



# DEANS' FORUM

*Creating talents for a New World*

27-28 august 2015









# EDITO



*Romain Soubeyran: a former student of the Ecole Normale Supérieure and Chief Engineer at the Corps des Mines, Romain Soubeyran is the Director of MINES ParisTech. Before taking on this job, he was the director for technology at CGG Veritas in Houston; he has also held several positions at the Ministry of Higher Education and Research. Previously he had worked at the Compagnie Générale de Géophysique (CGG) as director for technology at the seismic processing branch and at MINES ParisTech as director for the development of industrial relations and then assistant to the research manager.*

I was pleased to invite you to the first of our Deans' forums, on August 27-28<sup>th</sup> 2015, entitled Creating talents for a new world.

We organized this event to celebrate the 200<sup>th</sup> anniversary of our school's transfer in the very heart of the city of Paris.

We want to learn from other deans and benefit from their experience.

You will find, in the following pages some pictures and memories of this first meeting.

I hope you were interested by it, and look forward to meet you or someone from your institution for the second session dedicated to Women in science and engineering, end of August 2017.

Thank you again for the great success.

**Romain Soubeyran**

*Director of MINES ParisTech from 2012 to 2016*

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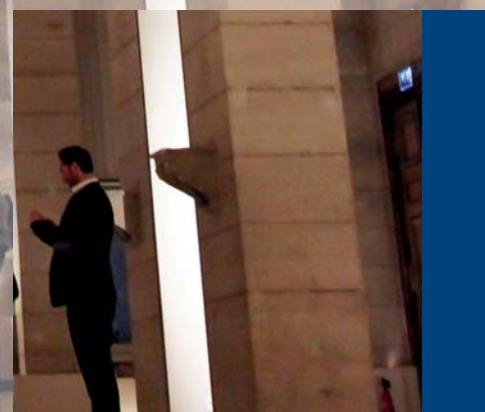
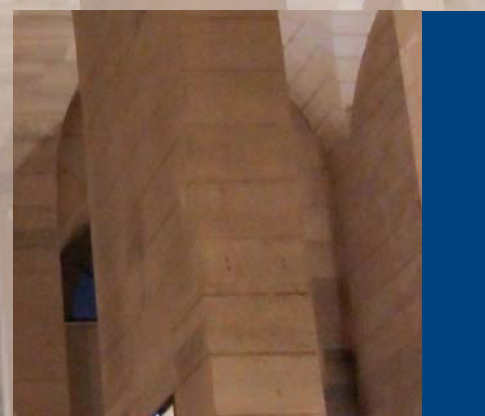
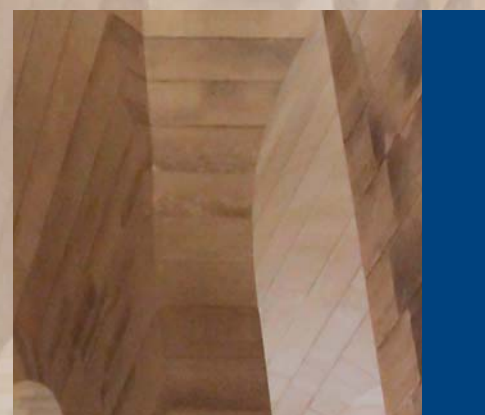
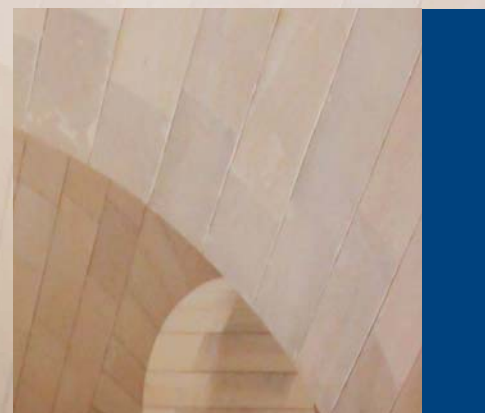
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*Eva Coupété  
PhD Candidate at CAOR  
MINES ParisTech*

# summary of all interventions

The « Dean's forum » entitled « Creating talents for a new world » was organized by MINES ParisTech to celebrate the 200<sup>th</sup> School's anniversary return in the heart of Paris. Since this come back, the world evolved, becoming more digital and open to the international. Universities and French "Grandes Ecoles" had to adapt to this new landscape.

Armand Hatchuel, Professor at MINES ParisTech, explained that in 1815, the Ecole des Mines de Paris was a professional school to train mining engineers and changed to become a multidisciplinary school with strong links with the research and the industry by, among others facts, the creation of five research centers working with industry partners and the set-up of a doctoral program.

In the next years, universities will have to overcome new challenges to prepare the new talents to the world that is being built. Nowadays, new keywords define the professional area: data explosion, multidisciplinary skills, flexibility, open source data, globalization, diverse career pathways, entrepreneurship... Furthermore, students should have a critical thinking to understand the potential scope of their discoveries, as pointed out by Ira Bennett, Co-Director of Center for Engagement, Training in science and Society at the Arizona State University.

New generations also have to face new issues like recurrent financial crisis, ecological impacts or resources depletion. Christer Karlsson, professor (Department of Operations Management at Copenhagen Business School) highlighted that incoming graduates will have to work in a multi-cultural context with the emergence of new markets. In the same time mutual expectations of the employees and the companies have changed. Companies are looking for innovative and multidisciplinary profiles and employees want dynamism, flexibility and are less willing to a strong hierarchy.

Moreover, new examples follow of "self-made-men", like Bill Gates (Microsoft), Mark Zuckerberg (Facebook) or Xavier Niel (Iliad), who built their companies without any degree, ask the question of the additional value to follow a university curriculum. Romain Soubeyran, Director of MINES ParisTech, noted that universities need to maintain their attractiveness by proposing relevant curriculum.

To meet the new world needs, universities give priority to customized curriculums and interdisciplinary skills to prepare the students to work in a changing world.

