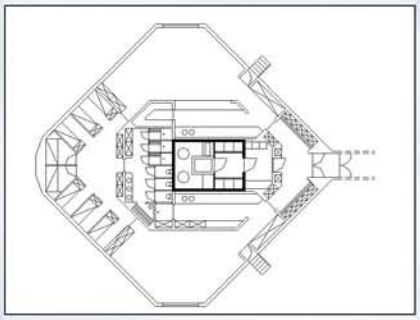

Construction and operation of the new Belgian Research Station, Dronning Maud Land, Antarctica

DRAFT COMPREHENSIVE

ENVIRONMENTAL EVALUATION (CEE)

February 2006

BELGIAN SCIENCE POLICY

THE INTERNATIONAL POLAR FOUNDATION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CONTACT DETAILS

This draft Comprehensive Environmental Evaluation (CEE) report has been prepared by the Belgian Federal Science Policy Office (hereafter referred to as Belspo, Brussels, Belgium), with support and input from Dr. H. Decleir (CEP scientific advisor, Belgium), Johan Berte (coordinator of the station design and construction, the International Polar Foundation hereafter referred to as IPF, Brussels, Belgium), Dr. F. Pattyn (glaciology unit ULB, Belgium) and Poles Apart Ltd (environmental consultancy, Cambridge, UK).

It has been approved and endorsed by the Belgian Federal Ministries of Foreign Affairs, Environment and Science Policy. The report was circulated to all Antarctic Treaty Parties on 10 February 2006 and is available for download via the Belspo website www.belspo.be/antar.

We welcome comments and suggestions on the draft CEE.

For further information on this CEE report and its contents or if you would like to comment, please contact:

Maaike Vancauwenberghe
Programme Manager
Programme "Antarctic Research"
Belgian Federal Public Planning Service Science Policy
Wetenschapsstraat 8 Rue de la science
1000 BRUSSELS
T.: + + 32/2/238 36 78
F.: + + 32/2/230 59 12
e-mail: vcau@belspo.be
http://www.belspo.be
http://www.belspo.be/antar/

NON-TECHNICAL SUMMARY

This CEE report, approved by the Belgian Federal Ministries of Environment, Foreign Affairs and Science Policy, covers the:

- construction, operation and maintenance of the new Belgian research station in Antarctica;
- building and operation of the temporary camp required during the construction phase and
- transport and movement of cargo and personnel to the station site south of 60° S.

The new Belgian research station will replace the former Belgian Roi Baudouin base, built in 1958 at Breid Bay in Dronning Maud Land, closed in 1967 and buried under meters of snow. The short operational period associated with the Roi Baudouin base, situated on the ice shelf, and with the nearby Asuka station (1986-1992), situated on the inland ice slope, both subject to high snow accumulation rates and strong katabatic winds, resulted in the decision to construct the new station on bedrock and in the protected western part of the Sør Rondane mountain range.

The proposed construction site is situated approximately 1 km North of Utsteinen Nunatak, on a small relatively flat granite ridge (71°57'S 023°20'E), 173 km inland from the former Roi Baudouin base and 55 km from the former Japanese Asuka station. With the closing of Asuka station in 1992, the 20-30 degrees east sector of Antarctica became again a vast territory having witnessed up to now only brief periods of systematic investigation. The new station will thus reoccupy the 1072 km empty stretch between the Japanese Syowa station (684 km) and the Russian Novolazarevskaya station (431 km).

The new platform is offered to the Belgian and international scientific community in a flexible way both operationally and with respect to research opportunities. The station will serve as a hub for field exploration in the 20-30 degrees east sector of Antarctica.

During the initial years emphasis will be placed on glaciology, earth sciences and (micro)biology. The station will also serve as a node in the network of geophysical observatories in this part of Antarctica. Apart from routine surface weather observations, the station will initially carry out observations in synergy with the earth sciences and glaciological programme. In line with guidelines set up by COMNAP, an environmental monitoring plan will be set-up to record the impacts of human activities on the Antarctic environment. Station research activities will go hand in hand with a publicity campaign and educational programme to inform the general public, students and schools about the importance and challenges of research in the Polar Regions including climate change and sustainable development.

The construction of the summer station is planned in the austral summer of 2007-2008. In this period the station will be built, the system acceptance test performed and then it will be handed over to the Belgian Science Office at the end of the season. The expected design life is 25 years minimum.

