## Nunavut Research Institute

## License Holder Reporting requirements

**For research undertaken in the 2025 calendar year (commencing January 01, 2025 and ending December 31, 2025)**

**Project Title:**

SuperDARN Radar Sites

**Project Leader(s):** Full name, affiliation, and contact information (address, phone number, email) of each project leader (principle investigator and co-investigators)

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**Project Team:** Full name, affiliation, and address (name of city/community and province/territory/state) of each member of the project team

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**Abstract:** A concise summary of what was done, found, and concluded to date, and how the results/information will be used. This summary must be translated into the appropriate dialect of Inuktut. Suggested length: 250-300 words. ***This section will be published in the NRI's annual compendium of licensed research and made available through the Isirvik research portal**

Super Dual Auroral Network (SuperDARN) Canada is a network of high0frequesncy (HF) radars located throughout the northern hemisphere. The purpose of the SuperDARN is to study plasma in the near-Earth space system, its interaction with the Earth's atmosphere and Geospace environment, its effects on the terrestrial "hard" infrastructure (e.g. communications, energy, transportation, etc., and its role in the Sun-Earth system. SuperDARN convection/voltage maps are essential for studies of the impact of space weather at Earth. Space weather researchers rely on SuperDARN data for putting their localized observations in context. SuperDARN radars are extremely reliable, being easily accessible for repairs and upgrades. This reputation has made superDARN a favorite tool for space weather scientists.

There have been no significant changes to the project, and the SuperDARN radars will continue to operate in 2026. More information about the project can be found on our website: https://superdarn.ca.

Note: Please see the annual summary report and the translated document on a separate sheet.

**Key messages:** Concise, plain language summary of key take-away messages of work to date, findings and conclusions. Preferably 3-5 points, in bullet form.

**Objectives:** Project objectives, preferably in bullet form.

* The purpose of SuperDARN Canada is to study plasma in the near-Earth space system, its interaction with the Earth's atmosphere and geospace environment, its effect on terrestrial "hard" infrastructure (e.g. communications, energy, transportation, etc.), and its role in the Sun-Earth system.
* SuperDARN convection/voltage maps are essential for studies of the impact of space weather at Earth. Space weather researchers rely on SuperDARN data for putting their localized observations in context.

**Annual activities:** A description of activities and methods carried out during the current reporting period. This section should answer the questions: What? Where? When? Who? How? Include dates team members conducted research at remote field sites or collected data (including interviews) in communities; append a map with locations and/or coordinates of remote field sites, if applicable.

During the July 9–17, 2025 maintenance trip to the Clyde River radar site, two SuperDARN Canada team members resolved several major issues that had left the facility in poor condition, including long periods of downtime caused by malfunctioning computers. Over several days, the team stabilized the site by splicing or replacing damaged ropes, installing three new screw anchors, and replacing a beacon light on the interferometer array. The two radar operating computers were fixed: main207 computer was restored by bypassing a faulty 10G Ethernet port, while the bore206 system required a full motherboard and peripheral replacement. Both computers were upgraded to OpenSUSE 15.6 and are now fully operational. The transmitters and antennas were mostly in good condition, though one faulty transmitter was replaced with a spare, and new receive-path circuitry was installed to improve overall system performance. To strengthen remote access, monitoring, and reliability, the team also installed a PiKVM, a networked UPS, voltmeters, thermometers, and a Raspberry Pi for airplane-tracking experiments.

During the July 18–30 maintenance trip to the Rankin Inlet radar site, four SuperDARN Canada team members completed extensive infrastructure upgrades to address significant wear to the exterior equipment. More than 120 frayed guy ropes and over 50 outdated rebar anchors were repaired, replaced, or upgraded to improve safety and long-term stability of the towers, and damaged sections of the reflector fence were reinforced. Guy guards were installed across all tower and reflector fence guy lines to help prevent future rope wear. Antenna performance was generally good, though Antenna 11 required repairs and Antenna 16 showed unusually high noise levels. Most transmitters were functioning well, but transmitter 2 required a new AGC board, and new receive-path circuitry was installed across all arrays to improve performance. The team also upgraded monitoring and remote-access capabilities by installing a PiKVM, a networked UPS, voltmeters, thermometers, and a Raspberry Pi for airplane-tracking calibration work. A multi-day investigation into long-standing noise issues identified aging transmitter power supplies as the likely cause; these were replaced in October 2025 and were successful in removing noise from the data. By the end of the visit, the site was in much better condition, but future maintenance should be planned for replacing aging guy lines, especially those supporting the reflector fence.

