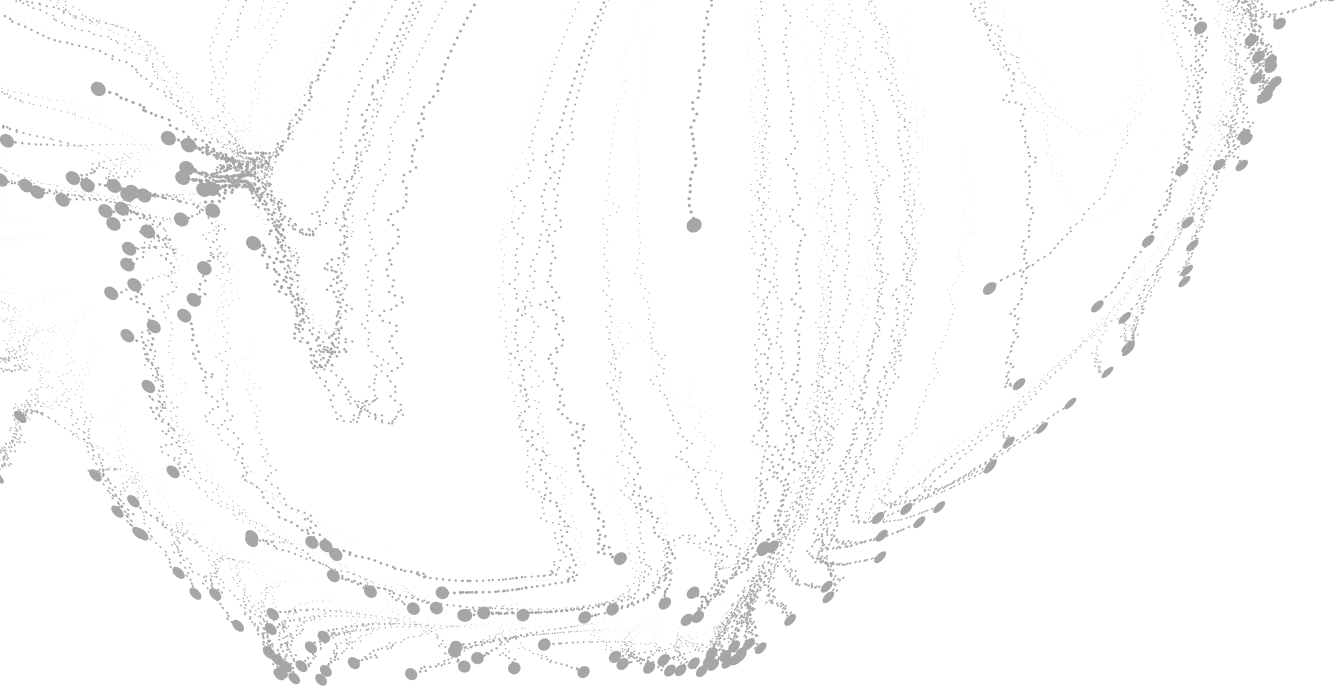
Annual report 17-18

Into the future

At the National Optics Institute (INO), 2017-18 was a year of transition and significant changes, marking the beginning of an upgrading period and reflecting the continuity of our core mission and long tradition of excellence. Set against a backdrop of accelerating technological and social progress, INO's business models will be reviewed in light of the challenges facing its clients, partners and stakeholders.

Playing a pivotal role in the innovation ecosystem, INO translates academic knowledge in tandem with industrial needs, thus serving as a bridge between new technology and industrial needs while delivering solutions that generate economic value. INO has fully embraced this role for nearly 30 years. Innovation actually goes much further than modernizing local companies and making them more competitive and productive on the global stage; it also means propelling them to the vanguard as role models. That is innovation's primary function; it is also INO's *raison d'être*. With external revenues totalling $14.6 million for 2017-2018, three technology transfers and 15 patents issued, the past year was in line with INO's long record of performance. Given the management team restructuring during the year, in addition to major changes to employees' roles and responsibilities, the organizational structure and internal work cycles, these results may be qualified as satisfactory. Indeed, INO's outlook is promising.



In 2017-18, INO established a new foothold in the Montreal area. Benefiting from closer proximity to its clientele and better business prospecting opportunities, the organization is poised to play a more active role in the innovation ecosystem throughout the greater metropolitan region. This new location is sure to facilitate business synergies while providing a more integrated offer to INO's clients, together with other applied research and technology centres in the region.

In the past year, INO also became an active member of two of the five Canadian innovation superclusters: the next generation manufacturing supercluster in Ontario, which is focused on advanced manufacturing issues, and the British Columbia-led digital technology supercluster, which aims to accelerate digital technologies such as the Internet of things. INO plans to join other superclusters once they have finalized the definition of their membership criteria and governance rules.

The past year was also marked by a number of hi-tech successes and the arrival of a new entrepreneur in residence, LynX Inspection. This company is seeking to capitalize on INO-developed intellectual property designed to facilitate the rapid and efficient inspection of internal or hard-to-access areas of objects created by additive manufacturing (3D printing).

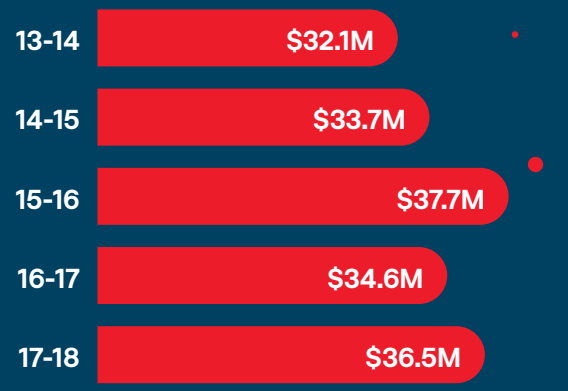
Drawing on INO's preliminary work, the company eSight was mentioned in *Time* magazine in its ranking of the 25 most important inventions of 2017 in recognition of the glasses it developed to restore partial vision to some legally blind individuals. In the field of precision agriculture, INO developed a greenhouse harvest optimization system enabling the identification of ready-to-harvest plants (using a laser), which can now be picked at the optimal point of ripeness. In the area of biopharmaceuticals, INO developed a prototype microscope used to characterize in-cell protein interactions the identification phase of potential candidates for new therapeutic molecules. This will significantly speed up the identification phase for certain classes of new drugs for pharmaceutical companies. Needless to say, these innovations represent only a small portion of the promising work carried out by INO's team of experts.

In addition, INO maintained its community involvement by taking part in activities geared towards the next generation of scientists and technologists, including Expo-Science, as well as solidarity initiatives such as the Light the Night walk and Centraide/United Way. If we can achieve a better understanding of the realities around us and show compassion towards our fellow citizens, we can help to make the world a better place.

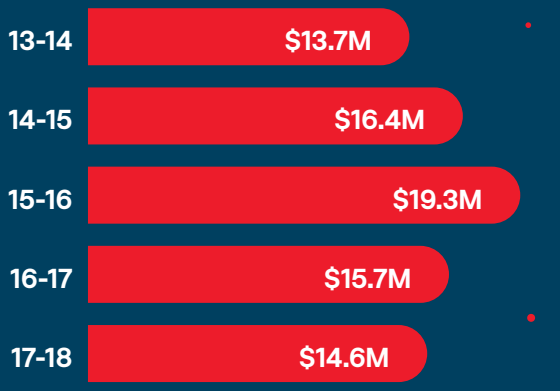
On a more personal note, I would be remiss if I failed to mention my sense of pride and enthusiasm upon joining the INO team. In the run-up to the organization's 30-year anniversary in 2018-19, I am resolutely focused on reaching new heights through my personal contribution. I am also committed to enhancing our standing and interactions within the innovation community, in which our clients and partners and society as a whole are stakeholders.

Alain Chandonnet,
President and CEO

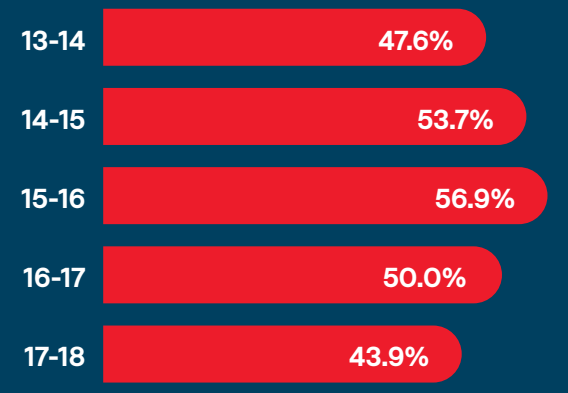
Year-to-year revenues



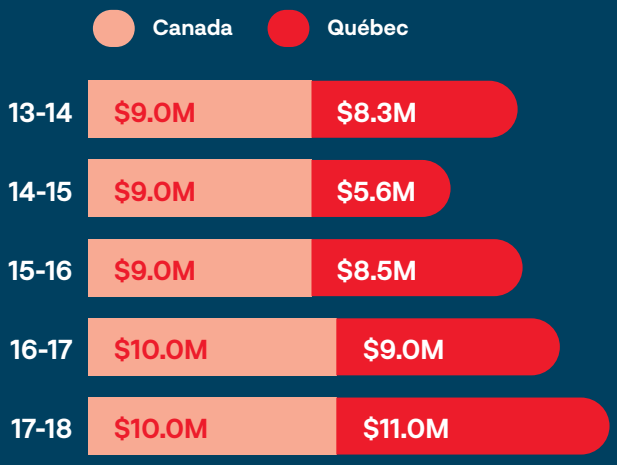
Year-to-year overall revenues
(outside revenues, governments financial support and diverse revenues)



Year-to-year breakdown of outside revenues
(R & D contracts, sales, transfer counterparts, royalties)



Year-to-year self-financing rate



Year-to-year breakdown of governments financial support

In the last 30 years...