The station is designed for optimal use by 12 people with a surface area (living, technical, research, storage) of 800 m². The use of a station "extension" will make it possible to accommodate another 8 to 18 people. This extension consists of heated shelters used for sleeping only. The station's facilities (kitchen, sanitary installations, offices …) are designed to cope with the larger occupation.

The station has a hybrid design, with the main building above ground-level and anchored onto snow-free rock area. The adjacent garage/storage building is located nearby and is mainly constructed under the surrounding snow surface. Both buildings are inter-connected by a weather protected corridor. The design and layout of the facilities will minimise snow management.

Consistent with the philosophy of the project, the station design will make best use of the terrain conditions for the integration of the buildings and will be such that it minimises impact on the environment and on the landscape during the construction, operation and removal of the station.

The system design of the station is based on sustainable technology and high energy efficiency, with a full-year monitoring and remote sensing capability. Nevertheless safety, health, comfort, functionality and cost are equally important design drivers. The facilities will use renewable energy as the primary energy source, integrating a comprehensive energy management regime, thereby minimising the use of fossil fuels. To assure a constant energy supply, two back-up generators will be installed. The amount of fuel used at the station will be mainly for vehicles.

The station will have a comprehensive waste management regime. Waste treatment will include the treatment of grey water and sewage and recycling capability for non-potable water applications. A Waste Management Plan (WMP) will be prepared that will comply with all the requirements of Annex III of the Environmental Protocol.

The station has been designed for low maintenance and recycling. Lifetime maintenance strategies will reduce the running costs. It is designed for easy repair and damage control. The manual handling and multiple handling of all stores and equipment will be minimised across all operations, including annual relief, normal operation and eventual decommissioning of the facilities. A risk contingency plan will be developed. By design the station has extended upgrade capability. It will be easy to integrate new state of the art technologies and, if required, the station can be upgraded to a full year station with minimal effort.

The environmental impacts of the construction and operation of the proposed research station have been considered. The geographical area affected includes the route of the ship, the unloading site at Breid Bay, the traverse route from coast to station (180km), aircraft flight routes, the station area and areas visited during scientific fieldwork. Operations will generally take place within a radius of 200km of the station.

The main sources of direct impacts have been identified as:

- atmospheric emissions from the burning of fossil fuels;
- fuel spills to snow or ice and
- grey water discharge.

These impacts are likely to be higher during the construction of the station as a large amount of cargo will be transported to the site, there will be more people and the renewable energy systems will not be in place. Atmospheric emissions should be significantly reduced once the station is operational.

Direct impacts are described and summarised using impact matrices. These matrices also identify prevention and mitigation measures in order to avoid or reduce the impacts.

An Environmental Management Plan will be prepared for the construction and operation of the station. During the construction phase, the IPF Project Manager will be responsible for compliance with this Plan, including the implementation of mitigation measures set out in the CEE. During station operation the Belspo Station Manager will take over these responsibilities.

The potential environmental impacts of the station have been considered from the start of the design process, with an aim of minimising impacts wherever possible. The station has an energy efficient design, with maximal use of renewable energy. Water will be recycled and all wastes minimised. Cooperation with other nations for shipping and aircraft support will reduce the overall impact of long distance transport. Improvements in the environmental performance of the station and logistic support will be made wherever possible during the lifetime of the station.

As the station is designed to have a low environmental footprint with low energy consumption and minimal waste output, indirect impacts will be minor. Cumulative impacts may result from emissions to air, fuel spills and local discharge of grey water during the construction and operation of the station and may reduce the scientific value of the area.

Monitoring is one of the key components of the planned science at the new station and baseline monitoring work has already been undertaken during the Belare 2004 and Belare 2005 site surveys. A monitoring program will be developed to integrate with other work undertaken by national operators and in line with COMNAP guidelines.

Monitoring will be designed to investigate the potential impacts of the activities, so that adverse effects will be discovered in good time. Information on the operation of the station will be recorded, including emissions, fuel spills and wastes produced. The CEE impact assessment will be reviewed regularly to establish if the impacts are as predicted and to assess the effectiveness of mitigation measures.

Gaps and uncertainties in this draft CEE report include the unpredictability of weather and sea ice conditions which may cause delays in construction, incomplete details of the station design and logistical arrangements, incomplete information on breeding species within 200 km radius of the station and possible changes in future scientific and logistic requirements.

