# **SPACE FOR ARCTIC**

Accelerating the use of space for climate action and civil protection

# EXECUTIVE SUMMARY



in collaboration with







# **ABOUT THE WORKSHOP**

On the 2-3 July 2024, ESA organised in collaboration with Eurisy, the Norwegian Space Agency, and Norwegian Polar Institute, a workshop in Tromsø, Norway:

## Space for Arctic:

Accelerating the Use of Space for Climate Action and Civil Protection

**KEYNOTE SPEAKERS** 



**Christian Hauglie-Hanssen** Director General, NOSA



**Josef Aschbacher** Director General, ESA



**Cecilie Myrseth** Norwegian Minister for Trade and Industry



Laurent Jaffart Director of Connectivity and Secure Communications (D/CSC), ESA



**Sara Olsvig** International Chair of the Inuit Circumpolar Council (ICC)



**Pascal Legai** Head of The ESA Crisis Response Office and Senior Security Adviser to the Director General, ESA













## **ABOUT THE WORKSHOP**



Average annual temperature anomoly 1980-2021: Arctic vs Global source: Rantanen, M., Karpechko, A.Y., Lipponen, A. et al. (2022)



### Enabling increased shipping activities on new maritime routes

As economic opportunities emerge, so to do increased risks to operators and inhabitants in the area.

Over the vast and sparsely populated Arctic region, ensuring responsible behaviour and guaranteeing safety for all is crucial but challenging.

### Effective cooperation is vital

To enable sustainable economic development, guarantee safety and security in the Arctic, and address climate challenges.



## Space plays a crucial role across the Arctic

Satellite technologies are fundamental for monitoring climate change, enabling maritime navigation, and supporting safety operations. More must be done, however, to connect space with local stakeholders to support the future of this fragile region.









## **SPACE FOR ARCTIC**

A range of currently operational space assets and initiatives provide crucial data and services for the Arctic region. Below are just a few examples of European capabilities supporting the region, with more missions planned for the future, including IRIS<sup>2</sup>, ROSE-L, and CRISTAL.



### Sentinel-1

Launched in 2014 (1A) and 2016 (1B) as part of the Copernicus space component, use Synthetic Apeture Radar (SAR) to measure sea-ice extent in the Arctic. The mission is crucial for environmental monitoring as well as safe martime navigation in the region

### Galileo

eesa

The world's most accurate navigation service composed of 26 currently operational satellites. Galileo not only supports navigation, but also aids in emergency response and search and rescue through the Return Link Service and upcoming Early Warning Satellite Service (EWSS)

### Arctic Weather Satellite

Launched in August 2024, the AWS will provide enhanced weather forcasting in the Arctic, filling current data gaps in the region and acting as a precursor for a potential constellation: EPS-Sterna

UPCOMING ESA MISSIONS BENEFITTING THE ARCTIC

**ROSE-L** 

CRISTAL









The Svalbard Satellite Station (SvalSat), operated by KSAT, provides ground stations services to more satellites than any other ground station worldwide, including to Sentinel, MetOP, and Galieo satellites. It is especially important for polar orbiting satellites.



support crisis & emergency management.





## SPACE FOR SUSTAINABLE ECONOMIC DEVELOPMENT



The Arctic is home to 4 million inhabitants, spread over a vast and diverse geographic area. With the emergence of new shipping lanes, increased maritime traffic, and the presence of natural resources but increasing ecological fragility, the Arctic faces a critical need to balance economic development with environmental protection. Effective management of these resources is essential to ensure long-term sustainability.

### MODERATOR

Annalisa Donati, Secretary General, Eurisy

SPEAKERS

Michelle Hermes Policy Officer, EARSC

Benoit Mathieu Managing Director, OHB Sweden

**Ole Morten Olsen** Director of Enterprise Development and Innovation, NOSA

Maja-Stina Ekstedt EVP Sustainability & Public Relations, K-SAT

Beatrice Iren Fløystad Leader, Saami Association of Norway (NSR)

**Dr, Dwayne Ryan Menezes** Founder and Managing Director, Polar Research and Policy Initiative (PRPI) The Arctic presents a range of challenges to ensuring sustainable economic development for its inhabitants: the vast and sparsely populated environment, increasing impacts of climate change, and the simultaneous pressures of increasing activities alongside the need to protect indigenous ways of life.

