3.1 Plain Language Project Description

Project Title: Copernicus Expansion Missions Sea Ice Experiment (CEMSIE)

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Summary of Project Background, Research Questions and Objectives

The **C**opernicus **E**xpansion **M**issions **S**ea **I**ce **E**xperiment (CEMSIE) is a Canadian-university led international research project designed to improve how researchers measure and understand Arctic sea ice and snow. The project focuses on first-year sea ice (FYI)—the seasonal ice that forms each winter and melts the following summer—because it now dominates Arctic ice cover and is highly sensitive to climate change. Europe is launching several new satellites that will collect free data on snow depth, ice thickness, and concentration—key indicators of Arctic change. CEMSIE will ensure these satellites provide accurate results by conducting detailed field and airborne measurements. The project addresses questions such as:

1. How do snow and ice characteristics — like salinity, density, grain size, and surface roughness — affect the signals that satellites receive?
2. How can combining data from multiple satellite sensors improve the accuracy of snow and ice thickness estimates?
3. How can these improved satellite measurements support climate monitoring, northern safety, and weather prediction?

The project will integrate on-ice, airborne, and satellite observations into a single dataset to develop improved methods for interpreting satellite signals, benefiting both science and Arctic monitoring operations. The project will operate in close coordination with CHARS for logistical support, safety, and community engagement, and all field activities will follow NRI and CHARS environmental and safety guidelines.

Justification for the Study

Arctic sea ice is central to global climate and northern communities, yet it is changing rapidly as the Arctic warms faster than any other region. FYI now forms later, melts earlier, and is thinner and more saline than multi-year ice. Satellites are the only tools capable of year-round Arctic monitoring, but current measurements of ice thickness and snow depth remain uncertain—especially over FYI. CEMSIE will provide essential on-ice validation data to improve how new satellites interpret their signals. These improvements will produce better local maps of ice conditions that support navigation, resource management, community safety, and environmental forecasting.

Where, When, and How Long the Field Research Will Take Place

Fieldwork will occur near Cambridge Bay, Nunavut, in Dease Strait, about 15–20 km west-southwest of CHARS. This area is ideal for its smooth landfast FYI, uniform snow conditions, and proximity—about a 30-minute snowmobile ride from CHARS. The campaign runs from March 25 to May 15, 2026. During this period, researchers will:

- Establish a small field camp accessible by snowmobile.
- Conduct daily snow and ice property measurements.

- Employ a CHARS field guide for daily excursions.
- Carry out 2–3 aircraft overflights in mid-April for aerial snow and ice measurements.

Methods Used to Conduct the Research

CEMSIE combines on-ice, airborne, and satellite methods to capture detailed snow and ice conditions.

1. **On-Ice Measurements**
    - Snow and ice thickness, temperature, salinity, density, and structure using specialized tools and portable ice corers, snow probes, and thermistor strings.
    - Handheld and ground-based instruments will measure radar reflections through snow and ice, while weather sensors will record air temperature, wind, humidity, and radiation.

    All equipment is battery-powered, non-invasive, and all waste will be removed.

2. **Airborne Surveys**
    - Two specialized aircraft will conduct 2–3 flights in mid-April from Cambridge Bay airport: **CIMRair**, equipped with a microwave radiometer, to measure natural emissions from the snow and ice surface; **CRISTALair**, equipped with radar altimeters, to measure snow and ice surface height and roughness. An airborne demonstrator for the CRISTAL mission | isardSAT

    These flights aim to bridge the gap between ground measurements and larger-scale satellite measurements.

3. **Satellite Monitoring** will be ongoing, and images will be shared with the EHTO and Cambridge Bay SmartICE knowledge coordinator to assist local travel and hunting.

How, When, and With Whom Research Results Will Be Shared in Nunavut

CEMSIE values Inuit Qaujimajatuqangit and is committed to open data, community engagement, and sharing results with Nunavummiut. The project will work closely with the Kitikmeot Inuit Association, Cambridge Bay Hamlet Office, POLAR, and CHARS to ensure information is shared respectfully through

1. **Community Meetings and Presentations** – Project lead John Yackel will travel before and after fieldwork to meet with the EHTO to discuss goals, plans, engagement, and results.
2. **Summary Reports and Visual Materials** – Plain-language summaries, posters, and maps showing snow and ice conditions will be shared with the EHTO, CHARS, and the Nunavut Research Institute.
3. **Training and Involvement** – Local participation opportunities in fieldwork (e.g., guiding, logistics, data collection) will be offered where possible.