PROCEEDINGS OF THE COMNAP SYMPOSIUM 2010
RESPONDING TO CHANGE THROUGH NEW APPROACHES

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Acknowledgements

The *COMNAP Symposium* was made possible by support from the hosts Dirección Nacional del Antártico. Special thanks go to that organisation and its Director, Mariano Memolli and the local Symposium organising committee head, Veronica Vlasich.

The COMNAP Symposium would not have been possible without the work of the Symposium Review Committee which consisted of Mariano Memolli (Symposium Review Committee Chair and Convener), David Blake (British Antarctic Survey), Patrice Godon (IPEV), Iain Miller (Antarctica New Zealand), Uwe Nixdorf (Alfred Wegener Institute) and Kazuyuki Shiraishi (Japan's National Institute of Polar Research) who is also the COMNAP Vice Chair with oversite responsibility for the COMNAP Symposium.

We are also grateful for those who participated in the Symposium by making an oral presentation or by submitting a poster.

Foreword

The 2010 COMNAP Symposium was held in the Panamericano Hotel, Buenos Aires, Argentina, on 11 August 2010. The theme of the event was "Responding to Change through New Approaches". This theme was very applicable; given this was the fourteenth Symposium, but the first since the change within COMNAP which saw the disbandment of the Standing Committee on Antarctic Logistics and Operation (SCALOP). It was SCALOP which, every two years, formed the Steering Committee which delivered the "Symposium on Antarctic Logistics and Operations".

So, the 2010 COMNAP Symposium was a response to change itself. As such, it included topics which were broader than logistics and operations.

The five topics were:

1. Technologies and the way forward;
2. International collaboration;
3. Best practice for outreach and communication;
4. Innovation in operations; and
5. The way ahead for environmental practices.

The Symposium Review Committee selected 13 proposals for oral presentations and 17 for posters from the number of submissions made. Submission was open and a number of individuals and organisations responded. The result was an informative and productive day which saw over 100 people register to attend.

It was a pleasure to participate and to see many of the innovative ways that National Antarctic Programs are continuing to respond to Antarctic challenges. It also was a valuable opportunity to encourage artists and those involved in outreach and education to showcase their talents.

The COMNAP Symposium will continue to be an excellent opportunity to share our Antarctic knowledge and experience with each other and with anyone who has an interest in Antarctica.

As such, I look forward to the next Symposium planned for 2012 - hope you will join us!

Dr. José Retamales
COMNAP Chair

Oral Presentations

THE DYNAMICAL POSITIONING OF THE NEUMAYER STATION III BUILDING

Hartwig Gernandt (presenting author)[1] (*Hartwig.Gernandt@awi.de),* Saad El Naggar[1] (*Saad.El.Naggar@awi.de),* Jürgen Janneck[1] and Hans-Jürgen Meyer[2]

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Abstract

After two seasons of construction, the new German winter station, Neumayer Station III, was opened on 20 February 2009. The construction was, technically and logistically, the most challenging project of Germany, to establish advanced infrastructure in Antarctica, during the International Polar Year (IPY).

Neumayer Station III is situated at longitude 70° 41' S and latitude 8° 16' W (2009) on Ekström Ice Shelf, next to Atka Bay, at the northeastern edge of the Weddell Sea in Dronning Maud Land.

The new building, basically a three-dimensional steel structure, comprises an underground section placed in a 76 metres long and 26 metres wide trench in the snow, a six metres elevated platform, surrounded by an insulated hull of 68 metres in length and 24 metres in width containing the two-storied station proper and the 26

metre long, lid-covered access ramp to the garage at 8.2 metres below the snow surface. Altogether, there are 4900 square metres of protected space, of which, 2100 square metres are heated. The whole construction, with its weight of approximately 2600 tons, rests on a hydraulic bearing system. The load is transferred by 16 foundation pads into the snow about eight metres below the snow surface.

The mean flow velocity of the Ekström Ice Shelf is of about 157 metres per year towards the breaking edge about 21 kilometres farther north. Over 25 years, the station will move about four and one half kilometres almost north bound. Along this flow line, the differential horizontal deformation rates will remain smaller than ± one per cent per year.

Neumayer Station III is not, as was common until now, designed to resist the forces resulting from such deformation of the underground, but rather to give way and thus avoid any undue increase of strain in the structure. This is achieved by articulated joints at the upper and lower ends of the hydraulic cylinders in the garage, which act as legs or stilts between steel structure and foundation pads. The cylinders were doubled at all 16 legs and inclined to form V-shaped bipods. The bipods

take vertical as well as horizontal loads. An automatic monitoring system will continuously monitor settlements of individual foundations and sound an alarm whenever preset stability or deformation limits of the steel structure have been reached.

Exceptional care had to be given to the maximum possible short-term bearing capacity and the settlement behaviour of snow under permanent loading in the long term. A creep failure can be excluded when the duration of the effected pressure is shorter than six years. The snow under the foundation pads is not really permanently subject to high pressure because 80 centimetres of backfill fresh snow will be placed under the pads every year. So the high annual growth rates of snow make it possible to apply higher loads of the building to the shallow foundation on snow.

The main purpose of the bipod hydraulic cylinders, however, is to use them for the compensation of equal and differential settlements and for raising the building once a year to bring it again safely in level with the surrounding snow surface. The 16 steel foundations with hydraulic cylinders will be lifted in pairs to allow backfilling with ground snow underneath. The raising operation requires about 80 person days.

During the first year of operation the technical running of the station was carried out with very special care and with thorough observation of all structure-underground interaction. The impact on the three-dimensional steel framework by differential settlement and horizontal strain of the ice shelf was within the limits of static stability. During the 2009/2010 season, the building was successfully raised up and adjusted to the accumulated snow surface.

This concept implies that no building parts will get buried in the snow and thus become irretrievable when the station will have to be dismantled under the regulations of the Environmental Protocol after its service time has ended. The station is planned to last 30 years.

See “Presentation 1 Gernandt et al” on DVD for full oral presentation.

CONCEPT OF ENERGY SUPPLY AT NEUMAYER STATION III

Saad El Naggar *(Saad.El.Naggar@awi.de)*, Hartwig Gernandt (presenting author) and Jürgen Janneck

Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany.

Abstract

The energy supply at Antarctic research stations is a major concern for station planning, design and construction. The operation costs and the impact to the environment have to be minimized.

The concept of energy supply at Neumayer Station III is based on four diesel generator sets, of 160 kW of electrical power, each. One of the generator sets is physically separated from the others and also used as an emergency generator set. The waste heat of each generator set is about 200 kW of thermal power at full load and it is this waste heat which is used to heat the station.

The minimum required electrical power in the winter period is about 140 kW and the minimum needed thermal power for the same period is about 200 kW.

During the winter period, only one generator set is running to cover the electrical and thermal energy needed at the station. In this way, the running costs will be optimized.

A wind turbine park consisting of five turbines of 30 kW of electrical power each, will provide the station with renewable energy and reduce fuel consumption and environmental impact. The first wind turbine is installed and in operation. The next four are in planning.

The diesel motors are electronically controlled and able to operate continuously down to 25 per cent of nominal load. This allows an effective use of the wind turbines in the station grid and simplifies the generator configurations.

An energy management system is used to control and to monitor all kind of electrical and thermal energy produced and used, such as diesel generators, wind turbines, solar panels, batteries and fuel cells.

See “Presentation 2 Naggar et al” on DVD for full oral presentation.

THE DEVELOPMENT OF A HOT WATER DRILL TO ACCESS SUBGLACIAL LAKE ELLSWORTH

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Abstract

Access to Subglacial Lake Ellsworth (SLE) is scheduled for the 2012/2013 Antarctic summer season. A hot water drill is to be developed to produce an initial hole diameter of 36 centimetres, to enable an instrumented probe to enter the lake. The design of the drill will build on previous concepts and developments used by the British Antarctic Survey (BAS) for hot water drilling in Antarctica.

SLE is to the south of the Ellsworth Mountains and has a ground transportation route to a blue ice runway at Patriot Hills. For the drilling programme at SLE, all equipment, materials and fuel will be carried from South America to Patriot Hills via airborne heavy lift. With a maximum aircraft load of 19 tonnes, attention to the maximum size of components and the overall weight is necessary to ensure materials can be transported by air. The drilling hose, at over 3200

metres, and the winch will be the largest component, need to be transported as one item.

A procedure has been produced and will be adopted to ensure all of the components are cleaned before they are used at SLE. Biological filtering will be employed to remove viruses and product from the water supply. The electrical supply, pumps and ancillary items will be housed in a field camp adjacent to the access hole. Sufficient fuel is to be provided in 205 litre drums to support the field site and enable two separate accesses of the lake.

The drill is being developed and assembled at the British Antarctic Survey in Cambridge, UK, and will be tested before delivery to SLE.

See “Presentation 3 Blake” on DVD for full oral presentation.

ROSS ISLAND WIND ENERGY PROJECT: SUSTAINABILITY THROUGH COLLABORATION

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Abstract

In January 2010, the Ross Island Wind Energy (RIWE) project was commissioned. The project consisted of one megawatt of installed wind generation capacity, to provide renewable energy to New Zealand's Scott Base and the United States McMurdo Station.

The RIWE project is the first of its kind in Antarctica, as it links Antarctic stations from two different countries into a common electrical network. The commissioning of the wind farm represents the culmination of five years of commitment from Antarctica New Zealand and the US Antarctic Program and the success of the project is a testament to the power of collaboration and cooperation between these two programs.

The RIWE project represents a serious investment in renewable energy technology and energy management equipment. The project was designed as a "Proof of Concept" for both the introduction of wind

power generators and the tying together of two formerly separate and different power production and consumption systems.

The project initiative had three main purposes:

- To reduce diesel fuel consumption on Ross Island and to reduce both programmes' environmental impact in Antarctica;
- To develop and test a fully integrated wind farm "Proof of Concept" on Ross Island; and
- To increase New Zealand's contribution to the shared joint logistics pool with the United States.

The project had a number of unique technical challenges including the use of frequency conversion and grid stabilization technologies. The wind turbine foundations were also specially designed to overcome difficulties associated with concrete manufacture in extreme cold. The project represents a working example of how two national Antarctic programs can work closely together to enhance the sustainability of operating in Antarctica.

Introduction

Antarctic Treaty Parties have designated Antarctica as a natural reserve devoted to peace and science. The Protocol on Environmental Protection to the Antarctic

Treaty provides that activities in Antarctica are to be planned and conducted to limit impacts on the environment.

In this context, the New Zealand and United States Antarctic programs (AntNZ and USAP) have recently concluded the establishment of a wind farm on Ross Island. On 16th January, 2010, the Ross Island Wind Energy (RIWE) project was officially commissioned by the New Zealand Foreign Affairs Minister, the Honourable Murray McCully, and the United States Ambassador to New Zealand, David Heubner.

The RIWE project is the first of its kind in Antarctica, as it links Antarctic stations from two different countries into a common electrical network. The commissioning of the wind farm represents the culmination of five years of commitment from AntNZ and USAP and the success of the project is a testament to the power of collaboration and cooperation between these two programs.

The Concept

McMurdo Station (USA) and Scott Base (NZ) burn approximately 4.26 million litres (1.125 million gallons) of

diesel fuel annually to generate electricity. This equates to approximately 11500 tonnes of $C0_2$ emissions.

The RIWE project represents a serious investment in renewable energy technology and energy management equipment. The project was designed as a "Proof of Concept" for both the introduction of wind power generators and the tying together of two formerly separate and different power production and consumption systems.

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- To reduce diesel fuel consumption on Ross Island and to reduce both programs' environmental impact in Antarctica;
- To develop and test a fully integrated wind farm "Proof of Concept" on Ross Island; and
- To increase New Zealand's contribution to the shared joint logistics pool with the United States.

The project was funded by the New Zealand Government with significant logistical and technical assistance and investment from the USAP. Under the agreement between AntNZ and the National Science Foundation (NSF, operator of the USAP), New Zealand funded and provided project management for the design, procurement and construction of the project.