1. INTRODUCTION

1.1. Purpose of the new station

Aware of the increasing impact of human activities on the earth system, Belspo launched in 1997 a research programme in support of a sustainable development policy. This umbrella programme included the Belgian Scientific Programme on Antarctic Research, already in operation since 1985. The Antarctica programme resulted as legacy of the famous 1897-1899 'Belgica' expedition and Belgium's involvement in Antarctic exploration as one of the original signatories of the Antarctic Treaty.

Understanding how the earth system works is paramount in establishing a policy of sustainable development. Recent findings highlighted the importance of the Polar Regions in the global weather and climate systems, their value as a treasure house for past environmental archives and their key role in major bio-geochemical cycles. Antarctica has also proved to be ideally situated not only to study life processes in an extreme (cold) environment but also to observe geophysical and astronomical phenomena.

In order to further this challenging endeavour and to facilitate Belgian scientists in their Antarctic work, a panel of experts (commissioned by Belspo) recommended the re-opening of a Belgian scientific station in Antarctica (The Belgian Antarctic Programme 1985-2002: Findings of the evaluation panel, final report, July 2002) (http://www.belspo.be/belspo/BePoles/links/publ_en.stm). Such a station, open to all countries interested in conducting research activities in this part of Antarctica, would foster scientific cooperation with other research programmes and significantly enhance Belgium's visibility within the Antarctic Treaty System.

The new Belgian research station will replace the former Belgian Roi Baudouin base, built in 1958 on the ice shelf at Breid Bay in Dronning Maud Land. The new station will be erected on the Utsteinen Ridge (71°57'S; 023°21'E), situated at the foot of the Sør Rondane Mountains, Dronning Maud Land, 173 km inland from the former Roi Baudouin base (1958-1967) and 55 km from the former Japanese Asuka station (1986-1992) (**Fig. 1.1 and 1.2**). Positioned halfway between the Japanese Syowa station (684 km) and the Russian Novolazarevskaya station (431 km) it will fill in a 1072 km unoccupied stretch between these two stations in one of the least occupied sectors of Antarctica that has only been intermittently investigated since the International Geophysical Year (IGY).

Although at present designed as a summer station only, power supply will be such that continuous year-round monitoring will also be feasible, allowing the station to function as an important node in the network of solid earth and upper air geophysical observations. The station will also be situated in the exit area of the Gunnestadbreen, one of the major outlet glaciers of the Sør Rondane, giving access to the inland Plateau (Japanese Dome Fuji Station: 765 km; German Heinz Kohnen Station: 807 km).

The station therefore occupies a central position for investigating the characteristic sequence of Antarctic geographical regions (polynia, coast, ice shelf, ice sheet, marginal mountain area and dry valleys, inland plateau) within a radius of 200 km. By monitoring environmental changes, Belgium hopes to take up its full responsibilities with respect to the aspects of environmental protection in Antarctica.

The station will be designed as 'state of the art' with respect to sustainable development, energy consumption and waste disposal, with a minimum lifetime of 25 years. If dismantling of the station is required, no significant or very little remnants of the occupation will be left, in order to meet the requirements of the Environmental Protocol and relevant Belgian domestic law.

With this IPY initiative Belgium wants to contribute to a new area of high-tech Antarctic stations, offering a platform for science and exploration, open to the international scientific community.

