Summary and Highlights 2009-2010

Research & Development (R&D)
Technology Transfer
ENVIRONMENT  
March 23, 2010:  
“Professor Jean-Sébastien Dubé has been awarded the Fernand Seguin Distinction for his article titled *La solidification/stabilisation au ciment : un nouvel outil pour une gestion durable des sols contaminés*. This distinction is given out annually by Réseau environnement to reward excellent and comprehensive content in an article published in the journal, *Vecteur environnement*.”

APPOINTMENT  
February 2, 2010:  
“Professor Pierre Bourque has been elected to the IEEE Computer Society Board of Governors for a 3-year mandate.”

INNOVATION  
December 15, 2009:  
“The Ministère du Développement économique, de l’Innovation et de l’Exportation (MDEIE) has awarded $300,000 to Kinova, a venture launched at Centech (the Centre for entrepreneurship at ÉTS) by two ÉTS graduates, to market the JACO robotic arm, designed for motorized-wheelchair users.”

WIRELESS COMMUNICATION  
December 7, 2009:  
“A newly created NSERC Industrial Chair at ÉTS. Five-year funding in the amount of $4.2 million will enable Professor François Gagnon and his principal partner, Ultra Electronics, to make great strides in emergency and tactical wireless communications.”

GREEN INTERNET  
November 17, 2009:  
“GreenStar, the first ever solar- and wind-powered internet network, will be led by Professor Mohamed Cheriet. This initiative was made possible thanks to a $2-million investment by CANARIE (Canada’s Advanced Research and Innovation Network).”

IT SECURITY  
November 10, 2009:  
“An article by Professor Jean-Marc Robert and his graduate-level student, Abdelkarim Chriqi, was selected as the best article presented at the WiMob 2009 Conference (5th IEEE International Conference on Wireless & Mobile Computing, Networking & Communication) held in Marrakech, Morocco.”

COMPUTER-AIDED RECOGNITION  
October 28, 2009:  
“The team led by Professor Pierre Dumouchel was awarded a prize at the inaugural Interspeech Emotion Challenge held in Brighton, England, in 2009, for its computer-aided emotion recognition technology.”

... FROM THE FIRST PAGE ...
TABLE OF CONTENTS

Overview: Key Figures .................................................................2
...And Key Messages .................................................................3
Strategic Research Plan .............................................................4
Chairs and research units by domain and sector of activity ..........5
Engineering for ENERGY ............................................................6
Engineering for the ENVIRONMENT ............................................7
Engineering for INFORMATION AND COMMUNICATIONS ........8
Engineering for MATERIALS AND DESIGN .........................9
Engineering for HEALTH ..........................................................10
Engineering for BUSINESS SYSTEMS ..................................11
Engineering for TRANSPORT ....................................................12
OVERVIEW: KEY FIGURES...

Since 2007-2008, grants for graduate and post-graduate studies are included in total funding.

Average funding per professor is above the Canadian university average.
Dear Reader,

École de technologie supérieure (ÉTS) is very proud to present its research and development (R&D) overview and highlights for 2009-2010. Results from the past 12 months were on an upswing, thereby reversing the trend from the previous year in which a global economic downturn had caused a major slowdown among many of our industrial partners.

These results point to a strong economic recovery, triggering significant increases in almost all R&D performance indicators. First, from an overall perspective, recurrent funding reached a new peak at $14.3 million, which is a 24% increase over last year’s result. Let us recall that recurrent funding represents the best gauge of overall research activity at ÉTS. As for total R&D funding, it exceeded the $20-million mark, a 12% progression since last year. This is only the third time in the school’s history that this level of funding has been attained, and the first time ever without a major contribution from the non-recurrent funding program at the Canada Foundation for Innovation (CFI) (Figure 1).

If you examine the funding figures more closely, you will note increases almost across the board, including both internal and external funding, subsidies, contracts, indirect costs, irrespective of the source: provincial, federal or other. The following remarkable increases are worth noting: 26% for total external funds, achieving a new summit at $13.2 million, including an 82% rise in provincial funds and a 5th consecutive increase from the NSERC (two new peaks). Contracts and subsidies (Figure 2) are also on the rise, up 32% for the latter. In addition, three new research chairs were created in the past year, including the first NSERC Industrial Chair in partnership with Ultra Electronics TCS. Please also note significant funding increases for all departments, including a new pinnacle in terms of “research intensity,” namely, average funding per professor of more than $110,000 a year, placing ÉTS researchers above the average for all Canadian universities in this regard (Figure 3).