One electricity network was developed to supply energy to both Scott Base and McMurdo Station. Previously, both programs operated independently on stand-alone diesel generators. The creation of the network provided the unique opportunity to pool all generating assets (i.e., McMurdo Station power house, Scott Base power house and the wind turbines) into one online, fully integrated network. This provides significant potential for energy efficiency, not only because the wind turbines are providing renewable energy, but because the network is designed to constantly seek out the optimum mix of generating assets, in order to provide the electricity demand from both bases at any one time.

The Ross Island Wind Farm

A three turbine wind farm was constructed during the 2008/2009 and 2009/2010 austral summer seasons. The wind farm is located on Crater Hill which is located between McMurdo Station and Scott Base (Figure 1). The wind farm is designed to generate a maximum output of 990 kW. On this basis, it may provide up to 70 percent of the electrical load requirements of both bases at any one time, but is estimated to substitute overall 11 percent of total fuel burned for electrical requirements on

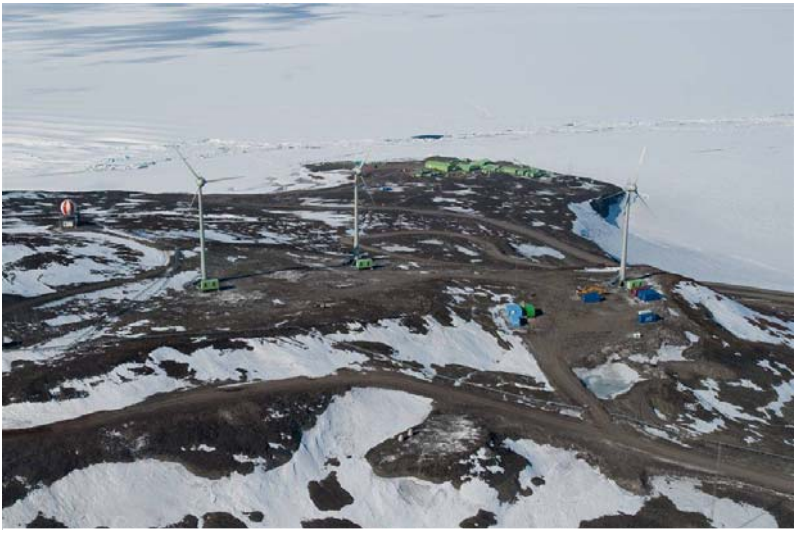


Figure 1 The Ross Island Wind Farm situated on Crater Hill, looking toward Scott Base. © J. Leach. Antarctica New Zealand Pictorial Collection: 09/10.

Ross Island. This equates to approximately 450,000 litres (122,000 gallons) of diesel per year or 1240 tonnes of avoided CO_2 emissions.

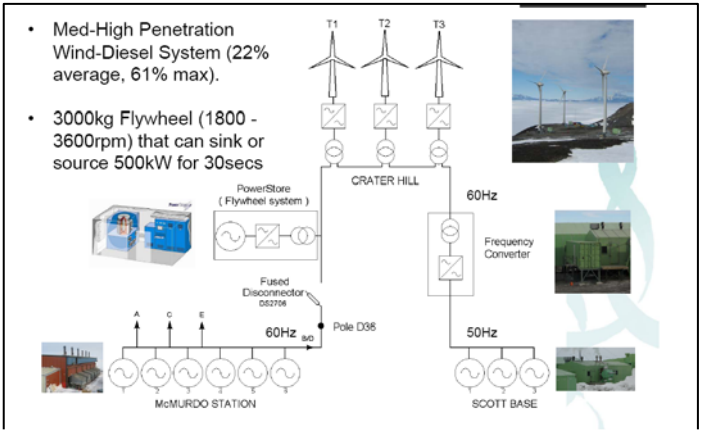
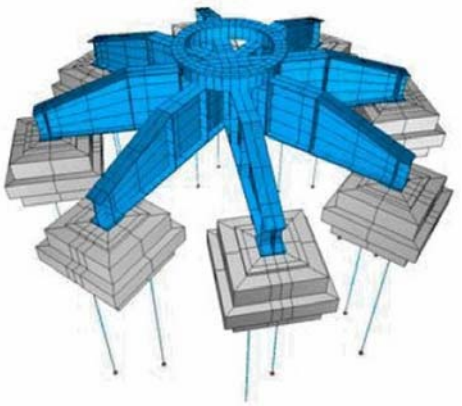


Figure 2 Ross Island Wind Energy Network.

Unique Features and Challenges

Wind farms are now common throughout the world. Wind energy is generally accepted as a reliable, cost effective and robust form of renewable energy. The Ross Island Wind Farm is, in principle, the same as these ‘generic’ wind farms, however, with a few distinct differences.

Foundations: The wind turbine foundations used in the Ross Island Wind Farm are unique. In order to minimize disruption of the local environment and avoid problems associated with on site concrete production and inferior grade aggregates, the foundations were designed so that they could be largely prefabricated in New Zealand and shipped to Antarctica. The resultant concrete, steel and rock anchor ‘spider’ foundation design is a unique engineering solution. Normally, wind turbine foundations are solid concrete blocks poured in situ.



Generation: The Ross Island Wind Farm demanded a wind turbine design that could withstand extreme cold, high wind speeds and requires minimum maintenance. On this basis, three Enercon E33 turbines were selected. The turbines are a state-of-the-art, variable speed, pitch-controlled machine. They are distinctive in that they are ‘direct drive’, meaning they do not have a standard gear box configuration as do other turbines. The advantages created by the direct drive configuration are: less energy loss between rotor and generator; lower sound emissions; and most importantly for a remote location, reduced mechanical wear and tear.

Integration and Energy Management: There were unique challenges faced by the integration of a proportionately large, variable energy source (i.e. fluctuating wind load) into a relatively small stand-alone energy network. This was further complicated by the fact that New Zealand electricity is generated at 50 Hz and the United States equivalent standard is 60 Hz. Most energy generated by wind farms throughout the world is injected into a large, stable electricity network. This means that a standard wind farm consists of wind turbines, reticulation cable and transformers. In such

cases, the large electricity network that the wind farm supplies easily absorbs peaks and troughs caused by the variable nature of wind as an energy resource, without destabilizing the overall electricity network. The Ross Island Wind Farm required two additional pieces of equipment and associated software to manage the fluctuations of wind energy and the de-stabilising effects of providing a very large percentage of the total electrical demand from wind energy. The first piece of equipment installed to manage grid stabilization was a 500 kW Powerstore® flywheel, a large spinning mass operating in a helium filled bearing. The Powerstore® flywheel stabilizes the grid by very rapidly absorbing high frequency power surges from the wind turbines (e.g. a wind gust) or from sudden reductions in demand, or alternatively supplying power to make up for sudden drops in wind turbine output, sudden increases in demand or loss of diesel generation.

The second piece of equipment installed was a 415 V, 60/50 Hz static frequency converter to manage the change from 60 Hz (USA) to 50 Hz (NZ). The converter was installed at Scott Base.

Project Delivery and Cooperation

The project was delivered on time over a very tight two season program (2008/09 and 2009/10). This was not possible without significant collaboration and cooperation between AntNZ and USAP. AntNZ, as the project manager, worked with a New Zealand energy company, Meridian Energy, to plan the project and manage the construction.

USAP was involved in design consultation and approval as the wind farm controllers fundamentally changed the way the McMurdo Station power house was controlled and operated. Support was also provided by USAP personnel in site preparation, electrical engineering and cargo and logistics activities.

The positive approach taken by the USAP via NSF (operator and manager of USAP), National Renewable Energy Laboratory (NREL, US Department of Energy), Raytheon Polar Services Company (RPSC; NSF's prime contractor for USAP) and the AntNZ staff is testament to the seriousness with which both programs are engaging in renewable energy and sustainability challenges in Antarctica.

Performance to Date

The Ross Island Wind Farm has been in operation since early February 2010. Commissioning work is ongoing as the new technology settles in and staff become familiar with a new way of operating. The newly established network has been very stable and Scott Base generators, which would normally run 24 hours a day, are silent. The wind farm is generating electricity in line with modelled expectations (Figure 4).

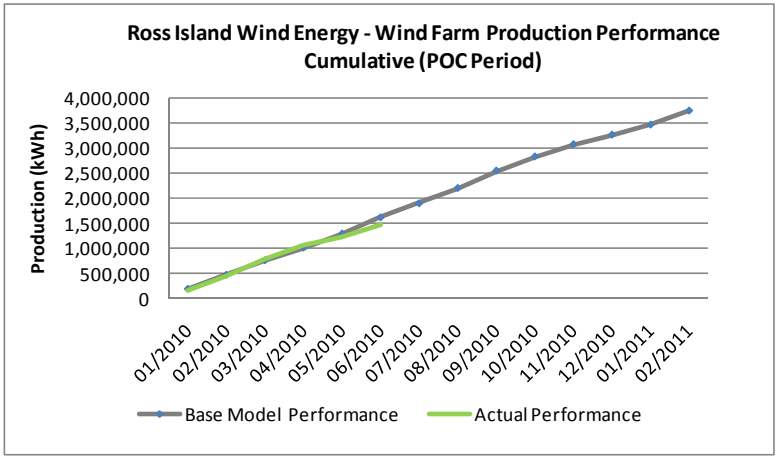


Figure 4 Cumulative wind farm production to 30 June 2010.

Wind farm performance is dictated by a number of variables including wind availability, turbine availability and reliability. Capacity factor is a good measure of how the wind farm is performing against internationally recognized standards. It is the ratio of actual energy

produced in a given period to the hypothetical maximum possible (i.e. running 100 percent of the time at full rated power output). Figure 5 shows the performance of the Ross Island Wind Farm against “Best in World” and “International Average”.

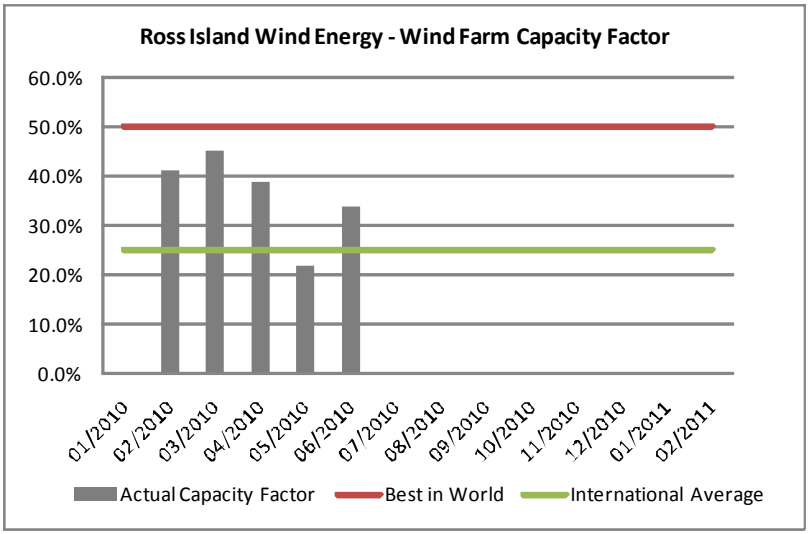


Figure 5 Wind farm capacity factor.

The average Capacity Factor of the Ross Island Wind Farm over the first 5 months of operation was 39.8 percent. This compares favourably with the International Average of 25 percent and “Best in World” of 50 percent. Under the Joint Pool logistics arrangement , the energy produced by the wind farm is shared between McMurdo Station and Scott Base.

Figure 6 shows the year to date energy share. It is interesting to note from a technical perspective the amount of energy consumed by network losses (6.5 percent) and operation of the energy storage fly-wheel system and frequency converter (6.2 percent).

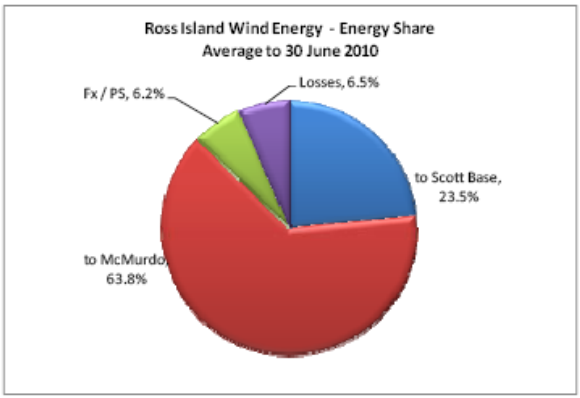


Figure 6 Wind farm energy distribution.