Some universities are opening divisions aboard to ease interna-

tional experience for their students and to export their pedagogy. For example Yves Berthelot, Vice provost for international initiative at Georgia Tech, presented an antenna of Georgia Tech (USA) in Metz (France). Also, MINES ParisTech trains engineers with the French "Grandes Ecoles" model in Shanghai (China) at the university ParisTech Shanghai Jiao Tong.

Exchange programs are rising to create a multi-cultural context for the students. Grants are also used to allow students from minorities to have access to a high level education, like in China, as explained by Cédric Denis-Remis, Dean at ParisTech Shanghai Jiao Tong.

To adapt to the digital world, online courses are now available like MOOC (Massive Open Online Courses) to allow students to do distance learning. At the moment, they do not all lead to a degree. At the MIT (Massachusetts Institute of Technology), as it was explained by Christine Ortiz, Dean of Graduate Education at the MIT, residential learning is still favoured because it enables to try out collaborative work and to experiment directly in laboratories. Also, the universities ecosystem, with a strong link with local companies and research centers is a basic element for the students to have a first contact with the research and the industry. This ecosystem leads an increasing number of students to create their own start-up. This dean's forum was the opportunity to meet young entrepreneurs who build their start up after their engineering studies at MINES ParisTech. Among them Franck Le Ouay, who co-founded Criteo and Honestica, spoke about his experience.

Entrepreneurship is also an integral part of numerous curriculums in order to teach the students how to be innovative in various contexts and to understand the needs of a constantly changing world.

In France, major projects have been initiated to make the French universities more prestigious and competitive at the international level. One of these projects, presented by Thierry Coulhon, President of PSL "Paris Sciences et Lettres", is to unite several high level universities from the heart of Paris under the same institutional entity: PSL, to be more visible and attractive. These developments will shortly change the university landscape in France. To prepare the new generation to evolve in a connected, changing and faster world, universities are moving towards tailor-made curriculum to pass down scientific knowledge, develop a collaborative spirit and inspire innovation.



# The Ecole des Mines de Paris:

*Armand Hatchuel*  
*MINES ParisTech-PSL Research University*  
*Member of the Académie des Technologies*

## a few lessons from a long history

I am honored that the organizers of this forum have asked me to present you with a short history of the Ecole des Mines de Paris. I'll have to be brief, but I would like to explain how we went from a Vocational Training School to a General Education School, then to a School based on Research; and how the image of engineers has changed over the last two centuries. The status of engineers as developed in France in the middle of the 19<sup>th</sup> century was invariably that of a scientist. But a scientist who also accepted explicit responsibility for his acts. The responsibility was progressively defined around three functions – critical, creative and social – whose content and relative priorities have changed and will continue to change with the major movements in technology, sciences and society. For the Ecole des Mines de Paris, we will see that these functions have been reinterpreted over time. I will present a few ideas on what this long history may mean for us in the face of our contemporary challenges.

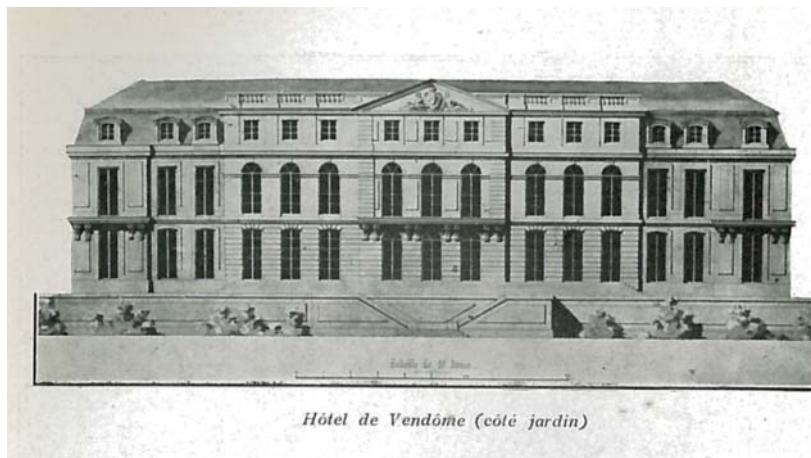
### *A tradition of historical thinking*

History has often contributed to collective thinking and orientations at the School. In 1889, at a time of major reforms, Louis Aguillon, Professor of Legislation, was asked by the board that ran the School to draw up a landmark historical report. The School was one hundred years old and the road traveled appeared to have led far from the initial project, giving rise to questions as to the choices made. This is where the historian's work takes on its full value because, as Aguillon pointed out, «We can better explain the reason behind current things when we know what circumstances they were built upon.» Since then, all the School's directors have supported historical thinking. The same holds true for the teachers at the School. But History cannot be studied without archives and without acces-

sible documents, and the School has always benefited from a high-level library which has preserved an extraordinary wealth of materials – which is now available on line.

As a reminder of some of the main chapters in the School's history, I will concentrate on how course content, pedagogical methods, the place of research and views of “the engineer” have changed over time. I am thus in line with the subject of this forum which invites us to think about what the talents of

the future will be. But it is also through pedagogical questions and the paradigms of the engineer that the School's unique history can dialogue with the international history of engineers and their training. These questions enable us to situate cultural and national particularities, both in terms of the exchanges that the School has benefited from and the influence it has had.



They shed light on the challenges shared by all major scientific training programs today.

To simplify things, I will make a distinction between three periods in the history of the Ecole des Mines de Paris. The first period was that of the Professional Mining School. This period came to an end around 1890. But the Professional Mining School did not disappear, it became part of a Generalist School that sought to train engineers adapted to all sectors of industry and more importantly their evolution. At the end of the 1960s, this second School in turn became part of a School based on Research. This does not mean that scientific research only dates from that period, but rather that the School began to be organized around research centers designed to produce and transmit knowledge adapted to a world that is innovating faster than ever before.