This issue presents specific projects by ÉTS professors and researchers that illustrate the excellence and diversity of our R&D activities in 2009-2010. In an effort to make our researchers’ multiple interests and areas of expertise easier to grasp, we created a strategic research plan that categorizes their endeavours into seven major domains and 28 sectors of activity (Page 4), which cover the main applications of technology in support of human activity. Certain domains clearly address strategic development sectors targeted by federal, provincial, and/or municipal governments, such as energy, the environment, computer and information technology, health technology, and aerospace. Other domains are areas of competition for all industrial sectors. It is worth noting that the fundamental feature of this chart is the interdependence of its multiple sectors and areas of expertise: it is at the nexus of R&D domains and sectors of activity that the most innovative and promising solutions emerge in response to the challenges our partners face. For the sake of brevity, we present only one key project from 2009-2010 for each domain. These projects represent but a glimpse of the vast scope of expertise that ÉTS researchers possess and of the excellence of their R&D achievements. For more information, please visit our website at www.etsmtl.ca.

Enjoy our latest issue!

Claude Bédard, Dean of Research and Technology Transfer
The Strategic Research Plan brings together the R&D interests and activities of ÉTS research-professors under seven major domains (centre), which in turn break down into 28 axes (surrounding).

The colour dots following each axis illustrate the interdisciplinary nature of such R&D activities, indicating how each axis is related to different domains. The colour code for domains is as follows:

- **ENERGY**
- **ENVIRONMENT**
- **MATERIALS, DESIGN AND PRODUCTION**
- **BUSINESS SYSTEMS**
- **HEALTH TECHNOLOGIES**
- **INFORMATION AND COMMUNICATIONS TECHNOLOGIES (ICT)**
- **AIR AND LAND TRANSPORTATION**
CHAIRS AND RESEARCH UNITS BY DOMAIN AND SECTOR OF ACTIVITY

ENERGY
- Canada Research Chair in Electrical Energy Conversion and in Power Electronics
- Canada Research Chair in the Aerodynamics of Wind Turbines in Nordic Environment
- Industrial research chair in technologies of energy and energy efficiency (T3E)
- Power Electronics and Industrial Control Research Group – GREPCI
- Thermal Technology Centre – CTT
- TransÉnergie Chair on Simulation and Control of Electric Power Systems

ENVIRONMENT
- Canada Research Chair in Characterization of Contaminated Sites
- Experimental Station of Pilot Processes in Environment – STEPPE
- Integration and Sustainable Development in Built Environment – GRIDD
- Pavement, Roads and Bituminous Materials University Laboratory – LUCREB
- Research group specialized in Development and Applied Research in Environmental Modeling – DRAME
- Research team specialized in Development and Research on Structures and Rehabilitation – DRSR

INFORMATION AND COMMUNICATIONS TECHNOLOGIES (ICT)
- Advanced Research in Telecommunications – COMunity
- Computer Systems Architecture Laboratory – LASI
- Multimedia Communication in Telepresence – Synchromedia
- Multimedia Research Laboratory – LABMULTIMEDIA
- Networks and Telecommunications Management Laboratory – LAGRIT
- NSERC-Ultra Electronics Chair on Wireless Emergency and Tactical Communication
- Software Engineering Research Laboratory – GÉLOG
- Telecommunications and Microelectronics Integration Laboratory – LACIME
- Vantrix industrial research Chair in video optimization

MATERIALS, DESIGN AND PRODUCTION
- Products, Processes, and Systems Engineering Laboratory – P2SEL
- Research team specialized in Production of Francis Turbine Shroud Ring
- Shape Memory Alloys and Intelligent Systems Laboratory – LAMSI
- Stress Analysis by Finite Element and Testing Laboratory

HEALTH
- Canada Research Chair in 3D Imaging and Biomedical Engineering
- Canada Research Chair on Biomaterials and Endovascular Implants
- Imagery and Orthopedics Research Laboratory – LIO
- Industrial Research Chair in In-Ear Technologies – CRITIAS
- Occupational Safety Research Team – ÉREST
- Research Chair on Materials used in Protective Clothing and Equipment in Occupational Health and Safety

