

Poles of Technological Innovation and Development

The remoteness of the Polar Regions need no longer be a valid reason for a lack of data.

Technology and innovation should be used to provide enhanced observational data, reduce logistical costs, and reduce human presence and environmental impact in sensitive ecosystems.

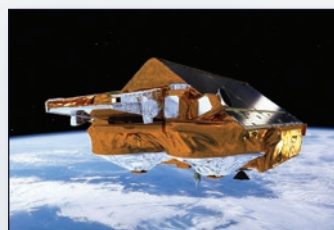
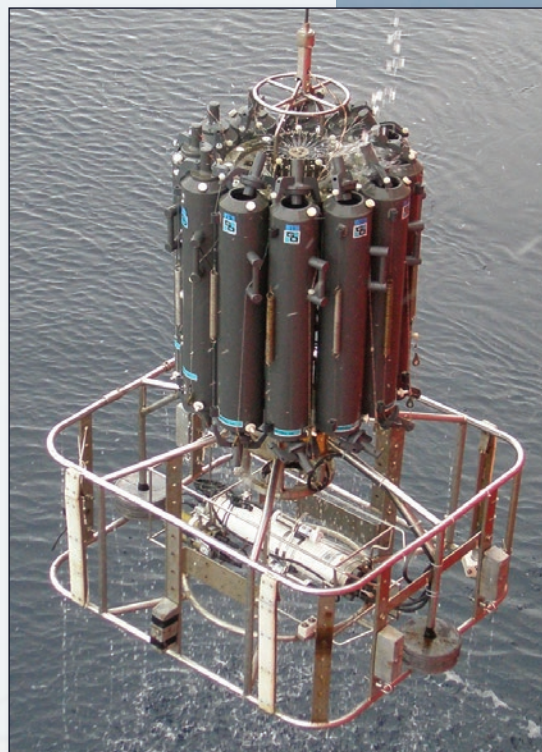
Increasing pressure on natural resources, shipping, and environmental security issues call for accurate monitoring data with high spatial and temporal resolution. Remote sensing, autonomous vehicles and new sensors linked together in **new environmental monitoring networks** will transform data to drive significant improvement in **real-time forecasting** for operations in the Polar Regions and for implementation of innovative environment managing strategies leading to better **understanding of global linkages**.

Environmental monitoring technologies are developing at a fast pace, with a range of new possibilities for wide-scale multi-parameter monitoring, including real-time data transfer. Environmental **scientists know the needs** and specifics for monitoring and have the necessary field knowledge, **while European industry**, through research clusters, small and medium enterprises and spin-offs, will be able to **provide the best solutions** and the polar environment will provide **an effective test bed**.

The vantage point of facilitated pan-European access to the polar regions should be stimulated within Horizon 2020. Technological innovation at the instrumental development level, as well as new monitoring strategies are within reach of European R&D teams which benefit from the wide-scale European polar infrastructures and now have an opportunity to bridge the current observational deficit in polar regions.

KEY ISSUES

- 1. Remote sensing:** Remote sensing is essential to evaluate the spatial extent of environmental change and its dynamics, including human impact through oil spills, ship accidents, etc. Large spatial coverage, short repetition intervals, high spatial resolution and significant spectral discriminating capacity – notably hyperspectral – all need to be further developed. Development of new remote sensing platforms (satellite, aircraft and unmanned aerial vehicles) implemented in an overarching programme linking atmosphere, oceans, land and cryosphere would be extremely important. With innovative use, remote sensing can be at the forefront of environmental monitoring, and the creation of global ecosystem and climate models. Collaborations in this field can be realised and supported by joint efforts of the European Polar Board (EPB) and the European Space Agency (ESA).



2. **Automated equipment: Robotics, automated equipment and autonomous vehicles** are key for monitoring from the air and ocean, but should also be used to a greater extent on land. Unmanned equipment significantly increases the temporal and spatial range of investigation and monitoring, while reducing energy needs and environmental impact. Complex multi-sensor and long term autonomous platforms are needed. Also smaller units developed by commercial organisations and technical institutions could be key for a wide variety of users as remote sensing platforms and for data transmission. Europe is well poised to develop and use advanced technology for the exploration and monitoring of Polar Regions.



3. **Sensors: High efficiency sensors** with increased accuracy and autonomy, networking capacity, and low maintenance costs are urgently needed, if we are to improve monitoring in the Polar Regions whilst reducing environmental impact. With miniaturized sensors we can unobtrusively access previously unexplored areas such as subglacial lakes, the depths of the frozen oceans, and the upper layers of the atmosphere. Better sensors will also allow for improved ground truthing, which remains a major challenge in remote sensing applications.



4. **Data sharing: Unrestricted and efficient near-real-time data management and data sharing, including open access policies,** would enable wide application of monitoring results into models, while providing added value for applications with societal relevance such as natural and technological risk management. With recent technological developments in data handling and dissemination capacity, and strong societal drivers, it is now timely to enhance united European action. With joint funding initiatives and institutional collaborations, Europe has the potential to set the stage for extensive data sharing that will provide much needed input for modelling, monitoring and large-scale scientific endeavours.

5. **Communications: Efficient and secure communications** are essential for work and exploration in remote areas. Communications are also essential for efficient search-and-rescue activities and environmental risk mitigation in such areas. Europe should use its globally-recognised capabilities in development of IT and communications, to address the issue of empowering remote areas by installation of efficient communications technology. Improving communications and data transfer over large distances in remote locations is an essential requirement for unmanned equipment and sensors. This can be achieved by shared and better usage of existing European infrastructures, combined with investments in new capacities such as cheap low earth orbit “store and forward” satellites. Such an initiative would also contribute to strengthening the competitive power of innovative European companies.



6. **Power supplies:** Technological development in extreme environments leads to an increased need for innovative **power supply** systems. These have to be efficient, light on emissions, reliable and autonomous. There is a need for both large power plants supporting polar stations, and for small sturdy power supplies for remote field work and for autonomous equipment. This is a challenge for European innovation industries, with very high potential on a global scale.



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