



AARMS

Formulating Success

Research Connector

Wu Centre • University of New Brunswick
Fredericton • 13:00 to 15:00 • July 17 • 2019





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Sanjeev Seahra

Director of AARMS

Professor and Chair

Mathematics and Statistics (UNB Fredericton)

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aarms.math.ca



Canada's Mathematical Sciences Institutes



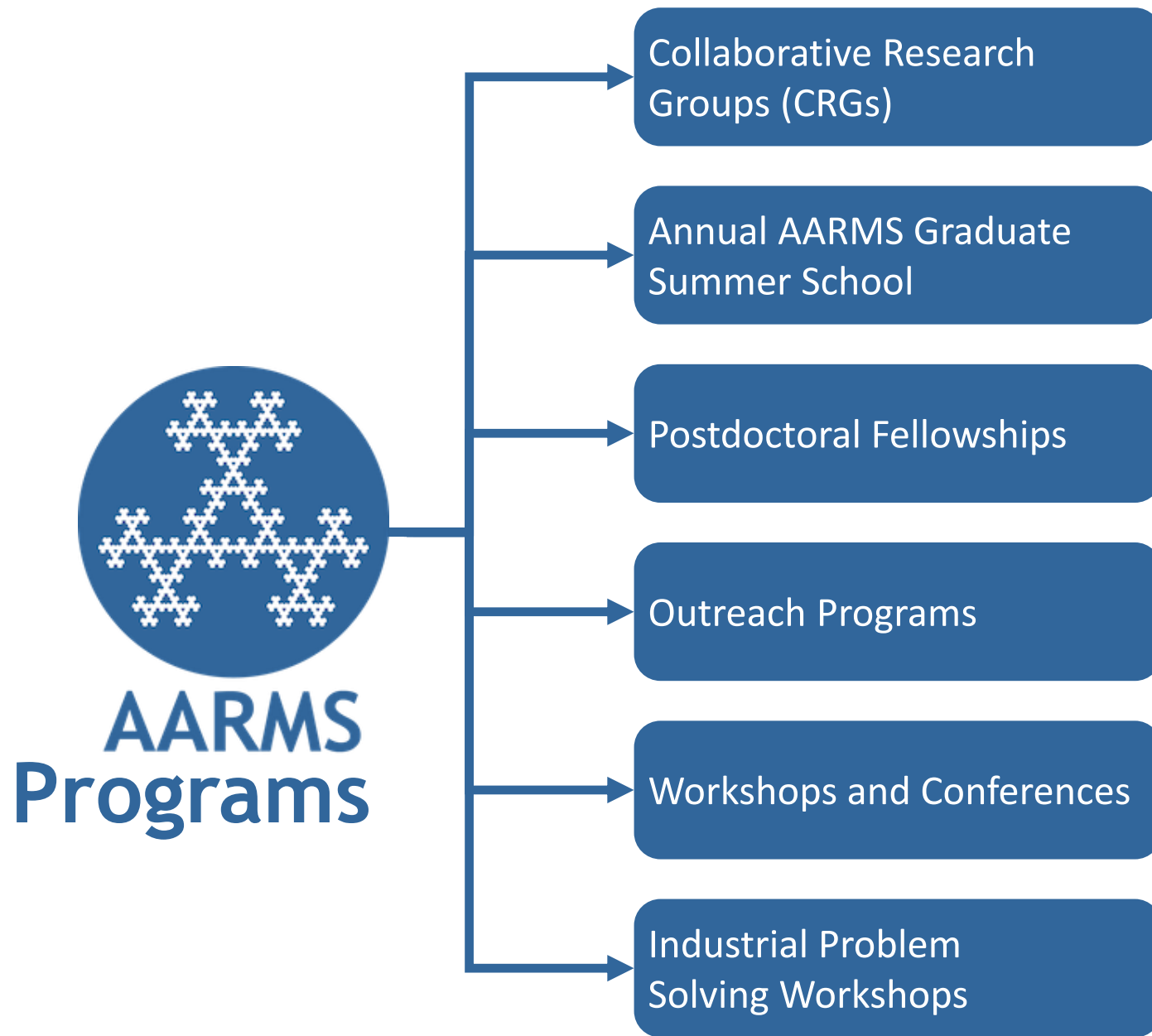


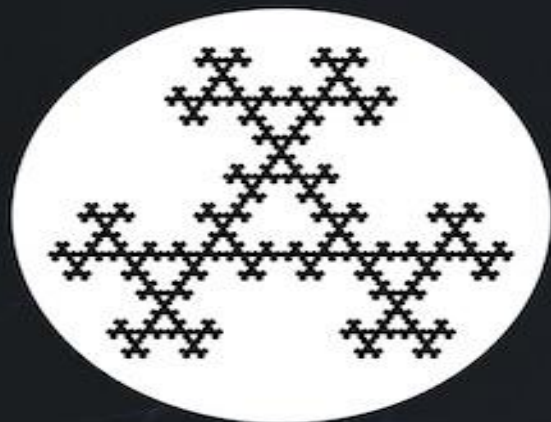
*“The mission of AARMS is to strengthen research and **education** in the mathematical sciences, with special focus on Atlantic Canada.”*