BUSINESS SYSTEMS
- Canada Research Chair in Precision Robotics
- Control and Robotics Laboratory – CoRo
- Design and Control of Production Systems Laboratory – C2SP
- Imaging, Vision and Artificial Intelligence Laboratory – LIVIA
- Machine Dynamics, Structures and Processes Team – DYNAMO
- Production Technologies Integration Laboratory – LITP
- Supply Chain Research Lab

TRANSPORT
- Aeronautical Research Laboratory in Active Control, Avionics and Aeroservoelasticity – LARCASE
- Canada Research Chair in Aircraft Modeling and Simulation Technologies
- Research Group on Digital Applications in Engineering and Technology – GRANIT
Hydro-Québec TransÉnergie owns a vast network of high voltage transmission lines several thousand kilometres long that connects multi-gigawatt power-generation plants located in the Far North to major consumption centres. Design requirements for long-distance transmission grids entail considerable challenges and the use of very sophisticated technology. In addition, numerous continuous current interconnections with other Canadian provinces and American states have contributed to an increase in network scope and complexity. Intermittent production by non-traditional energy sources (wind turbines, photovoltaic cells) has also made network operations more challenging.

Louis-A. Dessaint, Director of the Electrical Engineering Department, is the Hydro-Québec/TransÉnergie Chairholder on Simulation and Control of Electric Power Systems. This industrial Chair has contributed to the development of simulation tools required for the design, planning, and operation of electrical networks. It has also developed innovative control methods designed to manage instability factors common to large-scale networks.

The only means of ensuring optimal management of major networks is to integrate production programming and safe network operations planning more effectively. In fact, one of the research projects led by Professor Dessaint’s team is specifically designed to develop high-performance tools to enable optimal network operations while taking stability-related constraints into account.

Concurrent with the development of these new tools, the project is also actively contributing to the training of specialists in electrical network management. Indeed, as the current generation of experts continues to retire, a gap is emerging which Professor Dessaint’s training efforts aim to fill. The project is aligned with Hydro-Québec’s needs and is serving as an incubator for new research professionals.

In his resolutely forward-looking approach, Professor Dessaint has also launched a new project based on a hydrogen fuel cell, in partnership with the Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ), Bombardier Aéronautique, and Transtronic. The project, endowed with a budget totalling nearly $1 million, is designed to develop an emergency power supply system for aircraft. The hydrogen fuel cell recently acquired by ÉTS will allow him to carry out experimental work and simulations. One step closer to tomorrow’s aircraft: increasingly electric-powered and greener.
The lifespan of roadways paved with bituminous materials can be as long as 50 years if regular maintenance is performed. In reference to such cases, experts use the term “perpetual pavement.” As a matter of fact, the asphalt removed from a degraded roadway is not discarded: it is carefully stored, processed, and re-used.

Few people know that generally 80% of bituminous asphalt is recycled. It is by far the most frequently recycled material in North America – more than paper, plastics, and steel combined. This is good news, considering that a major part of the road network in North America has reached the end of its useful life. Rebuilding the entire North American road network is out of the question for obvious cost-related reasons and given the environmental impact of such a project. The solution is threefold: maintenance, rehabilitation, and recycling.

The great challenge that confronts the team led by Alan Carter, Professor at the Construction Engineering Department, is to reduce the costs of manufacturing or recycling bituminous asphalt. Traditionally, asphalt is produced at high temperatures (approximately 160°C) at an asphalt-production plant. However, technological advances have enabled lower-temperature processes, such as warm (roughly 130°C), half-warm (<100°C), and even cold mixes (ambient temperature).

Reducing production temperature also reduces energy costs. For the road industry, asphalt production is the main budget item where savings can still be achieved. However, not all asphalt paving is subject to the same processing methods and not all roadwork projects require the same techniques.

Accordingly, Professor Carter’s efforts are focused on formulating, characterizing, and optimizing warm and half-warm mixes as well as cold asphalt production. Professor Carter’s team receives funding from Quebec fund for research on nature and technology (FORNT) and uses equipment at Pavement, Roads and Bituminous Materials University Laboratory (LUCREB) at ÉTS.