The next planned maintenance visit to both the Rankin Inlet and Clyde River sites is expected in July or August 2027 to ensure continued system reliability and performance.

**Results and Achievements:** Findings and results to date of the above activities, highlighting any key research achievements (see guide below for formatting tips regarding tables and figures).

**Challenges/Obstacles:** In this section, please comment on any challenges/obstacles (if any) that you experienced during this project year. If there were any actions to mitigate or resolve these challenges, please list them here. Were any concerns raised regarding the conduct of research team members or the impacts of the project?

**Expected Project Completion Date:** Provide month and year of expected completion date of the project.

The project is expected to continue through the end of the funding period in March 2029.

**Project website (if applicable):** If your project has a presence on the internet, including a website and/or social media page, please provide the link and/or account handle.

superdarn.ca

**Citations:** Please append a complete reference list if citations are used anywhere in the document.

**POLICY RELEVANCE**

Does this research support policy development or decision-making in Nunavut? If yes, please describe.

**RESEARCH OUTCOMES: BENEFITS**

**Community engagement:** Briefly list and describe any community consultation, engagement, collaboration and outreach activities that you have undertaken for the project; describe the role(s) that community members and/or specific organizations have played in research co-design and activities.

**Youth engagement:** Briefly list and describe any outreach, school or classroom activities that you have undertaken for the project; describe the role(s) that youth have played in your research activities.

**Training and Employment:**

How many Nunavummiut received training from team members? Please describe training and/or compensation provided.

How many team members received training from Nunavummiut? Please describe training received and/or what knowledge sharing and/or skills exchange took place.

How many Nunavummiut received employment? Please describe employment type and length, role(s) and responsibilities, and compensation provided.

How many Nunavummiut received honoraria as research participants? Please describe method of participation (interview, observation, sample, survey, etc.), including compensation provided.

Please explain how the project directly benefited Nunavut organizations and/or businesses (e.g., through contract services, local purchases, equipment donations, etc.)

Local communities and service providers play an important role in supporting our operations. Mike Jaypoody (Clyde River) and Todd McKay (Rankin Inlet) are hired to provide us with field technical support for our remote operations, including site maintenance and electronic and antenna system issues. Local involvement also includes Internet services supplied by Qiniq in Nunavut and power services from the Qulliq Energy Corporation. In addition, lease payments for the land where the radar is located are paid to the municipalities of Clyde River and Rankin Inlet.

**OPTIONAL: Nunavut Team Members, hires, and/or trainees (excluding research participants e.g., interviewees)**

*The NRI is creating an inventory of Nunavummiut who are skilled and/or interested in research. The information provided below will not be shared publicly but will support long-term capacity sharing by connecting local and visiting researchers with research talent in each community.*

| Name | Expertise/skills | Training/interest areas | Contact Info | Community |
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**Academic Mobility**

If you are affiliated with an academic institution, please answer the following question: For which Level of Project(s) will the data be used? (Check all that may apply)

- ☑ Research
- ☑ Post-Doctoral Research
- ☑ PhD Thesis
- ☑ Masters (Major Research Paper)
- ☑ Masters (Thesis)
- ☑ Graduate Course Project
- ☑ Staff/Administration Research
- ☑ Undergraduate Honours Thesis

Other ☐ Space weather monitoring, government, camera operators, amateur radio operators, hobbyists

**BUDGET**

Please complete the table below to detail your projected and actual research expenditures during the reporting period.

| Category | Planned/Approved Expenditure | Actual Expenditure |
|---|---|---|
| Travel and Accommodation | | |
| Equipment, Materials and Supplies | | |
| Salaries/Wages for Nunavut residents | | |
| Salaries/Wages for non-Nunavut resident researchers | | |
| Professional Fees and services in Nunavut | | |
| Professional Fees and Services outside of Nunavut | | |
| **TOTAL EXPENDITURES** | | |

List the total $ amount of funding from each funding source for your full research program, including in-kind support

**RESEARCH OUTPUTS / REPORTING TOOLS**

What research outputs were generated? Please list below and append copies of each. Specify which outputs (if any) may be made public on the NRI research licensing database.