Member Universities







Industrial Problem Solving Workshop

University of New Brunswick

Fredericton • July 15 to 19 • 2019

AARMS

students, postdocs, and faculty collaborating on mathematical and statistical problems posed by companies and non-profits

problems presented by



the **Black Arcs**

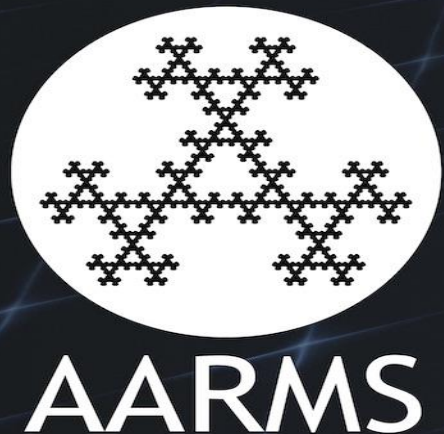


Institute of Biomedical Engineering
University of New Brunswick



New Brunswick
Health Council

Conseil de la santé
du Nouveau-Brunswick



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Fredericton · 13:00 to 15:00 · July 17 · 2019



the Black Arcs



	Time	Organization	Sector	Speaker
	1:00	AARMS	Welcome	Sanjeev Seahra
	1:05	Acadia University	Overview	Leigh Huestis
	1:08	Acadia University	Academia	Leigh Huestis
	1:11	Patriot 1 Technologies	Industry	Phil Munz
	1:16	UNB Office of Research Services	Academia	Matthew Douglass
	1:19	Ocean Supercluster	Funding Agency	Melissa O'Rourke
	1:22	Université de Moncton	Academia	Moulay Akhloufi
	1:25	Kognitiv Spark	Industry	Scott Flinn
	1:28	Dalhousie University	Academia	Hong Gu
	1:31	NBIF	Funding Agency	Daniel Hoyles
	1:34	ServUS	Industry	Vikram Devaguptapu
	1:37	BioNB	Industry	Jennifer O'Donnell
	1:40	Acadia University	Academia	Hugh Chipman
	1:43	NRC-IRAP	Funding Agency	Gary Underhill
	1:46	Acadia University	Academia	Ying Zhang
	1:49	City of Fredericton	Government	Adam Bell
	1:52	ACENET	Academia	Serguei Vassiliev
	1:55		Coffee Break	
	2:10	Venture for Canada	Funding Agency	Erica Ormiston
	2:13	University of New Brunswick	Academia	Jeff Picka
	2:16	Flaight Smart Media	Industry	Hugo van Rhijn
	2:19	Remsoft	Industry	Elliot Sullivan
	2:22	Memorial University	Academia	Tarun Sheel
	2:25	Data Science Practitioners East	Industry	Jason Urquhart
	2:28	UNB Engg. and Sci Co-op	Academia	Catherine Wilson
	2:31	C-Therm	Industry	Justin Furlotte
	2:34	Acadia University	Academia	Richard Karsten
	2:37	The Black Arcs	Industry	Dane Sheppard
	2:40	NSERC	Funding Agency	Jason Frenette
	3:00		Networking Reception	

Acadia's Office of Industry & Community Engagement (ICE)

Leigh Huestis, Director

Formulating Success – July 17th, 2019

grow exponentially



ICE - A Snapshot

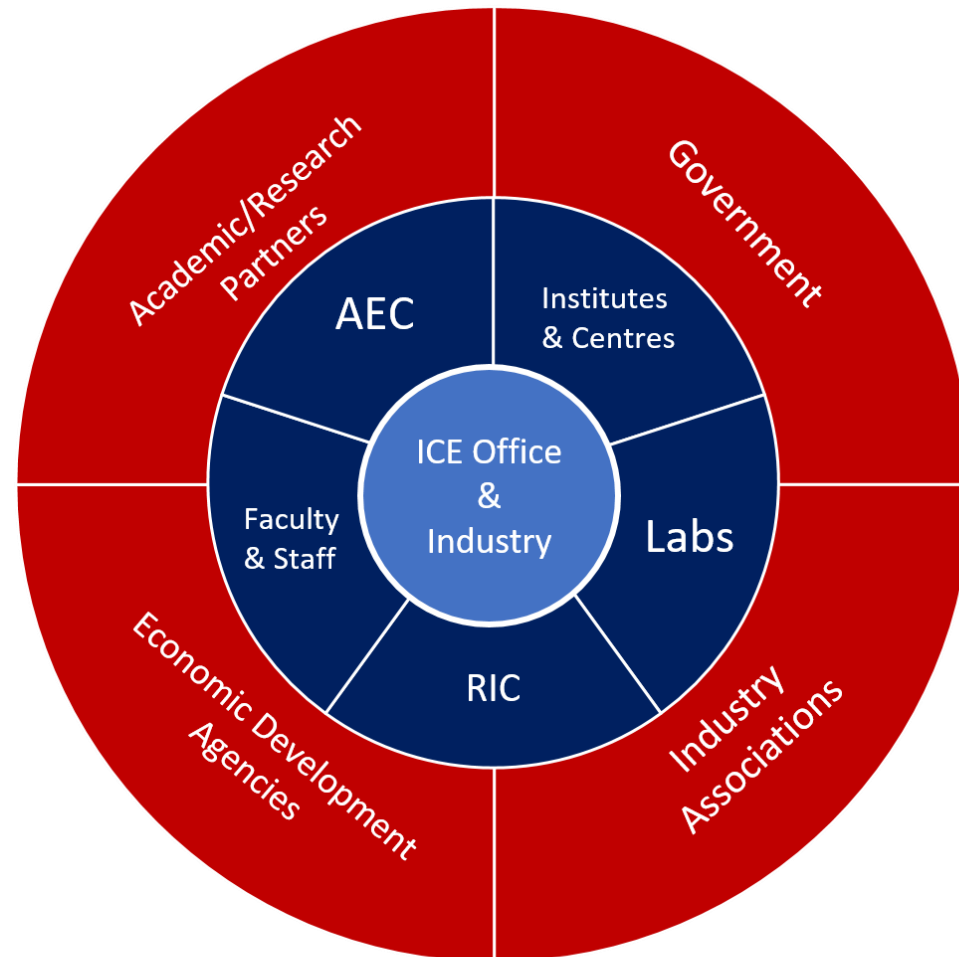
Three Core Functions:

- **Commercialization**
- **Support for start-ups**
- **Industry research & engagement (75%)**



- Acadia is the top performing small institution in Atlantic Canada
- During the past 4 years Acadia has supported over 130 start-up companies
- During the past 7 years Acadia has processed over 500 research contracts and agreements worth over \$25 million
- Technologies developed at Acadia are now being sold/used throughout the world (software, pheromone lures, etc.)

A Collaborative Approach – No Wrong Door!



A Few of our Industry Partners



Phil Munz, Principal Data Scientist



- **Company Overview**

- Overt and covert methods for detection of objects and events of interest
- PATSCAN VRS
- Camera agnostic software solution automates detection of weapons, disturbances and suspicious behaviors to alert security personnel in real time

- **History with AARMS**

- EhEye presented problem IPSW 2018
- NSERC Engage project with Dr. Hong Gu and Mia Parenteau
- MITACS Accelerate project with Suprit Singh



Phil Munz, Principal Data Scientist

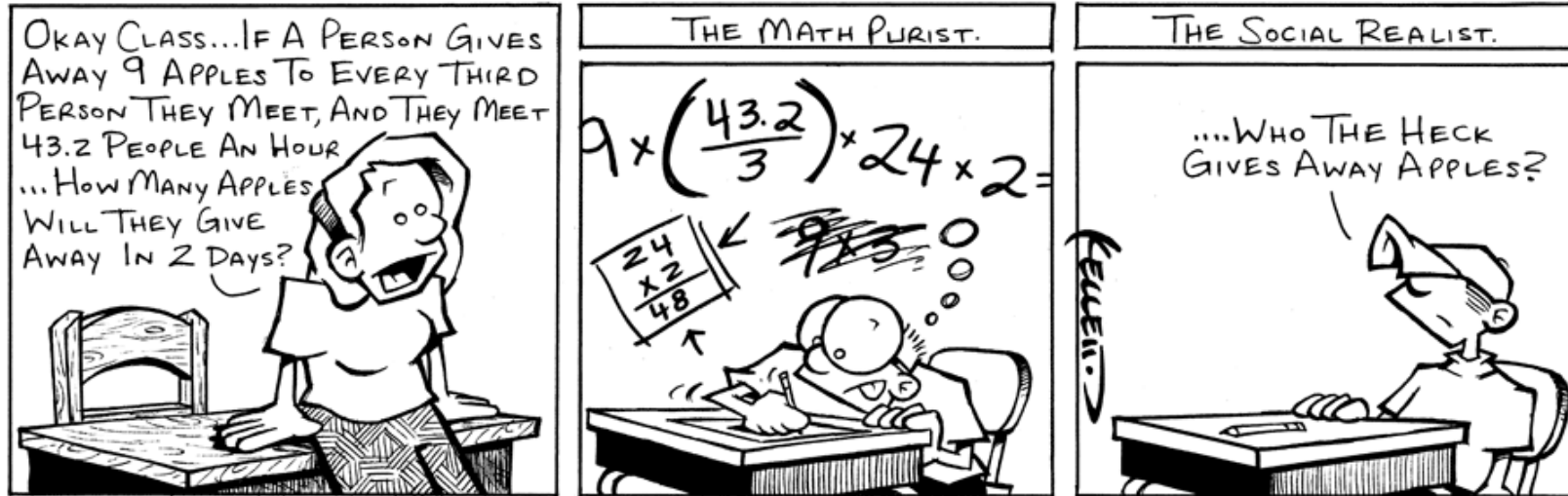


- **Research Interests**

- Computer Vision
- Machine Learning/Deep Learning

- **Expertise Sought**

- Some experience with coding
- Anyone interested in doing cool stuff



Matthew Douglass

Knowledge Transfer Officer



- **ORS Overview**

- Pre-award Services
- Financial Services

- **Industry and Government Services**

- Research Commercialization
- Collaborative Research Project Creation
- Manage UNB-owned Intellectual Property and establish various Research Agreements

- **Point of Contact for**

- UNB Researchers looking to become engaged with outside organizations
- Outside organizations seeking UNB research expertise

