COMNAP Symposium 2018

'Facilitation of Internationally Collaborative Antarctic Science'

Thursday 14 June (0830–1700)

Hosted by the Alfred Wegener Institute Helmholtz Center for Polar and Marine Research

Venue: Konzertstall/Concert Hall Richard Strauss, in the Kongress Centre Garmisch-Partenkirchen, Germany

Programme: Oral Presentations

Time	Title/Speaker/Organisation
Session 1: IPICS and the "Hunt for the oldest ice" *chaired by Uwe Nixdorf (AWI)*	
0830–0840	**Welcome** Uwe Nixdorf, Symposium Convener
0840–0910	***Keynote 1:*** **Tackling expensive and long-term science projects in Antarctica: What we learned from EPICA** Heinz Miller, Helmholtz Professor for Glaciology, Chair of the Scientific and Technical Council for *Polarstern II*, COMNAP Chairman (2011–2014), and Chair of the EPICA Scientific Steering Committee (2000–2006)
0910–0940	***Keynote 2:*** **The International Partnerships in Ice Core Sciences (IPICS) oldest ice challenge** Hubertus Fischer[1] and Tas van Ommen[2] [1]Professor & Deputy Head of the Climate and Environmental Physics Division, University of Bern, Switzerland, and Co-Chair of the IPICS Steering Committee [2]Australian Antarctic Division and Co-Chair of the IPICS Steering Committee
0940–1000	**Australian planning for contribution to the oldest ice project** Nick Gales and Rob Wooding, Australian Antarctic Division (AAD)
1000–1020	**The East Antarctic Ice Sheet ABC transect initiative: Opportunities for international cooperation** Bo Sun, and Tijun Zhang, Polar Research Institute of China (PRIC)
1020-1045	**Summary & Discussion: Working collaboratively on the oldest ice project**
1045–1115	Coffee Break/Poster Session
Session 2: Innovative technologies & Pre-planning *chaired by Felix Bartsch (INACH)*	
1115–1130	**Remotely controlled underwater vehicle for biological sciences** Alexsei Gaishadov, Belarus Antarctic Expedition (BAE)
1130–1150	**WindSled. A clean mobile platform for Antarctic research** Ramon Larramendi, Spanish National Antarctic Program (CPE)

1150–1210	**Mathematical modelling of priorities and costs of station Vernadsky infrastructure modernization** Oleksandr Kuzko, V. Lukiaschenko, and M. Leonov, National Antarctic Scientific Center (NASC), Ukraine
1210-1230	**A large, grant-funded, science project established through an infrastructure loan request** Mike Dinn[1] and Christine Wesche[2] [1]British Antarctic Survey(BAS), UK, and [2]Alfred Wegener Institute (AWI) Helmholtz Center for Polar & Marine Research, Germany
1230–1250	**Planning for the U.K.-U.S. Thwaites Glacier initiative** Jessie Crain[1] and Mike Dinn[2] [1]US Antarctic Program (USAP) and [2] the British Antarctic Survey (BAS), UK
1250-1300	**Discussion**
1300–1400	Lunch Break/Poster Session

Session 3: Learning from and building upon experiences; Strengthening regional alliances and partnerships *chaired by Chen Danhong (CAA/PRIC)*	
1400–1420	**Multi-national, multi-partner Antarctic research fleet: a dream of the past or the way of the new future?** Hyoung Chul Shin, Ji Soo Park, Key-Hong Park, and SangHoon Lee, Korea Polar Research Institute (KOPRI)
1420–1440	**New Zealand's new Antarctic science platform: A collaborative approach** Fiona Shanhun, Rebecca McLeod, Neil Gilbert, and Peter Smith, Antarctica New Zealand
1440–1500	**Importance of international scientific collaborations for the Bulgarian Antarctic program** Dragomir Mateev, Christo Pimpirev, and Yordan Yordanov, Bulgarian Antarctic Institute (BAI)
1500–1520	**Chilean Antarctic program, horizons for cooperation** Carlos Pineda, and Felix Bartsch, Instituto Antartico Chileno (INACH)
1520–1545	Coffee Break/Poster Session
Session 4: Role of traversing, ships, aircraft and infrastructure support *chaired by Robb Clifton (AAD)*	
1545–1605	**The success of international collaboration for supporting Antarctic science & logistics: The operation of the Chinese first fixed-wing aircraft Snow Eagle 601** Tijun Zhang[1], Robb Clifton[2] and Paul Sheppard[3] [1] Polar Research Institute of China (PRIC), [2]Australian Antarctic Division (AAD) and [3]US National Science Foundation (USAP)