Each period developed a richer, more open concept of



engineers. Their scientific identity has constantly been re-asserted, but we have become more aware of the multiple functions that they have to be prepared for. This evolution does not follow a brilliant, omniscient pedagogical plan. It is the result of hard choices and inventions made necessary by the history of the world and sciences that have always held surprises over these past two centuries.

The starting point gave no hints of such an evolution. Around 1750, the noble science was that of the engineer-architect and specialists in military and civil construction. In 1729, Forest de Belidor's work, "La Science des Ingénieurs" (The Science of Engineers), became the reference and was quickly translated into German.

Faced with this noble science, which was already highly mathematical and whose exploits were visible – inherited by the Ecole des Ponts et Chaussées – the art of mining lacked prestige. It was mainly based on practice, trade and observation. Working conditions in the mines were difficult and unhealthy. And yet, at the time, Saxony had a wealth of mining activities and had set up a New School, the Bergakademie, in Freiberg, which was famous for its teaching of the Art of Mining. Here, France copied Germany and took inspiration from the Freiberg School to found the Ecole Royale des Mines in 1783.

In 1815, with the fall of France's First Empire and following a number of ups and downs, the Ecole des Mines de Paris moved into its current home on Boulevard Saint-Michel. But the teaching was still the same as when it was created and reflected its mission, which was to be a Professional Mining School.

## PROFESSIONNAL MINING SCHOOL: 1815-1890

The curriculum included four main courses, each spread out over two years. Three courses were scientific: Metallurgy; Mineralogy and Docimasy; Mineralogy and Geology; and one Mine and Machine Operations course which was to have a long-lasting posterity. This course is precisely where our image of mining inspectors and engineers comes from.

The aim was to teach an enlightened, responsible Art of Mining, as the first function of the students was a critical function: it was a question of fighting against inefficient, unjustified processes, bad practices by mine concession holders who exploited their mines poorly and endangered miners' lives.

But academic training alone is not enough for this mission. For a full mastery of the Art of Mining, solid, varied experience in the field is needed. That is why travel-study periods were so important, sometimes taking students to distant mining areas, and during which they kept a precise, accurate journal. These journals are now a major part of the School's great heritage. What was the purpose of these trips? To discover the variety of mines and mining techniques from around the world, of course, but also to demonstrate, above and beyond their critical function, the students' real capacity to discover their social function in the difficult world of miners, which is

not easily accessible and occupy the most foreign of regions. Thus, the School was right away involved in globalization.

The Professional School's mission appeared to be clear and well suited to France's domestic challenges. But new dilemmas appeared starting in 1850, requiring reflection. First of all, there was a radical transformation in the art of mining itself, which led to a series of new basic sciences. Crystallography broke new ground in mineralogy. Thermodynamics, which is the science of transformations of energy and machines, shook up Belidor's physics and required new mathematics. Chemistry, which is so important to the art of mining, underwent a revolution that changed all sciences. From then on, the traditional subjects taught at the School required a much higher general level in sciences, and this need was met by creating preparatory schools in mathematics, physics and chemistry for so-called "external" students, i.e. not from the Ecole Polytechnique.

Mining engineers continued to be people skilled in the Art, because each mine is unique. But they also shared the concept of the engineer, as an "applied scientist", which took hold during the same period. This identity contributed to engineers' especially high social standing in France. They benefited from an image as intellectuals with vast scientific culture compared with "the engineer" in the English-speaking countries, who maintained the image of a technician. Furthermore, this new identity gave the engineer's critical function a more asserted legitimacy: alongside the subtleties of training in the Art of Mining, their scientific knowledge enabled them to make thorough analyses of, and sometimes to challenge, existing procedures.

During this period, the engineer's creative function became clearer than it had been before: the function of industrial inventor. This is explained in the major reference work of the day, Laboulaye's dictionary of arts and manufactures: "The second degree of intellectual work is that of the engineer, the industrial inventor who, with a special purpose, applies acquired knowledge to industrial practices and every day creates new progress, new increased wealth."

This new concept oriented the School's subsequent choices, as events continued to arise that led the School, after long discussions, to add three courses that should be mentioned as they resolutely moved away from the initial professional model and foreshadowed the debates with which all engineering training programs were repeatedly to be confronted.

### *New dilemmas and new courses*

The first of these courses was railways. Should this have been considered a completely different industry and not teach the fundamentals of this activity? After all, the Railways were replacing the ships and coaches that the School did not cover in its curriculum. But it is also true that the railways used techniques that came directly from the mining business. Lastly, it was an activity of national interest and its wide scope was to make it the leading employer of engineering graduates. The decision to introduce this course was a wise one, as can be seen in the many descendants that were to follow. But was it the School's role to provide training for all new activities in industry? Railways were a generic activity, i.e. necessary to all



the others and an amazing source of new inventions. A different choice was made later on concerning the automobile and aviation.

The second course that broke with the past was Legislation and Industrial Economy, which is an emanation/specialization in the Mining School's operating course. The School was concerned when it was introduced – political economy was a sensitive, contentious subject. But the major developments in social questions needed to be dealt with. Child labor was banned in 1841. Students needed to be made aware of their new legal responsibilities, but without dogmatism and maintaining an engineering point of view. Aguilon gave a reminder of this: «The council, considering that it is a question of applying political economy to mines and factories, was of the opinion that these lessons should be entrusted to an engineer who alone could understand the existing relations between mining laws and the questions of the art».

The third major course that gave rise to debates was Paleontology, which also lies on the edges of the professional model. During the first half of the 19th century, Natural History became a discipline that was inseparable from geological studies: Cuvier, Lamarck and Lyell were famous, but here again there were many controversies, notably with the Church. There were careful attempts at a few conferences, then the idea of having a course was accepted, not without concerns: "It was feared that the School would be diverted from its destination by producing naturalists rather than engineers."