Where to from here?

The “Proof of Concept Period” will last until February 2011. This will provide a 12 month data set to fully evaluate the performance of the wind farm and associated infrastructure. Once this evaluation has been carried out options for future expansion and associated ‘smart grid’ technologies will be discussed and evaluated

in conjunction with Scott Base and McMurdo energy management plans.

ENERGY INITIATIVES FOR SUSTAINABILITY

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Abstract

The US Antarctic Program (USAP) is engaged in an aggressive pursuit of improved energy management for all of its activities.

The approach has three components: avoidance of energy usage, conservation and efficiency, and development and application of alternative approaches and technology. Examples of this approach at work include consolidating operations at a single airfield and installing Smart Grid technologies to achieve greatly improved measurement, control, and optimization solutions.

USAP also developed renewable energy generation platforms for small field camps, and is currently designing a modular, self-sustaining deep field unit for addressing dynamic year-to-year changes in locations and populations for major research projects.

Through this approach, combined with education

and outreach, USAP is realizing substantial energy savings.

Introduction

The USAP year round presence in Antarctica includes approximately 1700 scientists and support personnel at three main stations (McMurdo, Amundsen-Scott South Pole and Palmer), on two research vessels (Laurence M. Gould and Nathaniel B. Palmer) and at numerous remote field camps of varying sizes. Generation and delivery of reliable power and efficient energy consumption have been critical to implementing USAP science projects.

The Program has been increasing its energy efficiency and use of alternative energy sources for some time. As examples, recycling of waste heat from diesel generators was initiated in 1999 and the first solar power systems were commissioned at field camps in 2001. Currently, the US is redoubling its efforts to improve energy efficiency and to reduce carbon emissions.

This paper summarizes the USAP energy management program, including a description of energy conservation measures (ECMs), results of implemented

ECMs, and a description of future program direction and improvements.

Energy Management Approach

The USAP uses a systems approach to manage energy generation and use. The approach considers and integrates components, processes and people. The four primary steps of the continuous improvement management process are: plan/design, implement, monitor and modify.

The early energy program focused on cost and reliability of energy generation and delivery. These early actions aimed to deploy proven technology and low cost/low effort solutions. Subsequent to this, reduced energy consumption actions were included in the program. More recently (2005 to the present), reduction of emissions (e.g. carbon), use of alternative energy sources, monitoring and participant education have been fully included in the program. Currently, the program reviews the system (components, process and people) and evaluates cost-benefit of proposals including retrofit of existing facilities and infrastructure, opportunities in new construction, changes to operations and process and opportunities to enhance worker awareness and

engagement. The goal is to continuously improve energy efficiency and meet energy requirements with less fossil fuel and without limiting science activities.

To achieve these goals, the USAP identified five key areas of improvement:

- Alternative energy generation via renewable sources;
- New facilities, retrofit components, and operational changes that increase efficiency and/or reduce consumption;
- Transportation (air, ground, and mixed use);
- Monitoring, metrics and smart grid technology;
- Worker education.

The following section highlights key actions taken, results of those actions and planned actions. From 2005 to 2010, the US actively measured various indicators of energy consumption at McMurdo, South Pole and Palmer Stations. These measures serve as a baseline to identify improvements from the actions taken over the same time.

Actions and Results

Alternative Energy Generation The USAP continues to expand its use of renewable energy sources at McMurdo Station and at field camps. In addition, capture and productive use of waste heat from electricity generation has been increased at McMurdo Station. Waste heat, control and distribution upgrades were implemented at McMurdo Station in 2008 and the systems that control the waste heat transfer were optimized in 2009. The USAP plans further expansion to the waste heat distribution system to include more buildings. In January 2010, electricity from the New Zealand wind turbine project was integrated into the McMurdo power grid to offset fuel use at Scott Base and McMurdo Station. Since January 2010 when the facility first became operational, approximately, 20 per cent of McMurdo's and 86 percent of Scott Base's electricity demand have been supplied by the wind turbines. This equates to a savings of approximately 450,000 litres of diesel fuel per year.

Installing additional turbines could, in principle, meet 90 percent of electrical load requirements at McMurdo Station. If realized, the reduction in fuel consumed for electric power could net a savings of

approximately 2.5 million litres of fuel per year. This represents an estimated carbon footprint reduction of 450,000 tonnes of CO_2 per year. Benefit/cost analyses will be used based on data from the three turbine wind farm to determine what the best overall generation scheme is for McMurdo. The USAP will study the cost/benefit analyses for installation of similar turbine wind farms at Amundsen-Scott South Pole and Palmer Stations.

The USAP has placed energy efficiency as a top priority in the design phase for a standardized seasonal structure for field camps. The concept is currently being studied to determine the cost-benefit and for implementation strategies. The approach would use a nine-room self-contained module as the basic building block (Figure 1) that would be sized for delivery in the ski-equipped Hercules aircraft (LC-130), could be assembled with minimal tools and equipment, and would rest on towable skids. Electrical demand will be met by photovoltaic collectors and heating will be supplied from a hot water tank heated by evacuated- glass solar-tubes. Primary lighting will be naturally provided by energy efficient windows and “solatube” (light-focusing skylights). Design calculations show that through the use

of high performance three-pane plastic windows, high R-factor wall and floor panels, battery and water tank energy storage systems, bifacial photovoltaic panels, and smart building management hardware and software, each berthing module would produce an excess of up to 10 kW that could be fed into a grid for use in shared modules (e.g. galley or ablutions facilities).

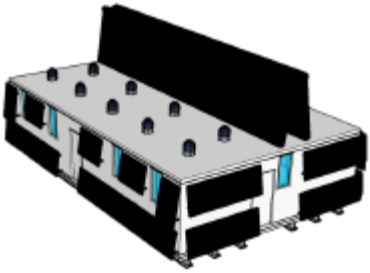

Figure 1 Modular, self-sustaining, solar powered, berthing module.

New Facility, Retrofit Components, and Operational Changes ECM implementation at USAP stations has included installing more efficient lighting ballasts and furnaces; automatic room lighting and water faucets; and closing and deconstructing obsolete buildings.

Measurable energy consumption reductions include: a 22 percent reduction in total kWh needed during 2010 austral summer compared to 2006-2008 average, despite a 15 percent population increase; a 94 percent reduction in supplemental generator operation

(engine hours of runtime); and a 31 percent per capita water use reduction and 27 percent annual reduction in total water produced in 2009/2010 compared to 2006 to 2008 average resulting in lower power consumption.

A major South Pole Station modernization program includes systematic trend analysis of electricity usage combined with graphics-rich dashboards to monitor proper operation of the control sequences. Commissioning of the new elevated station facility was completed in February 2010 and included assurance that the mechanical and utility system were operating as designed. This process will be applied in other areas of USAP and for all new facilities.

The results of the actions and ECMs, in terms of fossil fuel consumption are a 81 percent less supplemental heating fuel at South Pole Elevated Station from 2006 through 2009; 21 percent less generator fuel used over three years at McMurdo Station; and 31 percent less generator fuel used in 2010 compared to 2006 through 2008 at McMurdo Station.

McMurdo has 15,600 metres of heat-traced utility pipes that consume 2,850,000 kWh of energy annually (equivalent to more than 750,000 litres of fuel) to protect against freezing of liquids in those lines. A project is

currently underway to replace all the heat trace with a more energy efficient system (Figure 2). It will be installed in zones based on distance from the source, volume of fluid flow, and end use. The system will be controlled with a Smart Grid system of sensors and feedback software that will determine on and off cycles to achieve appropriate pipe fluid temperatures. The new system is calculated to require 1,480,000 kWh, resulting in an annual savings of about 390,000 litres of fuel.

Figure 2 Electrician pulling new heat trace and control wires for McMurdo water lines.

Proposals under consideration to reduce energy consumption at the three USAP stations include extending proven ECMs (e.g. installing efficient light systems, continuing building consolidation, installing laundry equipment that uses less water) as well as retrofitting motors with fine-tune schedule controls,

installing variable frequency drives, and replacing exhaust gas heat exchangers with newer, more efficient models. Consideration is also being given to installing a station-wide Smart Grid system at McMurdo Station. The system would reduce “spinning reserve” in the power plant by substituting instantaneous load shedding or load adsorbing candidates, and shedding or picking up those loads during peak demands or peak wind generation times. All utility functions would have improved optimization through automated controls. Data from the automated system could be analyzed to continue to improve system performance.

Transportation South Pole Station has traditionally been resupplied from McMurdo via LC-130 aircraft. These flights occur only during the three month summer season and more than 60 percent of the cargo delivered is fuel. Even when aircraft payload is optimized and flight conditions are at their most favourable, the LC-130 burns about 1.7 litres per kilogram delivered. This transportation method shows a delivery efficiency of 1.4 litres of fuel consumed for each litre of fuel delivered to South Pole.

Mobility, terrain and economic analyses indicated that hauling cargo overland from McMurdo to South Pole could be accomplished more energy efficiently than airlift, thus allowing airlift to be focused on more time sensitive deliveries. After a successful proof of concept project in 2008, the USAP began routinely hauling fuel to South Pole by tractor train (Figure 3). This transportation system is now delivering up to 20 percent of the station's annual fuel requirement with an efficiency of 0.36 litres consumed for each litre delivered, nearly four times better than use of the LC-130. Through the traverse, USAP reduced the fuel burned as a requirement to deliver fuel for South Pole use by about 550,000 litres during the 2009/2010 field season and is expecting to increase the amount of South Pole's annual fuel requirement delivered by traverse to 50 percent by the 2012/2013 field season.

Figure 3 Traverse tractors towing eight fuel bladders.

USAP operates a fleet of more than 30 light trucks/vans in McMurdo. About half of these vehicles do not leave the station's 25 km network of gravel roads. They annually accumulate less than 3250 kms at an average speed of less than 6.5 km/h. While these vehicles are vital to local transportation on Ross Island, the energy efficiency associated with a 2750 kg, 360 hp, fossil fuel powered vehicle, under these operating conditions, is very poor.

Starting in November 2011, USAP will trial two purpose-built electric trucks capable of operating on unpaved surfaces (Figure 4). It is expected that these trucks will prove capable of fulfilling most of the functions currently performed by conventional trucks including having adequate mobility to access McMurdo's entire road network (which includes some 16 percent grades).

Figure 4 Open-bed and closed-bed variety trucks to be trialled.

Energy savings will be realized by maximizing the productive use of the energy content in a unit of fuel by capitalizing on the power plant's efficiency to produce electricity to recharge the electric truck batteries while also capturing waste exhaust and cooling water heat (which is used to provide facility space heating). This dual use of the fuel represents a major improvement in energy management over simply burning the fuel to drive the conventional vehicle. An added benefit of an electric truck fleet is reducing the amount of hazardous materials associated with light vehicle operation (e.g. oil and glycol which are not used in electric vehicles). The upcoming vehicle trials will quantify these factors, verify expected performance, and assist with identifying further system refinements.

Since 1993, USAP has operated from three unique airfields over the course of the summer flight season. One airfield, Williams Field, supports only skied aircraft. Two other airfields support wheeled aircraft with the first half of the season operating from an annually constructed sea ice runway directly adjacent to McMurdo and the second half of the season from the permanent Pegasus airfield about 30 km from McMurdo. While this configuration allowed the USAP to enjoy almost

unlimited summertime airlift options, it also entailed a significant amount of energy expenditure due to simultaneous operations at dispersed locations. Construction, maintenance, and staffing (especially during dual airfield operations) represented more than 20,000 labour hours annually. Consolidating operations into a single airfield represented an opportunity to improve operational efficiency and reduce energy usage by having a single infrastructure for passenger, cargo, fuel and aircraft maintenance facilities for the ski and wheel aircraft, as well as shared air traffic control, emergency services and runway maintenance equipment and staff. During the 2009/2010 field season, USAP began the first of a multiphase transition to single airfield operations by successfully constructing a skiway at the Pegasus site. As a result, Williams Field was not used during the 2009/2010 season, and is not planned to be used during the 2010/2011 season. Once consolidation is achieved, a reduction in fuel consumption of 535,000 litres is expected, in addition to a smaller personnel and equipment footprint.