1605–1625	**Technology, risk management and opportunities: Operations across sea-ice (season 2017/18) in Adélie Land** Patrice Bretel[1] and Patrice Godon[2] [1]French Polar Institute (IPEV) and [2]Patrice Godon Polar Engineering
1625–1645	**Recent progress in Korean Inland Traverse Program (2017–2026), East Antarctica** Jong Ik Lee, Khanghyun Lee, Seong Joon Jun, Won Sang Lee, Joohan Lee, Ji Hee Kim, and Yeadong Kim, Korea Polar Research Institute (KOPRI)
1645–1700	Summation/Close of Symposium by Uwe Nixdorf

Programme: Poster Presentations

Poster Number	**Titles**/Authors/Organisation
1	**Nautical assets' fostering scientific research in the Antarctic Treaty Area** Andrea Colombo and Michelle Rogan-Finnemore COMNAP Secretariat
2	**Information exchange: how COMNAP productises data for Members & the community** Andrea Colombo[1], Brad Herried[2], Michelle Rogan-Finnemore[1] [1]COMNAP Secretariat, [2]Polar Geospatial Center, University of Minnesota, USA
3	**Antarctic facilities: hubs for science and environmental protection** Andrea Colombo and Michelle Rogan-Finnemore COMNAP Secretariat
4	**Development of a data logger suitable for the Antarctic environment** Joohan Lee, Dong Seob Shin, Ho Kyung Jun, Jae Beom Park, and Myeong Ha Choi Korea Polar Research Institute (KOPRI)
5	**Renovation of King Sejong Station as Multi-purpose Research Platform** Hyoung-Geun LEE, Min-Cheol SHIN, Young Hoon KWON, and Seonung CHOI Korea Polar Research Institute (KOPRI)
6	**Chilean logistic-scientific platforms: opportunities for research from a latitudinal transect along the Western Antarctic Peninsula** Marcelo Gonzalez, César Cárdenas, and Felix Bartsch Instituto Antartico Chileno (INACH)
7	**Design & material innovations in Antarctic shelters** Alfredo Fuentes, Rodrigo López Instituto Antartico Chileno (INACH)

Abstracts

Keynote 1

Tackling expensive and long-term science projects in Antarctica: What we learned from EPICA

Heinz Miller

The European Project for Ice Coring in Antarctica (EPICA) represented a landmark science project in many respects. It was a multinational project involving scientists and technicians from 10 European nations, not all of which had national Antarctic programmes, over a period of 11 years. It was successful in retrieving two deep ice cores, one at Concordia Station at Dome C, and the other at Kohnen Station in Dronning Maud Land. The two main goals were to get very old ice, and to get a high-resolution core covering the last glacial cycle for comparing the Antarctic record with the Greenland record. These main scientific goals were reached, and over 200 publications in high-profile journals are testimony to that. With hindsight, it is easy to say that this project was successful; however, getting there needed dedicated effort by many. The EPICA project showed that it is possible to tackle expensive and long-term science projects in Antarctica, in a concerted manner, between many different national programmes. It also proved that COMNAP is a major and able player in such undertakings. What we learned through EPICA can now be applied to current and future multi-national Antarctic research endeavours, including the search for the oldest ice but also many other projects.

Keynote 2

The International Partnerships in Ice Core Sciences (IPICS) oldest ice challenge

Hubertus Fischer[1] & Tas van Ommen[2] for the IPICS community
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The Mid-Pleistocene Transition (between 1.2–0.9 million years ago) represents an enigmatic period in Earth's climate history, characterized by a shift in glacial/interglacial periodicity from 40,000 to about 100,000 years. The cause and effect relationship that led to this change is not fully understood yet, as important information on global changes in the climate system (such as the radiative forcing by atmospheric greenhouse gases) is still missing. Most of this information, including the phasing of these changes in the Earth System, can only be derived from a continuous ice core from Antarctica covering the last 1.5 million years. Ice of this age is likely to be found on selected sites on the East Antarctic Plateau, but as this ice will be in the bottom-most 200 meters, the chance of flow-disturbances is high and replicate drilling essential. Accordingly, the International Partnerships in Ice Core Science (IPICS) community has identified the oldest Ice challenge as one of their top priorities for the coming decade and several national and international oldest ice projects are currently in preparation.

Oral Presentations

Australian planning for contribution to the oldest ice project
Nick Gales and Rob Wooding, Australian Antarctic Division (AAD)
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The Australian Antarctic Division is well advanced with planning to contribute to the oldest ice project. These plans include:

- The establishment of a traverse capability.
- The establishment of a science ice core drilling capability.
- Undertaking operational activities towards retrieving a core including participating in the internationally collaborative efforts.

This presentation will outline current capability development activities underway, along with broad operational plans and the potential requirements and opportunities for international collaboration.