Melissa O'Rourke – IE Program Manager

- An industry-led collaboration that will transform Canada's ocean economy into a sustainable, technology-driven, value-creating economic segment.
 - New business opportunities, new collaborations.
 - Seafood, shipping, energy, defense, tourism, etc.
- **Program Streams**
 - Technology Leadership (TL) Program
 - Innovation Ecosystem (IE) Program
- **Expertise Sought (A LOT)**
 - Ocean sensing and characterization
 - Data analysis and visualization
 - Operational intelligence





Moulay Akhloufi

Computer Science, Université de Moncton

- **Fields of Expertise**

- Artificial intelligence - Machine learning and deep learning
- Computer vision
- Robotics

- **Research Interests**

- **Defense and security:** Videosurveillance, Multimodal Biometrics, ...
- **Drones:** Large perimeter security, Multi-UAVs collaboration, ...
- **Industrial applications:** Robot vision in manufacturing, food processing, ...
- **AI in healthcare:** Medical imaging, Genomics & Proteomics, ...
- **Fintech:** Insurance, Impact investing, Predictive analysis, ...

Kognitiv Spark

Scott Flinn – Senior Developer



- **Company Overview**

- Mixed Reality remote worker support with interactive 3D intelligence
- Microsoft HoloLens paired with Azure cloud or on-premise backend

- **Research Interests**

- Immersive 3D interaction, including hands-free speech interaction
- Smart content acquisition: "What is this?"
- Rich 3D content on low-power device

- **Expertise Sought**

- Interaction: 3D and natural language
- AI based scenario recognition and content acquisition
- 3D computational geometry: large, detailed geometries on low-power devices

Hong Gu

Dept. of Math. & Stat., Dalhousie University

- **Fields of Expertise**

- Machine learning and statistical models
- Bioinformatics
- Statistical modelling in molecular evolution
- Missing data and measurement errors

- **Research Interests**

- Medical diagnostics, diagnostic image analysis
- Information extraction from text, maps for prediction

Daniel Hoyles, Investment Analyst

NBIF·FINB

- **Innovation Voucher**

- Pair NB Companies with researchers with researchers for project with non-repayable funding up to \$80,000 to cover 80% of an R&D project
- Intellectual property created is owned by the company

- **Eligible Research Projects**

- “Projects that develop a new or improved product, process or technology.”

- **Eligibility Criteria**

- Company: incorporated, fewer than 500 employees, 24 months operating history with meaningful sales, committed to the project
- Solid business case, strong market potential financial feasibility, create competitive advantage, economic impact in NB

daniel.hoyles@nbif.ca

Vikram Devaguptapu & Founder



- **ServUs Health Overview**

- Developing a software platform that enable older adults and their caregivers navigate and coordinate senior friendly services, products, and resources
- 266 Users - 161 Service providers; 61 older adults; 44 family members; operating out of Fredericton

- **Research Interests**

- Custom search engines and software
- Fuzzy matching methods and algorithms

- **Expertise Sought**

- Algorithm development and implementation to solve problems that can benefit older adults and their family members
- Application of technology for understanding the older adult user needs and matching with the resources, products, and services.

Jenn O'Donnell

Executive Director



- **Company Overview**

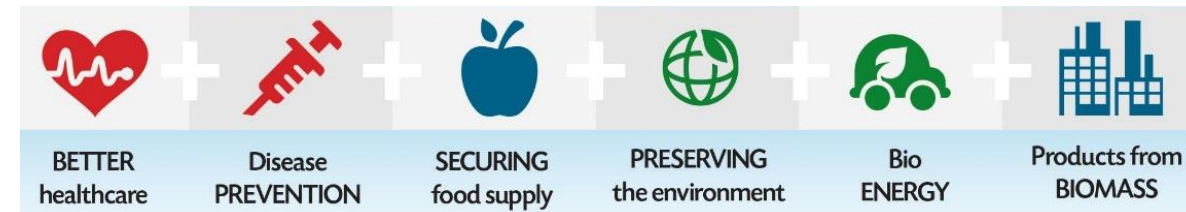
- Non-profit, Non-government, mandate to foster growth in the the bioeconomy
- Team of science, technology, commercialization and business experts

- **(Research) Interests**

- We work with start-ups, established companies, researchers and institutes who are active in the biosciences
- We provide:
 - Commercialization Services
 - Sector Expertise
 - Community Engagement and Advocacy

- **Expertise Sought**

- We can create links between research and the private sector
- We can advise on commercialization aspects of projects
- Help navigate the funding labyrinth
- Help make introductions and build networks



Hugh Chipman, Acadia/Math and Stats

- **Fields of Expertise**

- Statistical learning (supervised & unsupervised learning)
- Design and analysis of experiments
- Statistical computing

- **Research Interests**

- Quantifying uncertainty in flexible statistical learning models (Bayesian methods)
- Modelling network data
- Computer experiments
- “Rare target” predictive modelling (direct mailing, drug discovery, counter-terrorism)
- Motion capture data (Kinesiology)

Some recent / current collaborations



Classification, clustering and visualization of network structure based on communication patterns



Analysis of waveform from motion capture data to discriminate age / gender



Time series regression for wastewater monitoring

Gary Underhill

Industrial Technology Advisor



National Research
Council Canada

Conseil national de
recherches Canada

- **Industrial Research Assistance Program - IRAP**

- Support Innovative, Growth Oriented Canadian SMEs
- Federal Program with Non-Repayable Funding Support