33
spin-off companies

72
technology transfers

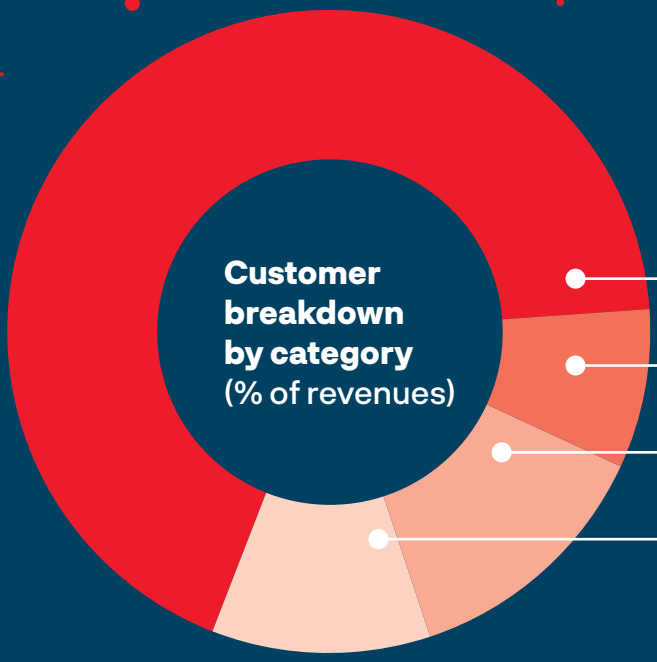
270
patents

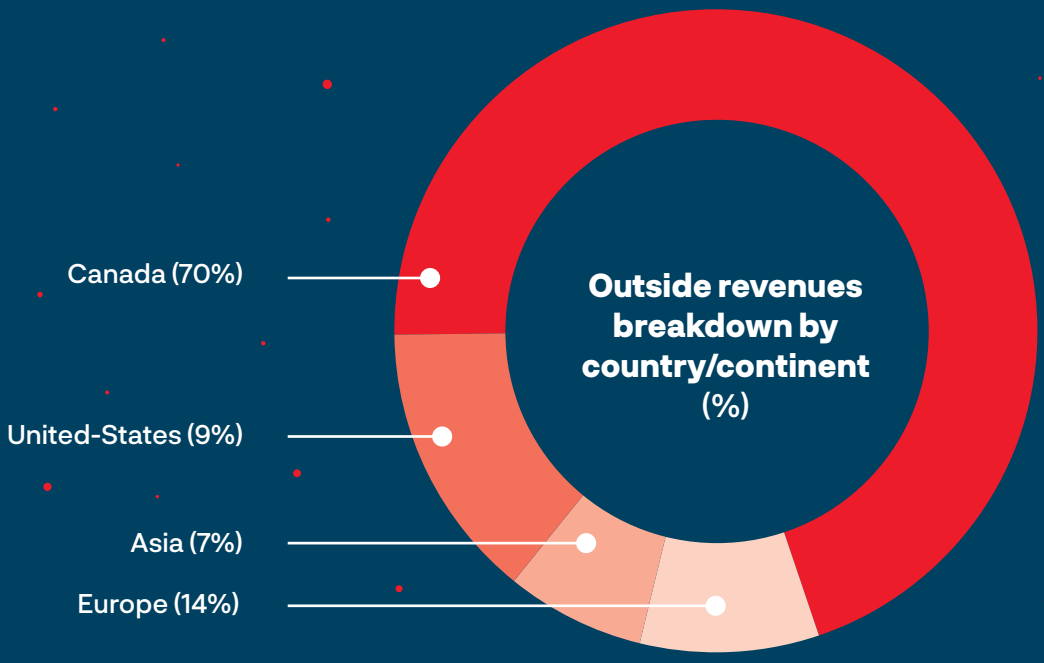
Over
6,500
solutions

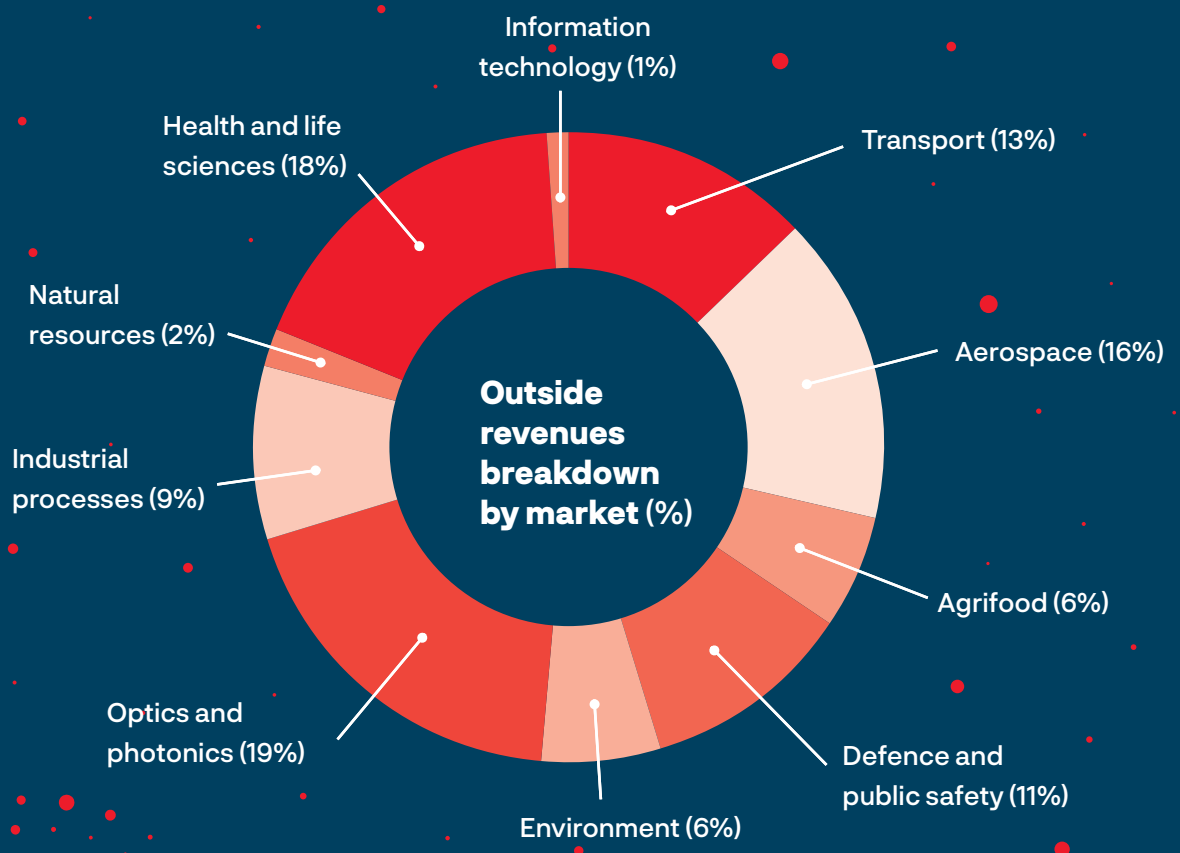
51.8%
average self-financing rate

The year in numbers

1
spin-off company

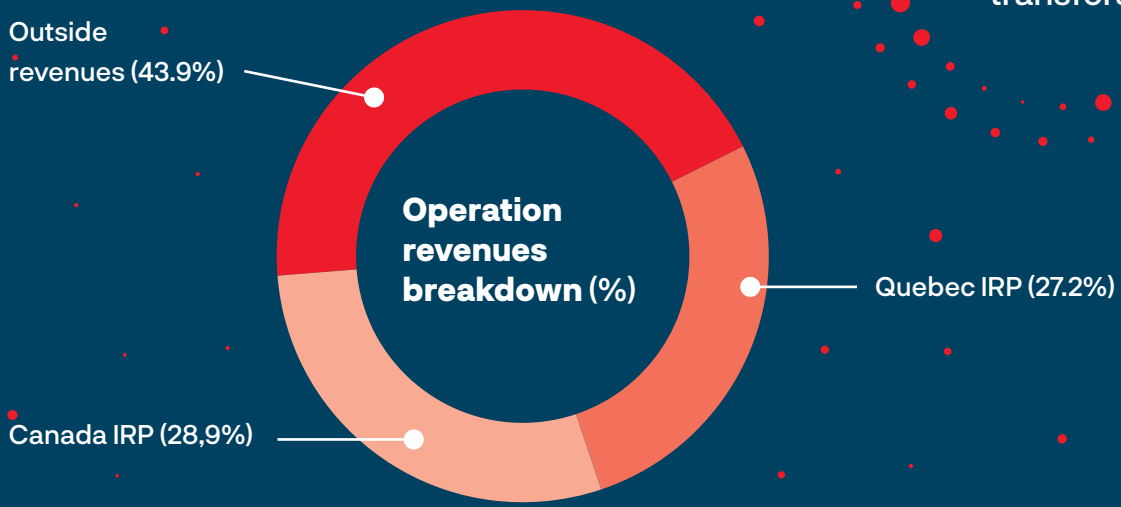






15
patents

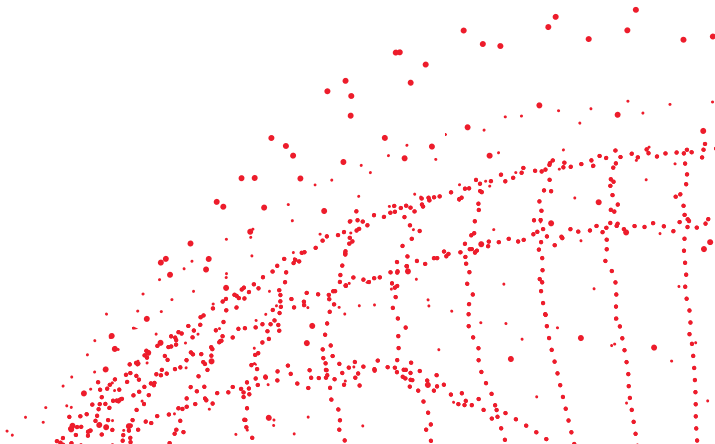
3
technology transfers



Review of technological activities

In keeping with the past two years, the Entrepreneur in Residence program, in partnership with the City of Quebec, played a key role in shaping INO's technology development program. This year, emphasis was placed on developing an airborne oil pipeline surveillance system targeting benzene as a leak marker, together with a robust UV laser compatible with the aforementioned application, a mobile robotic remote sensor and a combined 3D X-ray sensor for industrial inspections.

A number of other INO-developed technological platforms reached key milestones and enabled us to offer our clients noteworthy technological differentiators with a view to acquiring market share and boosting profit margins. Among the advances made in 2017-18, progress was recorded in the area of terahertz (THz) radiation as improvements to detector sensitivity, collection optics, illumination configuration and source power yielded the first high-quality THz reflective images, paving the way for vision applications for extreme environmental conditions. In addition, INO's membership in the US-based Center for Metamaterials (CfM) will provide access to cutting-edge THz materials, in addition to facilitating networking with major US military and industrial facilities.