The East Antarctic Ice Sheet ABC transect initiative: Opportunities for international cooperation
Bo Sun, and Tijun Zhang, Polar Research Institute of China (PRIC)
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This presentation will show a strategic vision for CHINARE investments in the East Antarctic ice sheet ABC transect initiative. The transect begins from the Zhongshan Station and ends at Inexpressible Island, through Dome A, Ridge B and Dome C ("ABC"), connecting and building through airborne scientific survey route and inland snow vehicle traverse route. The goal of the project of the ABC transect initiative is to promote the following as strategic priorities in the Antarctic Ice sheet research for the coming decade:

- A multidisciplinary initiative to understand the East Antarctic ice sheet stability processes and the impacts on how fast and how much the global sea level will rise, using remote sensing, geophysical survey, ice modeling and the records of past ice sheet change.
- To support the Dome A deep ice core drilling, and connect deep ice core drilling sites by airborne ice penetrating radar sounding to provide the inter-comparison of deep ice cores using the internal isochronous layers.
- To find the oldest ice core drilling site in ridge B and understand the ice flow evolution in the region of Ridge B and the upstream of Vostok ice core site.
- To seek the ideal blue ice site in East Antarctic Ice sheet to drilling ice sample possibly up to 5 million year old into a period on the planet when carbon levels resembled that of today to understand climate patterns and atmospheric carbon dioxide levels

It is beyond the capability of one nation alone to address these challenges. CHINARE wishes to promote international cooperation in support of this initiative.

Remotely controlled underwater vehicle for biological sciences

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This presentation is a brief (7 minute) video, in English, which will demonstrate the usefulness of autonomous technologies in support of international scientific research. Autonomous technologies were identified in the COMNAP Antarctic Research Challenges (ARC) project as being critical to delivering science results across all disciplines. The Belarussian Antarctic Expedition is using remote controlled underwater technologies in support of biological research. Such studies, in marine waters and freshwater lakes of the Antarctic using diving equipment is accompanied by certain difficulties. For example, it is impossible for a diver to stay under sub-zero water for a long time, as well as the work in a rugged underwater and under-ice relief, limited under-ice space and at great depths and during the southern polar night is problematic.

One of the scientific tasks of the Belarusian Antarctic Expedition in the seasons 2016–17 and 2017–18, was the extension of the possibilities for carrying out field studies of marine and freshwater ecosystems by using an unpersonned underwater vehicle (UUV) "GNOM" in addition to standard methods of hydrobiological research, including the use of diving equipment. All in all, twelve research dives of both a diver and a UUV "GNOM" were carried out in the coastal marine zone and freshwater reservoirs of East Antarctica during the period from December 2016 to March 2018. A detailed underwater photo and video study were carried out, samples of representative marine flora and fauna to determine their species diversity were taken, size and weight composition determined, as well as genotyping and samples of benthal sediments and algal -bacterial tufts in freshwater reservoirs were collected. The features of the formation and dynamics of the development of freshwater Antarctic lakes were also studied during the underwater diving (diver, UUV, diver + UUV).

In the process of carrying out of these field hydrobiological studies, Belarusian specialists have identified a number of undoubted advantages arising from the use of the UUV “GNOM” together with, and (or) separately from, the work of the diver:

- UUV “GNOM” is able to dive to a depth of 150 meters and move at speeds of up to 5.1 km/h with a submerged module weight of about 5 kg;
- the vehicle is equipped with a manipulator with gripper for collecting of biological samples, a video camera with resolution enough to recognize objects of 1–2 mm in size for carrying out underwater photography and video shooting;
- using the UUV “GNOM” requires a minimum number of personnel, only 1–2 people;
- the effectiveness of its operation, both from shore and from ice, was revealed;
- the device is characterized by a lower weight due to the use of high-strength composite materials as compared with alternative vehicles.

The Belarusian experts successfully tested the possibility of UUV “GNOM” to be equipped with optional attachments (Ph.-meter, GO-PRO camera, thermometer, saltimeter, UV recorder) in addition to the basic equipment of the vehicle during the vehicle operation in 2016–2018, which significantly expanded the range of possibilities for carrying out hydrobiological and hydrochemical studies in marine waters and freshwater reservoirs of the Antarctic.

The use of the “GNOM” allows us to supplement the traditional methods of hydrobiological and hydrochemical research effectively, to replace divers in some cases, and to provide underwater research at low ambient temperatures, at any time of the year and day, in hard-to-reach places, in difficult underwater and under-ice relief, and in limited spaces, which sets it apart from more bulky and expensive devices of other systems.

