



Northwest Territories Environmental Studies Research Fund

Annual Report and Budget
2020-2021



University of Waterloo graduate student collecting surface water samples under very challenging landing conditions.
Photo credit: David Rudolph, University of Waterloo

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Northwest Territories

Environmental Studies Research Fund (ESRF)

Message from the Chair

I am very pleased to present the sixth annual report for the Northwest Territories Environmental Studies Research Fund (ESRF). As everywhere, the COVID-19 pandemic presented many challenges to ESRF funded programs with a canceled field season in 2020, NWT border closures and continuing uncertainty. However, programs adjusted and were still able to make significant progress.

In addition to three existing multi-year funded projects related to caribou and groundwater monitoring, the NWT ESRF has provided support to two new projects, one led by the Yamoga Land Corporation in Fort Good Hope, NT and one on lichen seeding led by Wilfrid Laurier University.

I would like to take the opportunity to thank Scott Gedak, industry member on the Management Board whose term expired, for his efforts and leadership in ensuring the success of the NWT ESRF. I would also like to welcome Heather MacPherson, Imperial Oil as a new industry member and Richard Binder as a second public member which was made possible through the recent revisions to the *Petroleum Resources Act (PRA)*.

Andrew Applejohn
Chair
NWT Environmental Studies Research Fund



Introduction

The Northwest Territories Environmental Studies Research Fund (ESRF) is a research program established to finance environmental and social studies relating to oil and gas activity in the NWT that will help inform decision making. The fund is supported through the collection of levies from all interest holders of petroleum lands in the onshore areas of the NWT – Exploration Licences, Production Licences, and Significant Discovery Licences alike. Levy rates are determined by the ESRF Management Board on an annual basis, and interest holders are invoiced based upon their total land holdings (total number of hectares under licence) within the onshore NWT. With approved changes to the *Petroleum Resources Act*, a second public member has been added so now the Management Board is composed of representatives from government (2), industry (2) and public (2) of the NWT.

Management Board Membership

Chair: Andrew Applejohn – Environment and Natural Resources, GNWT member

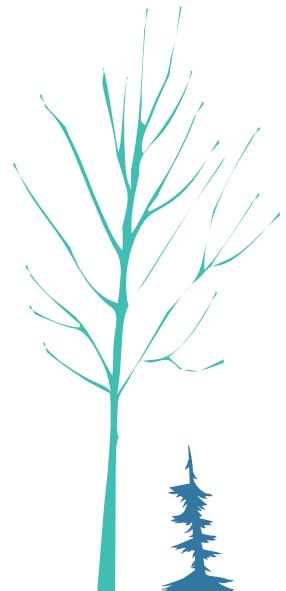
Vice-Chair: Ken Hansen – industry member

Menzie McEachern – Industry, Tourism and Investment, GNWT member

Heather MacPherson – industry member

Ray Case – public member

Richard Binder – public member



Summary of Activities in 2020-2021

Communications

1. In person meetings were not possible due to Covid restrictions. However, as part of virtual Management Board meetings, discussions were held with research project leads such as Dave Rudolph, University of Waterloo, and also Julie Marcil from the federal ESRF program to keep each ESRF program up to date and look for potential future collaboration opportunities.

Project reports available at <https://www.nwt-esrf.org/publications>:

- University of Waterloo, Regional hydrologic and ecologic characterization and baseline assessment 2020-2021 report;
- Wilfrid Laurier University, University of Colorado Boulder, Assessing terrain sensitivity to permafrost thaw and fire to understand and predict boreal caribou 2020-2021 report;
- Jesse Tigner, Swamp Donkey, Moose (*Alces alces*) habitat selection and influence on predicted boreal woodland caribou (*Rangifer tarandus caribou*) winter range in the Central Mackenzie Valley, NWT;
- Wilfrid Laurier University, Accelerating recovery of boreal caribou habitat via lichen seeding for oil and gas related remediation – Project Progress Report; and
- Yamoga Land Corporation, Improving Indigenous-industry collaboration on oversight of Imperial Oil's Aquatic Effects Monitoring Program through the establishment and convening of a Sahtú water monitoring 'Community of Practice'; and Jesse Tigner, Moose (*Alces alces*) habitat selection and influence on predicted boreal woodland caribou (*Rangifer tarandus caribou*) winter range in the Central Mackenzie Valley, NWT. In addition, a new two year program was approved with the first year being 2020-2021. The project, *Accelerating recovery of boreal caribou habitat via lichen seeding for oil and gas related remediation*, is led by Dr. Jennifer Baltzer, Wilfrid Laurier University.