Monitoring and Metrics Infrared cameras were used at all three stations to identify insulation and exfiltration problems. Power meters were installed at all of the main feeders at South Pole and McMurdo Stations to monitor trends and detect problems. Weekly energy analysis reports show energy trends and help identify necessary corrective actions. Monthly reports are used to show trends and compare energy use to expectations and baselines (Figure 5). In addition, new procedures for evaluating proposed changes and for tracking the impacts of implemented changes have been adopted.

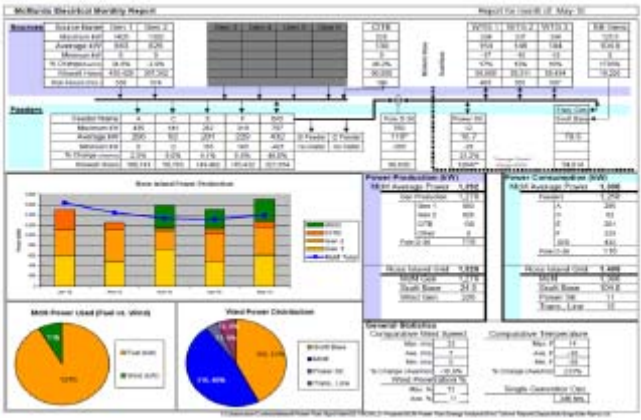

Figure 5 Monthly energy summary for McMurdo Station.

Energy consumption monitoring will be expanded at all USAP stations. A renewable energy survey for Palmer Station will be conducted in 2010 that includes

assessing wind potential and examining the power plant and switchgear for transformation into a hybrid-automated system.

Worker Education and Outreach Actions With a large and rapidly changing population at most of its field operating sites, USAP has instituted an aggressive training program that includes energy awareness. The training is tailored to help participants understand how their actions and habits impact the energy footprint. The training sessions are required for all participants, and have been found to be most effective when coupled with frequent, widespread feedback and reinforcement. Posters encouraging desired behaviour are placed in key locations at stations and camps. These notices are changed often (graphics are different but the message is the same) so as to present a “fresh” appearance. Recently, USAP has generated graphic feedback tools that are shared with the general population to show the resource usage (similar to, but less detailed than the dashboard shown in Figure 5).

Conclusion

Energy conservation and management efforts, combined with increased reliance on alternative energy sources, have significantly improved US Antarctic Program efficiency and reduced costs and carbon emissions. The Program is committed to continuous improvement and looks forward to implementing the next generation of improvements.

PRINCESS ELISABETH ANTARCTICA: INNOVATING TOWARDS ZERO EMISSIONS

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Abstract

In 2004, the Brussels based, International Polar Foundation (IPF) set out to prove that building a zero emissions research station in Antarctica was not a naive fantasy.

The context was the launch of the International Polar Year 2007-2008 and the historical precedent of the spate of station building set in Antarctica fifty years before. As an original signatory of the Antarctic Treaty, Belgium had a moral obligation to support collaborative research activity in Antarctica. Unfortunately, the exercise of this responsibility was handicapped by a lack of funds.

The King Baudouin Base, destroyed in the 1960s, had never been replaced. It was clear that, the new station would need to be launched as a private initiative. It would also need endorsement from the public sector. Funding for a feasibility study was obtained and the stage was set.

The IPF immediately began talking to Antarctic programs. The team wanted to learn as much as possible about “the station business” to absorb best practice before setting out. The key would be autonomy. The approach: designing and building a station that would blend more than perfectly into the chosen location. The systems approach allied with the partnership with technology companies willing to take up the challenge, led to the articulation of a project which has delivered a technological prototype owing as much to space engineering as to architecture in the purest sense.

The Princess Elisabeth Antarctica project had enormous support from ordinary citizens, and volunteers with special skills abounded. The private sector partners were also thrilled to have the opportunity to contribute to an environmental achievement of which they could be justifiably proud. This unusual juxtaposition of people and ideas, led to a ferment of creativity, inspiring and motivating those who had the privilege to take part. The day when full zero emissions was achieved for the first time, we were literally flying.

But no story is complete without adversity. Unexpected difficulties were encountered with the installations leading to trouble-shooting, rethinks,

rebuilding and retrofitting - a life lesson. The prototype continues to be improved every year. It is a learning process for the technical team and inspires continuous innovation.

The researchers were also thrilled to be handed access to this vast untapped research zone and they were even more thrilled to find that the potential was endless and everything was possible with a little imagination. The interest for research activity out of the station does not stop growing.

In the final analysis, the innovations that Princess Elisabeth Antarctica has brought in its wake are not just technological. There have been new modes of operation instituted between public and private, new forms of financial and technical partnership, new lessons to be learned about our relationship to energy. There has been a step change in thinking about our relationship with the environment.

See “Presentation 7 JohnsonAmin” on DVD for pdf of full oral presentation.

NEW BUILDING DESIGN: PREVENTING SNOW DRIFT AND UTILIZING SOLAR COLLECTORS AND HEAT PUMPS

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Abstract

A new two story building with workshops and a power control room is designed and planned for construction at Syowa Station in the 2010/2011 season. Two new technologies have been developed and adopted.

First, a streamlined roof holds laminar flow of wind and prevents snow drift. The optimum shape was determined by experimenting with wind models in a blowing snow tunnel. The upwind wall surface is built on a slant to let the wind flow smoothly. The top roof is also slanted from the upwind zone to the downwind area gradually for smooth flowing. The shape of the roof is expected to minimize the amount of snow drift.

Second, several kinds of space heating devices are adopted in the new building. A floor heating with hot water is set on the aluminum floor in the blow-by

workshop. The hot water is produced by a small kerosene burner.

Many solar collectors are attached on the outside walls on the north and northwestern areas. The collectors are estimated to gain 70,680 kWh of solar energy in a year for room heating. The warm air produced by solar collectors is sucked into the building. The small burner will boost the heating energy in winter time.

A heat pump will be introduced on a trial basis in the building. The coefficient of performance (COP) is estimated to be about 2.0 at -30 degrees C of outside air temperature. The operation of the heat pump would cut the fuel consumption by half compared with that of fuel usage by oil burner. The introduction of the heat pump has a great advantage of reducing fuel consumption and CO_2 emission in Antarctica.

See “Presentation 8 Ishizawa” on DVD for pdf of full oral presentation.

A NEXT GENERATION UAV FOR ANTARCTICA

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Abstract

For more than a decade, unmanned aerial vehicle (UAV) systems have been deployed in Antarctica. The main use of these is to expand the scientific area coverage at low cost and low risk. These systems are supposed to be easy to operate and adapted to the cold weather handling and operations. In practice, UAV's have limitations in deployment conditions, payload capacity, autonomy and most still require specialized operators. In this project, these limitations are challenged proposing an approach that answers the real requirements of Antarctic scientific operations.

To start, the selection of a well suited airframe is of paramount importance. An off-the-shelf airframe fully adapted to the Antarctic conditions is hard to find and proven solutions with minor modifications have the preference above experimental ones. The selected UAV system goes beyond the existing typologies of airframes. It combines vertical takeoff and landing (VTOL)

capability with a conventional, uncompromised, horizontal flight configuration. This hybrid concept can be launched and landed on difficult terrain, of which the surface needs no preparation. No vehicles or other launch aids are needed. An area of six by six metres suffices to land the aircraft.

Unlike helicopter-type systems, it has a large operational range without compromising payload capacity and speed. Importantly, both takeoff and landing, critical stages during the flight, are completely automated and no manual radio control is needed. As a result, the full mission is performed without the assistance of specialized personnel trained in flying these aircraft manually, hence allowing scientists to use it completely autonomously with minimal training prior to the expedition.

Mission plans are created with a graphical user interface and predefined missions can be modified during flight. To deploy the equipment, a small ground station is set up and the aircraft assembled. Special attention is paid so that manual handling outdoors is very limited. Further adaptations for Antarctic use consist of high elevation capability, extendable range, adapted electronic equipment and specific material use.

The system allows for takeoff and landing in snow drift conditions with winds up to 15 m/s (30 knots). Its wide airspeed range from 0 to 203 km/h (0 to 110 knots) allows for countering strong winds and using low speeds for high resolution monitoring. The modular airframe accepts different types of scientific payloads. The wingspan of 3.05 metres (10 feet) can be extended to enhance payload capacity (fuel and/or scientific). Doing this, the standard range of 800 kilometres (500 miles) can be more than doubled and payloads of 50+ kilograms are possible.

Data are logged onboard and depending on the requirements, a live telemetry link can be used even at large distance. The system can be easily transported using a compact, simple and robust over and storage unit developed for Antarctic conditions and designed to be used in combination with light vehicles, for example to provide in the field support to a scientific ski-doo traverse.

This system is a next step in UAV developments for Antarctica. The concept has been designed with local conditions and scientific requirements in mind. Apart from the scientific operations, the system has potential to be used as search and rescue support equipment. The

current state of the project is that different prototypes have been built and successfully tested. For the 2010/2011 Antarctic season we are looking for cooperation with National Antarctic Programs that can provide logistic support in order to test this system in the Antarctic environment.

See “Presentation 9 Berte” on DVD for pdf of full oral presentation.

TWO STRATEGIES TO TALK ABOUT ANTARCTICA & SCIENCE WHEN NOBODY KNOWS WHAT YOU ARE TALKING ABOUT

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Abstract

Science and technology issues have little presence in the Chilean mass media. It is an added challenge to get those issues associated with Antarctica, including the International Polar Year, into the media. Besides, the Chilean public is unaccustomed to consume scientific and technological news.

Therefore, INACH has developed two strategies to talk about Antarctica and science. First, in 2004, INACH created the “Antarctic School Fair” and “Antarctic School Expedition”, scientific events that promote the dissemination and appreciation of Antarctic science among Chilean teenagers. The first stage involves a research competition. Students must submit a research proposal in one of the categories (experimental or bibliographic). These are assessed according to established criteria. Selected students earn the right to participate in the Antarctic School Fair (Feria Antártica

Escolar, FAE, Punta Arenas) where selected students present their work. The two teams of students rated highest in each of their categories earn the right to participate in the Antarctic School Expedition (Expedición Antártica Escolar).

A special award, the Antarctic Spirit Award, is given to those students who remember the spirit of the Antarctic explorers, they also participate in the Antarctic School Expedition. This third stage consists of the winning teams from the Fair (including students and teacher guides), who travel to Antarctica to participate in a program specially prepared for them, that involves following the field work of researchers. These events have involved more than 2500 students, 300 teachers, 60 scientists and seven universities.

The second strategy is a new INACH website for promoting and stimulating the interest of people in Chilean science and Antarctica and its capacity to dialogue, share and collaborate on the construction of new knowledge. The thematic pillars are science and education. In the case of science, we put special emphasis on creating spaces for the dissemination of current science and expert opinion of members of the Chilean Antarctic community. It seeks to empower

researchers and top level information sources and to contribute to the discussion of the major national issues from the perspective of science. It also will open a new space entirely dedicated to dialogue between citizens and science. The aim is to put scientists in a context of direct and fluid communication with citizens, children and adults, through audio-visual resources about current issues or who can impact heavily on people's lives. On the other hand, it has enabled an educational zone with several educational resources including a "virtual classroom".

Our goal is to increase significantly the participation of all segments in the activities carried out by INACH.

See “Presentation 10 Gallardo” on DVD for full oral presentation.

ANTÁRTIDA URBANA

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Antartida Urbana, Argentina.

Abstract

Antártida Urbana is a multimedia project that aims at providing information on activities taking place in Antarctica in all fields of interest while giving special attention to social and cultural life.

It consists of four related productions designed in order to inform about life and scientific research in the Antarctic through a variety of mass media: print, broadcasting and multimedia. The productions involved are the following:

- *Antártida Urbana*: An independent, bimonthly, free distribution magazine which aims at spreading news concerning Antarctica;
- Antártida Digital (www.antartidadigital.com): A multimedia website on Antarctica;
- Antártida, el color del continente: A weekly radio show exclusively dedicated to Antarctica;
- Estación Esperanza: A documentary on daily life at Esperanza, the only Argentinean scientific research station where families are stationed for a whole year.