WindSled. A clean mobile platform for Antarctic research

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What is Windsled? Windsled is the first wind-powered vehicle developed and adapted to travel in interior Antarctica for very long distances, Consisting in a light convoy of sleds, propelled by giant kites in altitude, capable of covering autonomously thousands of kilometers with no assistance of fossil fuels.

Back ground and Developing period: Windsled was first tested in Greenland crossing in 2000 and 2001. In 2005–2006, the first crossing of Antarctica with a basic version of Windsled was achieved, and in 2011–2012, a second crossing of Antarctica was achieved with a more developed version, followed by several Greenland traverses in which improvement of capacity, payload and scientific use was achieved. More than 20,000 kms have been successfully travelled with Windsled.

The concept: Windsled consist in a simple, efficient, light and foldable sled, mixing traditional Inuit travel wisdom and techniques with high technology. Allowing a huge simplification of logistics in land transects, at a very reduced cost compared with any other available option, and in a totally ecological way with zero emissions.

Technical capabilities: Windsled is made up of 3 to 4 sleds platforms, measuring 10–14 meters long, but foldable and therefore can be transported in a Twin Otter, capable of transporting a team of 6 people on board, plus all things necessary for being autonomous 50 days, plus a scientific payload of 300–400 kgs. Maximum total weight of a full convoy including sled and people on board is 2500 kgs.

Applications in scientific research in interior Antarctica: Windsled is Ideal for the remote high plateaus of East Antarctica, all inland scientific stations can be linked by surface with Windsled, allowing any data collection that remain in this volume and weight parameters, including shallow coring with in situ analyzing. Windsled is versatile and can be easily customized for each specific project adapting itself-so, it is very practical.

Potential: For its incredible versatility, low cost, high capability and zero emissions, Windsled can become a powerful tool that potentially could substitute in many situations for the heavy, motorized, high fossil fuel consumption scientific transects.

Mathematical modelling of priorities and costs of station Vernadsky infrastructure modernization

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The topical issue of the Vernadsky Station infrastructure system modernization was investigated to prevent accidents and failures of the infrastructure constituent elements, to Antarctica environmental conservation, and to carrying out of Ukraine' international obligations in Antarctica. The Antarctic Treaty Consultative Meeting in 2010 introduced Resolution 3 with the "Check List A" to verify by the international inspections, particularly, the technical conditions of Antarctic stations infrastructures.

The authors used both this "Check List A" and the T. Saaty mathematical modelling of the hierarchies study (Saaty, T.L. (2008) 'Decision making with the analytic hierarchy process', Int. J. Services Sciences, Vol. 1, No. 1, pp. 83-98) to obtain the quantitative characteristics of priorities and costs of Vernadsky Station infrastructure modernization.

The quantitative characteristics obtained in the study provide the opportunities of:

- simulation of the infrastructure modernization process according to the priorities, costs, and time to optimize the modernization process in conditions both of the limited funding and the limited time for the modernization of Antarctic Station infrastructure;
- preparation of the Feasibility Study, Request for Proposal and Working Project for the infrastructure modernization;
- informing the general public about the Ukraine activities in Antarctica.

The developed method of mathematical modelling is proposed for the preparation and implementation of the system modernization of Antarctic stations infrastructure of other Antarctic Treaty Parties to ensure the synchronization, implementation and carrying out of national and international scientific projects.

A large, grant-funded, science project established through an infrastructure loan request

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The UK Natural Environment Research Council (NERC) and Alfred Wegner Institute (AWI) have just completed a three season broad scale systematic study of the Filchner/ Ronne iceshelf and feeding ice streams within the Filchner Ice Shelf System (FISS) project. The genesis of this collaboration was a straight logistics request by the British Antarctic Survey (BAS) to AWI for the loan of two Pisten Bully tractors. The equipment was to support extant BAS science commitment on the Ronne iceshelf & a grant proposal by BAS scientists, as well as various other BAS logistics work. Negotiation over the loan of equipment very quickly led to a broader collaboration to establish a much larger multi-million EURO project, with significant logistics and scientific sharing between BAS & AWI, vastly enhancing the respective science plans. Significantly, neither party was aware of the others' science plans, strongly suggesting more frequent discussion between National Antarctic Programs about science & logistics plans can lead to significant benefits. This equipment loan and modest equipment purchase allowed BAS to establish a second science support traverse, whilst concurrently running another NERC-funded study of the Pine Island glacier system. The cost of running two such projects concurrently would otherwise have been prohibitively expensive. Other shared logistics were rounded into the one program including; ship efforts, aircraft support, logistics & scientific expertise and specialist scientific equipment. To compliment all of this, effective use of resource, opportunistic logistic input of fuel and consumables for future project work has also been carried out. This experience reminded us that: Sometimes common goals are only realised through broader communication; Operational support can be as key to science outcomes as the science ideas themselves; and frank and open requests between National Antarctic Programs can sometimes lead to great outcomes and mutual benefit.