The results of this major research project will help to gradually replace the empirical approaches still too frequently employed by entrepreneurs. Alan Carter aims to create maintenance and rehabilitation techniques which, when performed on a timely basis, will help to maintain roadways in good condition almost indefinitely.
The volume of data flowing into optical networks doubles every year, and telecom operators face the constant risk of congestion in their networks. At the same time, cable operators and newcomers, like Google, are developing their own optical networks for new bandwidth-hungry data and video applications. But the problem remains: the download demands for movies, music, and data files exceed the planned network capacity.

This is the kind of challenge that Professor Christine Tremblay, founding researcher and head of the Laboratoire de technologies de réseaux, enjoys. With her research team, she explores and designs novel architectures for wavelength division multiplexing (WDM) networks which can respond dynamically to new bandwidth requirements in cost-effective and energy-efficient ways.

Until recently, it has been possible to improve the capacity and reach of WDM transmission systems by increasing the channel (or wavelength) number and line rate, and by limiting signal degradation in the transmission fibre. Today, the purity of the optical fibre is such that the attenuation is minimal, and more than 80 channels at 10 Gb/s can be transmitted in a single optical fibre over a distance of 1,500 km without signal regeneration. However, it is very difficult to increase further the capacity and bit rate using traditional transmission techniques, given the problems of dispersion and interference.

The solution lies in the use of advanced modulation formats and signal processing techniques that enable transmission at speeds of 40, 100, and even 500 Gb/s. By modulating the phase and not just the intensity of the signal, and by using electronic dispersion compensation, data can be transmitted at very high speeds over long distances. Next-generation optical networks based on these technologies and the so-called “filterless” concept are at the heart of the activities carried out by Christine Tremblay and her team.

In October 2009, Professor Tremblay joined a delegation of five SYTACom researchers as an expert in optical communications. The group participated in technical workshops at the Hong Kong University of Science and Technology (HKUST) and Shanghai Jiao Tong University. Also in 2009, she taught an intensive course in San Diego as part of the OFC/NFOEC International Conference in partnership with Verizon (USA).

Professor Tremblay has received major support for her research projects from Nortel, which has, over the years, invested $4.5 million in the laboratory’s infrastructure. She has also received tactical support from EXFO for optical fibre test instrumentation. Today, her research activities are funded by the Natural Sciences and Engineering Research Council of Canada (NSERC), Nortel (which has since become Ciena), the Canada Foundation for Innovation (CFI), and SYTACom.
How can businesses be enabled to manufacture high-quality parts at a reasonable cost while maintaining good productivity and ensuring occupational health and safety? Traditionally, mathematical models were developed that focused mainly on product quality and pricing. Today, a holistic approach that encompasses occupational health and safety and environmental protection is essential.

The clean machining of parts without toxic lubricants or hazardous dust particles and with minimal noise pollution has become a market imperative. Multiple government standards compel businesses to improve their modes of production in efforts to reduce their indirect healthcare and environment-related costs, thereby sustaining their competitive level.

Clean and high-performance machining – that is Victor Songmene's passion. Professor Songmene is a mechanical engineering specialist who spent six years at the Industrial Research & Development Institute in Toronto where he carried out key projects for Canadian and U.S.-based industrial clients, including General Motors and Fleet Aerospace. Since joining ÉTS in 2001, he has devoted his private sector experience to reconciling sustainable development and productivity.

These concerns are at the heart of Professor Songmene's research efforts on robotic deburring and parts finishing, with support from the Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ) and a group of major companies in this sector (Pratt&Whitney, AV&R Vision & Robotique, Groupe Meloche and L-3 MAS).

Another research project on machinability of materials deals more specifically with aluminum alloys. With the participation of Rio Tinto Alcan, Professor Songmene is striving to define the behaviour of new alloys with regard to machining speed, part quality, and chip formation.

Concurrent with these initiatives, Professor Songmene has launched a project more clearly focused on occupational health and safety whose objective is to develop at-source reduction strategies for nanoparticles generated in manufacturing plants. The project has received support from Nano-Québec and Quebec's institute for occupational health and safety research (IRSST).