These three examples were forerunners to the now recurring dilemmas facing all engineering training – how should we react to the emergence of new industries? How should we integrate changes in law, social doctrines and engineers' responsibilities? To what extent should scientific progress and the appearance of new sciences be taken into account?

In response to this, the School appears to have forged a guiding principle for its approach to novelties. This consists in not integrating new fields until it is possible to absorb their content, to adapt them to needs or even to develop them in a direction that is of interest to the School. Far from freezing the program in time, this principle was to organize the transition from the Professional School toward a new model that we will call the Generalist School, which preserved the content from the Professional School while inserting it into a more universal program.

### GENERALIST SCHOOL: 1890-1967

This transition had already begun to manifest itself in the 1870s when the effects of the second industrial revolution began to be felt, notably with the growing importance of industrial chemistry and the development of the science of electricity. Furthermore, the concept of the laboratory took hold as a teaching tool as well as progress in knowledge.

At the end of the 1880s, Henry le Chatelier developed the new "industrial chemistry" in his laboratory, which was his claim to fame. The opposite was true for electricity, for which there were just a few conferences and its main teaching was shoved off to the Machines course, which had replaced the mining operations course. At the same time, there was a trend among the main courses at the School to divide up into specializations: the geology course gave rise to a new branch with the Petrography course.

In 1885, the Legislation and Industrial Economy course separated into two courses. The new course was strongly influenced by the work of Frédéric Le Play, who invented social economy by developing his famous studies on working-class family life in Europe. This teaching was also linked to "*la société d'encouragement de l'économie sociale*" (*the society for the development of social economy*), which had a strong influence on the industrials of the period.

At the end of the 19<sup>th</sup> century, the School appears to have been able to take a breath and contain the expansion of its subjects. Aguilon stated, "They wanted to stay within the specialties that explain and justify the existence of the Ecoles de Mines, they did not give in to the temptation to appear to be teaching everything, with the risk of teaching students nothing." In 1900, the School's director, Carnot, also insisted, "The main goal of the reforms was to increase courses, in response to new branches in Industry... They avoided a general preparation that is necessarily insufficient for any career in industry and, conversely, they sought to delve as deeply as possible into all knowledge concerning the mineral industry..."

But history did not come to a halt, and it even started to speed up. Since 1890, the automobile and aviation industries had become an ever greater presence. What should be done? Once again, a few specialized





conferences were attempted, but they did not repeat what had been done with the railways: there were no grand, special courses. A course in non-ferrous metallurgy was created, however, in response to the needs of new industries.

Moreover, alongside the old legal questions, questions of industrial organization were increasingly on the table. With Henry Le Chatelier, the School gave an enthusiastic welcome to Frederick Taylor and Scientific Management. The idea of “industrial science” was already very present at the School and its extension to questions of labor and organization corresponded to a new scientific approach to the engineer’s social function, which took off in the 1950s.

From 1920 to 1949, countless industrial and scientific innovations came to the School. The number of teaching programs increased considerably. The School was de facto a generalist school, but it had not yet accepted this in its mission statement, and it did not yet have pedagogical structures adapted to the expansion of this model.

## *A new pedagogical model*

That came about in 1949, when the School no longer hesitated to take a position that was the opposite to that of 1900: “We can define the School’s curriculum as a general technical curriculum.” «The extremely fast evolution and development of industry – notably the mining and metallurgy industries – make it no longer possible to hope to delve in depth into all the major techniques and sciences that students may need.» Furthermore, in the field, «engineers are confronted with much greater specialization than before...»

A new pedagogical model therefore had to be formulated for the future: «We will therefore prepare students for the range of specializations, ... We will not sacrifice our training to the benefit of technology, ... we will not shirk a difficult compromise, ... and the focus will be on the work method, ..., and awareness of the mission of the future engineer.» This model gave rise to a new study structure which now had three levels:

- 1 *General scientific education* including the classical sciences (math, physics, chemistry) as well as natural sciences in the mining tradition. This preserved the dual epistemology of modeling and observation.
- 2 *Training in generic technologies* which, in principle, are found in all industries and which include law, economics and scientific management.
- 3 Lastly, *options*, which are specialized courses in which the School’s educational traditions can be maintained: personalized tutoring, as well as teaching based on industrial internships and travel.





At the end of the 1960s, this model opened the door to new, original courses, but also to multiple options. It notably made it possible to imagine a new kind of engineer combining two mutually-reinforcing identities:

A scientific identity that is no longer just “applied” because they have to develop new sciences as well as new techniques and, for this, they must mobilize the most rigorous, most effective methods. These skills ensure their critical and creative functions.

An identity as a modern manager because they have to take on their social function as organizers and managers in the business world based on the best scientific analyses of these questions.

This model corresponded relatively well to the needs of students after the events of May 1968. It also brought many young teachers to the School, who were to become the academic management of the new model of a School based on Research that absorbed the Generalist School, which was not sustainable over the long term without new resources and major institutional changes.



## SCHOOL BASED ON RESEARCH: 1967-2014

We cannot talk about the institutional changes of the 70s and 80s without mentioning the influence of Pierre Laffitte. But his influence would have quickly eroded if it had not been supported by the State and renewed by his successors at the head of the School.

What happened? Starting in the 1970s, the School undertook two interdependent changes:

- Implementation of a new academic model that included:
  - The creation of its own doctoral program (1983) along with the development of many scientific masters degrees with universities. The curriculum followed by the students at the Ecole des Mines was equivalent to a Master of Science degree in the English-speaking countries. This program was truly successful as the School now trains nearly a hundred doctoral students each year.
  - The creation of research and teaching centers in a wide variety of fields, including economics, management and sociology.
- Definition of an original research strategy, called “recherche orientée (collaborative research)”, aimed at developing fundamental work based on industrial or societal problems.

This academic model consolidates collaboration between research and companies with the development of Armines, a private, not-for-profit operator in public research. The creation of the Sophia Antipolis technology park, for which we have Pierre Laffitte to thank, was also designed to encourage cooperation between science and development on a regional scale; the School played a major role.

