e., human blood cells that are induced to return to their initial stem embryonic cell format, before they differentiate to fulfil various organ related functions.



"this enables us to access an unlimited number of "normal" human cells to carry out therapeutic and prediction tests", surmises F. BOIS. "My Chair has also been approached inasmuch as bio-maths are fundamental to characterising stem cells and transposing the results to the rest of the human body." The Chair is financed via a grant from INERIS to UTC's Foundation for Innovation, and allows for advisory work for partner enterprises; it also led to the creation of the UV BI01 Unit in Bio Computing Science which registers 25 students a year. One of these students has carried out an internship with Siemens at Princeton, NJ and post-graduates have been recruited by Rutgers University (USA), by Cosmo Company (Lyon) and by Laser Analytica (Paris)... ■

 <https://sites.google.com/site/utcchairmbsptp/contact>

RECHERCHE

Will cars soon be able to 'talk' to each other?

Every year, thousands of people die on the roads across Europe. For this reason, several research establishments are currently developing programmes to facilitate travel and make it safer, while reducing traffic impact on the environment. One of the paths explored is to develop inter-vehicular communication so that road safety or weather condition alert messages can be forwarded by wifi from vehicle to vehicle. The European Union recently allocated a specific radio-frequency band for such future applications.



Inter-vehicular communication is a sub-set of a wider class of phenomena, known as dynamic networks.

The latter consist of individual computers coupled together in networks where links are constantly created or lost, whereas in conventional networks the computer links are far more stable. The networks may be composed of vehicles, robots, drones, etc. The main challenge, when we want to use a dynamic network, is to find and use the best balance between range and performance; If the transmission range is too high, the target vehicles, etc., would maintain their contact for a longer period but would also receive too many messages, i.e., including those devoid of immediate interest. Moreover, there would be interference phenomena, hence lower performance ratings using current technologies; the aim therefore is to have lower range devices and information selected on a basis of the exact geographic position of the vehicles.

The Airplug software package receives and forwards messages

In order to study dynamic networks under the best conditions, the Heudiasyc "RO" team (Networks and Optimisation) have deliberately chosen a mixed theoretical and field-test approach. As Bertrand DUCOURTHIAL sees it, both angles are necessary. "Road experience provides new ideas while theory comes up with solutions that help solve practical situations." The team has developed a software package called 'Airplug', to test and validate the hypotheses and the algorithms developed. The latter are designed to handle system outages and temporary loss of signal (LOS) between vehicles. "The software is also capable of "recognising other vehicles on the same road but oncoming, as well as those heading in the same direction but in a different lane. In this way" says Bertrand DUCOURTHIAL "the vehicles only receive those messages that they are supposed to pick up". Once the Heudiasyc RO team has programmed its algorithms in Airplug, tests will be carried out on the roads in and around Compiègne. Of course one of the main difficulties of the experiments is that the environment is constantly changing, as the traffic itself changes. This inter-vehicle communication mode will help improve road safety. With the Airplug software package, if a

vehicle brakes suddenly, i.e., makes an emergency stop, or if the weather conditions are worsening (with the wind-screen wipers and head-lights on), the car can send an automatic status alert to nearby vehicles. In this way, the drivers can anticipate an impending danger, simply by slowing down, for example. Going farther, we could imagine the vehicle receiving parameter change orders. For example, the smart car team at Heudiasyc proposed stiffening the accelerator pedal movement, thereby discouraging the driver from accelerating in a potentially dangerous event ahead. With such a system, real-time alerts can be issued about traffic jams, road works, slow traffic, etc., and drivers can adjust their road manners accordingly. If a car is involved in an accident, an alert message could be issued and transmitted with exact GPS references. Road intersection traffic lights can be fitted so as to shift to green when ambulances (or other emergency vehicle) are approaching. "Tourist type information can be issued, such as pump prices ahead, and even 'chat' facilities could be offered," Bertrand adds.