Qualifying the FLIM/FRET analytical microscopy system for high-content screening applications will result in a significant increase in the number of potential drugs evaluated (this need has often been expressed within the pharmaceutical industry). The use of needle fibres (transparent samplers) during biopsies will facilitate immediate evaluation of the samples and will avoid having to repeat the procedure, which happens in 10% to 40% of cases.

Achieving mastery of technologies such as printable electronics and photonics, as well as microfluidics, will be crucial to future developments in the areas of point-of-service diagnostics and homecare. The use of video analysis techniques for pose estimation (without using markers) will make it easier to monitor changes in the condition of individuals with reduced autonomy.

In the area of granulometry, the development of a small-dimension real-time particle sizer will lead to better air quality control, an omnipresent problem not only in the industrialized world but also in the developing countries. The dimensional measurement system for interior cylindrical surfaces (3D-360) can be used to inspect industrial and municipal infrastructure, including water/wastewater network qualification.

In the area of photovoltaics, the demand for lower-cost components derived from micro-manufacturing processes, as well as for higher productivity, will require the use of larger wafers. INO thus acquired the necessary equipment to adjust to the new standard (200 mm wafers). In the past year, INO developed an imaging micro-spectrometer (3 11 µm band) for infrared hyperspectral imagery. This device can be used for a wide range of applications (agrifood, healthcare, security and the environment).

Entrepreneur in Residence

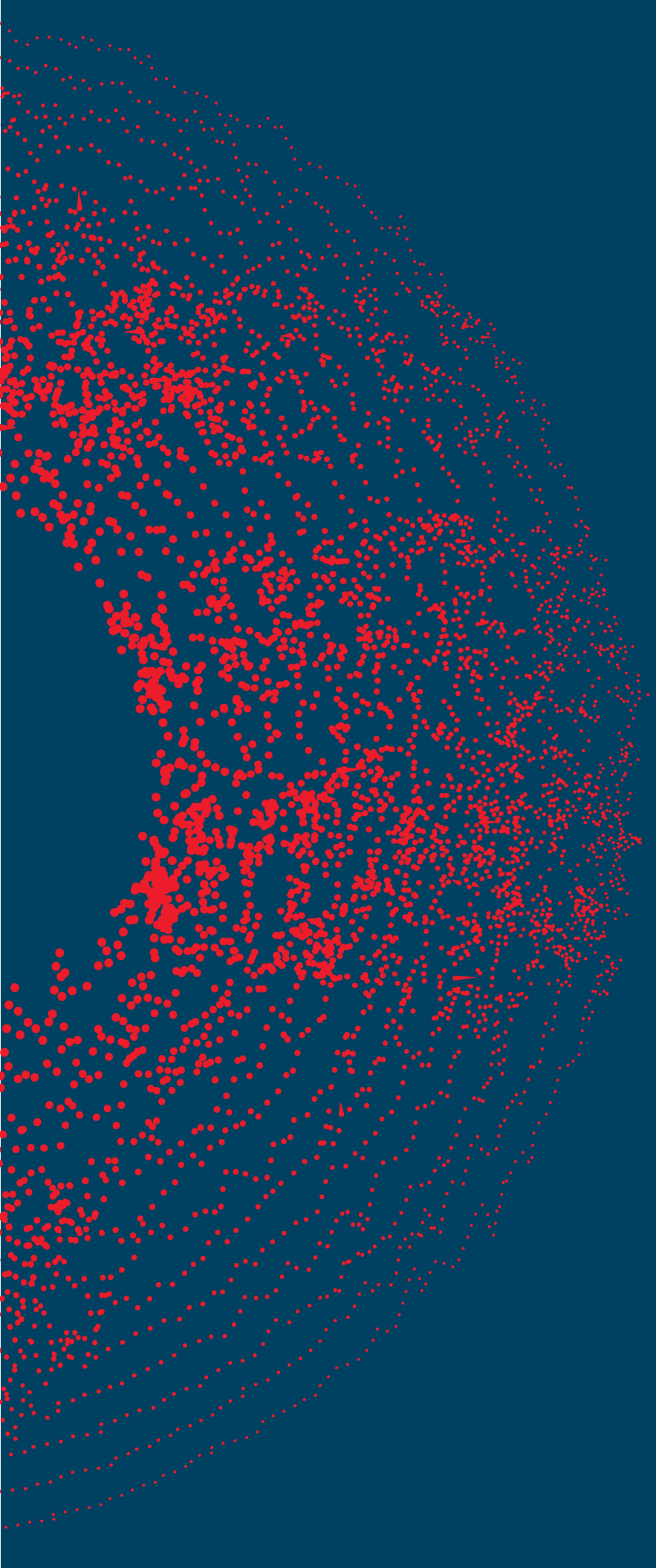
Once again this year, INO and the City of Quebec, in association with Anges Quebec, continued to foster business creation under the Entrepreneur in Residence program. Coordinated by INO, this program offers entrepreneurs a better chance of success when creating new companies derived from optics/photonics research and helping them make their way across what is known as “Death Valley”, a critical period running from the first round of fundraising until the time a start-up generates its first revenues.

LynX Inspection, a young high-tech company founded in 2016, was selected for the Entrepreneur in Residence project this year, including assistance with its creative process over an 18-month period. During that time, the entrepreneur will have access to INO’s vast array of material and human resources, thus enabling it to develop the technology lying at the heart of the inspection system it plans to bring to market. In addition to having its project nurtured at INO, LynX Inspection will be receiving support from the City of Quebec (up to a maximum of $200,000) to cover its pre-start-up expenses.

LynX Inspection develops cutting-edge digital vision solutions geared towards the industrial inspection market and non-destructive testing. The inspection system that LynX Inspection plans to market (thanks to the financial and technological support of the Entrepreneur in Residence program) will be used to detect machined part defects more accurately and more quickly than current techniques can. Combining 3D technology and X-ray imagery, this system can simultaneously analyze the internal and external structures of complex parts, including moulded/machined parts and those used in additive manufacturing.

“I am really very proud to have been selected for INO’s Entrepreneur in Residence program. In Quebec, assistance programs for technology companies such as ours are few and far between, so this was exactly the boost we needed at this point in our existence to complete the development of our technology and to lay the groundwork for the marketing process. This is the second time I’ve participated in a business start-up with INO, so I am well aware of the quality of their resources and the full potential of this collaboration.”

Luc Perron, founder, LynX Inspection



Examples of achievements

LaserAg

Bringing the benefits of optics to agriculture

Optics and agriculture may seem to have little in common, although they actually have a number of close links. The agrifood sector, like many industries, is in constant flux, and science is being used to optimize farming work. LogiAg, an INO partner, is a shining example of the links that can be created between optics and agriculture.

One of the challenges facing 21st-century farming involves determining the composition of cultivable soils so the correct fertilizers can be used and the correct nutrients can be provided for each type of agriculture. Thanks to the LIBS technique (laser-induced breakdown spectroscopy), LogiAg developed a prototype device used to accurately determine the composition of individual cultivable parcels of land. By analyzing a soil sample with this new system (known as LaserAg), farmers receive accurate information on the soil components. Using this information, they simply have to select the type(s) of fertilizer providing the missing nutrients to optimize crop growth.

Buoyed by the success of its prototype, LogiAg wanted to distribute this technology internationally. To that end, the Châteauguay-based company needed to make improvements to ensure greater stability and performance reproducibility from system to system, as well as reliability and reproducibility when the device is used by non-specialists. Ergonomics and ease of use were also very important considerations during the development stage. Thanks to INO's systems development and short-series production expertise, it was the ideal partner for bringing this project to completion. Well versed in laser-induced breakdown spectroscopy (LIBS) techniques and other systems using similar components, our researchers proposed and implemented a number of systems design improvements to meet LogiAg's objectives. Since the LIBS application was somewhat unreliable, various critical parameters had to be clearly identified, in addition to defining interrelations with various system characteristics. Accordingly, a number of improvements were implemented to refine the characteristics of the built-in laser beam and track them in real time. Since LIBS is based on the identification of very narrow spectral

atomic lines, the stability of the sub-system used to analyze the radiation emitted by the plasma was crucial; this point was of particular importance in this case because the analysis was focused on complex samples such as soils, which contain a wide variety of elements. A specific module to stabilize the spectrometer's mechanical and thermal characteristics was developed to meet the application's requirements.

The system development is now at a maturity level enabling LogiAg to provide the device to "early users". This step will yield valuable information on the system when used in a "real world" context. The final development iteration will then be created with a view to bringing the system to a production and marketing level. INO is working closely with LogiAg to manufacture pre-production units for "on the ground" validation and to complete the final development and production work.

Thanks to this collaboration, LogiAg is poised to provide its LaserAg systems to companies at the international level, thus facilitating agricultural work worldwide.

"Starting with my very first contact with INO, I have been greatly impressed by its entrepreneurial spirit. In addition, the employees involved in my project swiftly made it their own and put forward some very interesting design suggestions. The competence of the team that INO put in place for our project is outstanding and the project has been on schedule ever since the project began. After bringing clients into INO for a visit, each time I've come away with an agreement. That's because INO inspires confidence thanks to its ability to manufacture high-tech devices."

Charles Nault, CEO, LogiAg

Affinerie CCR

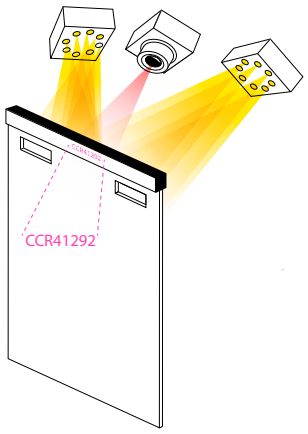
Optics and artificial intelligence : a high-performance alliance

Affinerie CCR, based in the Montreal region, is a refinery specializing in copper and precious metals. CCR carries out the final refining stage using an electrolytic plating process, during which copper is deposited on stainless steel plates (known as master plates). After 10 years of service, the numbered master plates were starting to show signs of surface corrosion, which was affecting the physical quality of the plates and reducing the production speed. Consequently, CCR undertook a plate restoration process and called on INO to design and implement a follow-up and monitoring method.

During the initial phase, which ended in 2012, INO developed an optical system and a digital vision algorithm to segment and classify the various characters in the codes used to identify the master plates. The system and algorithm are used to monitor the path of each plate from one end of the production facility to the other. Thanks to this system, continuous monitoring is provided and any plates requiring restoration are taken out of production without interrupting the operations.