With unwavering support from the State, these new institutions encourage the dynamism and flexibility of the new model of the School based on Research. The School has thus been able to: i) attract scientific staff who establish stronger, faster links between training and research; ii) quickly develop new disciplines and new research subjects; iii) support the strong expansion of collaboration with industry which is now a major share of its budget.

This model also brings new representations of engineers. Alongside the image of a scientist-manager, the engineer’s creative function is once again emphasized along with that of the designer and innovator scientist, and the scientist-entrepreneur. Thus, at the start of the 1990s, under the influence of Gilbert Frade, the School created the “entrepreneurial act”, inviting all students to develop their ability to take initiatives through personal projects.

The School also introduced several research programs and original teaching in the fields of design, entrepreneurship and innovation, some of which have become famous in France and abroad.



## WHAT SHOULD WE TAKE AWAY FROM THIS LONG HISTORY?

### CONTEMPORARY CHALLENGES AND NEW IMAGES OF THE ENGINEER

Many lessons can always be learned from such a long, event-filled history. First of all, I think the School has learned values and principles that have been implemented and are widely shared:

#### *On the pedagogical level:*

- Training for engineers is not just a matter of transfer of knowledge and also includes an educational project,
- Pedagogical methods must maintain dual epistemology: on the one hand, there is mathematical modeling, on the other, there is observation, experience, entrepreneurship and travel,
- Training for engineers cannot be isolated, it must maintain symbiotic relations with other forms of education, with business sciences, economics and society, but also with Art and Medical Schools.
- We need to increase awareness of the historical reality among our students: for two centuries, the concept of what an engineer is has evolved; it is still strongly marked by national cultures, but history also testifies to influences crossing from one culture to another.

#### *On the academic level:*

- Scientific research should be at the heart of training for engineers.
- It must be flexible and robust because the School needs to quickly develop new disciplines, but always based on solid scientific foundations to avoid academic and media bubbles.
- Research adapted to engineering training must be collaborative to a large extent, because engineers' mission is to deal with problems that arise in industry and in society, and also because fundamental discoveries sometimes arise from original studies of these questions. Furthermore, history has shown that, by cooperating closely with companies, public authorities and other university programs, the School has been able to foresee several major transformations and to prepare its students.

#### *And tomorrow?*

Are these principles still useful in the face of the major challenges awaiting us? We think so. These challenges concern all universities and, as in the past, the School will profit from following the most interesting initiatives taken in the developed world and in emerging countries. Personally, I will insist on three of these challenges





## Ecole des MINES de Paris, a few lessons from a long history

*First challenge:* the globalization in higher education is an invitation for the School to take its place in the “global village” of the university system. The School has chosen to do this by joining the PSL community, which will be presented during this forum. All the PSL establishments place great importance on the link between training and research and this point is crucial, because the engineers we train must remain high-level scientists. Furthermore, the cycle between the creation of knowledge and the development of innovations which is of interest for engineer training will continue to shrink.

*Second challenge:* the digital revolution is shaking up our own operations as much as those of our industrial and social partners. What teaching will we dispense tomorrow? How will companies operate tomorrow? We can think about this alone, but we are convinced that by maintaining strong collaborative research we will invent original forms of initial training and continuing education. As for many other revolutions over the past two centuries, the School will have to be a significant player in these transformations.

*Third challenge:* there is no denying that our times are marked by an accumulation of environmental and social crises and imbalances. The excesses of financial capitalism, the increase in social inequalities, the environmental and climate threats, the political chaos that reigns in many countries, etc. – over more than two centuries of existence, the School has been confronted with many difficult situations. All we need to do is to mention its date of birth – 1783 – to remember that, from the start, the School went through a particularly critical period in the history of the country and the world. We have every reason to believe that, as it has done in the past, it will have to participate in producing new models for training engineers. This effort will go through scientific, political and institutional revolutions in which the School will have to play an inventive role. On the road forward, there are a few lessons from its long history that can serve as guides. It is aware that the scientific training that engineers require entails close work with research. The School has also learned that the identity of its engineers is constituted through the three functions – critical, creative and social – that we mentioned above. But what content will these functions have in the future? Will others have to be recognized and will students have to be prepared for them? The importance of collective thinking on these points cannot be underestimated. On this subject, all I can do is to make a few suggestions based on work carried out at the School.

- In a world dominated by the rules of financial capitalism, it seems to me that the new critical function of engineers lies in their ability to resist the primacy of short-term financial logics alone. They can legitimately embody the value of productive investment and the need for radical innovation, whether private or public. Faced with the contemporary fears raised by a science that appears to be too blind to its own consequences, they can also try to demonstrate that the scientific approach can be oriented toward collective progress.
- Since the beginning of the digital revolution, engineers have been increasingly called upon to act as scientists who innovate by designing new techniques and new usages, and, more often than in the past, to create businesses. The new creative function thus seems to me to lie in developing robust, sustainable innovation and design methods that are up to the huge challenges of preserving the planet.
- Engineers' new social function is the product of these last two functions. It is thus a question of developing more participative and more inclusive forms of work, notably for the conduct and completion of complex, innovative projects. The task is all the more demanding in that these projects are usually carried out at globalized companies and will call for the intervention of many entities (subsidiaries, partners, associations, public authorities, etc.) in different countries and cultures. Some one hundred years ago, thanks to the scientific approach to organizations and to work, engineers contributed to an industry that is more attentive to its personnel. Today, they also have to think of ways to limit the abuses of globalized firms by improving the legal frameworks and standards that govern them. At the end of the 19th century, engineers played an essential role in the formation of modern companies. They must continue to pursue this mission today by participating in creating more responsible businesses, including in the poorest countries. Furthermore, as in the past, the School will have to respond to the humanistic aspirations of its students and society by adapting to their contemporary and future content.

