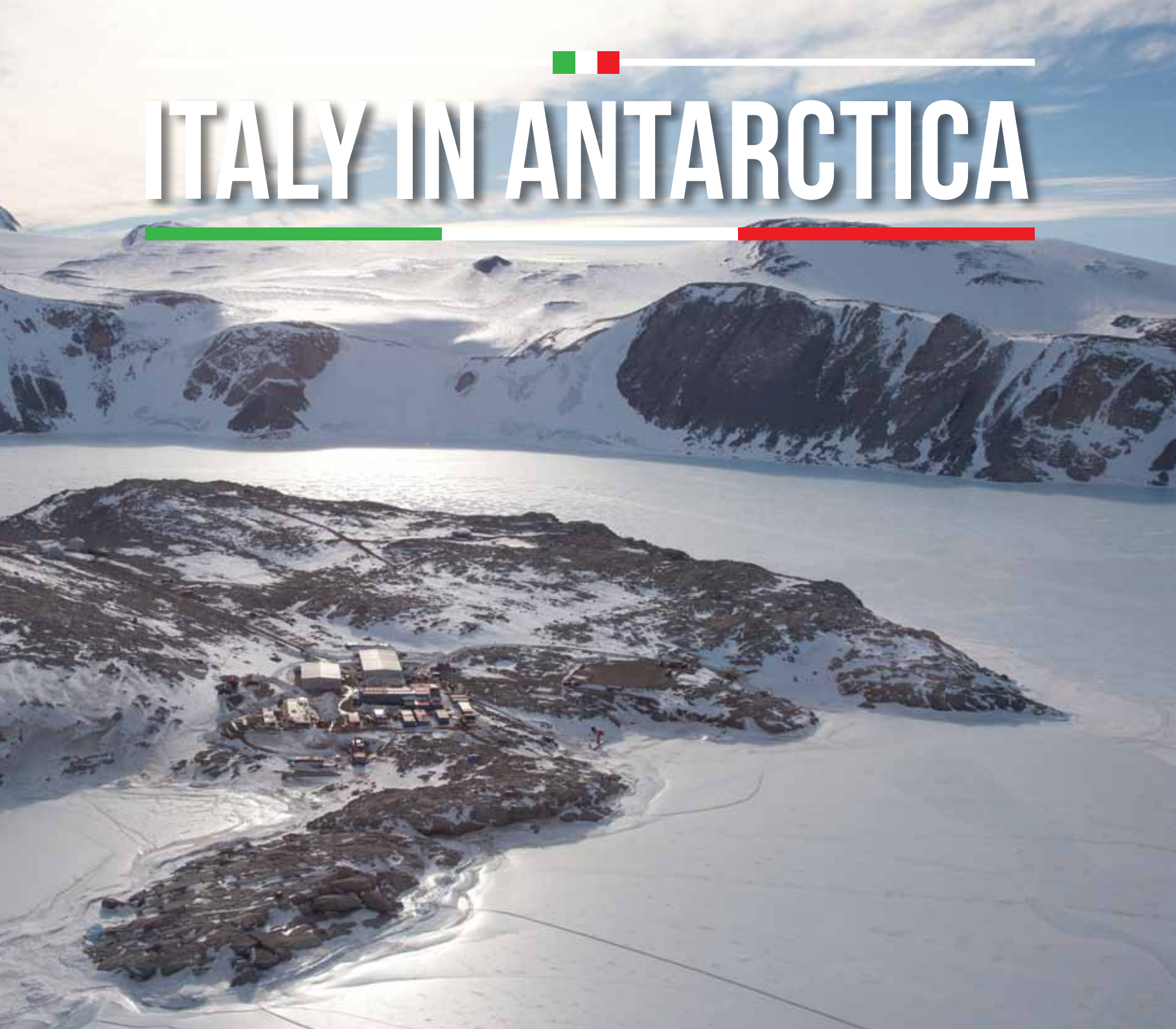
# ITALY IN ANTARCTICA




*Coring through sea-ice: a preliminary survey.*

# ITALY IN ANTARCTICA

*A small iceberg is visiting Mario Zucchelli Station.*

# *Foreword*

*Italy has been present in Antarctica with a governmental scientific programme since 1985. Until 1985 Italian scientists, alpine guides and other adventurous spirits went to the continent mostly as members of other national expeditions. After 1985 however, and during the following thirty years, the Italian national programme PNRA (Programma Nazionale di Ricerche in Antartide) has promoted a large scientific commitment, by organizing yearly expeditions and built two stations, the first on the coast of the Ross Sea, the second – jointly with France – on the East Antarctic ice plateau.*

*The purpose of the present publication is to stress, firstly, the global values of Antarctica, and secondly to document the activities of the Italian expeditions. Focussing on the close relationship established between Italy and Antarctica in these exciting years, whilst not forgetting our past and glimpsing into the future.*

*It is our hope that these pages may stimulate the readers to acquire more knowledge on the continent and may help them to perceive the spirit of collaboration that enlivens the parties of all Countries working in Antarctica or on Antarctic matters. This spirit makes this continent a unique land not only from the geographical but also human point of view.*

# WHY ANTARCTICA?

Man has always been attracted by the polar region. Although such an interest should firstly be attributed to our inborn curiosity, there are also scientific, economic, strategic and political reasons.

Antarctica is the continent that less than the others has been explored.

Because of its geographical position and physical characteristics it is home to a unique flora and fauna, whose study enlightens the complex relationship between living organisms and the environment.
Due to the distance from the main sources of pollution and the almost total absence of anthropic disturbance, Antarctica provides us with the opportunity to obtain some global knowledge of the planet from a remote observation point.
The ice of Antarctica contains the record of water precipitation over the last hundreds of thousands of years, thus providing an insight on past climate.