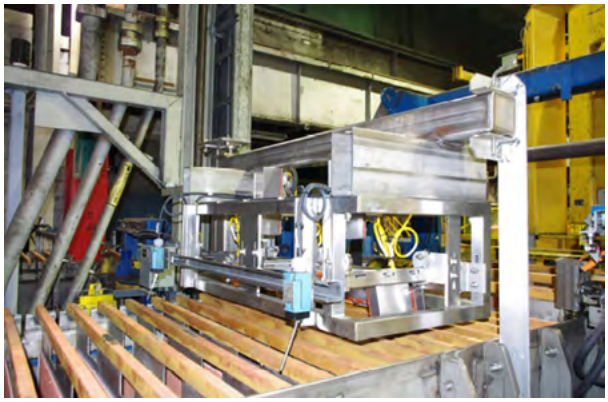
Recently, CCR called on INO again to modernize its system and boost the read rate. Thanks to their deep learning and artificial intelligence expertise, the members of the INO team developed a new character recognition algorithm using convolutional neural networks.

This type of algorithm is known to exceed human performance in various tasks, such as image recognition. The previous algorithm used hand-crafted features while the new algorithm learns the characteristics directly from the data with a view to minimizing the number of read errors. This makes the system much more adaptable since by adding images to the database, new learning is facilitated and performance is improved.



In addition, read accuracy performance was boosted from 94% to 99%, enabling CCR to better monitor the condition of master plates in the facility. Based on a total of 75,000 master plates read per week, the number of incorrect readings dropped from 4,500 to 750 per week.

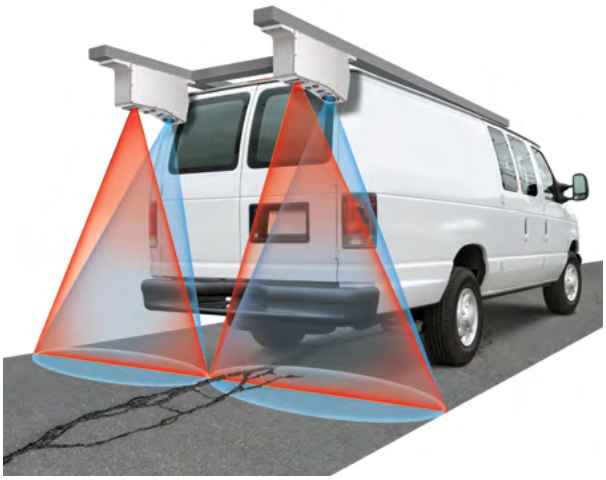
This second phase of the collaboration with CCR showed that by combining optics and artificial intelligence, two of INO's key areas of expertise, innovative solutions can be delivered to the manufacturing sector.



"INO provided us with state-of-the-art expertise that CCR lacked. In addition, INO's desire to teamwork with CCR and deliver a quality product made this project a success. The operators and CCR's management team are very pleased with the master plate monitoring system."

Anne Tellier, Senior Project Engineer, Affinerie CCR

Pavemetrics



Successful spin-off company

The mobility of goods and people is a key issue in the 21st century; the vitality of our economy largely depends on it. For that reason, it is essential that transportation infrastructure be developed and maintained properly.

Against that backdrop, Pavemetrics, an INO spin-off company, has developed rapid 3D inspection solutions using laser triangulation. The measurements gathered are highly accurate and can be used for structures such as roads, railways, tunnels and airport tarmacs. For example, the company's flagship product (laser crack measurement system/LCMS) is used to examine and monitor road surface conditions at speeds of up to 100km/h without impeding traffic. Laterally, the system can capture one point every millimetre and longitudinally every five millimetres.

Thanks to these measurements, road conditions can be determined using automated analytical software. With this information in hand, maintenance decisions are facilitated (roadwork planning, prioritization and optimization).

The company's success stems from product innovation, enabling it to maintain its leadership position and diversify its offer. Staying true to its unique spirit of innovation and to meet ever-growing market needs, Pavemetrics sought to develop a new generation of sensors, which perform better and are more accurate.

Once again, Pavemetrics collaborated with INO to develop this new technology. The main objective was to increase the acquisition frequency fivefold in order to capture one point every millimetre longitudinally. In addition, a more powerful laser line projector was developed and inertial sensors (e.g. accelerometers and gyroscopes) were added.

INO's varied expertise was used to develop this new sensor throughout the various steps in the process, from design and production to technology validation and certification.

INO's team of researchers takes great pride in the success of Pavemetrics, which has grown steadily since it was created in 2009. The company's products are available internationally and have helped to promote its optics expertise around the world. The INO team also takes great pleasure in contributing to this success by developing new generations of sensors.

"Under one roof at INO, Pavemetrics found everything it needed to develop the hardware for its new LCMS-2."

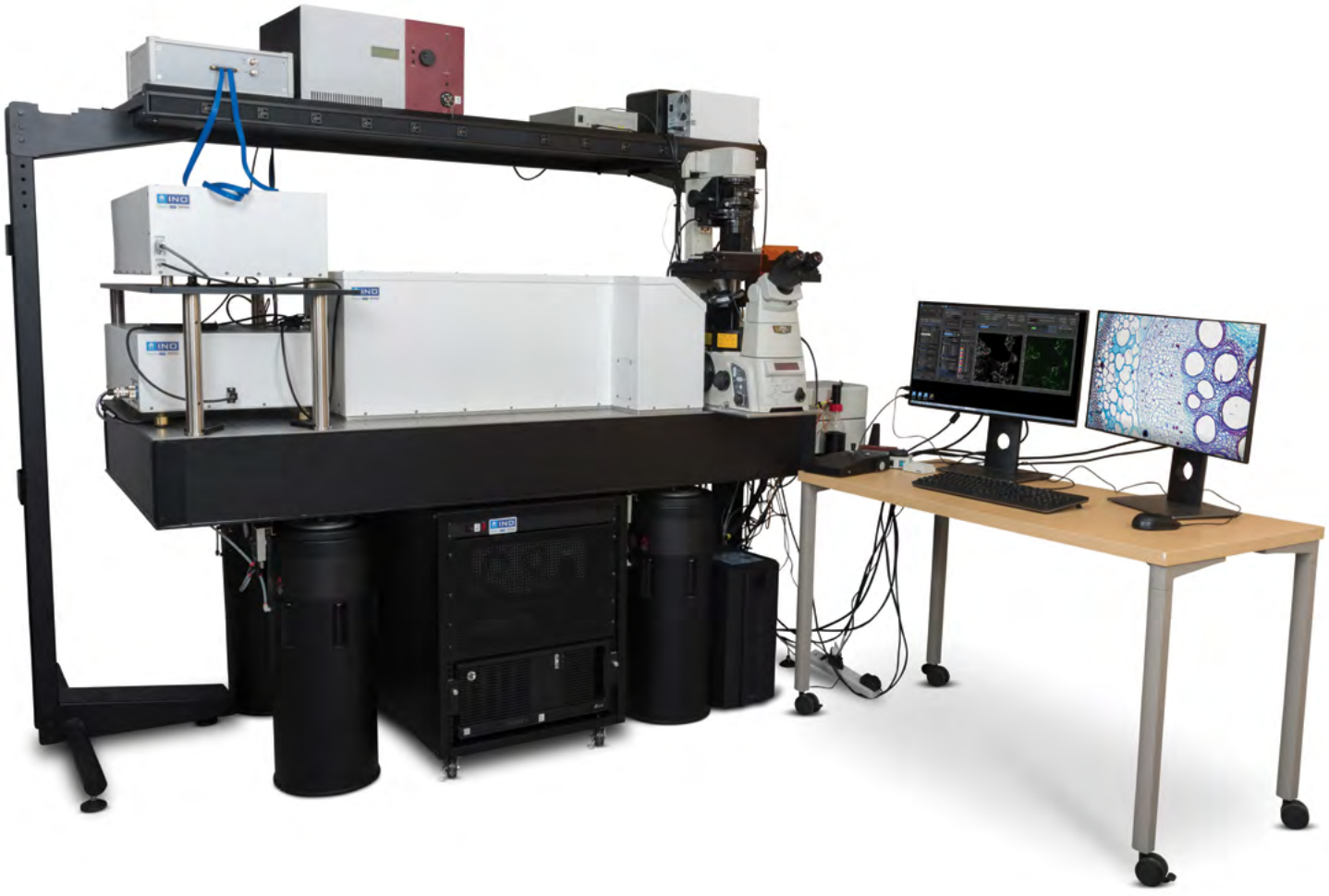
Richard Habel, CEO, Pavemetrics

FLIM-FRET

Enabling new cancer drug development through state-of-the-art microscopy

Early in the medical drug discovery process, screening tests are used to rapidly pinpoint drug candidates that will have a potent effect on the target pathology at the biomolecular level. Recently, screening has started to be conducted within living cells with sophisticated automated microscopy systems (high-content screening/HCS). However, there are limitations to these devices, notably for resolving and studying protein-protein interactions, a class of in-cell biochemical phenomena that are very relevant to anticancer drug development. Currently, identifying drug candidates that interfere with protein-protein interactions is done using sophisticated, automated microscopes that take pictures of specially designed fluorescent "probing" proteins in cells. These fluorescent probes are conceived to enable the capacity to measure how strongly a drug candidate molecule binds to the target protein in relevant molecular interactions.

To evaluate the binding strength of a drug candidate molecule, HCS microscopes must provide a high-resolution image of the cell samples (sufficient to resolve organelles within cells) with the time-resolved distribution of the probe molecule fluorescent intensity as it decays after a laser pulse, otherwise known as "fluorescence lifetime imaging microscopy" (FLIM). HCS automated FLIM microscopes are available commercially, but the nature of protein-protein interactions and the high number of candidate molecules in a screen make the capture of a complete automated drug screening test prohibitive in time on these systems.



In collaboration with Prof. David W. Andrews, Director of Biological Sciences at the Sunnybrook Research Institute in Toronto and a world-renowned expert in anti-cancer drug development, INO has designed and built a complete HCS automated FLIM-plus-hyperspectral microscope capable of conducting a benchmark secondary screening test of six compounds developed by Prof. Andrews on a full 384 well-plate in under six hours, compared to the full month of data collection previously required on state-of-the-art commercial systems. This new microscope is built with stability and flexibility in mind, requires little maintenance in terms of optical alignment, can be equipped with different optical filters for a variety of fluorescent probes and offers a complete acquisition/analysis software package that includes a plug-in architecture for end-users to provide their own analysis code.

The new INO F-HS microscope has already been used to start studies on new biochemical pathways within living cells that are good prospective targets for new anti-cancer drug development. The device's performance has already raised interest among industrial researchers in large pharmaceutical companies and strategies are currently under discussion to bring this new microscope to market.