Management Board Meetings

Three virtual meetings of the NWT ESRF Management Board took place: August 27 and December 15, 2020 and March 15, 2021.

Key program direction for the 2020/2021 fiscal year included:

1. Levy rate for industry would remain the same. Remediation retained as a research priority.
2. 2021/2022 budget of 375K (85K administration, 290K research) is approved.
3. Two new proposals approved for single year funding: *Yamoga Land Corporation, Improving Indigenous-industry collaboration on oversight of Imperial Oil's Aquatic Effects Monitoring Program through the establishment and convening of a Sahtú water monitoring 'Community of Practice'*; and *Jesse Tigner, Moose (*Alces alces*) habitat selection and influence on predicted boreal woodland caribou (*Rangifer tarandus caribou*) winter range in the Central Mackenzie Valley, NWT*. In addition, a new two year program was approved with the first year being 2020-2021. The project, *Accelerating recovery of boreal caribou habitat via lichen seeding for oil and gas related remediation*, is led by Dr. Jennifer Baltzer, Wilfrid Laurier University.



Photo credit GNWT ENR

2020-2021 Funded Projects

Improving Indigenous-industry collaboration on oversight of Imperial Oil's Aquatic Effects Monitoring Program through the establishment and convening of a Sahtú water monitoring 'Community of Practice'

Project Leader: Alexa Scully

Organization: Yamoga Land Corporation

Project Description:

The NWT Environmental Studies Research Fund (ESRF) funds research around how petroleum exploration, development and productive activities should be conducted on lands administered by the GNWT. The governance context of the NWT and the role of Indigenous governments in particular is changing, and as such this project seeks to support the establishment of an Indigenous-led 'Community of Practice' (COP) in Fort Good Hope, where traditional knowledge and current water research will be integrated to provide valuable oversight into the effects of Imperial Oil's operations on the MacKenzie River downstream from operations.

In Fort Good Hope, the re-establishment of operations by Imperial Oil in 2018, alongside the evolving role of Indigenous Governments across Canada create opportunities for a re-evaluation of the role of Indigenous governments in monitoring and remediation activities within their traditional territories. This is especially crucial for operations that pre-date these political context changes as the integration of new approaches into historical operations can improve transparency and collaboration opportunities between the petroleum industry and the First Nations contexts they operate within.

The Yamoga Lands Corporation is currently responsible for responding to and maintaining oversight of Imperial Oil's Aquatic Effects Monitoring Program (AEMP) via the Sahtú Land and Water Board (SLWB). However, there is historical distrust between the Kasho Got'ine of Fort Good Hope and

Imperial Oil making collaboration difficult. In addition, the Kasho Got'ine lack equivalent capacity to independently monitor impacts, making it difficult for them to accept the conclusions of Imperial Oil's AEMP at face value. For the Kasho Got'ine, understanding the true impacts of the Norman Wells operation as determined by Imperial Oil's plans is difficult to accept without independent verification, and without the integration of their own Traditional Knowledge (TK) at every stage of the process. Imperial Oil has also stated in its own responses to Yamoga's comments on its AEMP that it supports the development of independent working groups.

However, there is a vibrant research community currently examining the water across the Kasho Go'tine District and collaboration with TK experts is becoming standardized best practice in the industry. This proposal will fund Yamoga Lands Corporation (with the support of the K'asho Got'ine Community Council and the Fort Good Hope Renewable Resources Council) to convene a COP including all active aquatic researchers in the area (who agree to participate), alongside traditional knowledge holders. The COP will also invite industry observers and collectively the COP will discuss the landscape of water research in the Sahtú in relation to downstream to Imperial Oil's operations. They will identify common themes and/or research Yamoga Lands Corporation gaps, and use the conclusions of this platform to ensure transparency in relation to impacts and clear plans are identified between petroleum operators in the area and local governance bodies. The COP will allow Yamoga to understand the current aquatic landscape, to have an oversight of research findings and where gaps are identified, commission its own monitoring without fear of duplicating existing efforts. Participants in the COP will also benefit from understanding the current research landscape and be able to strengthen each other's work through discussion and collective inquiry. Industry observers will benefit from being able to access the knowledge and workings of the COP, strengthening their own AEMP, and potentially building greater trust and collaborative efforts between all stakeholders in the area.