This multimedia project has been designed to enable common people to get to know this wonderful land which is still unknown and inaccessible to most of them, so that they can easily get acquainted with it and learn about the rich natural resources in it, as well as all the contributions to society the people working and doing research there are making.

In all, Antartida Urbana, as a whole, aims at bringing activities in Antarctica closer to urban populations through the above mentioned media, therefore, generating awareness on the importance and potential of this continent.

See “Presentation 11 Lopez” for full oral presentation & Poster 8 Lopez on DVD.

POLAR SOUTH

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Abstract

Research carried out by the Argentine Antarctic Programme scientists on “Methane Chlorhydrates on glacial ice surface” and “Evidence of Climatic warming in the Antarctic Peninsula and retreat of Larsen ice shelf” were the first step of the art project which focused on effects produced by climatic changes in the Antarctic Peninsula.

This was the starting point for the “Art in Antarctica” Programme. Other artists were included, who perform aesthetic research in different fields, by joining art and science towards a reflexive conscience to diffuse works concerning Antarctica. Three stays of Foreign Artists and International Cooperation Programmes have been carried out with Canada, England, Austria, and Australia.

The first international exhibition “Polar South, Art in Antarctica” was displayed in March 2008 in Buenos

Aires, Argentina, and in then Mexico between February and September 2009.

The exhibition of paintings, photography, videos, objects, drawings, installations and scientific presentations is composed by artists from Argentina, Canada, Spain, France, Australia, New Zealand, USA, Brazil, South Africa and Argentinean scientists.

See “Presentation 12 Juan” on DVD for full oral presentation.

VIRTUALPOLE

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Abstract

VirtualPole is an application that allows virtual exploration of Antarctica. It has been conceived as a free website that merges various technologies and different types of data, in order to offer a unified interface with tools and information that may be useful while planning and performing logistic activities and scientific research in Antarctica.

The innovative way of handling satellite images introduced by Google Earth™ enables visualizing and knowing every corner of the planet with the greatest of ease, and yet exploration of Antarctica still remains a demanding task because of poor information provided about this continent, the few points of geographical reference compared with the extent of territory and the unfamiliarity with it.

Using a simplified web interface, VirtualPole helps user to interrelate data with geographical location and returns results of queries using the most suitable tools

and graphic solutions among those that the Google Earth™ platform makes available.

The current version of the product, in advanced prototype phase, allows testing adopted solutions through the use of placemarks, balloons, thematic layers and 3-D models applied to real data of various typology.

Introduction

In 2005, the distribution of Earth™ application by Google was a real revolution: the virtual exploration of every part of the globe became immediately accessible, easy and free, to the end user. The mosaic of images with which Google Earth™ reproduces Antarctica, originally displayed almost entirely with a low resolution, in recent years has been enriched by numerous high resolution areas, appropriately centreed at the position of the bases managed by countries performing research activities on the continent.

The opportunity offered by Google to virtually fly over an area of the earth, each time choosing the right perspective and appropriate level of detail, is an extremely useful feature to dominate a territory like Antarctica, for the most part unknown, large scale, with a low population density and a lack of geographical and

manmade references. The unfamiliarity with this continent means that although recognizing the geographic area that includes a human settlement of interest, it is hard to visually discover the very point where it is located, unless you know the extremely accurate coordinates.

For this reason, it becomes useful to visit, although virtually, areas of Antarctica through a tool that can guide us in the exploration and returns focused information through a motion experience certainly more realistic than a simple map. These basic operational requirements, coupled with the potential of Earth™ application, led to the conception of VirtualPole (http://www.virtualpole.it), a freely accessible website that merges various technologies and different type of data in order to offer a unified interface with tools and information that may be useful while planning and performing logistic activities and scientific research in Antarctica.

Creation

The spread of Google Earth™ API (Application Programming Interfaces) has enabled the creation of an application that, by installing a plug-in, incorporates the

Earth™ application within a webpage without the user having to install locally the corresponding stand alone software.

Although very stable, powerful and versatile, the API are still in a preliminary version (beta) and this has partially influenced some of the adopted solutions: currently, for example, is not yet possible to overlap the area that contains the globe of Google Earth™ with other layers of information.

VirtualPole design was guided by the desire to create a simple and ready to use product; out of this stems the choice of developing the user interface on a single page divided into two parts: the control area (at the top) and the display area (below that).

The display area contains the globe of Google Earth™, while the control area includes all the available features, distributed in a folders stacked menu to maximize available space and enable the transition from one function to another without losing chosen settings. The places and information to be displayed are selected using Ajax technology (Asynchronous JavaScript and XML) that allows dynamic updating of webpage content without the need of reloading the page each time.

While the user is browsing, the current view of the globe is continually updated with images taken from the database of satellite images of Google and when additional contents are requested to overlap the current view they are taken from the VirtualPole site. In both cases, the presence of a loading bar is essential in order to inform the user about the progress of data transfer. Particular attention was paid to make the site equally accessible by the major browsers currently supported by the Google Earth™ plug-in.

Content

In this prototype version of VirtualPole, there were used the most suitable tools and graphic solutions among those provided by Google Earth™ platform, applying them to real data. Through the “Features panel” the user is guided in selecting a type of settlement (e.g. Station, Camp Refuge, Depot) or an automatic weather station (AWS) belonging to a chosen nation. The software changes the view of the globe by putting the features at the centre of the screen and drawing a custom placemark in the corresponding coordinates. A click on the placemark shows information about the selected feature and you can also see some of them in a

3-D reproduction. The totality of features belonging to a single nation can also be loaded simultaneously, in order to have an overview of their distribution on the surface of the continent.

With the panel overlays you can overlay layers or thematic maps on the satellite image of Google Earth™. The Real-Time Data panel displays, in real time, weather conditions obtained from automatic weather stations (in this version only the Italian ones). At regular intervals an automatic procedure, through a satellite link, collects the current values and VirtualPole displays them at the corresponding sites of each weather station.

For a more immediate understanding of the scenery it is also possible to display only the values of temperature or wind vectors, the latter represented always in the right direction, whatever is the current orientation of the displayed image.

As in the stand-alone version of Earth™, with the panel “Free Explore” it is possible to insert full names of places or values of coordinates and then change the view to that destination.

Using the “Navigation Tools” panel you can customize the display area by adding controls and navigation tools that are part of the Google Earth™

application standard interface. The “Distance Tool” panel, finally, allows you to measure the distance between two points on the globe, drawing an imaginary line that joins them.

Limitations

Although extremely powerful, the use of Earth™ application currently poses limitations to the purpose for which VirtualPole was designed. First of all for the lack of recent satellite imagery in the Antarctic area: it would certainly be far more useful to have latest satellite imagery, especially in the period immediately preceding the start of an expedition. However, displaying the images of different and more "civilized" areas we often discover that they, in contrast, were acquired only a few dozen days before: this suggests that what happens with Antarctica is certainly not a technological limit, leaving hope of improvement for the near future.

Currently the plug-in that allows the inclusion of the Earth™ application within a webpage is compatible with Windows and Mac OS X operating systems, but not with Linux. This prevents displaying VirtualPole from a web browser running on this operating system.

Developments

The main graphics solutions, such as different types of overlays and 3-D models, displayed in this version of VirtualPole in a few examples, can certainly be increased in number and type, direct contribution with data and models by countries interested in VirtualPole project will be very appreciated.

The addition of real time data from weather stations belonging to countries other than Italy is in progress, thanks to the upcoming inclusion of Italy in the Antarctic IDD (Internet Data Distribution) project, a data distribution network to acquire and distribute meteorological data in the Antarctic community.

See “Presentation 13 Dolci” on DVD for full oral presentation.

POSTER PRESENTATIONS

TEST OPERATION OF 20KW VERTICAL AXIS WIND TURBINE AT NORTHERN JAPAN FOR SYOWA STATION

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1. National Institute of Polar Research (NIPR) Japan; 2. NIPPI Corporation; 3. Kanagawa Institute of Technology.

Abstract

NIPR is planning to develop a hybrid energy system using wind turbines and PV panels. A 20kW vertical axis wind turbine for Syowa Station was developed by NIPR and NIPPI Corporation and a test operation has been conducted since July 2009, at a mountainside area of northern Japan.

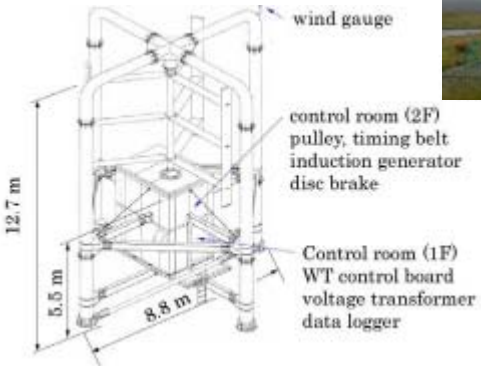
The turbine was developed focusing on easy maintenance, free yaw control, durability against strong wind and blowing snow.

The objectives of the test operation are as follows:

- Confirmation of the machine's durability under strong wind (annual mean wind speed 7 m/s) and heavy blowing snow conditions;
- Estimation of amount of snow drift developed leeward of the control room; and
- Measurement of power generation.

The performance of power generation turned out to be similar to what was estimated. Several kinds of trouble occurred during the operation, but they are not serious and could be improved easily.

The same type of wind turbine is planned to be constructed and connected to the power grid at Syowa Station in 2011/12 season and as many as five sets would be installed in the future.



See “Poster 1 Ishizawa et al.pdf” on DVD.

CONCEPTUAL POLAR PLATEAU ELEVATED STATION

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Abstract

Building an elevated station upon the Polar Plateau with its continually moving ice sheet presents special engineering and logistical challenges. Ultimately, what is most desired is a station that can be transported to the site in a modular form and erected as rapidly as possible, with the capability to withstand the differential movement of the strata that supports it.

Elevated stations such as DYE-2 (DEW-line) in Greenland and the US National Science Foundation's new Amundsen-Scott South Pole Station, do provide for snow to be "scoured" by the wind from underneath the station, but pay a heavy penalty in mass for the steel structures required support them. Also, with modern foam materials high degrees of insulation can be achieved allowing polar structures to exist without being buried in the snow.

The National Science Foundtion's "Bally Structure" on Black Island, near McMurdo Station, is an aluminum foam sandwich structure that has performed

well over the twenty years it has been in service. This conceptual station design utilizes ten heavy modular steel space frame structures, formatted on the 20 foot Mil-van (ocean container) for ease of shipping and handling that bolt together, making the first floor. The second and third floors are “Bally” type structures that are supported by the first floor, which later is clad in foam panels for insulation. The legs stand upon “Slip Form Footers” which basically are cylinders that have heating elements in them, so that, to elevate the station these are heated and as they are drawn up they cast a very large column of ice in the snow, that, when allowed to freeze gives the station its support.

All the station’s materials are stowed in the ten Mil-vans and their removable tops allow for the materials to be extracted in the proper sequence. Once the station is abandoned the construction materials can be crushed and placed back into the Mil-van structures and hauled away.

See “Poster 2 Sadler.pdf” on DVD.

INTEGRATED EXPERIMENTAL SYSTEM FOR ON-DEMAND ENERGY GENERATION AT BASE ESPERANZA

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Abstract

The use of sustainable forms of energy is a main goal for the Argentine Antarctic bases. Since 2002, our group at Defense Science and Technology Research Institute (CITEDEF) and University School of Technology (EST) has been working in research and development of hydrogen proton exchange membrane fuel cells. Results for portable applications were transferred to the Argentine Army Antarctic Command (CAE). From 2007 to the present, an experimental system is working, providing energy to several appliances (a portable TV set is used for performance and time studies).

Next developments include a 0.1 kW “stack” in order to get a 1 kW “stack” for stationary applications in the next few years.

Energy optimization that can be obtained from fuel cell stacks (FCS) depends on the improvement of several variables like temperature, gas flows, stoichiometry, pressure and humidity, among others factors. This is usually achieved by adding to the electrochemical system, a series of equipment, whose power cost reduces the energy available for work production. In addition, the utilization of the set by non-specialists must be as simple as possible, if we wish that in the future this technology be used in the daily life. Our system is simple, works in a “plug and play” mode and needs little maintenance.