This project was financed in part by the Consortium québécois sur la découverte du médicament (CQDM) [Quebec Drug Discovery Consortium] and the Ontario Centres of Excellence (OCE).

"INO delivered a very solidly engineered hyperspectral FLIM system. Unlike our other FLIM capable microscopes that require regular alignment, the INO hyperspectral FLIM system has not needed alignment since delivery eight months ago."

David Andrews, Director of Biological Sciences and Senior Scientist, Sunnybrook Research Institute

Presagis

Making the simulated world more real

Montreal-based Presagis Inc. delivers simulation and graphics software and services to defence and aeronautic organizations worldwide. It also provides end-users, system integrators, developers and manufacturers with advanced tools and dedicated services to help them achieve rich, immersive virtual environments for training, as a test-bench and for designing the cockpits of tomorrow.

To provide the most realistic simulation environments for aircraft training, the company's software tools must be able to model and visualize not just dynamic 3D scenes, but also a range of aircraft-mounted video cameras that capture them. Together, these cameras can cover a wide spectral range, from the visible to long-wave infrared. To provide its clients with accurate, validated airborne camera simulations, Presagis reached out to INO.

Drawing on its extensive experience in imaging, system modeling and characterization, INO provided Presagis with in-depth expertise to develop realistic models of various type of imaging cameras, from photovoltaic visible-band detectors to cooled/uncooled thermal band imagers. INO also acquired images of controlled scenes at its imagery characterization laboratory, using a series of various cameras at its disposal. These images allowed Presagis to confidently validate the detector models it had implemented within its Ondulus simulation environment. Having camera models validated using real-life camera data has given Presagis an edge over its competitors.

Following this successful first project, INO is now working with Presagis to produce better modeling atmospheric effects such as fog, clouds, dust and rain in its simulation environments.

"Within the Phase I cooperative research project between Presagis Inc. and INO, we were able to take advantage of optics expertise and experimental facilities from INO to save time and gain knowledge in technical details.

I am looking forward to start the next phase of our research project with INO to improve our atmospheric model and to support full spectrum infrared sensor simulations."

Xu Dong, Software Architect, Presagis Inc.

INOvation Awards

Every year, INO honours its most innovative employees with the INOvation Awards-4 annual prizes recognizing accomplishments of the last 12 months, and a special prize awarded every 5 years. This is an opportunity to highlight the significance of innovation and recognize our employees' expertise, creative minds and commitment. Here are the 2017 winning teams.

EURÊKA!

The EURÊKA! award is presented to the project or team whose invention disclosure holds the greatest potential to create economic value outside of INO. This year, the award was presented to Daniel Cantin for his invention *Detection and characterization of micro-organisms using a fluorescence-based grain-sizing method (iSIPS fluo)*. The iSIPS platform is used to determine the size of particles in aerosol form or in water by using mirrors and a camera to collect light diffused at different angles.

Congratulations!

ALL for ONE!

The ALL for ONE! award is given to the project team that had high engagement and commitment levels and drew on a variety of expertise to implement a novel and successful solution. The HCS FLIM-FRET team won the honours in this category this year for its microscope, which uses high-content screening (HCS) based on fluorescence-lifetime imaging microscopy (FLIM) and Förster resonance energy transfer (FRET). It is used to evaluate in-cell protein interactions and can also evaluate and select different molecules for cancer treatment (chemotherapy) more than 10 times faster than standard commercial microscopes.

Congratulations to:

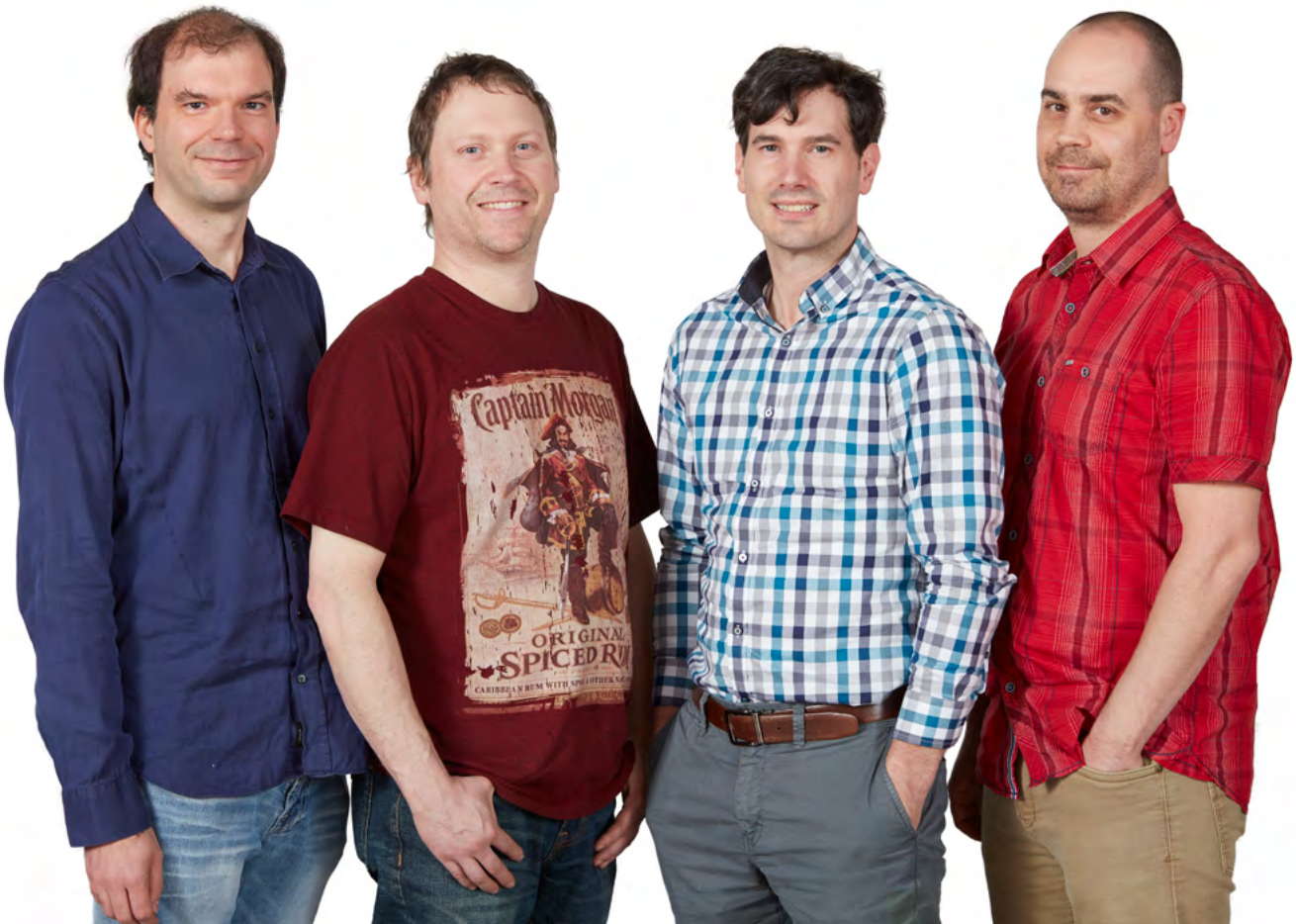
- Geneviève Anctil
- Guy Bergeron
- Katia Bilodeau
- Yvon Bilodeau
- Jean-Pierre Bouchard
- Robert Brown
- Mario Cantin
- Michel Doucet
- Frédéric Emond
- Luc Favreau
- Pascal Gallant
- Claudine Gosselin (absent from photo)
- Félix Houde Bouchard (absent from photo)
- Mélanie Leclerc
- Bruno Leduc
- André Lépine
- Frédéric Levesque
- Louis Martin
- Martin Massicotte
- Stéphane Melançon
- Ozzy Mermut (absent from photo)
- Jacques Régnier
- Christophe Rivière (absent from photo)
- Stéphane Rochefort
- Sébastien Roy
- Christian Tardif
- Manon Thibault
- Carl Vachon
- Steve Vignet
- Jessie Weber

MORE with LESS!

The MORE with LESS! award is presented to the project team or individuals whose innovative method was adopted, resulted in real time and money savings, and has growth potential. The improvement of the ceramic packaging process for the bolometer with gold-black in a vacuum, at a lower temperature (from 285oC to 175oC) and at a lower cost (reduced more than twofold) for a performance of close to 100% enabled the project team to gain distinction this year.

Congratulations to:

- David Béland (absent from photo)
- Dominic Carrier
- Yan Desroches
- Alex Paquet
- Marc Terroux
- Patrice Topart (absent from photo)



SYNERGY!

The SYNERGY! award is given to the team whose project made use of several technological platforms and favoured their reuse, leading to an innovative solution. Under the aegis of the Entrepreneur in Residence program, the team developed a complete spectroscopic lidar system used to detect benzene remotely. This initial prototype is designed to be installed underneath a helicopter during pipeline surveillance flights and can be used to detect leaks of liquid petroleum products.

Congratulations to:

- Martin Allard
- François Babin
- Guy Bergeron
- Katia Bilodeau
- Yvon Bilodeau
- Nathalie Blanchard
- Pascal Bourqui
- Martin Briand (absent from photo)
- Mario Cantin
- Félix Cayer
- Jean-François Cormier
- François Châteauneuf
- Patrice Côté
- Marc Deladurantaye
- Louis Desbiens
- Sébastien Deshaies
- Nichola Desnoyers
- François Duchesne
- Pascal Dufour
- Frédéric Emond
- Luc Favreau
- Jonny Gauvin
- David Gay
- Marc Girard
- Philippe Goyette
- Jean-François Gravel (absent from photo)
- Martin Grenier
- Anne Claire Jacob Poulin
- François Lagacé
- Mathieu Legros
- Martin Massicotte
- Stéphane Melançon
- Paul-François Paradis
- Jacques Régnier
- Stéphane Rochefort
- Vincent Roy
- Marco St-Pierre
- Yves Taillon
- Manon Thibault
- Carl Vachon
- Sonia Verreault

With INO since its founding

INO is celebrating its 30th anniversary this year—a milestone capping three decades of research, inspiration and innovation. Certain members of the INO team who have been with the organization since its founding have witnessed the development of myriads of inventions, including special fibre optics used in sensors, data sources for artificial intelligence systems, terahertz cameras and hyperspectral imagery. Today, we would like to pay tribute to their dedication and commitment.