NWT ESRF Funding: \$25,000

Project report available at
<https://www.nwt-esrf.org/publications>



Moose (*Alces alces*) habitat selection and influence on predicted boreal woodland caribou (*Rangifer tarandus caribou*) winter range in the Central Mackenzie Valley, NWT

Project Leader: Jesse Tigner

Organization: Swamp Donkey (consultant)

Project Description:

Conservation planning to meet the long-term needs of boreal woodland caribou (caribou) requires, in part, identification of critical habitats. In winter, caribou select for winter range to balance predation risk (i.e., avoidance of predators and alternate prey species) with access to food (i.e., lichen forage). Winter range is considered critical caribou habitat because its quality influences caribou productivity and fecundity into the following spring and summer seasons. However, a variety of land uses can reduce range quality for caribou by converting those habitats to habitats for alternate prey items thereby increasing caribou predation risk.

A primary tool for the maintenance of intact caribou winter range is to map its distribution so known locations can be directly integrated into regional and local land use planning decisions. A recently completed ESRF-supported project shows that in the Central Mackenzie Valley (CMV) the probability of use by moose is a primary driver of caribou winter range selection – caribou strongly avoided those areas where kernel density estimates predicted a high likelihood of use by moose (Tigner 2020). While informative, using a predicted use by moose parameter to model caribou winter range ultimately limits the predictive ability of winter range models to those areas with current data on moose distribution and use. Instead, if moose habitat selection patterns were evaluated directly, those habitat preferences could be used to efficiently predict the distribution of caribou winter range broadly even where current moose data are not available.

This project is comprised of three parts to evaluate and use moose habitat selection patterns to identify caribou winter range in the Mackenzie Plains ecological region in the CMV.

1. Directly evaluating moose habitat selection

- Use previously identified moose track locations to evaluate habitat selection;
- Habitat selection will be evaluated using a Poisson-based regression framework where track observations are treated as count data. Transects will be split into 1 km segments and each segment will be treated as a sample unit; and
- Moose selection will be assessed using the landscape variables previously used (Tigner (2020, though with some modification of land cover classification schemes) and model fit will be evaluated in a model comparison framework.

2. Incorporating moose habitat selection into predicted CMV caribou winter range distribution

- Outputs of part 1 (either top coefficients or top models, depending on outcomes) will replace the current moose use parameters in caribou winter range models (Tigner 2020, i.e., habitat selection will replace the likelihood of use to account for moose values in predicting caribou winter range potential); and
- The same modelling architecture and processes will be used (i.e., using the oil and gas grid sections and units as spatial extents, and weighting model coefficients by spatial extent of habitat variables within spatial extents).

3. Mapping predicted caribou winter range across the Mackenzie Plains in the Sahtú Settlement Area (SSA)

- Expand predictive modelling of caribou winter range spatially across the Mackenzie Plains ecoregion within the SSA where Ducks Unlimited data are available; and
- Models will use only identified moose habitat values (part 1), extent of lichen cover and extent of burned area as model inputs, and models would be assessed at the scale of oil and gas grid sections. This is meant to focus efforts on the most important identified variables in past work and a broader planning scale for land use planning considerations.