These proposals are not meant to be exhaustive. Moreover, new, heretofore unknown priorities are sure to arise. That is one of the most certain lessons of history. But along the lines that we have discussed, the Ecole des Mines in 2015 is on the right road.



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# CREATING CAMPUS VISION

## CREATING CAMPUS VISION

### *From Imagination to Impact: Creating an Ecosystem for Innovation in Graduate Education*

The graduate education at MIT is characterized by the global diversity of students, faculty and programs, the research undertaken, the entrepreneurial culture and continuous improvement.

The graduate alumni are pursuing a diverse set of career paths, experiencing dynamic career trajectories; they are extensively engaged in innovation and entrepreneurship. MIT has helped launch more than a dozen companies.

*University Center of Exemplary Mentoring (UCEM)* – successful grant proposal (\$870K) which will focus on the recruitment and educational success of URM doctoral students (total cohort of 36 students).

A structured program that addresses key barriers to retention and educational success (racial, social, academic, cultural, financial and personal).

#### Pedagogical Benefits:

- Engagement with an **international community**;
- Broader set of **peer review / feedback**;
- Instant and more detailed feedback on **advanced complex problems**;
- Instant access to rare, advanced course materials;
- Support **mentor/advisee discussions**, student self-study and in-person schools/workshops;
- Hierarchical structure of knowledge: Introduction, Foundation, State-of-the-Art, Bleeding Edge;
- Improve **world-wide access** to advanced knowledge to drive forward the frontiers of research.



*Christine Ortiz is the Dean for Graduate Education and the Morris Cohen Professor of Materials Science and Engineering at the Massachusetts Institute of Technology.*

Professor Ortiz obtained her BS from Rensselaer Polytechnic Institute and MS and PhD from Cornell University, all in the field of materials science and engineering, with a minor in theoretical and applied mechanics.

Dr. Ortiz has developed a research program that focuses on the multiscale mechanics of musculoskeletal and exoskeletal structural biological materials, with the primary goal being to quantify and understand new mechanisms, phenomena, and design principles and how they determine function, quality, and pathology. She has supervised more than 80 students from 10 different academic disciplines. In her current role as Dean for Graduate Education, she leads areas which include fellowships, personal support, professional development, policies and procedures, educational innovation, academic performance, graduate admissions administration, diversity initiatives, immigration, community-building, and Institute-wide data analysis.



## *An engineering school made in France in China*

ParisTech Shanghai Jiao Tong has the objective of training trilingual elite engineers with technical skills, adapted to innovation and management, and the know-how to work in an international environment.

As part of a strategic alliance between ParisTech and Shanghai Jiao Tong University, ParisTech Shanghai Jiao Tong created an innovative academic program, designed on the French system of Grandes Ecoles, and transforming and adapting educational models to prepare outstanding engineers for the increasingly global nature of knowledge, economy, and social development.



*Cédric Denis-Rémis is Dean of ParisTech Shanghai Jiao Tong.*

He earned a Master's Degree in Environmental Resources Management, then a Master's Degree in Anthropology and, lastly, a PhD in Science and Engineering from MINES ParisTech. Since 2005, he has been working in management, safety and sustainable development consulting. He is also the author of several publications on the subject.



*Jérôme Adnot is Dean for Education at the Ecole des Mines de Paris (Mines ParisTech)*

He graduated in engineering from the «Ecole des Mines de Nancy» and earned two Ph.Ds from the «MINES ParisTech» and «UPMCI». From 1991 on, his main research theme has been the evaluation of a number of new energy techniques. He is the co-author of numerous contractual reports on the subject, namely for the European Commission and Ademe, the French environmental agency, and has taken part in 100+ scientific papers on these topics. He has been continuously teaching and organizing major courses in the energy field and became dean for all degrees at MINES ParisTech in 2013.

## *Value scale of engineering degrees in the 21<sup>st</sup> Century*

It's a common place to recognize that “engineer” and “ingénieur” are two words with differing etymologies (“engine” and “Génie”). In each region of the world, the image of a given degree reflects the position of the School (influence of alumni, institutional position in the State and in other social structures, weight of faculty, namely through research or consulting) but also the discipline (Arts vs Science vs Type of Engineering, etc.). The paper gives a comparison of various organizations of engineering degrees. In France and part of Europe, the dominant model for engineering studies was –and still is – a 5-year integrated curriculum moving from the most general scientific theories (2 years) to applications at the end. Some conclusions can be drawn from the comparative analysis. Engineering degrees are part of the social structure of a given country and will change with social expectations. There are two pieces of information expected by employers: the name of the institution (mostly the main “entrance door”) and specializations (if any or various). One day, the following prospect may become reality: two degrees will be delivered to each engineering students, one for the entrance, and one for the areas of application, as in the other Master's Degrees.



# KNOWLEDGE TRANSFER

KNOWLEDGE TRANSFER

*Managers for the extraprise*

*Management development for the global network enterprise*



Globalization, emerging economies, inter-organizational structures, technological innovations, well-educated participants, all challenge management development in universities who are often grounded in traditional programs and formats. Demands include shorter issue-based programs, measureable companies and external network effects.

*Christer Karlsson is Professor of Innovation and Operations Management at Copenhagen Business School, academic director of CBS Competitiveness platform and professor emeritus at Stockholm School of Economics in the field of Innovation and Operations Management.*

His research interests are product development management (project types and their contribution to competitiveness, the role of product platforms, cross-functional integration and project organization), product development in industrial systems (development activities deployment, development sourcing) and production system design (global production networks, sourcing and partnership, outsourcing and off-shoring, lean production). He has written a few scientific publications on these subjects.