Pierre Galarneau, Alain Bergeron, Yves Taillon,
Thérèse Godbout, André Croteau, Hubert Jerominek

INO : involved in the community

Chefs' lunch for the Light the Night walk

Every fall, various members of INO's team get together, roll up their sleeves and offer their colleagues a feast known as the Chefs' lunch (Dîner des Chefs). In addition to showcasing their culinary talents, this event is used to raise funds to benefit the Light the Night walk organized by the Leukemia and Lymphoma Society of Canada. Thanks to this very special activity, a total of $1,720 was invested in blood cancer research and patient services.

2017 Centraide campaign (United Way)

Thanks to the generosity of our employees, a donation was made to the fundraising campaign for Centraide (United Way) in the Quebec City and Chaudière-Appalaches regions, exceeding our target for this year ($33,000). In the end, close to $35,000 was raised and will be used to support 13 projects and 200 organizations providing services to vulnerable individuals across the region.

2018 snow pentathlon

Once again this year, INO was well represented at the snow pentathlon (Pentathlon des Neiges), with 25 employees taking part. The five INO teams competing all finished in the top third of the standings and INO-1 did particularly well and rounded out the podium.

Encouraging the next generation

With the advent of artificial intelligence, the Internet of things and advanced robotics, optics and photonics are the twin fields of the future, destined to grow in the coming years. The success of this growth is based primarily on training new talent to form the next generation of high-level scientists. For that reason, INO is dedicated to encouraging a passion for science among young people through its involvement in various foundations and activities :

- Fernand Séguin Primary School Foundation
- La Pocatière CEGEP Foundation
- Girls and Science
- Expo-Science
- Science Storm (Tempête des sciences)
- Photonic Games
- Science Cup
- Avion Cargo project (Université Laval)

INO members

GOVERNMENT MEMBERS

Government of Quebec

Government of Canada

AFFILIATE MEMBERS

Bell Canada
Montreal (Quebec)

Caisse de dépôt et placement du Québec
Quebec (Quebec)

Communications Research Centre Canada
Ottawa (Ontario)

Desjardins Business
Levis (Quebec)

Industrial Alliance
Quebec (Quebec)

Thales Canada
Saint-Laurent (Quebec)

MEMBRES ASSOCIÉS

ABB
Quebec (Quebec)

Advanced Test and Automation Inc.
Milton (Ontario)

Airbus Defence and Space Canada
Ottawa (Ontario)

B-Con Engineering
Nepean (Ontario)

Celestica International
Toronto (Ontario)

CorActive High-Tech
Quebec (Quebec)

EXFO
Quebec (Quebec)

Faculty of Engineering and Design
Carleton University
Ottawa (Ontario)

Gentec Electro-Optics
Quebec (Quebec)

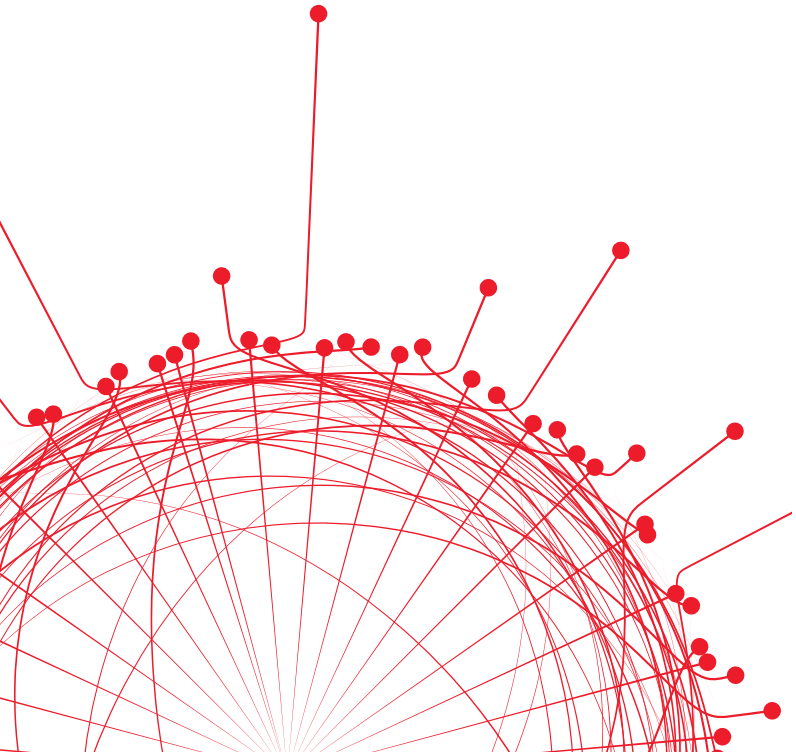
LeddarTech
Quebec (Quebec)

Telops
Quebec (Quebec)

TeraXion
Quebec (Quebec)

Université Laval
Quebec (Quebec)

University of Ottawa
Ottawa (Ontario)



Spin-offs

DxBioTech
Compact cytometer, 2017

Swiftsure
Optronic synthetic aperture processor, 2017

FlyScan
Lidar for benzene detection, 2016

RaySecur
Terahertz technology to detect letter bombs, 2015

Technologies and services INOOXX
LiDAR measurement of Brasque level, and laser triangulation technology to measure truck load volume, 2013

handyem
Compact cytometer, 2011

Opti Rythmix
Virtuo library, 2011

Company in the environment domain
Confidential, 2010

Pavemetrics Systems
Machine vision systems for transport infrastructure inspection, 2009

RealTraffic Technologies
Image analysis technologies, 2008

Hedzopt
Thermal weapon sight, 2007

LeddarTech
LEDs for detection and distance measurement 2007

Quantum BioMedical (QBM)
Endoscopic probe for intravascular diagnosis, 2006

IRphotonics
Fluoride glass and fibers, 2004

Neoptix
Fiber optic temperature sensors, 2004

OpSens
Fiber sensors, 2004

Optosecurity
Optical correlator, 2004

PyroPhotonics Lasers
PEFL laser technology, 2004

Cybiocare
Hypoglycemia sensor and glucose measurement, 2003

Obzerv Technologies
Vision systems, 2002

NEKS Technologies
Color-based gingival tartar detection, 2001

TeraXion
Optical components, 2000

CorActive High-Tech
Specialty Fibers, 1998

Pierre Langlois Consultant
Diffractive optics consulting, 1997

P&P Optica
Optics Engineering Shop, 1995

FISO Technologies
Fiber optic sensors, 1994

Lentilles Doric
Microlenses, 1994

Optiwave Corporation
Integrated Optics Software, 1994

AEREX Avionique
Optoelectronics consulting, 1993

I/FO Technologies
Fiber optic technology consulting, 1993

Optel Vision
Optical instrumentation, 1992

Instruments Régent
Optical instrumentation, 1990

Nortech Fibronic
Optical instrumentation, 1989

Technology transfers

ABB
Pyramid wavefront sensor

Arcane Technologies
Computing Library – Amazone

American enterprise
Diamond marking

Asian enterprise
Bolometers

Asian enterprise
Bolometers

Asian enterprise
Fiber components

Asian enterprise
Fiber Laser Cleaving with a CO2 laser

Asian enterprise
Reading circuit

Asian enterprise
Terahertz imaging

Asian integrator
MOPAW laser

Asian Research Institute
Bolometers

Autolog
3D imaging calibration software

Planovision
Source code

Avensys/Bragg Photonics
All-fiber photo-induced filters

Brio Conseils
Development process management innovation

Bristol Aerospace
Infrared detector

Canadian enterprise
Bolometers

Canadian enterprise
Infrared imaging

Communication Research Center Canada
Integrated processes system - SPI

CorActive High-Tech
Triple-clad specialty optical fiber

CTEX
Bolometers

Cybiocare
Hypoglycemia sensor and glucose measurement

Dellux Technologies
LED lights

DxBioTech
Compact cytometer

European enterprise
Lens auto-centering technology

FISO Technologies
End-of-service indicator for
respiratory protective device
Fiber optic sensors for temperature,
constraint and pressure

FlyScan
Lida for benzene detection

Gentec Electro-Optics
Holographic wave sampler

handyem
Flow cytometry

Hedzopt
Thermal weapon sight

Industries Maibec
Features detection on cedar wood shingles

Instruments Régent
Optical instrumentation

iOmniscient
Classification module

IRphotonics
Fluoride fibers

Krispy Kernels
Hyperspectral system for automatic sorting of contaminants

Lasiris
Diffractive optical elements

LeddarTech
LEDs for detection and distance measurement

Lentilles Doric
Refraction index gradient microlens

Microsphere
Optical correlator for inspection of plastic components

MPB
Infrared spectrometer

NEKS Technologies
Color-based gingival tartar detection

Netcorp
Optical switch

Normand PROJEX
Inspection system for 3D verification of hardwood floor mortise and tenon dimensions

Nortech Fibronic
Fiber optics temperature sensors
Tunable fiber laser

Obzerv Technologies
DALISTM laser illuminator

Opti Rythmix
Virtuo library

Optiwave Corporation
Integrated optics software

Optosecurity
INOSegmenter - Image segmentation software
Numerical optical correlator technology
Optical correlator

Pavemetrics Systems
Machine vision systems for transport infrastructure inspection
Machine vision systems for a new field of views

Petroleum sector enterprise
Fiber sensor technology

PyroPhotonics Lasers
PEFL laser technology
PYFL fiber laser unfolded cavity configuration

Quantum Biomedical (QBM)
Fiber endoscope for intravascular diagnosis

RealTraffic Technologies
Image analysis technologies

RaySecur
Terahertz technology

Searidge Technologies
Video monitoring technology
Video surveillance and video processing technology and source codes

Seastar Optics
Erbium fiber laser

Solvision
Structured light projector

STAS
Hydrogen fluoride detector

Swiftsure
Optronic synthetic aperture processor

SYGIF International
Integrated processes system - SPI

Symbiotech Medical
Intra-arterial analysis and detection

Teledyne Dalsa
Bolometers

Telops
Integrated processes system - SPI

West Coast petroleum sector enterprise
Fiber sensor technology

Board of directors

We would like to thank Mr. Jean-Guy Paquet, who resigned as chairman of the board this year.