NWT ESRF Funding: \$5,500

Project report available at

<https://www.nwt-esrf.org/publications>

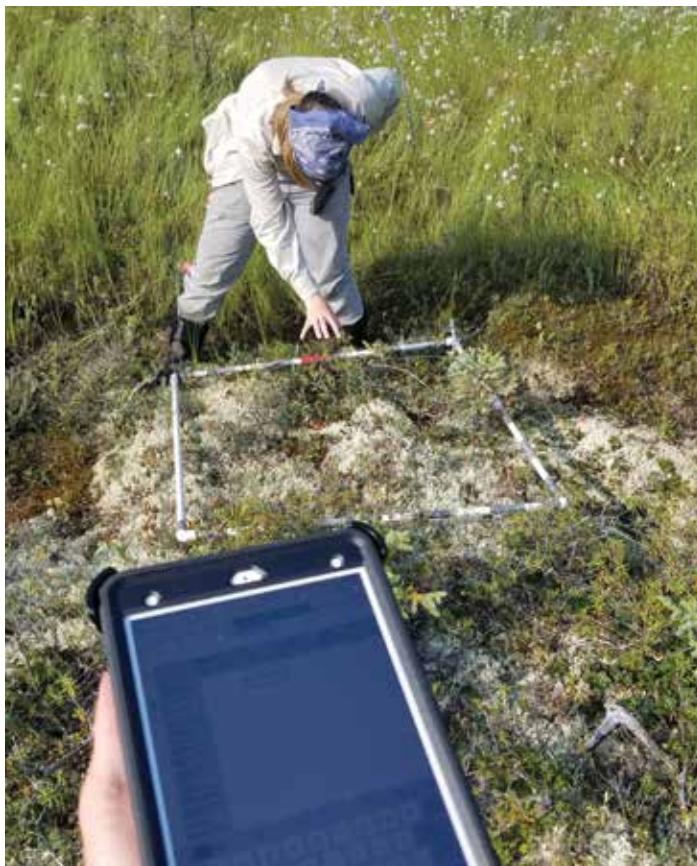
Accelerating recovery of boreal caribou habitat via lichen seeding for oil and gas related remediation

Project Leader: Dr. Jennifer Baltzer

Organization: Wilfrid Laurier University

Project Description:

Background: Boreal caribou is a culturally significant species and an important subsistence food source for many communities in the Northwest Territories (NWT). However, across Canada, boreal caribou is threatened and in the NWT there is concern over the cumulative effects of increasing climate warming-related acceleration of disturbances (wildfire and permafrost thaw) coupled with development activities on boreal caribou populations. Successful remediation of sites that have been naturally disturbed by wildfire or associated permafrost decay could, in part, mitigate modern habitat loss, reducing stress on targeted boreal caribou populations. Lichen seeding techniques represent a novel remediation strategy, however we have limited understanding of the environmental conditions best suited for this remedial practice, particularly in discontinuous permafrost systems common to the Northwest Territories.



Estimating caribou lichen abundance in a quadrat in the Sahtú region.
Photo credit: Emily Ogden

Objective: We will address this knowledge gap by determining under what landscape conditions caribou habitat recovery can be accelerated by lichen seeding.

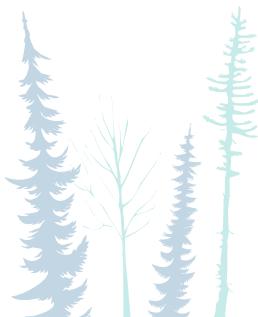
Expected Results: Our proposed research will determine the remedial potential of boreal caribou habitat historically impacted by wildfire and associated permafrost decay across southern NWT. Specifically, our program will identify the environmental conditions associated with degraded boreal caribou habitats that are primed for accelerated lichen establishment. By leveraging an established network of 503 permanent study plots we will be able to construct lichen seeding manipulations spanning a gradient of disturbance and landscape conditions found throughout the boreal caribou range. In doing so we will be able to create predictive spatial maps of caribou habitat rehabilitation potential.

This research program will be fully integrated with a broader Cumulative Impacts Monitoring Program (CIMP) funded project synthesizing the interactive effects of fire, permafrost decay, and anthropogenic development on caribou habitat quality in southern and central NWT. The results from our NWT ESRF program will combine with the ongoing characterizing of current caribou habitat quality as well as a historical aerial imagery analysis identifying long-term disturbance effects on caribou habitat to develop a collaborative decision support system. The system will improve boreal caribou habitat management as it is fed by spatially explicit permafrost and vegetation data, available data on caribou habitat use, and maps of hotspots for caribou habitat rehabilitation potential.

Overall, the results from our proposed research will empower decision makers, allowing them to determine if target areas, like seismic lines and access routes are amenable to mitigation efforts. The spatial maps of hotspots for caribou habitat recovery, will allow land use managers to target and prioritize remediation resources. This knowledge will ultimately facilitate planning by managers and communities for the long-term sustainability of boreal caribou, as stakeholders are able to understand where and how caribou habitat can be rehabilitated.