Results from the experiments are valuable in order to get the effective “Antarctization” of the systems:

- Fuel cell acclimatization to Antarctica conditions: temperature-performance studies from “in-door” (18 to 25ºC) to the minimum limit for Nafion Fuel Cells (-10ºC).
- Power generation increment and new applications. Main goal: to provide energy to a single-family dwelling.
- Total optimization for energy saving, which includes not only the energy generation system but also the appliances.
- Battery life time improvement.
- Economy optimization: materials and processes.

See “Poster 3 Fasoli et al.pdf” on DVD.

PROGRESS TOWARDS THE CONSTRUCTION OF HALLEY VI STATION

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Abstract

Halley V station on the Brunt Ice Shelf is being replaced by a new station which will be relocatable and have an extended design life in comparison to previous stations. Following preparatory works in previous years, onsite construction of Halley VI commenced during the 2009/2010 season.

The current schedule includes for fit-out of the buildings during the 2010/2011 Austral summer with commissioning and science equipment installation during the following season.

This poster gives an overview of the station design and the construction completed up to February 2010.

See “Poster 4 Tuplin et al.pdf” on DVD.

KOREA'S NEW PERMANENT STATION IN TERRA NOVA BAY, ROSS SEA

Joohan Lee[1] *(joohan@kopri.re.kr),* Yeadong Kim[1], Kyung Ho Chung[1], Ji Hee Kim[1], Tea Jin Choi[1], Seong-Cheol Choi[1], Jung Hwan[1], Young Seok Kim[2] and Gyu-Jin Bae[2]

1. Korea Polar Research Institute; 2. Korea Institute of Construction Technology.

Abstract

In 2006 the Korean government announced a plan to build a new research station in the Antarctic in order to enhance scientific capabilities of Korea and promote collaboration for the development of Antarctic sciences. Aided by Australia, Italy, New Zealand, Russia and the USA for consultation and transport support, Korean scientists had visited ten candidate places and chose two key areas for the station according to scientific interest: Cape Burks, Marie Byrd Land and Terra Nova Bay, Northern Victoria Land.

Intensive field survey was conducted by 22 scientists, onboard *ARAON*, the new Korean icebreaker, from January 12th to February 18th in 2010, in two key areas. All the activities were carried out under the Initial Environmental Evaluation (IEE) arranged before the expedition.

According to a study thoroughly conducted by the Korean team, Terra Nova Bay (74° 37´S, 164° 12´E) is considered the most suited for the station. The exact location was advised to avoid serious environmental disturbances.

Research related to climate change is the prime interest of the Korean program and the site for the new station was selected based on that criterion. A climate observatory, which Korea is planning to establish to participate in the global atmosphere watch (GAW) program in Terra Nova Bay, will provide a useful, long-term database regarding the atmospheric composition and climate change on the Pacific side of Antarctica. The Ross Sea is experiencing rapid freshening that may result in change in the rate of bottom water formation and in turn global climate change. We plan to establish long-term oceanographic data series that will assist us in detecting the trend with comparison to other regions and predicting the future changes.

Antarctic neotectonics, including volcanism, is another important subject. Multifold stations are proposed including seismic, infrasound, camera, and GPS systems at Mt Melbourne to observe microseismicity caused by its volcanic activities and, in

turn, understand correlation of volcanic activities with Ross Sea rifting and uplift of the Transantarctic Mountains rift shoulder.

Terra Nova Bay is located at geomagnetic latitude of 77°S, which will afford a good view of the site to check out upper atmospheric phenomena including Aurora. A Fabry Perot Interferometer for the thermospheric winds and Digisonde for the ionospheric drift velocity are to be installed, which are crucially important for the study of the coupling between the ionosphere and thermosphere.

In addition to the regular operations for long-term observations, it may also be needed to work with other stations to coordinate observations, different or similar, on specific events such as magnetic storms. With the new research station, Korea is expected to make significant contributions to the international collaboration and the effective management and conservation of the Antarctic environment.

See “Poster 5 Lee et al.pdf” on DVD.

RENEWABLE ENERGY - SOURCES & USES IN THE COMMON ENERGY SYSTEM IN THE BULGARIAN ANTARCTIC BASE

Yordan Yordanov *(agen_i@abv.bg)*

Bulgarian Antarctic Institute, Sofia, Bulgaria.

Abstract

Meteorological studies made in recent years, indicate high wind energy potential in the region of the Bulgarian base. During the summer season, large water flows have been registered coming from glaciers. This is a new source of energy.

Having a water tank as a buffer, is a solution for fire protection and energy storage. Energies balance of capability sources of electrical power – diesel generators, solar panels, wind generators and water turbine: parameters of producing energy (volt level, frequency).

Usually equipment using electrical power is common producing (220 V , 380 V, 50 Hz, AC). That means, the electrical power from solar panels and some wind generators or water turbine must have an inverter.

Possibilities of using the different lighting and heating systems which will use the electrical power directly from solar panels and wind generators without additional transformation and loses are being considered along with a control system for production and management of energy.

Solar panels for hot water and integration into a common system, use the waste heat from incinerators and diesel generators - heating system with economizer, buffering accumulator and automatic control system.

See “Poster 6 Yordanov.pdf” on DVD.

INTERNATIONAL ASSOCIATION OF CIRCUMPOLAR SOCIO-CULTURAL ISSUES (IACSI)

Enrique del Acebo Ibáñez *(edelacebo@yahoo.com)*

Universidad del Salvador, Buenos Aires, Argentina.

Abstract

IACSI is an international scientific association devoted to the study of different socio-cultural aspects related to the Arctic and Antarctic regions. It is integrated mainly by scholars from social sciences, anthropology and humanities and also from individuals with different backgrounds but interested in these perspectives and themes. As a new association which looks for integration and cooperation, we are also looking for new members in both circumpolar regions.

What are we after?

Assuming the importance that the socio-cultural approach has for a holistic understanding of the circumpolar phenomenon, we have also considered the need to study the "circumpolar theme" in its bi-polar dimension: the Arctic and the Antarctic, in order to look for convergences and divergences under the debates

"local/global", "North/South",

"development/sustainability" and also looking for the

production and transference of knowledge. In this sense,

we privilege scientific investigation with reference to:

- Local Communities in Extreme Environments;
- Social Problems and Human Well-being;
- Participation and Community Attachment;
- Habitat and Identity;
- Minorities and Native people;
- Migration; and
- Environment and Sustainable Development.

What do we do?

- Generate scientific and academic projects bound up with circumpolar socio-cultural issues.
- Organize, once a year, an international seminar on the circumpolar issues.
- Organize cultural events, such as films and documentary festivals related to these issues.
- Support academically the "ARCTIC & ANTARCTIC INTERNATIONAL JOURNAL of CIRCUMPOLAR SOCIO-CULTURAL ISSUES" (published annually).
- Encourage relationships and academic collaboration between universities and research centres sited in one or both circumpolar regions.
- Promote international workshops, seminars, and conferences.
- Contribute and award prizes to investigations and activities that look to solve problems in one or both circumpolar regions.

- Establish nets with national and international institutions, associations and NGOs linked to the matters which are the interest of the IACSI.

Arctic & Antarctic International Journal of Circumpolar Socio-Cultural Issues

According to the aims and goals of IACSI, and the interchange of ideas, strategies and scientific projects since 2001 between scientists from social sciences, anthropology and humanities from Finland, Argentina, Iceland, Canada, Norway and United Kingdom, a new annually published journal is launched.

During these last years, different ideas were interchanged in terms of concrete aspects of this journal between the Circumpolar Studies Program of the Universidad del Salvador (Argentina), the Department of Social Sciences and Philosophy of the University of Jyväskylä (Finland), the Thule Institute of the University of Oulu (Finland), the Faculty of Social Sciences of the University of Iceland (Iceland) and the Foundation for High Studies on Antarctica and Extreme Environments (FAE, Argentina).

See “Poster 7 Ibanez.pdf” on DVD.

INNOVATION IN OPERATIONS: BUILDING A MOBILE SCIENCE FACILITY AT ROTHERA RESEARCH STATION

Dick van der Kroef[1] *(d.vanderkroef@nwo.nl)* & John Shears[2]

1. Netherlands Organization for Scientific Research (NWO), The Netherlands; 2. British Antarctic Survey.

Abstract

Twenty years a fruitful collaboration exists between the British Antarctic Survey (BAS) and the Netherlands Organization for Scientific Research (NWO), since 1995 recorded in a Memorandum of Understanding between both parties. The Netherlands wishes to intensify its scientific efforts in Antarctica and it has been agreed that there will be an extention to the existing collaboration, by means of building a mobile Dutch Research Facility at Rothera Research Station. The concept of this research facility is to create flexible laboratory modules that will be connected to a docking station at the base (see figure).

These modules are compact laboratories designed to fit the needs of scientific researchers, build in sea containers. BAS will take care of the necessary connections for power and water supply and discharge and environmental measures with the construction of the

docking station. Design and preparation of the lab modules will take place in the Netherlands.

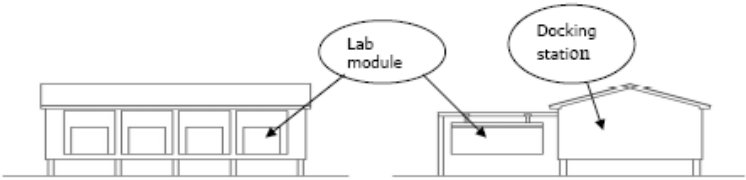


Figure illustrating docking station with containerized laboratories.

This concept provides a flexible approach of doing research in the Antarctic. Whenever a project ends, a container can be replaced by another module, from the Netherlands or the UK. In the long term, if this concept proves to be useful, involvement of other partners can be considered.

Our plan is to construct a temperature controlled dry lab, a wet lab, a clean lab, a geophysical field preparation lab and a lab for atmospheric measurements, all provided with the relevant equipment.

Science projects that are initially planned are measurements of seasonal oscillation of CO_2 and O_2 in seawater, sea ice and the overlying atmosphere; ocean acidification; availability of essential trace nutrient

elements (Fe, Mn, Zn); phyto-, bacterio-, and vireo-plankton; climate change impact on coastal phytoplankton; meteorological observations at the base and in the region; and continuous measurements of atmospheric CO_2 and O_2. For every project, collaboration between Dutch and British researchers is envisaged.

Our initial planning is to start transporting material to Rothera Research Station this upcoming summer season (2010/2011). The actual construction of the docking station will start in the austral summer of 2011/2012. In the mean time, the lab containers will be designed and built in close collaboration with the scientists. The science projects can then start in 2012.

See “Poster 9 VanDerKroef et al.pdf” on DVD.

USING OPERATIONAL DATA TO SUPPORT AN ASSESSMENT OF CUMULATIVE IMPACTS: A PRELIMINARY ASSESSMENT OF NEW ZEALAND'S ACTIVITIES IN ANTARCTICA

Irfon Jones[1], Robyn Andrew[1], Jana Newman[2] and Bryan Storey[1]

1. Gateway Antarctica, University of Canterbury, Christchurch, New Zealand; 2. Antarctica New Zealand, Christchurch, New Zealand.