Victor Songmene manages the Products, Processes, and Systems Engineering Laboratory (P2SEL) and acts as an institutional coordinator for ÉTS at the Aluminum Research Centre (REGAL), which brings together all Quebec researchers in this field. As coordinator of REGAL, he has drawn the International Aluminum Conference (INALCO) to Montreal – an event that will bring together specialists from all over the world at ÉTS in 2013.
Musculoskeletal health is a hot topic. The baby boom generation is aging but its members are determined to remain active and continue to take part in sports activities; as a result, the incidence of joint problems is soaring. Today, musculoskeletal disease ranks second in terms of healthcare cost.

The fight against this new scourge is a leading priority at Imagery and Orthopedics Research Laboratory (LIO) located at Centre hospitalier de l’Université de Montréal (CHUM) of Hôpital Notre-Dame. Its director, Jacques de Guise, Professor at the Automated Manufacturing Engineering Department, has assembled a multidisciplinary team of about 50 researchers, all engineers or healthcare professionals.

His work on imagery and 3D modelization led to the design of the first biplanar (two sources and two sensors) radiography system integrating the Micromegas gaseous detectors developed by Georges Charpak, Nobel Prizewinner in Physics in 1992. Known as EOS™, the system produces X-ray images of the human skeleton using very low-dose radiation.

Professor de Guise and his team are also carrying out 3D in-motion functional evaluations of the musculoskeletal system. Using a harness equipped with motion sensors and strapped to the femur and tibia, they have been able to measure and analyze even the slightest movements of the knee bones. Used in two clinics in Greater Montreal, the system – known as KneeKG™ – was recently approved by Health Canada and the Food and Drug Administration (FDA) in the United States.

One of the several challenges is to combine complex but static information from EOS medical imagery and functional information from KneeKG on a single platform thanks to funding support from Quebec fund for research on nature and technology (FQRNT) and Quebec fund for research on health (FRSQ) in the amount of $1.2 million. Longstanding industrial partners Biospace med and Emovi are also involved in this new project.

Thanks to the support of the Canada Foundation for Innovation (CFI) and the government of Quebec, the network of engineers and clinicians assembled by Jacques de Guise has been able to acquire a special treadmill and stationary stepping exercise machine equipped with 3D force sensors as well as a professional-grade 3D imagery platform.

It is estimated that this research effort will yield a major breakthrough in the diagnosis and treatment of musculoskeletal disease. Given that the main characteristic of these pathologies is pain – acute and chronic – the importance of the work carried out by the joint ETS and CHUM innovation network is certainly appreciated.
Following a 10-year stint in both banking and telecommunications, including as a lead researcher in system security at Alcatel, Professor Jean-Marc Robert has been teaching information security at the Software Engineering and IT Department at ÉTS since 2006. He has focused his research interests and activities on information system security, from telecom networks to business networks and from onboard systems to distributed systems. His main project, however, concerns the development of protocols designed to safeguard security in ad hoc wireless networks.

Ad hoc wireless networks are networks in which nodes (mobile phones or laptop computers), equipped with WiFi interface communicate directly without using telecom infrastructure. These networks are particularly useful in the event of natural disasters, such as the earthquake that struck Haiti in January 2010. In such cases, telecom infrastructure is often damaged; as a result, rescue teams cannot communicate effectively.

In an ideal ad hoc network, each node cooperates with all other nodes to route packets of information. But in practice, a “selfish” node can refuse to relay messages addressed to other parties in order to conserve energy. Professor Robert is working on routing protocols designed to alter the behaviour of selfish nodes.

For example, selfish nodes can be “punished” by having communication services gradually withheld from them. It is up to “rational” nodes to report the illegitimate conduct of selfish nodes. Consequently, all rational nodes would see their “reputation” grow or they would receive micro-payments each time they agreed to relay information. Using these simple carrot-and-stick scenarios, Professor Robert is developing effective incentive mechanisms based on game theory and negotiation by auction. The task is even more challenging when one considers the need to differentiate between the refusal to cooperate and node transmission failure.

But that is not all. In addition to selfish nodes, there are also ill-intentioned nodes that can introduce spy software or launch denial-of-service attacks. Jean-Marc Robert is currently defining the various attack models in an effort to develop new routing protocols designed to detect ill-intentioned nodes more effectively and respond to the threat they represent.

In either case, Professor Robert’s research is designed to align each node’s individual interests with the effective overall operation of ad hoc networks.
The industrial revolution was the Age of Steel; closer to our era, the development of petrochemical technology launched the Age of Plastics. We have now ushered in the Age of Composites. Accordingly, in the aeronautical industry, composites now rival metals.