NWT ESRF Funding: \$50,000 over two years

Project Year 1 update report available at
<https://www.nwt-esrf.org/publications>



Multi-year Funded Projects – Updates

Assessing terrain sensitivity to permafrost thaw and fire to understand and predict boreal caribou habitat and forage quality in the Sahtú

Project Leaders: Drs. Jennifer Baltzer and Merritt Turetsky
Organization: Wilfrid Laurier University and University of Colorado Boulder

Project Description:

The proposed research will address how fire and permafrost conditions interact to determine caribou habitat responses to climate change and human activity in the Sahtú, a resource-rich region poised for substantial oil and gas development. Using a combination of field measurements and remotely sensed land cover change, we will improve predictions about the sensitivity of permafrost to fire and human activity in the Sahtú and how this relates to caribou forage availability and quality and caribou habitat use. This will be accomplished by quantifying key metrics of land cover change, terrain stability, and vegetation across a range of permafrost conditions and disturbance gradients.

2020-2021 is the fourth year for this project.

NWT ESRF Funding: \$50,000/ year for four years

Full project update available at
<https://www.nwt-esrf.org/publications>



Permafrost coring and peat sampling in a collapse scar in the Sahtú region.
Photo credit Emily Ogden



Putting together the corer: Jennifer Baltzer and Emily Ogden assemble the Russian Corer as Anastasia Sniderhan records the GPS coordinates of a site.
Photo credit Alexis Jorgensen

Multi-species monitoring using winter track surveys in the Sahtú Settlement Region

Project update for NWT ESRF 2020/21 annual report

Project Leader: James Hodson

Organization: GNWT Environment and Natural Resources

Project partners: Sahtú Renewable Resources Board (SRRB), Tulit'a Renewable Resources Council (TRRC)

Project Description:

This year marked the final year of ESRF funding for the winter track survey program. Due to the COVID-19 pandemic, ENR staff were not able to travel to meet in person with the Tulit'a Renewable Resources Council (TRRC) and Sahtú Renewable Resources Board (SRRB) this year or do the annual training session at the beginning of the season; however, meetings were held by video and teleconference on October 27, 2020 and February 10, 2021 to plan the surveys for winter 2021. One of the surveyors from the TRRC who has been involved in the project since it began in 2014 was able to train the new survey crew members this year. Eight routes (the same as in previous years) were surveyed around Tulit'a between February 17 to March 19, 2021, and each route was surveyed 3-4 times. Preliminary results indicate that tracks of 12 different species were recorded this winter (up from 11 last year). Marten, lynx, moose and ermine continue to be the most frequently encountered species, and other notable, but less common species detected included boreal caribou, muskox, porcupine and otter.

Analysis of the data from the first 6 years of the project are ongoing, with a focus on evaluating how variables related to weather, observers, and land cover composition influence the likelihood of species detection on survey transect segments, and the probability of occupancy (presence/absence) of species within 5 x 5 km grid cells overlaid on the study area. The final report will be completed by the end of summer 2021 and will discuss some of the successes and challenges in carrying out this collaborative community-based monitoring program, including recommendations on how to continue or expand the program.

NWT ESRF Funding: \$50,000/ year for four years



Boreal caribou tracks observed along the Willow Lake survey route on February 18, 2021
Photo credit TRRC/GNWT-ENR

Regional hydrologic and ecologic characterization and baseline assessment of remote northern Canadian terrain in advance of shale oil and gas development

Project Leader: Dr. David Rudolph

Organization: University of Waterloo

During the fourth year of the project, there were a series of minor challenges related to limitations associated with the Covid-19 pandemic that influenced the planned field activities. It has been necessary to postpone the field activities to a subsequent year. However, a major objective of the research work planned for Year 4 involved completing the assessment and interpretation process related to the data collected in the previous 3 years of the project. This work could be conducted in house at the University of Waterloo.

A second major activity was the continued development of a numerical modeling tool and the completion of initial scenario simulations to assess the applicability of the new model. This also was conducted at the University of Waterloo. Specifically, the Year 4 work activities associated with the project focused on:

1. Geochemical and isotopic characterization of the various identified sources of water within the hydrologic system in the study area;
2. Summary of the utility of the portable and remote investigative strategies adopted and implemented for hydrologic field monitoring within this type of remote northern terrain;
3. Continued development of a conceptual model of the groundwater flow system within the Bogg Creek Watershed; and
4. Complete development of the initial version of a fully coupled thermal-hydraulic-mechanical (THM) model for variably saturated freezing soil and initial simulations relevant to the study of groundwater flow in discontinuous permafrost environments.

