SAON Task Proposal

1: Task Title:

The Svalbard integrated Earth Observing System (SIOS)

2: Name of leader and partners

(*leader's e-mail address and partner names, affiliation and country):*

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OTHER SIOS-PP PARTNERS

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3: Objective

(*please be clear and specific):*

Establish in and around Svalbard an upgraded and world class regional observing system, based on already existing research infrastructure and excellence, and guided by an Earth System Science (ESS) perspective.
Develop governance, coordination and integration of the distributed research infrastructure on the basis of "*Best Practice*" management principles.
Elaborate and manage a joint strategy for optimize, further upgrade, the research infrastructure, thus providing guidance and advice for national plans.
Establish a Joint operational Knowledge Center through which provide relevant core services (Data, Access, Logistics, Knowledge) to the research community and stakeholders.
Promote a culture of openness and stimulate "*best practice*" with respect to and sharing of data, in coherence with Principles and Practices for Arctic Data Management adopted by IASC.
Address key ESS questions mainly relating to processes acting on annual to decadal time-scales (SIOS core activities).
Build close cooperation and coordination with other ESFRI projects with Arctic nodes, existing regional research networks in the European Arctic and pan-arctic initiatives.

SIOS-PP Structure:
Work package 1: Project Management
Work package 2: Legal & Governance Structure
Work package 3: Finacial Strategy
Work package 4: Infrastructure Access Policy
Work package 5: Logistic Plan
Work package 6: Data Management and utilization plan
Work package 7: SIOS Remote Sensing Strategy
Work package 8: Internal Integration Strategy
Work package 9: International Cooperation and Integration
Work package A: Special Legal Aspects
Work package B: Environmental Framework
Work package C: Scientific Framework - Gap analysis

4: The need

(*please state briefly which need will be met by your proposal, and who has the need)*

The Arctic is warming more rapidly than almost anywhere else on Earth and this is resulting in equally rapid environmental change. There are signals that Arctic climate change is possibly accellerating. The research community is still struggling to keep pace with the scale of these changes and the complexity of the processes, interactions and feedbacks that underlie the changes. Global climate models demonstrate that polar regions play a crucial role in the climate system – what happens in the Arctic does not stay there. Environmental changes in the Arctic will have local, regional and global implications.

These changes already affect local residents. Humans are inextricably linked to the changes we are observing today, both as drivers of change through our greenhouse gas emissions and as the very populations needing to prepare for the uncertainties that lie ahead. The ongoing and anticipated changes provide vast economic opportunities; but at the same time they pose significant threats to the environment. Important decisions will need to be made in the coming years which take into account economic, societal and environmental issues. In this context, a reliable knowledge base, on which decisions can be based, is a prerequisite to

provide sustainable solutions. There is an urgent need for increased observations in the Arctic, and it is recognised that coordinated monitoring of this still very data-poor region is essential for improve modelling and prediction capabilities of polar weather and climate, and increase our understanding of the Arctic system and its role in the Earth system.

SIOS seeks to build a regional observational system for long term acquisition and proliferation of fundamental knowledge on global environmental change (GEC). System will be designed around topics related to GEC in such a manner that we can, at regional level, detect change, attribute change, describe the effect of change, understand and communicate what will be required to mitigate, adapt to and/or reverse change.
SIOS will enhance the scientific environment in Svalbard by providing the core measurement program and the special expertise of the Knowledge Center. Primary goal will be to elucidate and quantify the role of the interfaces on the state of the Arctic, prioritizing measurements of variables who's coupling with other entities are believed to be significant in Svalbard over decadal and shorter time scales. This core observational program will provide the research community with systematic observations that are guaranteed to be available over time.
The SIOS Knowledge Center will use the observations and knowledge to continuously develop the core program. The core observational program will be stable over time, yet dynamic, as new methods and questions from society appear. An important capacity-building activity at the SIOS-KC will be to stimulate the development of new observational techniques for environmental monitoring that are clean, energy efficient and robust in the Arctic environment. The SIOS-KC will provide an intellectual environment where sampling strategies and observational practices will be developed with an Earth system science perspective, and will continuously inform users and society about the accrued knowledge within its field of expertise.

5: Short description

(*please limit to one page, use attachment if strictly needed)*:

The Svalbard Integrated Earth Observing System (SIOS) is conceived as a regional response to the Earth System Science (ESS) challenges posed by the Amsterdam Declaration on Global Change. SIOS is intended to develop and implement methods for how observational networks in the Arctic are to be designed and implemented in order to address these issues in realms approaching the continental scale. SIOS seeks to be consistent with and contribute to the strategy envisaged by the Earth System Science Partnership (ESSP; www.essp.org). SIOS will provide upgraded and relevant *Observing Systems and Research Facilities* of world class in and around Svalbard. The initiative builds on the extensive observation capacity and research installations already in place by many nations. It is a distributed research infrastructure set up to provide a regional observational system for long term measurements under a joint framework.