## *Strategic issues*

I am going to be talking about (much like the other participants) challenges in training scientists and engineers to be ready to take on modern societal challenges while not creating the challenges of the next generation. The talk will outline the problems and then will transition to potential solutions that are made possible by the launch of our new school here at ASU, the School for the Future of Innovation in Society <https://sfis.asu.edu/>

*Ira Bennett is co-Director of the Center for Engagement & Training in Science & Society...*

... assistant Director of Education for the Center for Nanotechnology in Society, assistant Research Professor, Consortium for Science, Policy and Outcomes and the Center for Nanotechnology in Society at Arizona State University. He has a PhD in Chemistry and he has written scientific publications on nanotechnology.



## *Status and perspectives for renewable energy*

*Arthouros Zervos is a Professor at the National Technical University of Athens. He is Chairman of the Renewable Energy Policy Network for the 21st Century (REN21).*

He was Chairman and Chief Executive Officer of the Public Power Corporation - Greece as well as Chairman of the Public Power Corporation Renewables, both from 2009 to 2015. He has more than 30 years of high-level expertise in policy, science, research and technology across the renewable energy sector. He has led key European renewable energy bodies and has acted as policy advisor to Governments, EU bodies and policy fora. He was President of the European Wind Energy Association (EWEA) from 2001 to 2013, President of the European Renewable Energy Council (EREC) from 2000 to 2012 and President of the Global Wind Energy Council (GWEC) from 2005 to 2010. In 2013 he received the "Poul La Cour" prize for outstanding achievements in wind energy. From 1990 to 1995, he worked as a scientific officer at the Renewable Energy Unit of the DG for Research of the European Commission in Brussels.

## *Mineral and Natural Resources, The School's foundations and the jobs of the future*



*Damien Goetz is a civil engineer of the Ecole des Mines de Paris and holds a doctorate specialized in the Techniques and Economics of Subsurface Exploitation.*

He is the Research Director at MINES ParisTech. He formerly held the position of Director of the Center of Geosciences at MINES ParisTech. His career has been marked by research and teaching in the Earth Sciences, in close cooperation with surface and subsurface industries.



*Didier Nectoux is the curator of the MINES ParisTech Mineralogy Museum, after having been the curator of the Mineralogy Museum at the Ecole des Mines d'Alès. He received a doctorate in engineering geology from the Ecole des Mines de Paris in 1986.*

He was a research professor and was in charge of engineering training at the Ecole des Mines d'Alès for 20 years. He taught the petrography course and for 10 years provided field geology training to Life and Earth Sciences teachers for the Académie de Montpellier. Didier Nectoux is (co-)author of the book, «Curiosités Minérales». (source: <https://www.mooc-list.com/instructor/didier-nectoux?static=true>)





# NEW SUBJECTS

NEW SUBJECTS

## *PSL: A new opportunity for French higher education and for MINES ParisTech*

PSL is a world-class research university driven by innovation and value creation.

PSL's distinctive federal structure brings together 26 prestigious self-governing academic and research institutions, 21200 students, 3200 faculty and researchers as well as 178 research centers and over 80 libraries and museums. PSL has united the sciences, arts, humanities and social sciences in a single institution to create a unique, agile and fertile intellectual nexus where the best and brightest can share, exchange and invent the future.



*Thierry Coulhon has been a University Professor of Mathematics since 1992. Before he was elected to the Presidency of PSL Research University on 16 December 2014, he had held the position of Director of the Mathematical Sciences Institute at the Australian National University in Canberra, Australia, since 15 August 2012.*

He was President of the Université de Cergy-Pontoise from 1 September 2004 until he joined the staff of Mrs. Valérie Pécresse, Minister of Higher Education and Research, on 31 July 2008, where he worked as a special advisor and then deputy director of the Minister's Office. He then held the position of Director of the "Centers of Excellence" program at the Commissariat Général à l'Investissement (General Commission for Investment) from 2010 to 2012. He was also First Vice-President of the CPU (Conférence des Présidents d'Université – Conference of University Presidents) from 2006 to 2008.

Paris Sciences et Lettres - PSL Research University was founded on a two-fold conviction: first, that innovation and creativity are the only solutions to today's global challenges and second, that major academic centers across the globe will be instrumental in developing these solutions.

Paris Sciences et Lettres - PSL Research University brings together some of France's most prestigious and internationally respected academic and research institutions in a broad range of disciplines from engineering, chemistry and oncology to economics, management, the humanities and the performing arts. Some of our member institutions, founded during the Enlightenment, are steeped in history (the Collège de France, L'Observatoire de Paris, the Beaux Arts), while others are more recent. All of them share a resolutely contemporary and forward-looking worldview and are committed to the pursuit of excellence.

### PSL Membership ●●

Chimie ParisTech Collège de France Conservatoire National Supérieur des Arts Dramatiques Conservatoire National Supérieur de Musique et de Danse de Paris Ecole des Hautes Etudes en Sciences Sociales Ecole Française d'Extrême Orient Ecole Nationale des Chartes Ecole Nationale Supérieure des Arts Décoratifs Ecole Nationale des Beaux Arts Ecole Normale Supérieure Ecole Pratique des Hautes Etudes Fondation Pierre Gilles de Gennes pour la Recherche IBPC Fondation de Edmond de Rothschild Institut Curie Institut Louis Bachelier La Femis Lycée Henri IV MINES ParisTech L'Observatoire de Paris Université Paris Dauphine CNRS INRIA INSERM Ecole Supérieure de Physique et de Chimie Industrielles de Paris

*Educating Global Citizens:  
Internationalization of the  
curriculum and engagement in  
social and environmental res-  
ponsibility, both at home and  
abroad*

*Yves Berthelot is currently Vice-Provost for International Initiatives and Steve Denning Chair on Global Engagement, overseeing Georgia Tech's international activities in education, research, economic development, and alumni affairs.*

He continues to serve as President of Georgia Tech Lorraine (since 2006), Georgia Tech's largest and oldest international campus, located in Metz, France. Berthelot joined the Georgia Tech faculty in Mechanical Engineering in 1985. His main research interests are in acoustic materials and ultrasonic nondestructive testing.