- **Funding Programs & Assistance**

- Develop, adapt or adopt technology for new or improved products, processes or services
- Enhance innovation, productivity, and competitiveness

- **Expertise Provided**

- Over 250 ITAs with Technical and Business Experience in Industry
- Access to NRC Researchers and Facilities
- Linkages to Expertise in Canadian Research Facilities, Universities and Colleges

Ying Zhang

Department Of Mathematics and Statistics, Acadia University

- **Fields of Expertise**

- Time Series Analysis
- Rank-sign-based nonparametric statistics

- **Research Interests**

- Statistical Methods for Intervention Analysis (especially in Public Health Research)
- Quantitative Methods for Ecology and Environmetrics

- **Collaborative Research Involved (sponsored by AARMS CRG, CNODES, NSHRF, NSDNR, NSHCF, MITACS, CANSSI, and NSERC)**

- AARMC CRG, [Statistical Learning for Dependent Data with Applications in Medical and Environmental Sciences](#)
- CANSSI [Maritime Statistical health Science Collaborative Centre \(MSHSCC\)](#)

Adam Bell, CIO

- **City of Fredericton**

- Smart Cities Challenge Finalist 2019
- Implementing IoT devices collecting real-time data and rich data sets

- **Availability of Handicap Parking**

- Looking for the “Goldilocks” of Spaces
- Realtime data with historic data on frequency, dwell time etc.

- **Statistical and predictive analysis**

- How would you use the data to reasonably calculate the availability of spaces? What is the right measure of occupancy?
- How do we know if we have too many spots, too few or just right? What predictive models could be developed to dynamically assign new spaces?

Hide Map

Fredericton

Select a time range for the data. (Default: Midnight yesterday to midnight today)

Hourly

From: 2019-04-01

To: 2019-07-15

Refresh

Current Status

Vacant

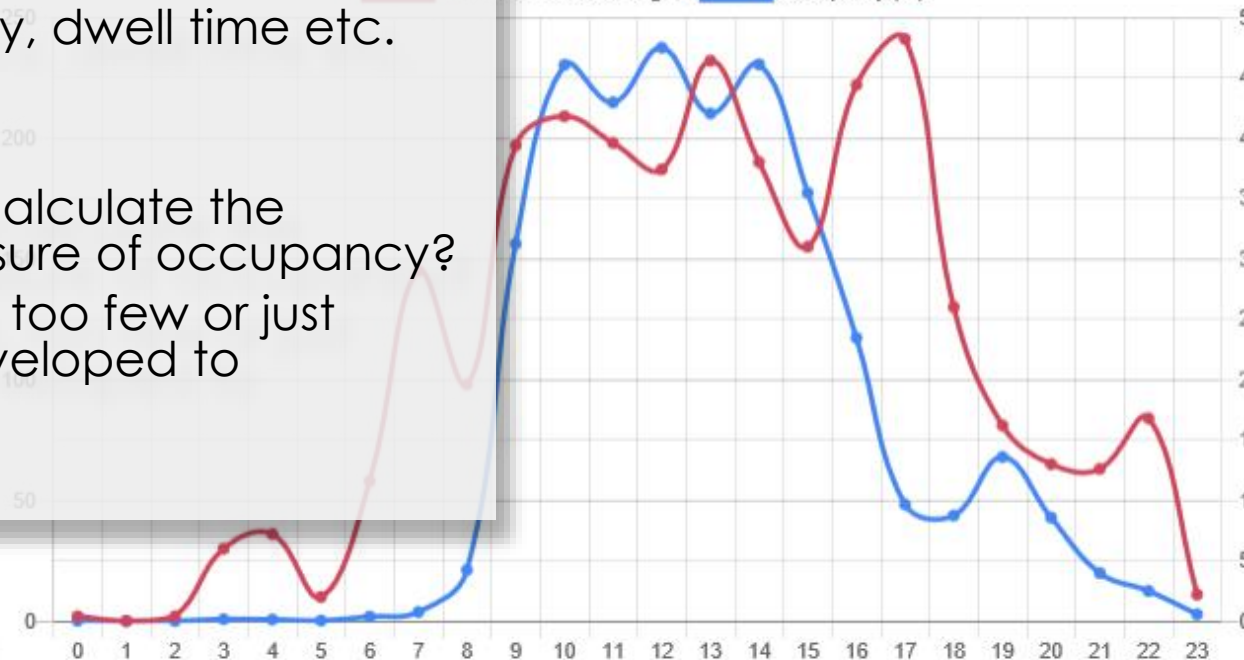
For Specified Time Period

Total Occupancy 15.3 %

Average Daily Turnover 25

Number of State Changes

Occupancy (%)



ACCESS TO:

- State-of-the-art systems
- Thousands of CPU cores
- Managed cloud space
- GPUs
- PBs storage
- Secure, fire-and-forget large file transfer portal (TBs)

SUPPORT:

- Local!
- Help figure out needs
- Help design, configure, optimize, troubleshoot code
- Onboarding
- Help solve challenging issues
- Specialists:
 - Big Data / Cloud
 - Data Management
 - Molecular Dynamics

TRAINING:

- Group and individual
- Novice to advanced
- Standard, discipline-specific, customized
- Research Computing Bootcamps
- Data management
- In-person, webinars, Wiki, slides, videos

Free of charge for researchers • Data stays in Canada

www.ace-net.ca
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15 MINUTE COFFEE BREAK

ATLANTIC INTERNSHIP PROGRAM

Surfacing, celebrating and accelerating successful entrepreneurial journeys.