Have peer-reviewed manuscripts been published as a result of your project? If Yes,

complete the following table:

| Full citation | Publicly accessible/ free to access (Y/N) | Link (if available) and DOI (if available) |
|---|---|---|
| Ponomarenko, P., Ghalamkarian Nejad, M., & Koustov, A. V. (2025). Application of SuperDARN interferometry for improved e | Y | https://doi.org/10.1029/2024RS008084 |
| Shi, X., Chakraborty, S., Baker, J. B. H., Hartinger, M. D., Wang, W., Ruohoniemi, J. M., et al. (2025). Statistical characterizat | Y | https://doi.org/10.1029/2024JA033452 |
| Walach, M.-T., Fogg, A. R., Coxon, J. C., Grocott, A., Milan, S. E., Sangha, H. K., et al. (2025). Reliability of matching AMPER | Y | https://doi.org/10.1029/2024JA033253 |
| Khanal, K., Zou, Y., Shi, X., Zank, G., Ruohoniemi, J. M., & McWilliams, K. (2025). Controlling factors of the local time extent | Y | https://doi.org/10.1029/2024JA033392 |

If No, do you intend to submit a manuscript (or manuscripts) for peer reviewed publication?

Were non-peer reviewed materials produced to either communicate or synthesize results to the public? Examples of these materials include (but are not limited to): websites, reports, brochures, podcasts, webinars, presentations, non-peer reviewed publications, etc.

If Yes, complete the following table:

| Title | Description of Materials | Link (if available) | DOI (if available) |
|---|---|---|---|
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Did your project develop a communications plan? Please describe communications/reporting tools used, and list the target audience for each and/or who requested which.

SuperDARN Canada maintains a robust online presence through our website, https://superdarn.ca/. This platform offers a wealth of resources, including publications, a forum, surveys, real-time data displays, a mailing list, and our contact email and information. Since our radars operate autonomously and remotely (our home is based at the University of Saskatchewan in Saskatoon), we encourage interaction with all interested parties through our online resources.

How were Nunavummiut credited and/or acknowledged in all project outputs, such as co-authorship, participant biographies, article acknowledgements, etc.

**DATA AND INTELLECTUAL PROPERTY**

Did you enter into a research agreement, data-sharing agreement and/or intellectual property rights agreement with a community and/or designated Inuit organization (DIO)? If yes, please explain.

Do intellectual property rights apply to your research? If yes, please explain.

Who owns the data? Has the raw data been shared with the appropriate community and/or DIO? If yes, how? How is data security and storage handled by community-based co-owners?

Where is the data stored and will the data be destroyed within a set timeframe?

The data we store does not contain personal information, so confidentiality is not a concern for this project.
In terms of our data storage policy, we have planned for creating a reliable data product with an eye to long-term data preservation. We keep the original data (Level 0) at the research site for more than two years. Every one to two years, during a site visit, we copy this data onto external hard drives and bring it back to the University of Saskatchewan in Saskatoon for safekeeping. We store it on special network drives and also rotate it between different hard drives.

The processed data we share with others (Level 1) is also backed up at the research site for more than two years. We transfer this data to the University within approximately 24 hours for distribution to the international SuperDARN partners. The data is transferred to and stored by the Federated Research Data Repository (FRDR) for long term storage. We also keep a backup copy of Level 1 data on campus.

Is the data trackable and/or available in a public data repository? If yes, please provide the appropriate information and/or link to ensure the findability and accessibility of the data.

Please append a copy of your data management plan.

**CLIMATE CHANGE**

Is your research about climate change (causes, impacts, mitigation, adaptation, etc.)? If yes, explain.

**PHOTOGRAPHS**

*If possible, please provide high-resolution photos of licensed research activities that NRI may use in communication materials, organizational reporting, and other promotional purposes. Please also complete the table below for each photo provided and submit to NRI along with all required NRI photo release forms. The photographer/owner will be credited in all uses of the photograph(s).*

| File Name | Location | Description | Subjects | Photographer/Owner | Date |
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