Dr. Berthelot holds a Diplôme d'ingénieur from the University of Technology of Compiègne in France, a M.Sc. from the University of Southampton (ISVR), UK, and a Ph.D. from the University of Texas at Austin, USA.



Several studies have shown that the expectations and the attributes of the college-educated workforce in 2020 will be very different from what they were in 2000. We will briefly review some of these trends and discuss how Georgia Tech is shaping the educational experience of its students through three examples: (i) the internationalization of the curriculum; (ii) the "serve-learn-sustain" initiative; and (iii) the French-US brain bridge through Georgia Tech Lorraine.

*Complex Systems:  
New Architectures,  
New Skills*

Academic institutions continually adapt to the cycles of economic and technological development undergone by society. This presentation will describe such cycles and argue that the challenges of resource constraints and the impacts of pollution require urgent adaptation through a new engineering education based on design, life cycles and systems thinking.



*Chris McMahon is Professor at the Department of Mechanical Engineering at the University of Bristol.*

He has teaching and research interests in engineering design, especially in design informatics and in design for sustainability and resilience. From 2011 to 2013, he was President of the International Design Society.



## NEW SUBJECTS



### *Talent for the digital age: Jacobs at Cornell Tech*

Cornell Tech is educating talent for the digital age. I will describe the reasons we need to re-invent education, our thinking on how to teach and what to teach. The «what» includes discipline-based degrees, as well as new domain-based two-year degrees and a deep-technology entrepreneurship program, both run by the Jacobs Technion-Cornell Institute at Cornell Tech. Finally I will provide perspectives on the home institutes - Cornell and Technion, and future plans for Cornell Tech.

*Adam Schwartz was educated in Israel (Ben Gurion University) and the US (Brown University). He has been a professor at Technion - Israel Institute of Technology since 1984, and his research is in stochastic processes.*

He was Associate Dean of Undergraduate Studies, Deputy Vice-President in charge of IT, and Chairman of the Department of Electrical Engineering at Technion. He was involved with the Jacobs Technion-Cornell Institute from the beginning of the initiative by the City of New York (2011), helped draft the Technion-Cornell winning proposal for the city of NY and has been on the Board of Directors of the Jacobs Institute since its inception. Since 2014 he has been the Director of the Institute.





## NEW TALENTS CONNECTED TO THE BUSINESS WORLD



### *Entrepreneurship education in an engineering school: the journey is the reward*

Entrepreneurship is now an established scholarly discipline. Entrepreneurial skills have broad applicability, and entrepreneurship education is not limited to those who want to create new businesses. Developing entrepreneurial teaching and learning practices demands a shift from transmission models of teaching to experiential learning.

*Philippe Mustar is a Professor at MINES ParisTech. At the Ecole des Mines, he created the Innovation and Entrepreneurship option and the Entrepreneurship Center.*

He has published a dozen books and over sixty articles in peer-reviewed journals and academic works on the topics of innovation, entrepreneurship and public policy. As a Visiting Fellow at Imperial College Business School in London, he has advised many start-ups and is an expert with the OECD on innovation and entrepreneurship policies. He is an urban planner (D.I.U.P) and holds a doctorate from the Ecole des Mines de Paris.

### *Criteo*

*Franck Le Ouay was the conceptual brain behind Criteo's predictive tool. He is widely recognized as an expert in scalable complex algorithms.*

He started his career as a software engineer at Microsoft in Redmond, WA. He architected the graphics engine of popular console games and took part in the launch of the Microsoft Research Lab in Germany. Franck Le Ouay is a civil engineer of the Ecole des Mines de Paris.





# Roundtable

*Tomorrow's managers must understand everything*

## of entrepreneurs

*Kilian Bazin*



Kilian Bazin is the managing director of **ToucanToco** created in 2014. Graduate from Polytechnique and MINES ParisTech, he teaches in the Data Story telling and the Data Visualisation. ToucanToco publishes reporting solutions, dashboards to traders and managers.

Khady Nakoulima runs **Nest For All**, a company she started with her brother, Ousseynou, in 2009, soon after graduating from Mines-Paristech. Growing up in a family of doctors, they were both concerned about the poor conditions for women at birth. Inspired by the social impact of hospital chains in India, they decided to start Nest for All, a network of clinics providing quality health care services for women and children at a reasonable cost.

*Khadijatou Diop Nakoulima*



*Benjamin Saada*



Benjamin SAADA is CEO of **Expliseat**: he oversees the product development and industrial management, ensuring the alignment of Expliseat's expertise with client needs. His responsibilities included managing tenders and negotiations. Before becoming CEO of Expliseat, he worked in San Francisco for EDF, analyzing and selecting strategic technologies for electric vehicles. Benjamin holds an engineering degree from MINES ParisTech. He is the creator of the Titanium seat, the lightest one in the world.

Victor Landau is the co-founder of the **Spotistic** created in 2012. He is a graduate from MINES ParisTech. Spotistic is a comprehensive online marketing software focused on shops, bars and restaurants. It combines traditional online marketing (social media marketing, email marketing, search engine marketing, search engine optimisation and social advertising) with targeted online coupons allowing location owners to secure measurable payoffs: in-store traffic and sales.

*Victor Landau*





**revenues** management BUSINESS development  
professional qualification **job** GROWTH **career** market  
TECHNOLOGICAL CHANGE project **quality** product innovation  
success consulting **increase** strategies graduate  
**marketing** investment **business report** START-UP  
**contracts** **team** SUCCESS STORY





A unique concert conducted by Pierre Antoine d'Andrea Novelle and played by professional musicians closed this event. This concert gave life to the last 200 years of the School in the world and through the ages slideshow.



# Concert

selected tracks







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# DEANS' FORUM 2015

*Creating talents for a New World*





# SAVE THE DATE

## DEANS' FORUM 2017

August 31<sup>st</sup> to 1<sup>st</sup> September

**“Women in science and engineering”**

“Women in science and engineering”



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