Michel Audet[1]
Corporate Director
Montreal (Quebec)

Monique L. Bégin[2]
Corporate Director
Quebec (Quebec)

André Bolduc
Director - Account Management
Bell Canada
Montreal (Quebec)

Normand R. Bourque[2]
Corporate Director
Lorraine (Quebec)

Denis Faubert
President, CEO
CRIAQ
Montreal (Quebec)

François Giroux[2]
President
Gentec
Quebec (Quebec)

Simon Jacques
President
Airbus Defence and Space Canada
Ottawa (Ontario)

Guy Laberge[1]
Corporate Director
Quebec (Quebec)

Liliane Laverdière
Corporate Director
Quebec (Quebec)

Jean-Guy Paquet
Corporate Director
Quebec (Quebec)

Jean Pronovost[1, 2, 3]
Corporate Director
Quebec (Quebec)

Hugues St-Pierre[1]
Corporate Director,
President of MAXXAB
Rimouski (Quebec)

Jacques Topping[1, 3]
Corporate Director
Quebec (Quebec)

Jean-Marie Toulouse
Professor Emeritus
HEC Montreal
Montreal (Quebec)

1 Executive Committee Members
2 Audit Committee Members
3 Investment Committee Members

R&D advisory committee

In memoriam, Michel Bélanger 1950-2018

The optics/photonics community, particularly in the telecommunications sector, lost an illustrious member this year, Michel Bélanger. A pioneering researcher and builder of INO's micro-manufacturing division, Michel went on to work at Teleglobe Canada, Nortel and Ciena. During his latter two mandates, he joined INO's R&D advisory committee, where he played a key role in determining the overall technological approach. His unswerving support, judicious comments and wise counsel will be greatly missed.

Michel Arseneault
PARI-CNRC
Quebec (Quebec)

Eugene G. Arthurs
SPIE
Bellingham (Washington)

Michel Bélanger
Ciena Corporation
Ottawa (Ontario)

Richard Boudreault
Polar Knowledge Canada
Ottawa (Ontario)

Sylvain Charbonneau
University of Ottawa
Ottawa (Ontario)

André Fougères
INO
Quebec (Quebec)

Pierre Galarneau
INO
Quebec (Quebec)

Jean Giroux
Telops
Quebec (Quebec)

Marie-France Laporte
ABB
Quebec (Quebec)

Jean Maheux
DRDC-Valcartier
Quebec (Quebec)

Martin Maltais
UQAR
Levis (Quebec)

Michel Piché
Center for Optics, Photonics and Lasers (COPL)
Quebec (Quebec)

Ruth Rayman
NRC
Ottawa (Ontario)

Antonio Scandella
Bell Canada
Montreal (Quebec)

Michael Schmidt
Friedrich-Alexander Universität
Erlangen-Nürnberg (Germany)

Brian C. Wilson
University Health Network
Toronto (Ontario)

Management Committee

Alain Chandonnet
President and Chief Executive Officer

Michel Arnault
Vice-president, Operations

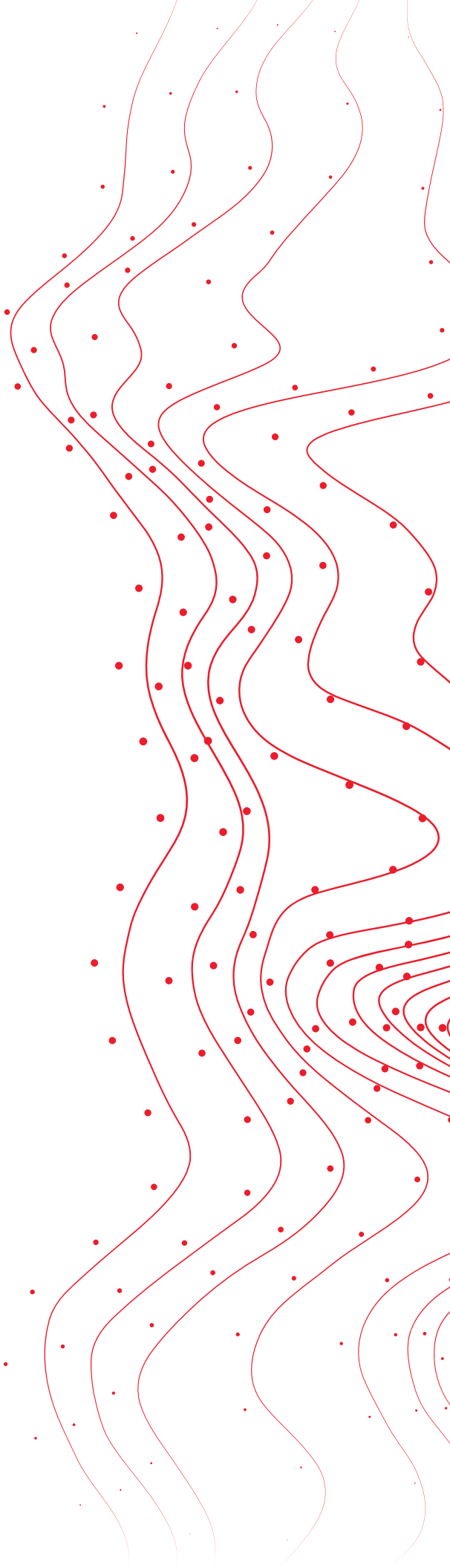
Philippe Boivin
Vice-President, Corporate Affairs

André Fougères
Vice-President, Innovation and Technology

Pierre Galarneau
Vice-President and Chief Technology Officer

Martin Larrivée
Vice-President, Finances

Louis Martel
Vice-president, Business development
and partnerships



Associate researchers

Jacques Albert
Carleton University

Claudine Allen
Université Laval

Gideon Avigad
Vineland

Hamed Pishvai Barzargani
Institut national de la recherche scientifique (INRS)

Frédéric Bernardin
CEREMA, Clermont-Ferrand, France

Magella Bilodeau
Canmet Mining

Jean-Pierre Blanchet
Université du Québec à Montréal (UQAM)

Robert Campbell
University of Alberta

Lukas Chrostowski
University of British Columbia

Sylvain Cloutier
École de technologie supérieure (ÉTS)

Michael Daly
York University

Sylvie Daniel
Université Laval

Ronald Dekker
Philips

Yves de Koninck
Université Laval

Jocelyn Faubert
Université de Montréal

Tigran Galstian
Université Laval

Philippe Giguère
Université Laval

Clément Gosselin
Université Laval

Knut Gottfried
Fraunhofer ENAS, Germany

Florent Goutailler
ENSEA, France

Ashraf A. Ismail
McGill University

Steffen Kurth
Fraunhofer ENAS, Germany

Jean-François Lalonde
Université Laval

Frédéric Leblond
Polytechnique Montréal

Mario Leclerc
Université Laval

Odile Liboiron-Ladouceur
McGill University

Ming Li
Chinese Academy of Sciences, China

Matthias Mecklenburg
Hamburg University of Technology, Germany

Marco Meinig
Fraunhofer ENAS, Germany

Michel Piché
Université Laval

Steve Prescot
University of Toronto

Eric Rehm
Université Laval

Alexandra Rink
University of Toronto

Patrick Rochette
Université Laval

Stephan Roth
BLZ, Germany

Jean Rouat
Université de Sherbrooke

Safieddin Safavi-Naeini
University of Waterloo

Armen Saghatelyan
Université Laval

Alireza Saïdi
ICI, Collège Ahuntsic

Yves Saint-Amant
Université Laval

Michael Schmidt
SAOT, University Erlangen, Germany

Daria Smazna
Technische Fakultät – Christian-Albrechts-Universität zu Kiel, Germany

Vivek Subramanian
University of California at Berkeley, United States

Simon Thibault
Université Laval

Christine Tremblay
École de technologie supérieure (ÉTS)

Réal Vallée
Université Laval

Jean-Pierre Véran
NRC Herzberg

Brian Wilson
University of Toronto

Yeni Yucel
Ryerson University

Summary Financial Statements

March 31, 2018

June 7, 2018

Report of the independent auditor on the summary financial statements

To the Members of the National Optics Institute

The accompanying summary financial statements, which comprise the summary statement of financial position as at March 31, 2018 and the summary statements of operations, changes in net assets and cash flows for the year then ended, and related notes, are derived from the audited financial statements of the National Optics Institute for the year ended March 31, 2018. We expressed an unmodified audit opinion on those financial statements in our report dated June 7, 2018.

The summary financial statements do not contain all the disclosures required by Canadian accounting standards for not-for-profit organizations. Reading the summary financial statements, therefore, is not a substitute for reading the audited financial statements of the National Optics Institute that are available from the organization.

Management's responsibility for the summary financial statements

Management is responsible for the preparation of a summary of the audited financial statements.

Auditor's responsibility

Our responsibility is to express an opinion on the summary financial statements based on our procedures, which were conducted in accordance with Canadian Auditing Standard (CAS) 810, *Engagements to Report on Summary Financial Statements.*

Opinion

In our opinion, the summary financial statements derived from the audited financial statements of the National Optics Institute for the year ended March 31, 2018 are a fair summary of those financial statements.

PricewaterhouseCoopers LLP[1]

[1] CPA auditor, CA, public accountancy permit No. A118597

Summary Statement of Financial Position

As at March 31, 2018

	2018 $	2017 $
ACTIF		
Current assets		
Cash and cash equivalents	**263,498**	1,036,372
Accounts receivable	**3,503,906**	2,950,139
Financial support receivable related to		
Internal Research Program (note 2a)	**2,193,468**	2,967,033
Tangible capital assets and intangible assets (note 2b, i)	**392,966**	626,852
Inventories	**2,075,002**	2,593,982
Research contracts in progress	**516,238**	1,137,714
Prepaid expenses	**760,059**	796,240
Net investment in a finance lease	**-**	104,524
Investments – Current portion	**5,327,501**	-
	15,032,638	12,212,856
Investment	**16,549,214**	22,000,000
Investments in private companies	**229,233**	229,233
Financial support related to the building (note 2c)	**77,270**	70,732
Tangible capital assets	**25,967,902**	24,847,412
Intangible assets	**109,870**	131,488
	57,966,127	59,491,721
LIABILITIES		
Current liabilities		
Excess of outstanding cheques over bank balances	**538,384**	-
Bank loans	**2,707,195**	1,210,514
Accounts payable and accrued liabilities	**4,943,335**	5,672,157
Deferred revenues and advances on contracts	**1,032,869**	1,698,469
Current portion of long-term debt	**214,298**	729,817
Deferred financial support related to additional financial support program (note 2a)	**5,000,000**	-
	14,436,081	9,310,957
Long-term debt	**1,778,269**	368,956
Employee future benefit obligations (note 3)	**4,916,136**	5,949,443
Deferred financial support related to		
Tangible capital assets and intangible assets (note 2b, ii)	**18,518,778**	18,784,778
Business and Regional Growth / Innovation Program (note 2d)	**-**	16,248
Additional financial support program (note 2a)	**17,268,725**	25,000,000
	56,917,989	59,430,382
Net assets	**1,048,138**	61,339
	57,966,127	59,491,721

Approved by the Board of Directors

Director

Director

The accompanying notes are an integral part of these summary financial statements.