Space technologies offer a range of capabilities to support people to live and prosper in the Arctic. From satellite communications connecting communities enabling digital financing opportunities and online banking, to improved weather and sea-ice forecasts ensuring safer and more efficient navigation, as well as Earth Observation satellites able to identify deposits of minerals and resources, and monitor their responsible exploitation.



The space sector must work further to understand the local needs of current and potential users of space data, ensuring that technologies are effective, accessible, and conducted responsibly. Collaborating across the diverse stakeholder groups present in the Arctic is key to ensuring space technologies are developed and delivered based on the needs of local communities.

# USE CASE

Enforcing fishing regulations in the Arctic can be challenging due to the size of the region and amount of activities. Ensuring responsible fishing is crucial to protecting the Arctic marine environement and supporting legitimate fishers.

The Vessel Detection Service by KSAT enables detection, tracking and monitoring of ships activities using optical and radar satellites, highlighting potentially illegal fishing activities over large areas. Analysing satellite data autonomatically using a range of advanced methods, KSAT can disseminate results to users within minutes of downlink.

### **KEY FINDINGS**



**Involing indigenous groups** throughout the entire process, integrating needs and local knowldge in the development of space activities.



**Balancing economic development with environmental protection** enabling growth opportunities to local communities whilst protecting traditional ways of life.



Norsk Romsenter Norwegian Space Agency

**Collaborating accross disciplines and sectors** to take advantage of local space infrastructures for innovative solutions addressing societal challenges

# **SPACE FOR SAFETY**

The vast and sparsely populated Arctic region poses considerable risks to people's safety. These challenges are exacerbated by the growing likelihood of extreme weather events caused by climate change, as well as the increased maritime activities taking place across the Arctic's waters. Providing for safety in the Arctic requires protecting safe navigation and transportation, enhancing rapid emergency response and search & rescue, ensuring sustainable resource management, and enabling community resilience across the region.

Space-based technologies offer a distinct advantage in the Arctic by providing rapid, automated, and wide-scale detection and monitoring of potentially illicit activities or threats to safety. Space systems, such as Copernicus and Galileo, already play a crucial role in monitoring activities, enabling safe navigation, and locating persons in distress. The upcoming IRIS<sup>2</sup> constellation will contribute to secure, resilient, and reliable communications available in the remote Arctic region.



For space technologies to deliver real-world impacts, satellite systems and services must provide actionable information based on the specific needs and expertise of the end-user. Improving the delivery of satellite information during crises is an important next step from existing and planned capabilities. To guarantee the reliable delivery of data during emergencies, satellite systems must also be resilient and robust against cyberattacks.

Finally, safety in the Arctic relies on safety in space. The proliferation of space debris and deorbiting of satellites threaten both the continued access and exploitation of space, as well as communities and ecosystems on Earth. Space must be used responsibly for its benefits to be enjoyed by all.

### MODERATOR

**Isabelle Duvaux-Bechon** Senior Advisor – Civil Security from Space/Rapid and Resilient Crisis Response, ESA

#### SPEAKERS

#### **Chrisopher Topping**

Acting Head of Civil Security from Space Programme Office & Rapid & Resilient Crisis Response Accelerator Lead, ESA

> Yannick Arnaud, Project Manager at EU SatCen

Flavio Sbardellati, Governmental and Downstream R&I Manager, EUSPA

> Barbara V. Scarnato, Principal Consultant & Earth Observations Lead, DNV

Rosario Ruiloba, Director of Business Development, Unseenlabs

**Michael Byers,** Canada Research Chair in Global Politics and International Law, University of British Columbia

### **KEY FINDINGS**



More must be done to **ensure timely delivery of actionable information** during accute emergency phases.

Space assets must be **resilient and secure** to ensure reliable and continuous availability.

The **responsible use of space** is intrinsically connected to the safety and wellbeing of people on Earth.

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When vessels turn off their AIS transponder, it makes them more difficult to locate, creating risks to other vessels in the area and potentially signifying illicit activities being conducted. The vast size of the Arctic seas makes monitoring socalled 'dark vessels' especially challenging.