Planning for the U.K.-U.S. Thwaites Glacier initiative

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The UK Natural Environment Research Council (NERC) and US National Science Foundation (NSF) are supporting a 5-year joint research effort in the Thwaites Glacier region of West Antarctica. The science objective is to substantially improve both decadal and longer-term projections of ice loss and sea-level rise originating from Thwaites Glacier. BAS and NSF are in the pre-planning stages, in advance of field work scheduled to start during the 2018–2019 summer season. The overall initiative will require substantial commitment of aircraft, traverse platforms, and research vessels, and will involve personnel and supply input from both the Peninsula and the Ross Sea regions. Both organizations have mature planning models to support work in West Antarctica. In this presentation, we will discuss the approaches we are using to integrate those models and to plan a complex collaboration, along with initial challenges encountered as we integrate multiple interdisciplinary research teams.

Multi-national, multi-partner Antarctic research fleet: a dream of the past or the way of the new future?
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The utility of a multi-program research fleet in the Southern Ocean is as immense as it is difficult to arrange and operate. Such a fleet, even when loosely organized, is a powerful tool in addressing pending science and policy questions. We examined the past experiences as well as some of the planned exercises in order to determine possible fleet types and the range of objectives that could be achieved. The most common cases of fleet dispatch would be to dispatch many vessels at the same time over a large area to obtain a synoptic picture, often circumpolar. The other case would be to have a good number of ships sail on recommended tracks as opportunities arise, and compile data accordingly. A third approach would be to have a small number of ships visit the target areas, that are often difficult to access.

The cases from BIOMASS, CCAMLR 2000, GLOBEC, MEASO and SOCCOM provide useful references, indicating that the cost involved does not diminish the value of a research vessel fleet. Our proposal for the future is to augment the fleet with newly emerging automated instrumentations that can manoeuvre freely or as programmed. Another consideration is to have some committed ships take turns in visiting remote target areas outside their usual operation range for particularly demanding projects. Ensuring the respective commitments over different funding cycles will pose a challenge, rendering national programs' institutional will and policy as critical as is systematic dialogue necessary to maintain the momentum and facilitate the planning.

New Zealand's new Antarctic science platform: A collaborative approach
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New Zealand is currently developing an "Antarctic Science Platform" – a dedicated fund to support Antarctic research. The fund represents a longer-term investment in New Zealand's Antarctic research programme, and provides an opportunity to establish a more coordinated approach to addressing science priorities. The Platform specifically aims to facilitate enduring international collaborations, align research efforts with policy needs, foster innovation through multidisciplinary collaborations and technology development, incorporate indigenous (Māori) knowledge, and integrate planning for science and logistics needs. Research priorities focus on understanding Antarctica's impact on the global earth system and how this will change in a warming world.

This presentation will highlight the aims of the Platform, outline the planned research programmes and discuss opportunities to develop science and logistics collaborations with other National Antarctic Programmes.

Importance of international scientific collaborations for the Bulgarian Antarctic program

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During the 2twenty-six year long history of the Bulgarian Antarctic Expeditions, international collaboration in science and logistics has played a very important role. Statistics show that, during those years, more than 250 scientists, of which 64 were from fourteen different nations, have worked at the Bulgarian Antarctic Base St. Klimente Ohridski (BAB). Projects that focused on all the main science branches: Geosicences, Life Sciences, Physical Sciences and Human Medicine, have been carried out at the BAB as well as many interdisciplinary projects

The infrastructure of BAB provides a very good opportunity for work in different science fields for groups of limited number of scientists. The BAB is organised in such a way that the logistics team is always able to support and assist researchers in their projects. As a small program, we try to work on many joint international projects but we have also encouraged scientist with their own projects to join our expeditions when we do not have the ability to fill the capacity of the base.

The Bulgarian Antarctic Institute, through the years, has been a supporter of countries just beginning their research in Antarctica. We have been the host to the first scientists from Mongolia, Turkey and Macedonia who started their initial work in Antarctica. Very close collaborations, more than a quarter century with our Spanish neighbours and more than ten years with the Portuguese Polar program, contribute not only to important scientific results but also to the development of infrastructure of BAB. However, none of this scientific collaboration would exist, if it wasn't for the logistic support and cooperation of other Antarctic nations such as Spain, Brazil, Argentina, Chile, Uruguay.

International scientific collaboration gives an opportunity for creation and expansion of regional partnerships. The good example of that is the Bulgarian and Turkey partnership which grew even outside of the work in BAB, with several joint meetings and events related to Antarctica.