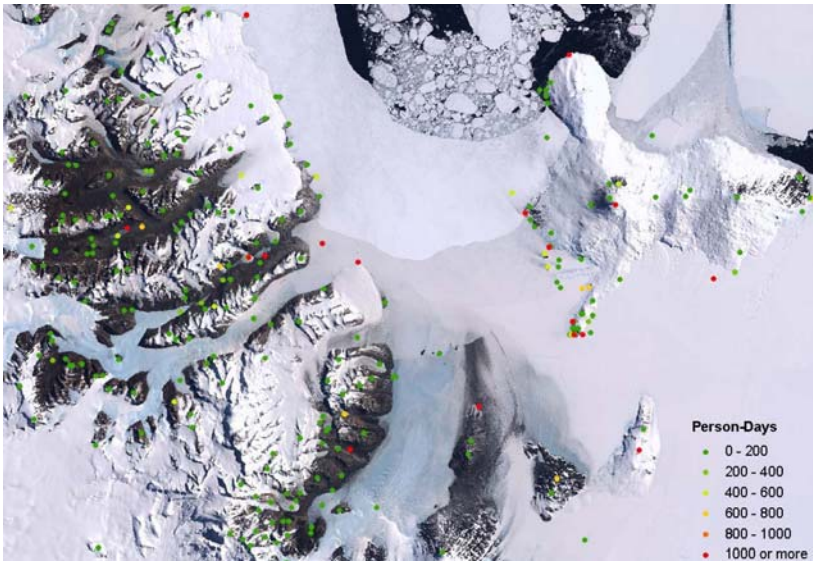
Abstract

The Environmental Protocol requires activities in Antarctica to be planned and conducted taking into account their cumulative impacts. New Zealand has a data set comprising information on the location, duration and type of New Zealand's activities in Antarctica that goes back 50 years. A pilot study assessing these data with a view to linking them to an assessment of the cumulative impacts of the New Zealand Antarctic Programme from 1956/1957 through to 2008/2009 has been conducted.

The data on the number of person-days spent at visited locations has been displayed graphically. The different kinds of activities carried out at these locations, and how these have changed over the decades is also displayed. The methodology and results show that such a retrospective study of data to support an assessment of cumulative impacts is possible and demonstrates the

value of collecting detailed data on national Antarctic programme activities. A full report will be submitted to the CEP in 2011.

This poster presents the data, methodology and results from this study, along with conclusions. The figure below shows the number of person-days spent on Ross Island and in the Dry Valley region for the New Zealand Antarctic Programme.



See “Poster 10 Jones et al.png” on DVD.

HEALTH SURVEY AND MORBIDITY OF MEMBERS IN SOVIET AND RUSSIAN ANTARCTIC EXPEDITIONS FOR THE PERIOD 1956 THROUGH 2006

Gorbunov, G.A. (*gorbunov@aari.ru*), Levando, K.K., Kozak V.F. and Mikhaylova V.Yu

Arctic and Antarctic Research Institute, Russian Antarctic Expedition, Russia.

Abstract

During the period of 1956 through 2006, there were a total of 22,165 members that participated in Soviet and Russian Antarctic expeditions.

Also during this period, the total number of diseases was 47,357.

This poster gives information on the ratios of diseases, morbidity, medical operations and evacuations.

See “Poster 11 Gorbunov et al.pdf” on DVD.

POLAR VIEW
IMPROVED SEA ICE INFORMATION FOR THE SOUTHERN OCEAN

Andrew Fleming (*ahf@bas.ac.uk*) and Andreas Cziferszky

British Antarctic Survey, Cambridge, UK.

Abstract

Since 2005 Polar View has developed and delivered a wide range of sea ice monitoring services which provide information to support polar logistics and shipping in the Southern Ocean. This information is also valuable to those involved in environmental monitoring and climate change adaptation in the Polar Regions.

The Polar View service portfolio comprises detailed local and regional-scale products derived from ENVISAT satellite imagery, plus lower resolution products generated from passive microwave, ENVISAT and visible sensors such as MODIS. In combination these services provide an up to date and comprehensive picture of sea ice distribution, structure and movement.

In the past year access to Polar View services has improved significantly through developing a new web interface and establishing novel methods to efficiently deliver large images over low bandwidth data connections.

This poster will update the COMNAP community on the following:

- The new website and information delivery options;
- Examples of recent use of Polar View by users;
- Plans for new information services such as iceberg and lead detection;
- Other future developments including delivery tailored to specific users and locations;
- The current situation about funding and sustainability of Polar View services.

Additionally following the International Polar Year, we will provide an overview of Polar View activities during this time, including launch of the Ice Logistics Portal (http://www.ipy-ice-portal.com/) developed in collaboration by Polar View, the International Ice Charting Working Group (IICWG) and the JCOMM Expert Team on Sea Ice (ETSI).

See “Poster 12 Fleming et al.pdf” on DVD.

BHARATI - THE INDIAN RESEARCH STATION AT LARSEMANN HILLS ANTARCTICA

Andreas Nitschke (*a.nitschke@ims-ing.de*)

IMS Ingenieurgesellschaft mbH, Hamburg, Germany.

Abstract

The New Indian Research Station, Bharati, at Larsemann Hills, will overcome the extreme climate conditions thanks to its new type of construction. Being undertaken according to state-of-the-art aspects of building services, it will provide the staff occupying the building with comfortable working and living conditions whilst ensuring the required level of safety, and simultaneously fulfilling the stringent demands of environmental sustainability in the highly sensitive Antarctic region. Experience gained from the National Centre for Antarctic & Ocean Research (NCAOR) activities over the course of several decades had to be drawn upon in the planning of the station by the team of IMS-Ingenieurgesellschaft mbH and its partners of total twenty engineers, architects and specialists.

The design includes a two storey structure made from prefabricated containers that will be shipped to the site. The areas for building services engineering, and living and working are separated from one another by means of vibration damping, whilst high standards in the containers ensure

comfortable and effective work. To cope with the strong and cold winds, the station contour consists of an aerodynamically formed outer shell made from highly insolating sandwich elements. The station will be installed on piles above the ground to let the wind pass over and underneath the station and to avoid snow accumulation. It has a defined operating life of 20 to 30 years, using tried and tested materials and processes used under similar circumstances.

The technical equipment includes essential infrastructure like energy and water supply, heating and air conditioning, sewage water treatment, units for a hospital and cooking facilities. All service devices are supervised by a central building control system, with on site access as well as remotely from India through satellite. The equipment will be designed under consideration of the sensitive ecosystem according to the Antarctic Treaty.

Utilisation of the CHP (combined heat power unit) waste heat, will reduce the electrical energy demand by the energy consumption of the oil-based electric radiators. The build-up of the hydraulic heating entails higher investment cost once, but will result in sustainable high savings of operating costs over the life-time of the station. The eco-friendly engines provide excellent quality in compliance to EU II of the European Union. The station will also have provision for using wind energy.

The waste water treatment plant uses state of the art technology. It is designed to process the waste water to a degree of purity which complies with the Bathing Water Directive of the European Union. In order to reduce the fresh water consumption the waste water will be recycled for toilet flushing. All things taken into account, Bharati Station is designed as environment friendly and can also be dismantled easily due to its modular design.

See “Poster 13 Nitschke.pdf” on DVD.

RE-SUPPLY AND SCIENCE SUPPORT EVALUATION OF PALMER STATION & THE ANTARCTIC PENINSULA REGION

Will Colston (*wcolston@nsf.gov*) and Brian Stone

US National Science Foundation, Arlington, Virginia, USA.

Abstract

Palmer Station is a United States research facility located at 64°46' S, 64°03' W, on a protected harbor on the southwestern coast of Anvers Island off the Antarctica Peninsula. Palmer is the only US Antarctic Program (USAP) station north of the Antarctic Circle, and is superbly located for biological studies of birds, seals and other components of the marine ecosystem. It is equipped with a laboratory and sea water aquaria. In 1990, it was designated by the National Science Foundation as a long term ecological research (LTER) site. Ocean and climate systems, aeronomy and astrophysics, glaciology also have been pursued at and around Palmer.

In February 2010, USAP hosted a workshop in Arlington, Virginia, USA, to review the current operational procedures and science support and to discuss long term options for resupply of Palmer Station. The current practice for resupplying the station uses a combination research/logistics support vessel. Now is an opportune time to review this resupply process since the current pier is over 40 years old and is in need of repair or replacement.

This poster will present the workshop report and solicit input from other COMNAP members on the recommendations and possible future approaches for supporting the station.

See “Poster 14 Colston et al.pdf” on DVD.

TRANSPORTATION AND MOBILITY IMPROVEMENTS

Will Colston (*wcolston@nsf.gov*) and Brian Stone

US National Science Foundation, Arlington, Virginia, USA.

Abstract

The US Antarctic Program is making many changes to portions of its surface transportation network to improve efficiencies in processes, energy consumption and expenditure of labor resources. Continued refinements in bulk fuel transportation for resupply of remote field sites (e.g. South Pole Station) has occurred and the program is now developing approaches for moving solid cargo payloads with similar efficiencies. New vehicle components and entire transport platforms have also been developed and are now being fielded in the McMurdo Station area to achieve significant mobility improvements.

See “Poster 15 Colston et al.pdf” on DVD.

SPANISH ANTARCTIC RESEARCH ACTIVITIES AND INFRASTRUCTURES

M.A. Ojeda[1], S.Ramos[2], J. Sorribas[1], J.J. Dañobeitia[1] and J. Felipe[1]

1. Unidad de Tecnología Marina (UTM), Consejo Superior de Investigaciones Científicas (CSIC), Barcelona, Spain; 2. Comité Polar Español (CPE), Ministerio de Ciencia e Innovación, Madrid, Spain.

Abstract

The International Polar Year has been a splendid occasion for a significant increase in the national investments to support and to consolidate the Spanish Polar Research, particularly in Antarctica. The consequence is a rise on the number of funded research projects and an important improvement on the large-scale facilities behind such activities, such as the Antarctic stations and research vessel.

Concerning the activity, during the last season (2009/2010) we achieved a total of 17 research programs at the Antarctic stations Juan Carlos I and Gabriel de Castilla, mobilizing during more than 100 days a total of 152 scientists from different national and international research centers and universities and 25 technicians and engineers. The *RV Hesperides* is the Spanish polar vessel, which dedicates an average of 40 days per year to the marine research at the Antarctic

seas. Last season we achieved two oceanographic expeditions, accounting 30 scientists and seven technicians and engineers.

The Ship Supplier *Las Palmas*, maintains and supplies the two Antarctic stations (Juan Carlos I and Gabriel de Castilla), and transported around 300 people (scientist/technicians) with a total of 124 operation days which is 65 percent of her time, the remainder of 35 percent for transit and ports.

Moreover, the Spanish Antarctic Programme gave logistic support to other Antarctic National Programmes such Bulgaria, Chile, Germany, Korea and Russia. The ship sldo supported some of the rebuilding activities at the Antarctic Station Juan Carlos I.

Regarding the Spanish infrastructures in Antarctica, the two stations have been on renewal or expanding projects during the last two seasons. The Gabriel de Castilla Station was enlarged allowing now a comfortable accommodation for 28 researches/technicians, expanding service areas such as kitchen, dining, etc. The BAE Juan Carlos I is being carried out the renewal project until the end of the season 2011/2012. This project represents a significant

improvement in the accommodation, services and in the scientific laboratories.

The project has made a special emphasis on the use of more efficient energy systems, such as cogeneration and in the data storing and communication services. During 2009/2010 season a new broadband satellite communication system was been installed. It is based on a C-band Very Small Aperture Terminal system. The Antarctic Station Juan Carlos I will be permanently connected to Internet and to UTM headquarter LAN allowing for the sending of real time data from several of the scientific instrumentation to research centers where the data will be analyzed. It will also be possible to monitor and remote control critical live systems such as energy production, fuel consumption, heating from UTM site. The new communication system will also improve the tele-video conference calls, as well as the tele-medicine facilities.

See “Poster 16 Ojeda et al.pdf” on DVD.