Special relay antennae for certain road segments

In order to have a robust system, you need to have a sufficiently dense set of vehicles equipped with the Airplug package. On roads with low traffic levels, you could install relay antennae in the dangerous bend sectors that would store and forward information between two car passés. Using such communication antennae and also the 3G mobile phone networks, vehicle networks would receive and store road and weather conditions, traffic levels and problems, etc., and would forward these to vehicles before they reach the zones and also to inform the appropriate road authorities. To expand the possibilities of the system, the Heudiasyc research team are working on what they call 'augmented status. "Cars equipped with Airplug share data produced by their sensors and build up a collaborative, reliable, accurate information, that can be sent in a few bounds either to approaching vehicles or to the infrastructure authorities, via road-side antennae", explains Bertrand DUCOURTHIAL.

Data and Information content control is essential

However, if we want a fully efficient inter-vehicular communication mode, we still have a few problems to solve, described briefly by Bertrand: "Firstly, the system must not only be able to authenticate the origin of information by positively identifying the emitter, but must also ascertain that the alert is not due to a system failure. Moreover, with the equipment as it exists today, information cannot be forwarded, generally speaking, beyond a small number of vehicle to vehicle retransmissions. The range of the

French national record for Julien Bahain and Patrick Favre

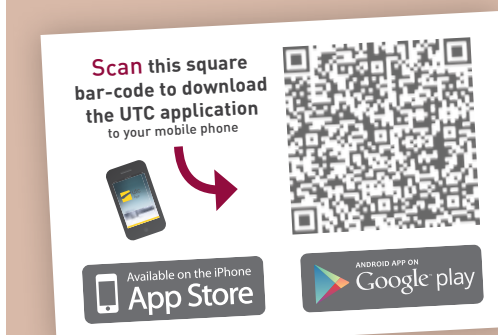


It took 49 days, 2 hours and 59 minutes for Julien BAHAIN [bronze sculls medallist at the Peking Olympics] and his comrade Patrick FAVRE to reach the French island of Martinique, Feb.26 at 13h59 local time. Family, friend and UTC supporters welcomed them to the pier landing stage, after 864 000 oar-strokes! They did not break the world record – which stands at 45 days, 4hours and 19 minutes, but they did achieve the 8th world time for this crossing, beating the national record held by Jo LE GUEN and Pascal BLOND, 1997.

plus d'infos ► <http://www.tremplin-utc.asso.fr>
<https://twitter.com/JulienBahain>

Creation of a specific UTC Apple® "appli"

UTC Compiègne now has its own official Apple® "appli" for iPhones, iPads and Android Smartphones. The appli is designed for all present and future UTC undergraduates, their lecturers, the research staff ... and indeed anybody who is hearing about interested in UTC activities and news. All items on the interactions.fr site are accessible, as are the videos, the UTC Facebook , plus a host of other useful information. ■



equipment in the test configurations is set at 400m, but more recent equipment, that comply with a new onboard wifi standard (IEEE 802.11p) should extend the range to 800m. Certain transmission channels have been reserved for exclusive priority safety alerts. These changes should allow for a better, more fluid inter-vehicular data flow." The Airplug system could be rapidly deployed to all vehicles, if the price is reasonable and seen to provide a real service to drivers. One factor in the cost of installing such a system, would be to use the sensors that are already factory fitted to new vehicles. Nonetheless, to pursue and develop the system in the future, more research is needed particularly in terms of protocol standards; decisions will also be needed to decide who is going to pay for the system and who will be responsible for operating it. ■



The art of being **rigorous** and **open-minded**

Catherine Choplin's work lies somewhere between the timeless Mickey dolls and future models derived from next Xmas's annual film, or between Space Mountain and Alice in Wonderland; she is the current Director for Merchandise Planning and it is her responsibility to organise the offer and line-up of products for over-the-counter sales in the shops at Disneyland Paris.

For the past 5 months, Catherine's life has been in tune with the activities of the Park. "I simply love the events and amusements here; they are part of the job" she adds enthusiastically.