Chilean Antarctic program, horizons for cooperation

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The recent Chilean Scientific Antarctic Expedition (ECA54) make by the Chilean Antarctic Program was carry out with the support of a special vessel called *Karpuj* in order to expand the investigation to other places so that it allowed and facilitated the biology, oceanographic, geology and others sampling. The ship sailed 2000 miles across the Antarctic and its oceanographic equipment allowed the deployment of the CTD-O up to 1080 m of depth. This great achievement, that is to say, the descent to a great depth, was due to the available equipment and tools of this special ship. The ship's characteristics (L: 25 m, B: 5.24 m and D: 2.2 m) mean that it can get to places easily.

This season we developed various activities in science and logistics, our own, and also those in collaboration with other programs, including China, Poland and Germany. Other platforms for cooperation are our stations, our Navy vessels and Air Force planes, where it is possible to develop scientific activities and logistics collaborations. Finally, the invitation to other national Antarctic programs is opened in order to coordinate investigation together that can be addressed for future expeditions in the vessel *Karpuj* and with other platforms.

The success of international collaboration for supporting Antarctic science & logistics: The operation of the Chinese first fixed-wing aircraft Snow Eagle 601

Tijun Zhang[1], Robb Clifton[2] and Paul Sheppard[3]
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The operation of the Chinese first fixed-wing aircraft could not be considered as a success without international collaboration both in logistics and science. Many stakeholders had made substantial contributions to this project, including relevant national operators, the scientists, the commercial operator and so on. The authors of presentation intend to draw some knowledge and experience from the first three seasons of operation of Snow Eagle 601, and emphasize more important learning for advancing future collaboration.

In the field of aviation operation in Antarctica, supporting itself is a big issue. The first challenge faced will be deploying the aircraft to the continent, which involves a lot of coordination and preparation in the home country and hard work in the field. This is especially true in the case of China, since China does not operate a runway in Antarctica and does not own a gateway facility- so, the deployment of Chinese aircraft and the operation itself demands a great deal of international collaboration among several national operators.

Science is the fundamental goal for CHINARE Antarctic aviation activities. Providing support for air-born survey is not easy. Station support, air ground support, coordination between pilots and scientists, and so on, are all needed. The presentation would like to draw on the experience from the past three Antarctic seasons' operation and try to formulate better lessons for future implementation of collaboration.

Technology, risk management and opportunities: Operations across sea-ice (season 2017/18) in Adélie Land

Patrice Bretel[1] and Patrice Godon[2]
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The 2017–2018 season was very crucial for the French Polar Program. Looking at the season from a project management perspective (deployment, time schedule, objectives) a successful season was far from guaranteed. Experience, careful preparation and technology innovations were all needed … and a bit of luck as well.

Sea-ice conditions have been changing since 2011–2012, and then especially since 2013–2014 with no sea-ice break up being experienced. As mentioned at the last COMNAP AGM, a brand new ship owned by France's Overseas Department (TAAF) and IPEV and crewed by the French Navy was deployed this season. Because of a very low refuelling in 2016–2017, the stations were due to run out of fuel in early January 2018. So, the margins for guaranteeing a success were very small. The strategy decided early 2017 was to:

- arrive as soon as possible on site with a system permitting safe and large transfers across sea-ice; and
- strongly push the shipyard to respect the time schedule and providers to implement the sea-ice transfer devices.

IPEV was able to draw on the experience of consultant Patrice Godon (retired from the French public service) to develop and implement a concept discussed the year before of transferring loads over the sea ice.

The presentation describes in details the system and the different optional steps, from the helicopter survey to the deployment of the new system which was built in 2017 between the two seasons. This has been done with the financial support of the Italian polar operator ENEA UTA, as Concordia Station is directly implicated by the success of the operation.

Sea-ice conditions finally revealed themselves much better than the previous years and allowed us to run large transfers of loads during the two first calls. Then a complete break-up gave us the opportunity to reach Dumont d'Urville Station in January and February. At the ship's last voyage, the pack-ice came back, recalling the difficult conditions which can occur all the time.

Recent progress in Korean Inland Traverse Program (2017–2026), East Antarctica

Jong Ik Lee, Khanghyun Lee, Seong Joon Jun, Won Sang Lee, Joohan Lee, Ji Hee Kim, and Yeadong Kim, Korea Polar Research Institute (KOPRI)
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Korea inaugurated Jang Bogo Station, at Terra Nova Bay, in 2014, to support national and international multidiscipline research programs in Antarctica. Many scientific expeditions are currently operated there, including geology (KAGEX), geophysics (EGG), meteorite searching (KOREAMET), ecosystem monitoring (CEMP) and shallow ice coring. From 2017, KOPRI started a new inland traverse program with a duration of ten years with a multidisciplinary purpose. The program includes: 1) finding a safe and reliable traverse route, 2) developing a 2000 m hot water drilling program in cooperation with the British Antarctic Survey for subglacial lake exploration, and 3) developing a 3000m deep ice core drilling technology.