Students

- Paid internships for STEM + Business students from any Canadian post-secondary school
- Marketing, Computer Science, Business Development, Engineering, etc roles in startups
- 20 hours of professional development; access to national network of young innovators

Employers

- Up to \$7,000 in wage subsidies, per student, per semester
- Organizations must be located in Atlantic Canada + have fewer than 500 employees

September, January + May internships available.

www.ventureforcanada.ca

Jeff Picka

Department of Mathematics & Statistics, UNB

- **Fields of Expertise**

- Validation of spatial models
- Foundations of model validation in complex systems

- **Research Interests**

- Developing methods for critically evaluating validation efforts
- Developing methods for assessing simulation models for powder flows, foams, composite materials, and turbulent flow



flaigh
smart media inc.

HUGO VAN RHIJN CEO

MATHEMATICS MEETS MEDIA

The Best Seat is in the Air™



Elliot Sullivan, Director of Product Management

Software and experience to optimize, schedule, manage and visualize high-value assets that improve asset value, profitability and sustainability

- **Company Overview**

- World leader in optimized planning for sustainable land and infrastructure asset management , 25+ years of experience
- 150+ clients in 15 countries with over ½ billion acres of land-based assets managed sustainably, with a mix of both private and public clients
- Apply a combination of mathematical optimization (LP and MIP), monte carlo simulation, GIS, spatial optimization, analytics, and decision support solutions

- **Research Interests**

- Matrix and Shadow Price Visualizations and Insights
- LP/MIP Solving constructs and efficiencies
- AI and machine learning from actuals

- **Expertise Sought**

- Linear Programming, Mixed-Integer programming
- Operations Research (OR)
- Predictive modeling
- AI and deep learning
- Visualization and graphing

Tarrun Sheel

Mathematics and Statistics, MUN

- **Fields of Expertise**

- Scientific Computing
- Numerical Simulation
- Computational Fluid Dynamics

- **Research Interests**

- High Performance Computing Techniques
- CFD Model on Submarine Landslides
- Turbulence Modeling around offshore structures
- Reduction of local scour near the bed of the bridge pier

DSPEast

- **Overview**

Canadian East Coast network of practicing data scientists, researchers and supporting organizations

- **Research Interests**

Driven to expand our capabilities in Data Science & AI

- **Expertise Sought**

- Multi-disciplinary diverse bench strength
(our value is our perspective)
- A mentoring inclusive network



Data Science Practitioners East



Cat Wilson, Coordinator Engineering & Science Co-op Program

- **Co-op Overview**

- Applied discipline related work experience
- Flexible terms: Summer, Fall or Winter; 4,8,12 or 16 month terms

- **Employer Services**

- “Extended” on-the-job interview
- Top quality, motivated minds (opt-in program)
- Tips/ assistance for funding (i.e. Co-op specific SEED)

- **Student Benefits**

- Stand-out
- Develop valuable skills
- Grow your network

C-Therm

- **Company Overview**

- C-Therm is a thermal analysis company with over 20 employees located in downtown Fredericton.
- We offer non-destructive testing of thermal properties of materials, such as thermal conductivity ($q = -k\nabla T$) and thermal diffusivity ($\dot{u} = \alpha\nabla^2 u$), and more.

- **Research Interests**

- Applied PDEs
- Computational physics/numerical regression

- **Expertise Sought**

- Mathematical modelling
- Materials science

C-THERM
TECHNOLOGIES™

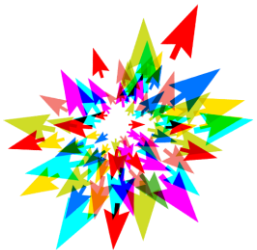


Richard Karsten, Acadia/Math and Stats

- **Areas of Expertise/Interest(s)**
 - Numerical Analysis
 - Physical Oceanography
 - Mathematical Modelling
- **Applied Expertise**
 - Tidal energy
 - Dynamics of the Bay of Fundy
 - Analysis of oceanographic measurements
 - Modelling population dynamics



Example of a project: Measuring flow past a turbine



Dane Sheppard
Director of Technology



- **Company Overview**

- Making predictive analytics accessible and intuitive
- Multi-layered mobility model - CitiSketch

- **Research Interests**

- Transportation and population modelling
- Health/Environmental/Financial prediction

- **Expertise Sought**

- Expertise to connect health with transportation
- Help refining and validating existing layers



NSERC Alliance Grants

Jason Frenette

Natural Sciences and Engineering Research Council of Canada

July 17th, 2019

Alliance

Benefits

Prior Programs

- Engage Grants
- Collaborative Research & Development (CRD) Grants
- Strategic Grants
- Industrial Research Chairs (IRC)

Alliance Grants

- one program
- more flexible
- scalable
- simpler processes
- no application deadlines
- faster decision times
- enhanced partnerships
- fewer restrictions on research topics within NSE