However, she wasn't really predestined for this position at Disneyland. Catherine graduated in chemical engineering at UTC, with an optional speciality in "rational use of energy" and did a postgraduate degree in industrial process engineering, these diplomas being contemporary with the oil crises that placed energy saving issues in the limelight. "After graduating, my first orientation was re-engineering of industrial processes with energy-saving objectives, but unfortunately the attractiveness for this market slot was extremely short-lived. I wanted to move on and that was how I turned to the advisory/consultancy world", she recalls. Catherine's first employer was a consultancy office specialised in logistic affairs, where indeed she worked for 12 years. That was where she learned all about warehousing and storage operations. However, given that she felt she could not progress career-wise in such a small structure, she decided to apply for a job with PricewaterhouseCoopers. This brought her a change in scale and a change in responsibilities: "I really did learn a lot about consultancy, advising and accompanying enterprises during change", she explained. "My posting was in the areas of distribution and general public consumer products and I carried out a very important mission for the Fnac". After what we can call a sequences of lucky events, after 4 years in the advisory business, Catherine was recruited by the Fnac Supply Chain where she could implement her previous recommendations, responsible for the co-ordination of the entire supply chain. "This new posting was the perfect answer to my frustrations, common to those who work in an advisory capacity inasmuch as they never see the results of their recommendations" adds Catherine, with a smile. She was the appointed to

the Supply Chain Directorate at Conforama, at a time when this brand (as indeed the Fnac) belonged to the PPR Group. She was responsible for a team of around thirty collaborators but with a strong unsatisfied urge to leave fork-lifts behind her in the warehouses and to move closer to shop outlets and consumers.

Among numerous postings offered, one stood out: from Disneyland Paris, to become their next Director of Merchandise Planning.

"The objective I follow here is to assess the potential of each line of products and to overview their complete supply path to the customer outlets, from product procurement to the shop shelves. There necessarily is a lot of reactivity between my department and the shops and this is the rewarding part of the business. You must know that 70 to 80% of the goods we offer for sale in our Paris park are exclusive models!" she adds, delighted as she is to hold a position that allows her to rub shoulders with other worlds than those of 'pure' engineering. For example, reporting to Merchandise Planning, we find the teams of designers and artists who create future souvenirs and gifts. "This way, I work at the core of creative activities, heading a Department that brings together a great variety of personalities and professional skills in a typically rich Anglo-Saxon style and atmosphere. It's a wonderful experience, since you have to find and work together using a common language. We engineers can expand our vision professionally when we open our minds, accept the viewpoints of non-engineers and keep a rigorous approach throughout. UTC Compiègne taught me this rigour, consisting of being able to identify targets and solve problems within a given time horizon, involving appropriate team work." For students who may be tempted by this sort of job, Catherine recommends strongly that they start with a job in an advisory cabinet and then move on to those products or processes that they specially like and favour. ■

BIO EXPRESS

1962

Born in Paris

1979 - 1981

Baccalaureate D, then C, and the prep. classes for engineering school competitive entrance exams (Lycée Chaptal, Paris), based mainly on high level maths and physics

1981

Admitted to UTC Compiègne

1986

Graduated in Chemical Engineering followed by a DEA in Industrial Process Engineering

1987

Became a Supply Chain Management consultant (cabinet DIAGMA) then Retail/General public products Manager with PriceWaterHouse Coopers

2002

Joins the Fnac as Director for Operational Coordination (of the supply chain and after-sales services)

2008

Director of the Supply Chain, and Member of the Executive Board of CONFORAMA

2012

Appointed Director of Merchandise Planning at DISNEYLAND Paris



Interactions

Direction de la publication
Alain Storck
Rédaction en chef
Nadine Luft
Rédaction
Laure Verhaeghe
Marilyne Berthaud
Conception / Réalisation
L'agence
Dorothee Tombini
Assistantes
Corinne Delair
Véronique Bisiaux
Illustrations Une/dossier
Delius
Translation by
Alan Rodney, BABEL TWO
Impression
Imprimerie de Compiègne

UTC-BP 60319
60203 Compiègne cedex
www.utc.fr

Imprimé sur papier certifié
Attribution ISSN en cours
Avec le soutien de



If you prefer receiving a digitised version of Interactions, Please make your request via :
communication@utc.fr