APPENDICES

COMNAP Symposium 2010

Responding to Change Through New Approaches

Buenos Aires, Argentina

11th August 2010

PROGRAMME

Time	Presentation/ Event	
9:00-9:15	Introduction by the convener, Mariano Memolli	
	Oral Presentations	
Session 1. Technologies and the way forward. Chairs: Iain Miller & David Blake		
9:15-9:40	The dynamical positioning of the Neumayer Station III building *Hartwig Gernandt, Saad El Naggar, Jürgen Janneck and Hans-Jürgen Meyer*	
9:40-10:05	Concept of energy supply at Neumayer Station III *Saad El Naggar, Hartwig Gernandt and Jürgen Janneck*	
10:05-10:30	The development of a hot water drill *David Blake*	
10:30-10:50 Coffee break		
10:50-11:15	The Ross Island Wind Farm *Iain Miller*	
11:15-11:40	Energy initiatives for sustainability *Will Colston and Brian Stone*	
11:40-12:05	Green Lights Design in Antarctic Scientific Stations *Wang Lei, Dai Deci, Liu Fuli and Zhao Ping*	(not presented)
Session 2. Innovation in operations. Chair: David Blake		
12:05-12:30	Princess Elisabeth Antarctica: Innovating towards Zero Emissions *Nighat F.D. Johnson-Amin*	
12:30-13:30Lunch break		
Session 3. The way ahead for environmental practices. Chair: Patrice Godon		
13:30-13:55	Shape of a new building for preventing snow drift and heating installations with solar collectors *Kenji Ishizawa, Tsuyoshi Nagaki and Toshio Hannuki*	
13:55-14:20	A next generation UAV for Antarctica *Johan Berte, Steve Morris, Bernard Bleeckx and Vincent Piret*	
Session 4. Best practice for outreach and communication. Chair: Uwe Nixdorf		
14:20-14:45	Two Strategies To Talk About Antarctica And Science When Nobody Knows What You Are Talking About *Elías Barticevic C. and Jorge Gallardo*	
14:45-15:10	Antártida Urbana *Natalia Lopez, Matías Sodor and Mariana Martí*	
15:10-15:35	Polar South, Art in Antarctica *Andrea Juan*	
15:35-16:00 Coffee break		
Session 5. Other topics. Chair: Mariano Memolli		

Poster Session. Chair: Kazuyuki Shiraishi		
16:25-17:15	Introduction of Posters (three minutes each)	
17:15-18:00	Poster Session	
List of Selected Posters		
Topic: Technologies and the way forward		
Test Operation of 20kW Vertical Axis Wind Turbine at Northern Japan for Syowa Station *Kenji Ishizawa, Toshihito Ono, Hideaki Nakamura, Shigeo Kimura and Takeaki Mori*		
Conceptual Polar Plateau Elevated Station *Phil Sadler*		
Integrated experimental system for on-demand energy generation at Base Esperanza *Héctor Fasoli, Alfredo Sanguinetti, María José Lavorante, Fernando Isla, Cristian Cabrera, Wenceslao Busca and Pablo Cañete*		
Progress towards the construction of Halley VI Station *Karl Tuplin*		
Korea's new permanent station in Terra Nova Bay, Ross Sea *Joohan Lee, Yeadong Kim, Kyung Ho Chung, Ji Hee Kim, Tea Jin Choi, Seong-Cheol Choi, Jung Hwan Oh, Young Seok Kim and Gyu-Jin Bae*		
Renewable Sources of Energy Near the Bulgarian Base *Jordan Jordanov*		
A next generation UAV for Antarctica *Johan Berte, Steve Morris, Bernard Bleeckx and Vincent Piret*		
Topic: Best practice for outreach and communication		
International Association of Circumpolar Socio-Cultural Issues (IACSI) *Enrique del Acebo Ibáñez*		
Antártida Urbana *Natalia Lopez, Matías Sodor and Mariana Martí*		
Topic: Innovation in operations		
Building a mobile science facility at Rothera Research Station *Dick van der Kroef and Johns Shears*		
Using operational data to support an assessment of Cumulative Impacts: A Preliminary Assessment of New Zealand's activities in Antarctica *Irfon Jones, Robyn Andrew, Bryan Storey and Jana Newman*		
Other topics		
Health survey and morbidity of members in Soviet and Russian Antarctic expeditions for 1956 - 2006 *Gorbunov, G.A., Levando, K.K., Kozak V.F. and Mikhaylova V.Yu*		
Polar View – Improved sea ice information for the Southern Ocean *Andrew Fleming and Andreas Cziferszky*		
Bharati- the Indian Research Station at Larsemann Hills Antarctica *Andreas Nitschke*		
Resupply and Science Support Evaluation of Palmer Station and the Antarctic Peninsula Region		

Appendix B: List of Registrants

Name	Organisation
Aiello, Tco Qco Ricardo	Instituto de Investigaciones Científicas y Técnicas para la
Amaral Silva, Mr. Marco Antonio	Brazilian Antarctic Program
Arata, Dr. Javier	INACH
Balsalobre, Silvina	Dirección Nacional del Antártico
Barreto, Juan	Ministerio de Relaciones Exteriores
Beg, Shri. Mirza Javed	National Centre for Antarctic and Ocean Research
Blake, Mr David	British Antarctic Survey
Brennan, Mr. John	Tasmanian Polar Network
Bunge, Carlos	Direccion Nacional de Antartico
Casella, Hugo	Dirección Nacional del Antártico
Cattaneo, Meteorologo Norberto	Escuela de Ciencias del Mar-Instituto Universitario Naval
Caula, Mrs Nicole	Uruguayan Antarctic Institute
Cervellati, Dr. Roberto	Consorzio PNRA
Chen, Danhong	Chinese Arctic and Antarctic Administration
Claire, Le Calvez	French Polar Institute - IPEV
Clifton, Mr Robb	Australian Antarctic Division
Colston, Mr William	National Science Foundation
Crosbie, Dr Kim	IAATO
Cucinotta, Ing Antonino	Consorzio PNRA
Culshaw, Mr Robert	British Antarctic Survey
Dahlbäck, Director-General Björn	Swedish Polar Research Secretariat
Dañobeitia, Profesor Juanjo	UTM-CSIC
de Abelleyra, Captain (N) (Ret Juan	Escuela de Ciencias del Mar - Instituto Universitario Naval
del Acebo, Dr Enrique	International Association of Circumpolar Sociocultural Issues
De Rossi, Giuseppe	PNRA
De Santo, Marcela	Dirección Nacional del Antártico
Di Vincenzo, Director Andres	Servicio de Hidrografia Naval
Dolci, Mr. Stefano	P.N.R.A. S.C.r.l. Consortium (ITALY)
Drew, Carlos	Ejercito
Faber, Mr Daniel	Aerospace Concepts Pty Ltd
Facchin, Eugenio	Armada
Fasoli, Dr. Héctor José	Instituto Superior de Enseñanza del Ejército-Escuela Superior
Ferreira, Mr. Marcos Jose	Brazilian Antarctic Program
Fewkes, Mr Peter	William Adams Pty Ltd
Figueroa, Victor	Ejercito
Flesia, Carlos	Ejercito
Fonteyn, Dr Dominique	Belgian Federal Science Policy Office
Fortunato, Mr. Jose Luis	Instituto Antartico Uruguayo
Frenot, Dr Yves	IPEV
Fujii, Director-General Yoshiyuki	National Institute of Polar Research

Gallardo Turiel, Mr Jorge	Chilean Antarctic Institute
Garea, M. Sc. in Oceano Maribel	COPLA - Comisión Nacional del Límite Exterior de la Plataforma
Gernandt, Dr Hartwig	Alfred Wegener Institute for Polar and Marine Research
Godon, Mr Patrice	IPEV
Gupta, Dr Vasudha	Ministry of Earth Sciences
Gurko, Mr Alexey	JSC "Avialift Vladivostok"
Hall, Mr John	British Antarctic Survey
Hedman, Ulf	Swedish Polar Research Secretariat
Hernandez, Alexis Benjamín	Fuerza Aerea
Idiens, Melissa	Gateway Antarctica (Research Centre)
Ishizawa, Kenji	National Institute of Polar Research
Isla, Fernando	Ejercito
Jin, Mr. Dongmin	Korea Polar Research Institute
Juan, Andrea	Dirección Nacional del Antártico
Kalakoski, Mika	Finnish Meteorological Institute / FINNARP
Klokov, PhD Valery	Russian Antarctic Expedition
Kohlberg, Dr. Eberhard	Alfred Wegener Institute for Polar and Marine Research
Lavorante, Lic María José	Facultad de Ciencias Fisicomat. e Ingeniería-UCA
Lee, Dr Hong Kum	Korea Polar Research Institute
Lee, Dr Joohan	Korea Polar Research Institute
Leite, Mr. Márcio Renato	Brazilian Antarctic Program
Leminen, Keijo	Finnish Meteorological Institute
Levando, Mr Konstantin	Russian Antarctic Expedition
Long, Wei	Chinese Arctic and Antarctic Administration
Lopez Crozet, Fausto	Ministerio de Relaciones Exteriores
Lorenzo, Beatriz E	Dto Meteorología - Glaciología
Lukin, Mr Valery	Russian Antarctic Expedition
Lusky, Jorge	Dirección Nacional del Antártico
Machado, Mrs Maria Cordelia	Ministry of Science and Technology
Maddock, Ms Lyn	Australian Antarctic Division
Maglione, Fernando	Armada
Marchesini, Osvaldo Enrique	Fuerza Aerea
Martyanov, Mr Viacheslav	Russian Antarctic Expedition
Memolli, Mariano	Dirección Nacional del Antártico
Miller, Heinrich	Alfred-Wegener-Institute for Polar and Marine Research
Miller, Mr Iain	Antarctica New Zealand
Mixa, Dr Petr	Czech Geological Survey
Mohan, Dr Rahul	National Centre for Antarctic and Ocean Research
Nixdorf, Dr. Uwe	Alfred Wegener Institute for Polar and Marine Research
Ojeda, Miguel Angel	Unidad de Tecnología Marina - CSIC
Olmedo, Jose	Instituto Oceanografico de la Armada
Ortúzar, Lic Patricia	Dirección Nacional del Antártico
Oyarbide, Ricardo Miguel	Armada
Palet, Guillermo Mariano	Armada
Parica, Dr. Claudio	Universidad de Nacional de General San Martín
Pazmiño, Andres	Instituto Oceanografico de la Armada

Pedersen, Ken	Norwegian Polar Institute
Penhale, Dr. Polly A	Office of Polar Programs
Phamoli, Ms Chuma	SANAP
Pimpirev, Professor Christo	Bulgarian Antarctic Institute
Piriz, Mr. Javier	Instituto Antartico Uruguayo
Pomelov, Mr. Victor	Russian Antarctic Expedition
Potter, Dr Sandra	Austraian Antarctic Division
Pozzi, Mariano	Armada
Pugliese, Mrs. Gabriela	Libre
Rastelli, Mr. Fabio	Brazilian Air Force
Ravindra, Dr Rasik	National Centre for Antarctic and Ocean Research
Rebull, Fernanda	Dirección Nacional del Antártico
Reinke, Dr Manfred	Antarctic Treaty Secretariat
Retamales, Dr José	Instituto Antártico Chileno
Rickby, Administration O Ann-Sofie	Swedish Polar Research Secretariat
Roballo, Jorge	Ministerio de Relaciones Exteriores
Rogan-Finnemore, Ms Michelle	COMNAP Secretariat
Romero, Adriana	Ejercito
Sanchez, Rodolfo Andrés	Dirección Nacional del Antártico
Sanson, Mr Lou	Antarctica New Zealand
Sharma, Dr. R. K.	Ministry of Earth Sciences
Sharp, Mr Mike	IAATO
Shears, Dr John	British Antarctic Survey
Shiraishi, Dr Kazuyuki	National Institute of Polar Research
Silva, Mr. Glenio	Brazilian Antarctic Program
Souza, Haynnee	Brazilian Antarctic Program
Stone, Brian	National Science Foundation
Sun, Yunlong	Polar Research Institute of China
Troisi, Mr Ariel	Servicio de Hidrografía Naval
Trousselot, Ms. Chrissie	Antarctic Tasmania Science and Research
Valentine, Mr Henry	SANAP
Vallejos, Ms Veronica	Instituto Antartico Chileno
van der Kroef, Drs Dick	NWO
Videla, Enrique Oscar	Fuerza Aerea
Vlasich, Veronica	Direccion Nacional de Antartico
Wang, Lei	Architecture Research and Design Institute
Wei, Wenliang	Chinese Arctic and Antarctic Administration
Yordanov, ingineer Yordan	Bulgarian Antarctic Institute

Appendix C: List of files contained on Accompanying Symposium DVD

Oral Presentations

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Folder: Presentation 3 Blake

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Presentation 9 Berte.pdf

Presentation 10 Gallardo.ppt

Presentation 11 Lopez.ppt

Presentation 12 Juan.pps

Presentation 13 Dolci.ppt

Poster Presentations

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Poster 2 Sadler.pdf

Poster 3 Fasoli et al.pdf

Poster 4 Tuplin et al.pdf

Poster 5 Lee et al.pdf

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