During the 2016–2017 austral summer season, the airborne ice penetrating radar survey with helicopters was conducted for ten days to find the suitable subglacial lake candidate to explore around the upper stream of the David Glacier. Automatic weather station (AWS) and GPS were set up at survey area. During the 2017–2018 summer season, the traverse and a preliminary survey was conducted, from 24th October to 4th December in 2017, to the candidate place. A temporary camp for seven personnel was operated on an approximately 300 km traverse route (Korean Route). In order to minimize the environmental impact, mitigation measures were carried out during the period, complying with the Initial Environmental Evaluation (IEE) document for the scientific and logistic field activities that had been endorsed by the Ministry of Foreign Affairs in September 2017.

Poster Presentations

Nautical assets' fostering scientific research in the Antarctic Treaty Area

Andrea Colombo and Michelle Rogan-Finnemore, COMNAP Secretariat
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Vessels play a pivotal role in science and science support for the national Antarctic programs operating in the Antarctic Treaty Area. In fact, vessels not only deliver people and supplies to coastal infrastructures but also, while sailing, conduct an array of multi-disciplinary scientific projects thanks to their on-board facilities and personnel. The Council of Manager of National Antarctic Programs (COMNAP) developed two tools to display and share vessels position data for national Antarctic program vessels operating in waters below 60°S (as per ATCM XXXVI Resolution 4 (2013)). These tools help to foster international scientific projects through, and with, the support of national Antarctic programs and are also useful in times of emergency. The poster showcases examples of successful international collaborations on board of vessels operated by COMNAP Members, and hopes to create new opportunities for future multi-disciplinary and "big science" international projects. The sharing of capabilities on vessels amongst the international scientific community is another good example of international co-operation in Antarctica.

Information exchange: how COMNAP productises data for Members & the community

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COMNAP often requests information from its Member national Antarctic programs. Once collected, the information is housed in the COMNAP database and is used and exchanged in a range of COMNAP products. Those products support the work of COMNAP Member national Antarctic programs in regards to international co-operation in science, science support, operations, logistics, and in Search and Rescue (SAR) situations to name only a few examples. COMNAP has produced procedures for such information exchange and there are also information exchange requirements which are an obligation on Antarctic Treaty Parties in Articles III and VII (5) of the Antarctic Treaty, in several articles of the Protocol on Environmental Protection to the Antarctic Treaty and in a number of Recommendations, Measures, and Resolutions as adopted by the Parties. This poster gives an overview of the projects and products served by the COMNAP database and how these can inform and advance exchange of information with Members, the wider Polar community and the general public. The COMNAP database was developed as a source of information primarily for use by Member national Antarctic programs and the COMNAP Secretariat. However, advances in technology coupled with good planning in development mean that information exchange into duplicate fields in separate databases is now possible.

Antarctic facilities: hubs for science and environmental protection

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This poster showcases a portion of the facilities-related data in the COMNAP database. Ninety-seven facilities (stations, camps, laboratories, refuges, depots, and airfield camps) are run and personned by the COMNAP Members in the Antarctic Treaty Area (2017–18 season data). A great array of facilities-related data, from main scientific disciplines supported, to hydroponics facilities, through medical capabilities and climate-related data are available for the Members through the COMNAP database. The non-sensitive data are also available to the Antarctic Treaty System organisations and to the general public.

In light of the COMNAP Antarctic Roadmap Challenges (ARC) project outcomes, sharing information on facilities and capabilities are seen as a tool which can directly support the key goal of improving international co-operation in Antarctica. The poster introduces some of the facilities-related data in the COMNAP database showcasing scientific activities, measures in place to reduce direct impact on the environment and waste management practices. The final aim is to stimulate the exchange of knowledge, scientific personnel and best practices furthering international co-operation.

Development of a data logger suitable for the Antarctic environment

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The role of Antarctica in the climate system is very important, although isolated from other continents, because it is connected to the rest of the world through the ocean and atmosphere. Direct observations of Antarctica are difficult to make because of its remoteness and harsh weather. As a result, records of Antarctic climate data are very rare.

Many commercial data recorders for automatic weather systems are used in Antarctica for many decades. However, most of data loggers are not designed for the Antarctic environment, so it is very difficult to use in harsh weather in Antarctica. Therefore, the Korea Polar Research Institute has developed a data logger called “KELOS” (Kopri Extreme environment LOgging System) that can be used in any condition of Antarctica.