Svalbard is a region within the Arctic that provides physical barriers for at least some of the entities and processes that are particularly relevant for a system understanding. This make it possible to formulate studies where one utilize the boundary to separate internal transformations within the region and external factors. Svalbard is also a region with relatively substantial data coverage already as well as infrastructure and access capacity. It, thus, singles itself out as a region of choice to develop the ESS approach. Such an endavour will provide increased understanding of the region and will significantly advance ESS methods.

Overarching approach of the SIOS monitoring programme will (a) integrate the monitoring of vertical coupling through the entire atmosphere, down to the Earth surface and into the ocean, (b) integrate measurements of horizontal transfer of Earth System relevant variables across the archipelago and within the surrounding ocean and (c) monitor changes in the land-based environment and its biodiversity. The intention is that a clearly defined set of sites, across Svalbard and in the surrounding ocean, be recognised, with each site contributing to a number of Earth System science questions to facilitate better integration and optimisation of sampling and data collection

SIOS will enhance Svalbard by establishing an experimental environment where it will be attractive to perform shorter term basic and applied research against the combined backdrop of both the core measurement program and the Knowledge center. The nature of such basic and applied research will not be restricted by SIOS but can potentially inform subsequent evolution of SIOS monitoring activities.

Two fundamental pillars, the core program and to SIOS-KC, the main assets of SIOS will build the coordinated observation capacity guided by a joint strategy and development plan and the joint services set up. They will provide better and open access to the research facilities and observations, data, logistics, as well as providing better knowledge management, training and meeting places for scientists and students.

SIOS Data Management System (SDMS) will be a functionality enabling component of the Knowledge Centre, supporting data submission, discovery, access, use and preservation of SIOS relevant data sets. As the SDMS will be designed as a distributed system which intends to make extensive use of already existing data centres holding data relevant for SIOS, a common data policy is defined which clarifies the relations between contributing partners as well as the necessary conditions for public access to SIOS data. SIOS will implement a data policy which matches the ambitions of an open access policy and Principles and Practices for Arctic Data Management adopted by IASC, but at the same time be flexible enough to consider '*historical*' legacies.

SIOS will develop and secure a robust communication with other bodies carrying out and funding research activities in the Arctic (observational as well as modelling) and actively promote a sustained Arctic observing network. This involves interaction with the EC European Arctic Strategy and the European Polar Board, close collaboration with other Arctic projects such as INTERACT or ESFRI projects that include Arctic segments (e.g. EuroArgo, EMSO, ICOS) as well as with existing EU and Nordic infrastructure projects. It further requires the establishment of regular communication and cooperation with non-European nations, not involved in SIOS, notably Russia, USA and Canada, and with the various international bodies charged with developing a pan-Arctic observational network under SAON.

As one of the large scale research infrastructure initiatives on the ESFRI roadmap (European Strategy Forum on Research Infrastructures), SIOS is currently developing its scientific case as well as working out sustainable legal, organizational and financial plans. This is done under its preparatory phase project (2010-2014) with 26 partner institutions based in 14 countries, which have existing research and research infrastructure in Svalbard.

6: Funding

(*estimated budget and likely funding sources):*

SIOS Preparatory Phase: commitments of 6,641,168.40 Euro total, with 3,999,965.00 Euro from FP7, THEME [INFRA-2010-2.2.3] [SIAEOS (Upgrade of the Svalbard Integrated Arctic Earth Observing System)], more resources for WPs A, B and C supplied by Norwegian Research Council, over 4 years.
The funding model of the SIOS-KC, the planned central coordinating facility of SIOS, will be based on membership fees with a significant contribution by the Norwegian host. Estimated costs of operating the SIOS-KC can range between 2 up to 5 Meuro/year depending on ambitions and level of services.
In addition to the SIOS-KC the research infrastructure (RI) will be upgraded on the basis of an RI Development Plan. Prelimninary RI Development Plan does also provide costs for the RI upgrade, however, the cost estimate is not yet done in sufficient detail and the upgrade will depend on national funding and variable geometry. However, RI Gap Analysis performed clearly indicate that the more ambitious SIOS RI upgrade will have a cost from 80-to 100 Meuro.
The same gap analysis and follow up studies identify requirements for access to infrastructure and logistics that clearly indicate as operational costs amounting to 10 Meuro per year.

7: Time line

(start and ending):

SIOS preparatory phase started October 2010 and, with a required extention of 12 months, will end 48 months later in October 2014.
Later ESFRI (and thus SIOS) commitments have a decadal perspective

8: Expected outcome/product:

SIOS shall contribute to the further development of the research infrastructure in and around Svalbard, into a world leading large scale research infrastructure in the Arctic, providing state-of-the-art research infrastructure to the international polar research community, building on the

- Norwegian Governmental Research- and Svalbard Policies
- ESFRI and OECD principles of Best Practice & Excellence
- Established qualities of the international partners, the research communities and their research priorities.