Composite materials consist of a frame and a sheath. The carbon fibre frame is a reinforcing element that provides mechanical strength. The protective sheath, known as the matrix, is generally a plastic material used to ensure the structure’s overall cohesion.

The advantages of composite materials over metals are numerous: they are light, provide mechanical and chemical resistance, require less maintenance, and allow more customized shape design. Accordingly, every time that an aircraft’s mass can be reduced by 100 kilograms through the use of composite materials, it is possible to accommodate more passengers or reduce greenhouse gas emissions. However, composite materials require more challenging and onerous machining than metals.

In composites machining, fibres must be cut without compromising resistance and without damaging the area where the cut is made (pulling fibres or causing external or internal delamination). In addition, the fibre’s abrasiveness severely tests cutting and routing tools, which are not yet completely adapted to fibrous materials.

This is the field in which Jean-François Chatelain, Professor in the Mechanical Engineering Department, operates. His project, which aims to optimize machining processes for graphite-epoxy composites and multilayer materials, is designed to develop effective means of trimming, drilling, and milling composite material surfaces. The challenge is to develop cutting processes and tools that are cost-effective and that meet the quality requirements of the aeronautical industry.

Before joining ÉTS in 1998, Professor Chatelain worked as an engineer specializing in manufacturing technology at Bombardier Aeronautics where the focus is on rapid and cost-effective construction in the competitive worldwide market of light and green aircraft.

Professor Chatelain’s current project, valued at $1.9 million, is funded by the Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ), the Natural Sciences and Engineering Research Council of Canada (NSERC), MITACS, Nano-Québec, and five industrial partners.
PROFESSOR: RESEARCHER
SEPTEMBER 23, 2009:
“Najim Dehak, a brilliant ÉTS postgraduate in software engineering and IT, has been awarded a post-doctoral position at the Lincoln Laboratory at the prestigious Massachusetts Institute of Technology (MIT) in Boston, United States.”

WIND POWER
SEPTEMBER 2, 2009:
“Professor Christian Masson, an internationally renowned expert in the field of wind power, has been welcomed to the Circle of Excellence of the University of Québec Network for his exceptional contribution to university life.”

BIOMEDICAL IMAGING
MAY 21, 2009:
“Professor Jacques A. de Guise and his team have received $1.2 million from Ministère du Développement économique, de l’Innovation et de l’Exportation to design and develop a computer platform to enhance the evaluation and treatment of musculoskeletal disease.”

SOFTWARE PROCESS IMPROVEMENT
MAY 19, 2009:
“Following its deployment in Belgium, France, Finland, and Thailand, the expert network for software engineering in support of small enterprises at ÉTS is being rolled out in Luxembourg, Ireland, and Colombia, under the supervision of Professor Claude Laporte.”

GREEN PLANE
MAY 15, 2009:
“The new Green Aviation Research and Development Network, GARDN, has entrusted one of its first projects to Professor Ruxandra Botez and her partner CMC Electronics; the project focuses on flight management systems.”

OPTICAL NETWORKS
MAY 5, 2009:
“Professor Christine Tremblay is among the experts invited to teach an intensive course as part of the Optical Fiber Communication Conference and Exposition (OFC) and the National Fiber Optic Engineers Conference (NFOEC) in San Diego, United States.”

(From April 2009 to March 2010)
ÉTS (École de technologie Supérieure), part of the Université du Québec network, educates professional engineers and researchers who are renowned for their practical and innovative approach. In the 35 engineering schools and faculties in Canada, ÉTS ranks among the best, with over forty chairs, research centres and laboratories, to which, PDFs and graduate students are associated. This synergy of expertise and experience contributes to scientific progress, higher industrial productivity and quality, as well as the training of a highly qualified workforce.

For additional information on ÉTS’s chairs, laboratories and research groups, please refer to the Research and Innovation section of the ÉTS web site at www.etsmtl.ca.

École de technologie supérieure
1100, rue Notre-Dame Ouest
Montréal (Québec) Canada H3C 1K3
etsmtl.ca

Office of the Dean of Research and Technology Transfer (DRTT) 514 396-8829
Graduate studies and admissions: 514 396-8888