Unseenlabs can locate, identify, and track vessels using Radio Frequency even when the transponder is not active. By providing accurate and timely information to users, Unseenlabs can support regulators and responders tackle a range of maritime safety challenges, such as illegal activities and search & rescue operations.





## SPACE FOR CLIMATE AND ENVIRONMENTAL CHALLENGES



### MODERATOR

Rune Floberghagen Head of Climate Action, Sustainability and Science Department, ESA

### SPEAKERS

**Camilla Brekke** Director, Norwegian Polar Institute

Daniel Robert Leeb Executive Mission Director / CEO, Iceland Space Agency

Tina H.P. Schoolmeester Head of Programme, Polar and Climate, GRID-Arendal

**Roar Skålin** Director General, Norwegian Meteorological Institute

### Bojan Bojkov

Head of the Remote Sensing and Products Division in the Department of Technical Support and Science, EUMETSAT

**Teresa Cunha** Senior Project Officer, Safety, Security and Surveillance Department, EMSA

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The effects of climate change are already present in the Arctic, from declining sea ice, retreating galciers, coastal erosion, and disruption to biodiversity. The unprecedented changes happening across the region increase the risk of extreme weather events, putting communities at risk. Understanding these impacts across different time-scales, from immediate weather forcasts to long-term climate models, is paramount to informing populations about ongoing risks and mitigating climate change impacts.

Utilising space data to understand the Arctic environment and changing climate is crucial for actors in the region, but difficulties remain. The Arctic's remoteness makes ground truthing satellite data significantly more challenging, potentially leading to inaccurate forecasts (for example in sea ice thickness) which can pose dangers for actors in the region.

Many key climate indicators can only be observed adequately from space. However, the insights from space data on the environment and climate must be made more accessible to policymakers to ensure policy impact. Focusing on actionable insights from space data, and reducing communication gaps between scientists and policymakers is crucial to facilitate this.



Developing space capabilities for the Arctic remains an ongoing priority. Weather forecasting capabilities in the Arctic are significantly lower quality compared to the rest of the world. Recent and upcoming missions such as CIMR should help to continue to reduce this gap. As well, emerging technologies such as AI will be pivotal for processing satellite data faster and more accurately, significantly enhancing forecasting and environmental monitoring in the Arctic.



Oil spills in the ocean, either from maritime accidents or deliberate discharges, produce substantial amounts of pollutants, damaging ocean and coastal ecosystems.

The European Maritime Safety Agency (EMSA) operates the CleanSeaNet service, detecting oil spills, identifying polluters, and monitoring the spread of oil spills using Synthetic Aperture Radar (SAR) satellite images. After analysing imagry, CleanSeaNet provides coastal states with near-real time information to respond quickly, mitigating the impact of spills and identifying those responsible.

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## **KEY FINDINGS**

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Improving the **accessibility and usability of space data** is essential for supporting local livelihoods and enhancing safety in the Arctic region.



Satellite data must be transformed into **actionable insights for policymakers**, requiring a common understanding of needs and knowledge.

Satellite weather forcasting requires specific capabilities and considerations in the Arctic. Upcoming missions should contribute to filling data gaps, however, ground truthing of satellite data remains particularly challenging.

# SPACE AND ARCTIC POLICIES

Space data plays an increasing role in supporting policies in the Arctic, contributing to UN Sustainable Development Goals (SDGs), monitoring regulatory compliance, and informing environmental policies. Space can also foster international collaboration between states, without which many key societal challenges cannot be addressed. Connecting space data with policies at national and international levels to ensure the effective and inclusive utilisation of space across society is key to unlocking the benefits space can bring.

Satellite data is essential for environmental monitoring, detecting illegal fishing, crisis management, and supporting sustainable development in the Arctic. A range of actors relies on satellite technologies on a daily basis to understand natural and technological processes which can only be achieved over an area as vast and remote as the Arctic through space technologies.



Gaps remain, however, between needs and capabilities. Users need timely insights delivered in an accessible manner validated through ground truthing, a particularly challenging task in the Arctic. Different challenges also require a range of capabilities, which should be integrated and connected with their distinct use cases. Going forward, ensuring sensor diversity, adequate revisit times, integration with other technologies, and rapid delivery through accessible user-oriented systems must be the ongoing focus of space activities for the Arctic.