Projects

ONE PROGRAM

1 to 5 years

\$20,000 to
\$1,000,000
per year

Single researcher
and partner to
multiple
participants and
multisectorial

Focus on NSE
based research
activity



Partnerships

Private - Public - Not for Profit

All organizations needed to achieve the research goals

- Active in research activities
- Collectively provide cash and in-kind support
- Utilize or mobilize the project's research results
- Achieve desired impact



Partner organizations recognized in cost-sharing calculations

Private Sector

Cash contributions can be recognized*	Cash contributions <i>cannot</i> be recognized
<ul style="list-style-type: none">• Canadian private companies• Multinationals with a presence in Canada• Foreign companies (but not as the sole partner organization)	<ul style="list-style-type: none">• Venture capital / Angel investors / Seed companies• Holding companies• Companies with less than two full-time employees

*if NSERC cost-sharing requirements are met)



Partner organizations recognized in cost-sharing calculations

Canadian Public Sector

Cash contributions can be recognized*	Cash contributions <i>cannot</i> be recognized
<ul style="list-style-type: none">• Municipalities and local or regional governments established by or under provincial or territorial statute• Provincial/territorial government departments• Federal government departments• Indigenous organizations• Public utilities• Crown corporations	<ul style="list-style-type: none">• Funding organizations (federal, provincial, territorial, international) whose primary mission is to fund R&D• Organizations whose primary mission is to perform R&D and are funded or controlled primarily by government• Foreign governments

*if NSERC cost-sharing requirements are met)



Partner organizations recognized in cost-sharing calculations

Canadian Not-for-Profit Sector

Cash contributions can be recognized*	Cash contributions <i>cannot</i> be recognized
<ul style="list-style-type: none">• Producer groups• Industrial associations• Registered charities that have a mandate to carry out and apply research (within natural sciences and engineering)• Organizations whose primary mission is to maintain collections (e.g., historical, scientific, artistic, or cultural) for the public good, such as libraries, museums, zoos or aquariums• Community organizations	<ul style="list-style-type: none">• Not-for-profit organizations whose primary mission is to fund R&D and are funded or controlled primarily by government• Post-secondary institutions• Incubators and accelerators• Other registered charities• Hospitals and medical/clinical research institutes• Philanthropic organizations• Consortia with the majority of their funding originating from government sources• Foreign not-for-profit organizations• Individuals

*if NSERC cost-sharing requirements are met)



Cost-sharing

Alliance Grants are calculated based on cost-sharing with the partner organizations

- The portion that can be cost-shared with NSERC includes only the cash contributions from partner organizations recognized for cost sharing

In-kind contributions are important for the success of the project

- In-kind contributions are considered as part of the proposal evaluation
- In-kind should not be considered when determining NSERC's contribution to the project costs



Cost sharing

OPTION 1	
50% 1:1 leverage ratio	66% 2:1 leverage ratio
Large partner organizations only	Small & medium sized partner organizations - Large organizations with SMEs (value chain) - Multisectoral partnership (private, public, not-for-profit)

OPTION 2
90 to 100% of the shareable costs
100%: Public & not-for-profit 90%: Private sector - Limit of 2 applications per partner organization and per applicant per 12 months period - Grants limited to \$200k/year



Review

Financial risk-based approach - Simpler review format - Shorter processing time

Project Size	Small	Medium	Large
Avg. Annual Request	\$20,000 to \$30,000	\$30,000 to \$300,000	\$300,000 to \$1,000,000
Review mechanism	NSERC File Managers Supported by existing NSERC peer review	External Reviewers With expertise directly related to the proposal	Ad hoc committee members With expertise directly related to the proposal
Funding decisions	NSERC assigns merit indicators to determine priority for funding		
Expected decision time*	4 weeks	8-12 weeks	12-16 weeks



Evaluation criteria

- 1 **Relevance and outcomes**
- 2 **Partnership**
- 3 **Quality of the Proposal**
- 4 **Training**



Research agreements and intellectual property

- Agreements should be aligned with NSERC's Policy on Intellectual property, which promotes the use and/or exploitation of knowledge and open access to results of research funded by NSERC
- NSERC claims no rights of ownership to any intellectual property generated by Alliance Grant projects
- NSERC's IP policy stipulates that each student must maintain their right to defend their thesis without delays or impediments
- All participants, including trainees, should consult this policy to ensure they are aware of their rights and obligations



Example cost-sharing scenarios...



Cost-sharing example 1

OPTION 1

Large partner organization(s)* only

**public, private, or not-for-profit*

**50% cost-sharing
(1:1 ratio)**

Total project cost: \$180,000

- **Partner(s) cash contribution** : \$90,000**
- **NSERC contribution: \$90,000**

***Contributions recognized in cost-sharing calculation*



Cost-sharing example 2

OPTION 1

Large partner organization(s) with not-for-profit and/or public sector organizations

**public, private, or not-for-profit*

66% cost-sharing
(2:1 ratio)

Total project cost: \$180,000

- Partner(s) cash contribution^{**}: \$60,000
- NSERC contribution: \$120,000

***Contributions recognized in cost-sharing calculation*



Cost-sharing example 3

OPTION 1

Small / medium-sized organizations*

**public, private, or not-for-profit*

**66% cost-sharing
(2:1 ratio)**

Total project cost: \$180,000

- **Partner(s) cash contribution** : \$60,000**
- **NSERC contribution: \$120,000**