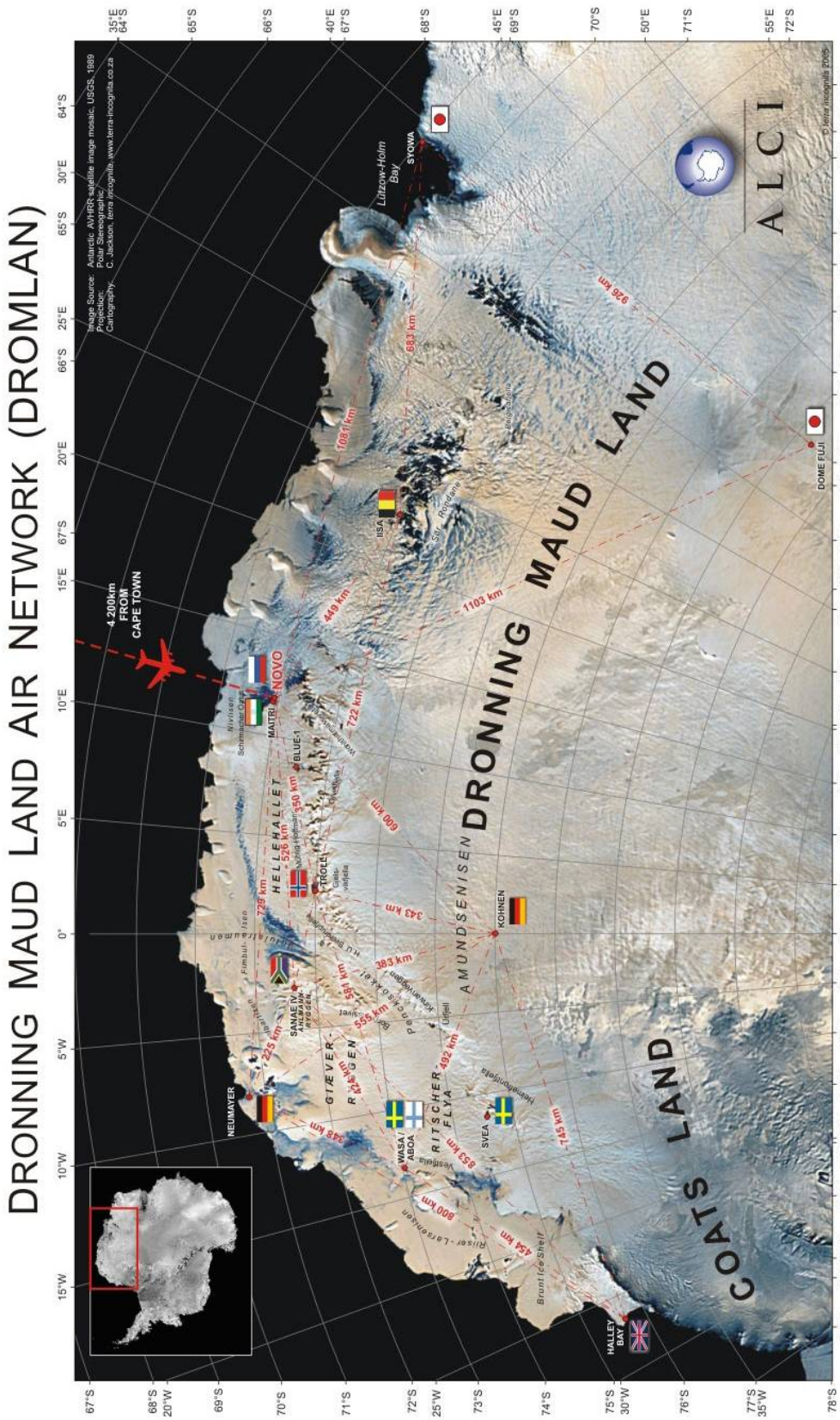

Fig. 1.1: DROMLAN-ALCI map giving an overview of research stations in Dronning Maud Land and the distance to all stations from Novo Air Base.
Source: Antarctic AVHRR satellite image mosaic, USGS, 1989.