Cooperation within, across, and beyond the Arctic is key. Multilateralism is the only pathway to peaceful space exploration and governance, however, difficulties from the ongoing Russian war in Ukraine have precluded scientific cooperation across the Arctic states.

Integrating diverse perspectives through multidisciplinary approaches to draw from indigenous voices throughout space activities and policymaking is vital for creating inclusive policies and ensuring space activities are both technologically effective and socially responsible.

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#### **MODERATOR:**

image: bawa/Unsplash

Bruno Reynaud de Sousa Professor of International Law, University of Minho

### SPEAKERS:

Laurant Jaffart Director of Connectivity and Secure Communications (D/CSC), ESA

> Rolf Skatteboe President and CEO, K-SAT

**Morten Høglund** Senior Arctic Official at the Ministry of Foreign Affairs, Chair of the Senior Arctic Officials, Arctic Council

Aleksandra Bukała Director of the Department of Strategy and International Cooperation, Polish Space Agency

Thomas Hoerber Professor, Head of the EU\*Asia Institute, ESSCA School of Management

## **KEY FINDINGS**

**The Arctic is home to key space infrastructure**, such as the Svalbard Satellite Station, with new and upcoming space capabilities filling data gaps and delivering on policy needs.

**Stable and sustainable long-term policies are essential** for guiding space initiatives and ensuring equitable benefits. To achieve this, policies and space activities alike should be developed through an inclusive, multidisciplinary, and multilateral approach.

**Designing user-friendly satellite systems and ensuring data is delivered in a timely manner** is critical for decision-making, especially during crisis managment.

**Integrating indigenous insights is vital** in order to create inclusive policies and develop space programs that support their way of life.

## CONCLUSIONS

The Arctic is home to 4 million people, who live and prosper across the region. But challenges from climate change, increased maritme activity, and ongoing geopolitical tensions create increasing risks to the region.



Space technologies can continue to keep the region's inhabitants safe, support sustainable development, and monitor and protect the fragile Arctic environment. More must be done however, to ensure the benefits of space technologies are delivered to those who rely on it, and those who could in the future.



The Arctic is key for observing climate change, with the effects of increasing global temperatures taking hold in the region. Space assets are crucial for monitoring key environmental variables in the Arctic, improving understanding of climate change and providing near real time ice-extent, weather, and pollution information. More must be done, however, to link space data to policies and policymakers.



Real-time crisis management via satellite monitoring is essential for safety in the Arctic. ESA's Civil Security from Space program, including the SERENITY system, offers a network of hubs providing situational awareness and crisis response based on users' and operators' needs, utilising and making existing services accessible.



The Arctic must balance economic development and environmental protection, in particular through respecting and including indigenous perspectives in space activities. Space technologies can continue to support economic growth, and this can be enhanced through collaborative approach ensuring development is conducted responsibly and inclusively.

## Flash Talks





Develops solutions for maritime surveillance, integrating satellite data for vessel tracking, infrastructure protection, and ice monitoring.



Real-time tracking and detection of vessels without AIS to combat illegal fishing, asset protection, and environmental crime.



Supports emergency response with real-time video, high-resolution 3D mapping, and AI integration, deploying drones and Synthetic Aperture Radar to improve situational awareness



Monitors ice velocity and discharge in Greenland using Sentinel-1 satellites, providing ice velocity maps and high-resolution SAR interferometry products to track polar ice dynamics and validate ice sheet models.

During the workshop, companies were invited to demonstrate their services, showcasing a range of operational solutions supporting Arctic challenges.







Leading Norwegian research centre based in Tromsø hosting 20 leading institutions focused on Arctic research. Supporting projects like SUDARCO and PermaRich to enhance understanding and management of Arctic conditions.



Provides coastal erosion monitoring services using radar and optical data, focusing on addressing data gaps in intertidal areas, vegetation, and bathymetry.















Eurisy is a non-profit association of 24 national space agencies and offices from Europe and beyond mandated to work collective to bridge the gap between space and society.

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