The SIOS Core Activities – based on the observation that most changes occur at the interfaces between different spheres (e.g. ocean-atmosphere, ocean-biology, atmosphere-biology). SIOS will prioritize measurements of variables whose interactions are believed to be significant in Svalbard, in particular those able to elucidate important processes acting on annual to decadal time-scales. the SIOS Research Infrastructure Optimization Report took the view that the study of Earth System parameters be grouped under vertical coupling and horizontal transport coupled with Svalbard landmass and biota interactions with changing climate. The vertical coupling includes the entire atmosphere and the vertical profile of the ocean whilst horizontal transport includes atmospheric and ocean circulation, long range transport of pollutants and migration of wildlife.
SIOS will establish the network of sites to ensure effective coverage across the archipelago and the surrounding ocean to capture horizontal transport of key variables. Similarly will be

established a network of sites across the archipelago to provide a balanced 360° view of events in the vertical column of the atmosphere. Existing infrastructure and sites will be complemented with new measurement sites, mainly in the East Svalbard. At the same time, instrumentation will be upgraded to realize a structured framework and an integrated monitoring programme, identifying variables to be measured and the sampling frequencies for these variables. Earth System relevant variables are the focus of SIOS and these will be changing over seasonal and decadal time scales which need to be factored into SIOS when it becomes a full blown integrated observational system. Observational activities across all relevant instrumentation will be performed at time intervals that can capture the scale of variability in the signals.
The SIOS Research Infrastructure Optimization Report presents the first suggested observation priorities which will be the basis for the future SIOS research infrastructure development strategy.

The SIOS Knowledge Center - will be the coordinating unit of the distributed SIOS research infrastructure, managing its daily operation and services offered to the polar research community. It will manage the interests of the owners and stakeholders of the SIOS consortium and is the first point of contact for all enquiries concerning SIOS. It will be the main connector between the users of SIOS and the capabilities it provides, implementing the joint policies agreed by the SIOS community. By building on existing networks, infrastructures and services the scope and scale of the SIOS KC will be unique providing coordination and integration between scientific fields ,access and use of research infrastructure and data/datasets to the observational platforms in Svalbard and the surroundings.
SIOS supporting facilities such as national research stations, vessels, existing databases and instruments are not part of the SIOS legal entity – e.g. not owned by SIOS, but made available to SIOS and accessible through the KC. Operational relations between SIOS and these facilities will be established through bilateral agreements and organizational meeting structures with regular meetings of the Infrastructure Coordination Committee. The main services provided by the SIOS-KC will be the provision of
- One access point for users with a joint information and evaluation system
- An open access data policy with a state-of-the-art meta database system
- Integrated logistical services for coordinated operations
- Scientific integration, meeting places and training programs for the research community
- A dynamic knowledge management system for infrastructure utilization and development

The SIOS Data policy - SIOS aims to provide an effective, easily accessible data management system which is fully compatible with and makes use of existing data handling systems in the thematic fields covered by SIOS. As a final result, the SIOS Data Management System (SDMS) will be a functionality enabling component of the Knowledge Centre, supporting data submission, discovery, access, use and preservation of SIOS relevant data sets. As the SDMS will be designed as a distributed system which intends to make extensive use of already existing data centres holding data relevant for SIOS, a common data policy is defined which clarifies the relations between contributing partners as well as the necessary conditions for public access to SIOS data. The largest challenge hereby arises from the wide spectrum of scientific fields, which, to a large degree, have developed individual solutions of data handling, partially through international agreements. SIOS will, therefore, implement a data policy which matches the ambitions that are set for the new European research infrastructures, but at the same time be flexible enough to consider these '*historical*' legacies.
As a European Research Infrastructure, SIOS will give special considerations for the legal as well as the political and strategic frameworks for the European Research Area. The first draft data policy of SIOS can be downloaded at the following address:

http://www.sios-svalbard.org/prognett-sios/Project_Documents/1234130481050

SIOS will be a new research infrastructure organization in Svalbard, with a legal personality and with the main task to establish, operate and provide a state-of-the-art research infrastructure and observing system for the polar research community. The new organization, hosted by Norway, will require international membership and co-funding, while the physical research infrastructure and observing system will still be nationally owned by those nations that have already built observing capacity on the Svalbard shores. The national ownership and legacy invoke constraints on how it is possible to organize the inception and development of the observational system in Svalbard. There are also a number of previous initiatives at stations or within villages to seek coordination measures. To build a new structure with whole region ESS responsibilities is a delicate process that simultaneously should offer enhanced efficiency for all. SIOS is presently in a process of defining these aspects of its organization.