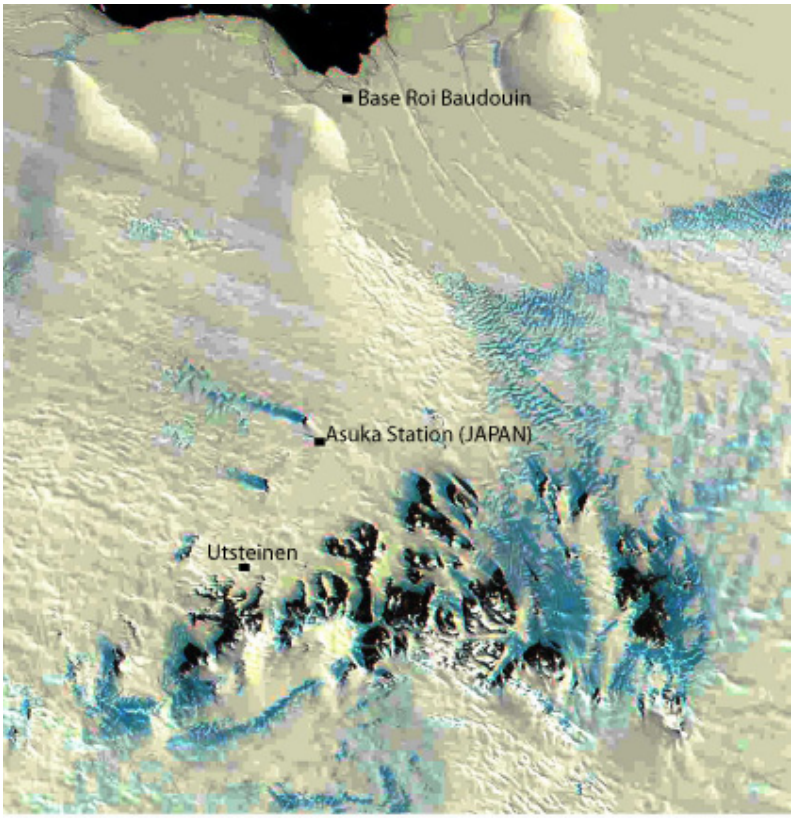

Fig. 1.2: MODIS image displaying the Sør Rondane Mountains and Breid Bay.
Situation of the former Belgian Baudouin Base, the former Japanese Asuka station and the proposed Belgian Utsteinen site.
The size of the image is approximately 250 by 250 km.

1.2. History of Belgian Antarctic research

Belgian involvement in Antarctic exploration began with the well known '1897-1899 Belgica Expedition' of Adrien de Gerlache. This expedition was the first expedition to winter in the Antarctic pack ice and is generally considered as one of the first genuine scientific expeditions to the Antarctic regions. The "Belgica Expedition" heralded the so called "Heroic Age" of Antarctic exploration which culminated in 1911 with the attainment of the South Pole by Roald Amundsen, second mate on the 'Belgica'.

In 1958 Belgium took an active part in the conception and preparation of the International Geophysical Year and, based on the legacy of the Belgica expedition, Belgium's commitment to the IGY included the establishment in January 1958 of the Roi Baudouin Research Station (70°26'S; 024°18'E) on a floating ice shelf of the Prinsesse Ragnhild Kyst in Dronning Maud Land. The Belgian base was integrated in a synoptic network of geophysical observations, carried out at more than 50 stations which contributed to our knowledge of surface weather and climate, and to our understanding of the upper atmosphere. The station also served as a base of operations for field work and geographical reconnaissance further inland. Geological and glaciological investigations were carried out for the first time in the Sør Rondane Mountains and new mountains were discovered further to the east (Belgica Mountains and Queen Fabiola Mountains). At the political level Belgium took an active part in the discussions leading to the Antarctic Treaty, one of the major outcomes of the IGY and was one of the original signatories. From 1964-1966 Base Roi Baudouin was the home of Belgian-Dutch Antarctic Expeditions. When the base was abandoned and closed in 1967, it was buried under meters of snow and was unsafe to inhabit.

After the closure of the Roi Baudouin base, a period of discontinuous activities followed. In 1985 Belgium resumed its Antarctica activities at the scientific level with a multi-annual research programme, while at the political level Belgium took active part in the development of the Protocol on Environmental Protection to the Antarctic Treaty (referred to hereafter as the 'Environmental Protocol') in 1991.

The scientific programme started with nine 4-year projects, financing 10 scientific teams for about 2 MEUR. Today, 15 scientific teams are financed within five 4-year network research projects for about 6.5 MEUR. The programme has evolved from a 'stand alone' programme within Belspo, to a part of a more general programme of sustainable development, positioning as such the Antarctic research and the role of Antarctica within the global environmental system. The major current research themes are climate change and biodiversity. At present Belspo supports high quality research teams, internationally recognised within the fields of ice-dynamics modelling, biogeochemical modelling, food-web dynamics, shelf slope dynamics and marine biodiversity.

Since closing Roi Baudouin base in 1967, Belgian scientists have depended solely on the hospitality of other nations to invite them to participate as guests in their scientific campaigns. Although this situation has led to a number of important and sustainable collaborations with other countries, this was not a long lasting situation as Belgium couldn't give an adequate return for the support, while it limited the selection of favourable sites for specific research activities.

1.3. Planned science

The new platform is offered to the Belgian and international scientific community in a flexible way both operationally as with respect research opportunities. It means that the research will be able to adapt not only to the evolution of science and technology but also to increased environmental concern. Initially the station will be open the summer only (November-February) but if required at a later stage the station can - without major modifications - be used as a wintering station.