Summary Statement of Operations

For the year ended March 31, 2018

	2018 $	2017 $
REVENUES		
Financial support related to		
Internal Research Program (note 2a)	**19,400,000**	16,400,000
Tangible capital assets and intangible assets (note 2b, ii)	**1,862,355**	1,764,772
Financing costs (note 2b, iii)	**11,348**	26,853
Business and Regional Growth / Innovation Program (note 2d)	**16,248**	32,493
Sales and contracts	**13,761,534**	14,998,421
Royalties	**171,223**	110,716
Technology transfer agreements and other agreements	**694,386**	587,457
Rent and other revenues	**296,222**	612,750
Gain on disposal of assets	**196,015**	39,467
Members' contributions	**49,000**	53,000
	36,458,331	34,625,929
EXPENSES		
Salaries and fringe benefits (note 3)	**19,406,870**	18,231,643
Cost of goods and services pertaining to project completion	**6,511,360**	6,218,655
Other operating expenses	**6,952,340**	6,742,531
Foreign exchange loss	**111,296**	107,432
Interest on long-term debt	**48,405**	31,842
Interest and bank charges	**192,025**	155,074
Depreciation of tangible capital assets	**2,609,877**	2,490,168
Amortization of intangible assets	**69,059**	66,526
	35,901,232	34,043,871
Excess of revenues over expenses for the year	**557,099**	582,058

The accompanying notes are an integral part of these summary financial statements.

Summary Statement of Changes in Net Assets

For the year ended March 31, 2018

	2018 $	2017 $
Net assets – Beginning of year	**61,339**	676,482
Excess of revenues over expenses for the year	**557,099**	582,058
	618,438	1,258,540
Remeasurements and other items (note 3)	**429,700**	(1,197,201)
Net assets – End of year	**1,048,138**	61,339

The accompanying notes are an integral part of these summary financial statements.

Summary Statement of Cash Flows

For the year ended March 31, 2018

	2018 $	2017 $
CASH FLOWS GENERATED BY (USED IN)		
OPERATING ACTIVITIES		
Excess of revenues over expenses for the year	**557,099**	582,058
Items not affecting cash		
Depreciation of tangible capital assets	**2,609,877**	2,490,168
Amortization of intangible assets	**69,059**	66,526
Amortization of premiums and discounts on coupons and bonds	**113,747**	-
Adjustment related to employee future benefits	**(603,607)**	(204,758)
Financial support related to tangible capital assets and intangible assets (note 2b and d)	**(1,878,603)**	(1,797,265)
Deferred financial support recognized in revenues (note 2a)	**(3,000,000)**	-
Gain on disposal of assets	**(196,015)**	(39,467)
	(2,328,443)	1,097,262
Changes in non-cash working capital items	**2,794,572**	(3,831,566)
	466,129	(2,734,304)
FINANCING ACTIVITIES		
Change in bank loans	**1,496,681**	661,733
Long-term debt contracted	**1,670,000**	514,822
Repayment of long-term debt	**(149,352)**	(95,478)
Investment income generated related to deferred financial support (note 2a)	**268,725**	-
Financial support received (used) (note 2a and 2b, ii)	**(1,469,283)**	26,469,283
	1,816,771	27,550,360
INVESTING ACTIVITIES		
Acquisition of tangible capital assets	**(3,924,595)**	(3,312,002)
Acquisition of intangible assets	**(58,154)**	(40,718)
Proceeds from disposal of tangible capital assets	**274,530**	39,467
Finance lease, net of repayments	**104,524**	134,593
Acquisition of a term deposit	**-**	(22,000,000)
Disposal of a term deposit	**22,000,000**	-
Acquisition of investments	**(22,590,463)**	-
Disposal of investments	**600,000**	-
	(3,594,158)	(25,178,660)
Decrease in cash and cash equivalents during the year	**(1,311,258)**	(362,604)
Cash and cash equivalents – Beginning of year	**1,036,372**	1,398,976
Cash and cash equivalents (excess of outstanding cheques over bank balances) – End of year *	**(274,886)**	1,036,372
Supplementary information		
* Cash and cash equivalents (excess of outstanding cheques over bank balances) includes the following amounts presented in the summary statement of financial position:		
Cash and cash equivalents	**263,498**	1,036,372
Excess of outstanding cheques over bank balances	**(538,384)**	-
	(274,886)	1,036,372

The accompanying notes are an integral part of these summary financial statements.

Notes to Summary Financial Statements

March 31, 2018

1 STATUTES AND NATURE OF ACTIVITIES

The National Optics Institute (INO) was incorporated on December 13, 1985 under Part II of the Canada Corporations Act and continued on September 11, 2013 under the Canada Not-for-profit Corporations Act. Its mandate is to provide the Canadian optics industry with research and development support and the technical assistance necessary to sustain its growth and to play a leading role in the development and application of optics in Canada.

As a non-profit organization, INO is exempt from income tax.

2 FINANCIAL SUPPORT

a) Financial support – Internal Research Program

The financial support that INO receives as part of the Internal Research Program is as follows:

			Revenues	
	Total support (from 2017 to 2022) $	Remaining support available as at March 31, 2018 $	2018 $	2017 $
Government of Canada Canada Economic Development	50,000,000	30,000,000	**10,000,000**	10,000,000
Government of Quebec	57,000,000	41,200,000	**9,400,000**	6,400,000
Financial support – Internal Research Program	107,000,000	71,200,000	**19,400,000**	16,400,000

Government of Canada

In August 2016, the Government of Canada, through the Business and Regional Growth Program of Canada Economic Development, granted INO financial support of up to $50,000,000 for the five-year period ending on March 31, 2021, for its Internal Research Program. As at March 31, 2018, an amount of $2,193,468 ($2,967,033 as at March 31, 2017) was still receivable on the second tranche of $10,000,000 allocated for the year.

Government of Quebec

In July 2016, the Government of Quebec granted INO financial support of $32,000,000 over a five-year period ending on March 31, 2021 for INO's Internal Research Program. The amount of $6,400,000 allocated for the year was received in full as at March 31, 2018.

In addition, in March 2017, the Government of Quebec granted INO additional financial support in an amount of $25,000,000 for the period from April 1, 2017 to March 31, 2022 to carry out research activities and develop expertise in the areas of IoT (the Internet of things), advanced robotics and 3D printing, as well as to establish an office in the Montréal area. As at March 31, 2017, this financial support had been received in full and an amount of $3,000,000 was used in fiscal 2018.

Notes to Summary Financial Statements

March 31, 2018

Deferred financial support under the additional financial support program:

	2018 $	2017 $
Balance – Beginning of year	**25,000,000**	25,000,000
Investment income generated	**268,725**	-
Amount recognized in revenues during the year	**(3,000,000)**	-
	22,268,725	25,000,000
Less: Current portion	**5,000,000**	-
Balance – End of year	**17,268,725**	25,000,000

As at March 31, 2018, a total of $22,268,725 in deferred financial support under the additional financial support program was held as investments.

b) Support program for the purchase of research equipment – Government of Quebec

i) Financial support related to tangible capital assets and intangible assets

The financial support receivable pertains to the following items:

	2018 $	2017 $
Term loan of an original amount of $1,880,868, reimbursed during the year	**-**	626,852
Financial support receivable for research equipment acquired during the year *	**392,966**	-
	392,966	626,852
Less: Current portion	**392,966**	626,852
	-	-

* Under the financial support agreement, the Government of Quebec refunds INO directly for 80% of the acquisition cost of equipment. Acquisitions made in fiscal 2017 and 2018 are covered by financial support in a maximum amount of $3,989,463 granted during fiscal 2017. As at March 31, 2018, a balance of $392,966 was receivable ($1,469,283 was received as an advance as at March 31, 2017) (note 2b, ii).

Notes to Summary Financial Statements

March 31, 2018

ii) Deferred financial support related to tangible capital assets and intangible assets

	2018 $	2017 $
Balance – Beginning of year	**18,784,778**	17,549,595
Financial support related to the purchase of tangible capital assets and intangible assets for the year	**3,059,100**	1,124,409
Financial support related to the building for the year	**6,538**	406,263
Financial support received as an advance (note 2b, i)	**-**	1,469,283
Use of financial support received in advance	**(1,469,283)**	-
Transfer to revenues to offset the corresponding depreciation and amortization	**(1,862,355)**	(1,764,772)
Balance – End of year	**18,518,778**	18,784,778

iii) Financial support related to financing costs

INO receives financial support for the interest charges related to certain long-term debt items. The financial support received for this purpose amounts to $11,348 ($26,853 as at March 31, 2017) and has been included in revenues.

c) Financial support related to the building

In 2016, the Government of Quebec granted INO financial support of up to $772,691 for major work on the building. Financial support is paid as disbursements are made by INO. As at March 31, 2018, an amount of $77,270 ($70,732 as at March 31, 2017) was receivable for the disbursements made during the year.

d) (d)Business and Regional Growth / Innovation Program

In 2009, INO obtained special financial support through the Business and Regional Growth / Innovation Program of Canada Economic Development for the purpose of improving its ability to market the technology and technological know-how produced by its Internal Research Program.

The deferred financial support related to tangible capital assets and intangible assets is broken down as follows:

	2018 $	2017 $
Balance – Beginning of year	**16,248**	48,741
Transfer to revenues to offset the corresponding depreciation and amortization	**(16,248)**	(32,493)
Solde à la clôture de l'exercice	**-**	16,248

Notes to Summary Financial Statements

March 31, 2018

3 EMPLOYEE FUTURE BENEFITS

INO offers employee future benefit plans, including a defined benefit plan guaranteeing the payment of pension benefits to some of its employees.

Defined benefit pension plan

The most recent complete actuarial valuation of the pension plan was performed on December 31, 2015 and was extrapolated as at March 31, 2018. Information related to the defined benefit pension plan is as follows:

	2018 $	2017 $
Defined benefit obligations	**(45,328,900)**	(43,694,500)
Fair value of plan assets	**40,755,300**	38,346,200
Defined benefit liability	**(4,573,600)**	(5,348,300)

As at March 31, 2018, the employee future benefit obligations were as follows:

	2018 $	2017 $
Defined benefit pension plan	**4,573,600**	5,348,300
Other employee future benefits	**342,536**	601,143
Passif au titre des prestations définies	**4,916,136**	5,949,443