The KELOS has a cylindrical housing with a diameter of 10 cm and records more than 14 channels of sensor data at the same time. It can be used for AWS, ocean buoy, and glacier flow monitoring, etc. It can be monitored in real time with satellite communication and can communicate with other KELOS within 100 m with on-board Zigbee communication. In order to manage electric power efficiency, power control functions such as sleep mode and board internal temperature monitoring function which prevents malfunction of electrical parts under minus 40 degrees Celsius is implemented.

In this poster we introduce the KELOS in detail, and its application examples, and plans for research using the KELOS.

Renovation of King Sejong Station as Multi-purpose Research Platform

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A permanent Antarctic research station is one of the key elements in Antarctic science. Operated year-round, these stations provide a stable environment for researchers and operators conducting field research activities by offering access to research equipment, power supply, food, accommodation and transportation. At the same time, these facilities should be operated with minimum impact to the Antarctic environment in accordance with the Antarctic Treaty System (ATS).

Antarctic stations are operating under harsh and severe natural conditions, causing their facilities to deteriorate faster than in normal weather conditions. Therefore, consistent maintenance and renovation of station facilities is essential, and the impact to the environment should be carefully considered throughout the process.

During the last three years, from 2016 to 2018, the renovation of King Sejong Station (KSJ) was undertaken and completed in February 2018. Situated in the Barton Peninsula, King George Island, KSJ has mainly been used for environmental monitoring, marine and terrestrial biology and other ocean-oriented research, a research platform since its inauguration in 1988. As most of the research and summer accommodation facilities at KSJ had been used for nearly 30 years, they were in need of repair and reconstruction along with partial dismantlement.

This renovation work was not only focused on safety concerns from the outworn facilities, but has also considered further elevating the quality of research support as a multi-purpose research platform. Through its expanded research capacity, KSJ will now be able to advance the scope of station-based scientific research. Through this poster, KOPRI would like to share its experience in the renovation of KSJ and its future plan as multi-purpose research platform with other National Antarctic Programs.

Chilean logistic-scientific platforms: opportunities for research from a latitudinal transect along the Western Antarctic Peninsula

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Evidence of climate change in the Western Antarctic Peninsula (WAP) is well documented, with warming alongside with increases in precipitation, wind strength, and melt season length driving significant environmental change. Therefore, the WAP area constitutes an interesting area for various national programs that aim to study current, past and future climate change.

The Chilean National Antarctic Program, developed by INACH, currently has a network of logistic-scientific platforms that allow the development of several types of research, both marine and terrestrial on this topic from the King George Island (South Shetlands Islands) to Doumer Island (Palmer Archipelago). These platforms provide support for multidisciplinary research projects that aim to compare both terrestrial and marine environments using a latitudinal component.

Currently, INACH manages two main scientific stations: Professor Julio Escudero and Yelcho stations, located in Fildes Peninsula (King George Island) and Doumer Island, respectively. These stations have several logistic and scientific facilities such as aquariums, temperature-controlled rooms and multipurpose laboratories. Both stations support diving activities and, in their wet labs with aquarium facilities, it is possible to develop temperature-controlled experiments related to climate change. During the last season Antarctic field season, the *RV Karpuj* (managed by INACH) increased and improved the maritime connection between both stations and also provided support for oceanographic samplings.

In this poster, we invite other National Antarctic Programs to collaborate, and propose joint research activities that could be addressed for future collaborative projects utilizing these Chilean platforms.

Design & material innovations in Antarctic shelters

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In 2017, The Chilean Antarctic Program started a cooperation project with a local businessman, Mr Tomislav Babaic (owner of Patagonia House local company), for the development of an Antarctic small station/shelter, adding value to the city by improving the number of services and industries offering Antarctic services.

The shelter will be constructed using a synthetic material (high density plastic) normally used in other applications, but for this innovation, we want to use their isolation properties in order to maintain a ambient temperature inside, with a minimum usage of energy and the lower weight for logistics. This plastic is not a contaminant, because the construction will be in Patagonia House facilities. The strengths of this innovation are:

- Short time of deployment.
- Easy to move from Punta Arenas, to final destiny in Antarctica.
- High durability.
- Weightless (compared with a traditional container shelter).
- Ease to connect to energy and water systems.
- Furniture is included as shelter structural parts, helping to support the entire structure.
- No need of painting (in field).

The modular design can handle the union of several modules, adapting the shelter as the research demands in the place where it is being installed. During the 2018–2019 summer season, INACH should take the shelter prototypes, transport them to Antarctica, deploy them in a specific location and do resistance probes during a year. Simultaneously, we will make a test with personnel living inside them during the Antarctic season.