(i) *The New Belgian Research Station as a hub for field exploration in the 20-30 degrees east sector of Antarctica*: access to the station is feasible throughout the whole summer season via the DROMLAN air network, allowing maximum use of surface transport vehicles for multiple field trips to the Sør Rondane and the coastal area. During the initial years emphasis will be placed on glaciology, earth sciences and (micro)biology. The glaciers flowing around and in the Sør Rondane are among the least investigated glaciers in Antarctica. The ice-dynamic surveying of the glaciers will be coupled with ice modelling and geochemical-isotopic studies, fields in which Belgian research teams excel. The study of rock outcrops in the Sør Rondane, belonging to the East Antarctic basement shield, was initiated by Belgian geologists and further explored by Japanese scientists in the period 1986-1992. It is clear that the Sør Rondane (together with Enderby Land) forms a key area in Antarctica for investigating the crustal evolution of Gondwana Land and international research teams will carry out such investigations from the new Belgian station. In the past, the blue ice fields characterizing the hinterland of the Sør Rondane (Nansenisen) have been successfully used by Japanese scientists to collect meteorites and cosmic dust. Using the gateway to Nansenisen via the Gunnestadbreen a new period of search for meteorites will contribute to the study of fundamental planetary processes. The dry valleys in the Sør Rondane will allow study of the waxing and waning of glaciers in the mountain area, as well as the periglacial (permafrost) environment. Finally, the different landscapes from the coast to the inland plateau represent varying environmental conditions for microbial habitats. Physiological experiments as well as molecular-genetic and genomic approaches are planned to gain a better understanding of which biological and environmental processes have shaped microbial communities and which factors are likely to be important in the context of future climatic change.

(ii) *The New Belgian Research Station as a node in the network of geophysical observatories*: the addition of a new node in the network of geophysical observatories will significantly complete the coverage of stations in this part of Antarctica. Apart from surface weather observations, the new Belgian Research Station will initially carry out observations in synergy with the earth sciences and glaciological programme. A broad-band seismometer will help to improve understanding of intra-plate seismic activity and the lithospheric structure. The combination of absolute gravity measurements each year and continuous GPS measurements (surface deformation measurements) will allow scientists to estimate the change in ice load and hence the regional mass balance in this region. At the same time, GPS dual frequency measurements can be used to reconstruct ionospheric disturbances and ionospheric scintillations. Such measurements in the upper atmosphere would significantly benefit from continuous monitoring of the geomagnetic field. The continuous monitoring of the geomagnetic field with an absolute accuracy is, at present, considered part of a second phase of geophysical measurements at the new station. The same applies for experiments to monitor the D-region of the ionosphere by passive and active electromagnetic sounding.

(iii) *The New Belgian Research Station as a monitor of environmental change in Antarctica*: in line with guidelines set up by COMNAP, standard measurements will be carried out to record possible impact of human activities on the pristine Antarctic environment. This will be done not only by samples of air, water, soil, snow and ice in the immediate vicinity of the station but a more ambitious plan will be set up for eco-toxicologic research of lichens and birds in a broader environment to monitor the introduction of non-native biota, diseases or toxic substances caused by increased human activities elsewhere and/or global warming.

(iv) *Education and outreach*: Belgium's decision to take up its share of responsibilities with respect to Antarctica will go hand in hand with a publicity campaign and an educational programme – set-up in collaboration with the IPF, in order to inform the general public, students and schools about the importance and challenges of research in the polar regions, climate change and sustainable development.

Scientific projects at the new station will be financed separately from the scientific projects funded within the Belgian multi-annual research programme and thus will not necessarily be part of the multi-annual programme. This will allow the continuation of multi-annual research projects such as marine biodiversity, marine biogeochemistry, terrestrial research in other specific regions of Antarctica, independent of the new station's activities.

The first scientific projects at the station will commence at the end of the construction season 2007-2008. The first field campaigns will start in the 2008-2009 season. Apart from the monitoring programmes, requiring continuous measurements, the plan is to start-up with a number of core projects and to expand gradually.

1.4. CEE preparation and submission

The CEE report has been prepared to meet the requirements of Article 8 and Annex I of the Protocol on Environmental Protection to the Antarctic Treaty and the provisions of the Belgian Law in execution of the Protocol on Environmental Protection to the Antarctic Treaty (Official Journal 19 May 2005).

The draft CEE was circulated for comments and approval to the Belgian Federal Ministries of Environment, Foreign Affairs and Science Policy. The draft CEE was circulated by the Belgian Government to the other Antarctic Treaty Consultation Parties not less than 120 days before the XXIX