NWT ESRF Funding: \$100,000/year for five years

Full project update available at

<https://www.nwt-esrf.org/publications>



University of Waterloo and Wilfrid Laurier University graduate students collecting shallow cores of permafrost with a portable coring technique in the Central Mackenzie Valley.
Photo credit: David Rudolph, University of Waterloo

Budget for NWT ESRF Supported through 2020-2021 Levies

1. Administration of the Fund

This budget provides funding for a half-time equivalent position to perform Secretariat functions. Other costs associated with the budget are related to Board travel, direct meeting expenses and communications.

Administration Budget		
Compensation and Benefits	\$	60,000
Travel	\$	15,000
Communications and Promotions	\$	3,000
Publications	\$	2,000
Other	\$	5,000

2. Science Budget

The following science programs were recommended for approval by the ESRF Management Board.

NWT ESRF Project Funding		
Industrial Activity and Caribou Populations	\$	75,000
Baseline Hydrogeological Evaluation of Central Mackenzie Valley Oil and Gas Exploration Areas Sahtú Region, NWT	\$	100,000
Various Projects	\$	25,000
Remediation Studies	\$	90,000

Financial Statement of the NWT ESRF for the Fiscal Year 2020-2021

Revenue *		
Industry Levies	\$	228,448
Expenses		
Administration		
Compensation and Benefits	\$	-
Travel	\$	-
Communications and Promotions		
Publications	\$	(2,516)
Other	\$	(6,250)
Total Administration Expenses	\$	(8,766)
Science Program		
Caribou Studies	\$	(101,149)
Sahtú Hydrogeological Baseline	\$	(100,000)
Various Studies	\$	(50,000)
Total Science Program Expenses	\$	(251,149)
Total Expenses	\$	(259,914)
Total 2020-2021 Surplus (Deficit)	\$	(31,467)

Proposed Budget of the NWT ESRF for the Fiscal Year 2021-2022

Revenue *		
Industry Levies	\$	225,000
Expenses		
Administration		
Compensation and Benefits	\$	(60,000)
Travel	\$	(15,000)
Communications and Promotions	\$	(3,000)
Publications	\$	(2,000)
Other	\$	(5,000)
Total Administration Expenses	\$	(85,000)
Science Program		
Caribou Studies	\$	(75,000)
Sahtú Hydrogeological Baseline	\$	(100,000)
Various Studies	\$	(25,000)
Remediation Studies	\$	(90,000)
Total Science Program Expenses	\$	(290,000)
Total Expenses	\$	(375,000)
Total 2021-2022 Surplus (Deficit)	\$	(150,000)

* Industry levies are shown in the Main Estimates in the year they are invoiced and these amounts are to fund the projects for the following fiscal year. Revenue total of \$228,448 was invoiced in 2020-21 to fund projects in 2021-2022.

Summary		
Opening Balance (April 1, 2020)	\$	275,083
Revenue **	\$	228,448
Expenses	\$	(259,914)
Closing Balance (March 31, 2021)	\$	243,616

Summary		
Opening Balance (April 1, 2021)	\$	243,616
Revenue **	\$	225,000
Expenses	\$	(375,000)
Closing Balance (March 31, 2022)	\$	93,616

** The ESRF budget and actuals are provided each year in the main estimates as information. As 2021-2022 progresses and information on the current budget is updated, the revised main estimates for 2021-2022 will be reflected in the 2022-2023 main estimates.

Levy Breakdown 2020-2021

Description	Hectares	Amount
Significant Discovery Licences	626,491	\$ 202,356.59
Production Licences	36,265	\$ 11,713.60
Pioneer Production Licences	321	\$ 103.68
Total	663,077	\$ 214,173.87

Location	Hectares	Amount
Mackenzie Delta / Arctic Islands	130,173	\$ 42,045.88
Central Mackenzie Valley	434,012	\$ 140,185.88
Southern NWT	98,892	\$ 31,942.12
Total	663,077	\$ 214,173.87



Visiting a groundwater-fed wetland area within the Central Mackenzie Valley near Norman Wells NWT.
Photo credit: David Rudolph, University of Waterloo

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