***Contributions recognized in cost-sharing calculation*



Cost-sharing example 4

OPTION 2

Any size of private-sector partner organization

90% NSERC cost-sharing

Total project cost: \$180,000

- Partner(s) cash contribution^{**}: \$18,000
- NSERC contribution: \$162,000

^{**}Contributions recognized in cost-sharing calculation

Limit of two applications in a 12-month period



Cost-sharing example 5

OPTION 2

**Not-for-profit and/or
public-sector only**

**100% NSERC
cost-sharing**

Total project cost: \$180,000

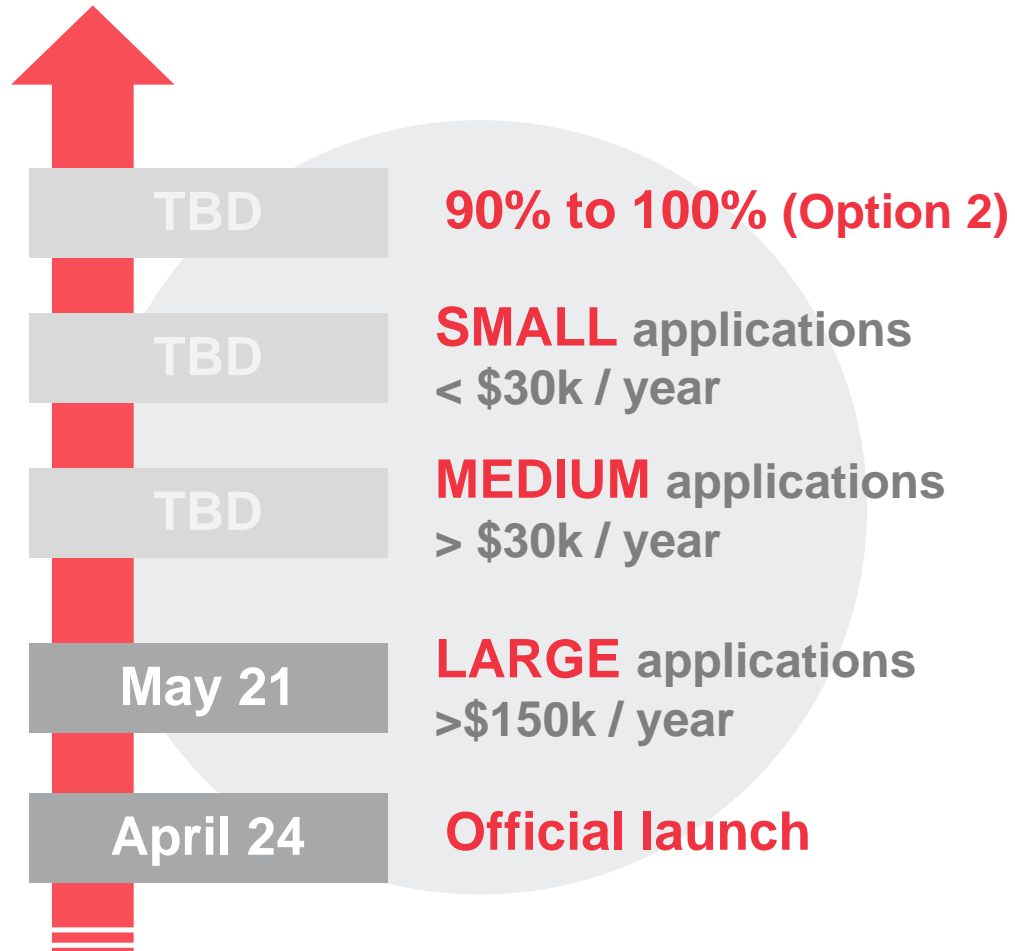
- **Partner(s) cash contribution^{**}: \$0**
- **NSERC contribution: \$180,000**

*^{**}Contributions recognized in cost-sharing calculation*

Limit of two applications in a 12-month period



Transition



Alliance Grants



Deadline for last invited applications for Industrial Research Chairs

September 2

Application deadline for CRD, Engage and Engage+

May 31

Prior Programs



Thank you!

Visit nserc.ca/alliance
to learn more about the
new Alliance grants.

NSERC Head Office

613-995-1111

alliance@nserc-crsng.gc.ca

NSERC Regional Offices

Toll-free

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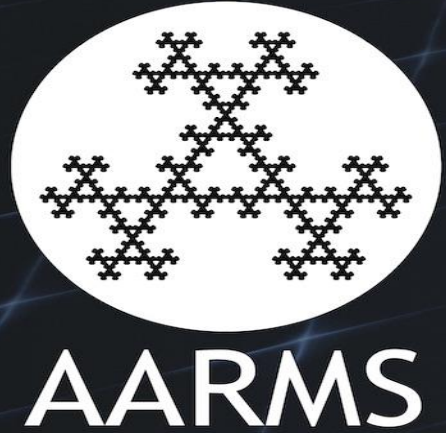
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Natural Sciences and Engineering
Research Council of Canada

Conseil de recherches en sciences
naturelles et en génie du Canada

Canada



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NETWORKING RECEPTION