Furthermore, due to its location with respect to the geomagnetic field, Antarctica (as well as the Arctic region) enables us to study phenomena ensuing the interactions between the Sun and the Earth.
The transparency of the atmosphere makes it ideal for astronomic observation, consequently for cosmological research.
The harsh conditions and isolation of some Stations may also turn an Antarctic expedition into an efficient training field for space missions.

In these few pages we will not even attempt to list all the scientific reasons for Antarctica's enormous importance. What's more, they are already well known.
However, by simply going through the activities performed by the Italian expeditions in Antarctica, its scientific goals as well as the demands on logistics, the reason for electing the continent the largest natural laboratory on earth will eventually ensue.

Valuable results have been already collected by the Italian scientist.
However for many schoolboys and laymen in Italy the far-away Antarctica is still a novelty. In this context, the Italian National Antarctic Research Programme (PNRA) has become since 1985 an opportunity for the development of an Antarctic culture.
The Antarctic values have also driven scientists to get acquainted with specific problems and most advanced technologies; last but not least, to interface with the large spectrum of international research in progress in Antarctica now and for the years to come.

Antarctica is the region on Earth where the countries respond more freely to the suggestions and needs for common research programmes. SCAR, the Scientific Committee on Antarctic Research, ICSU, the International Council of Scientific Unions, and other international organisations promote interdisciplinary research programmes, envisaging co-operation for global scale problems:
IGBP, International Geosphere-Biosphere Programme WCRP, World Climate Research Programme JGOFS, Joint Global Ocean Flux Study SCOR, Scientific Committee on Oceanic Research.

SCAR initiatives and programmes aim at problems connected to Antarctica. A tremendous range of scientific fields is covered. They range from geology to biology, from geographic information to space physics.
Among European co-operation programmes where Italy is involved, at least two deserve to be mentioned here: EPICA and EUROMET.
Interdisciplinary studies aiming at the chronological reconstruction of Earth's climate, are carried out within EPICA, the European Programme for Ice Coring in Antarctica which finds an Arctic equivalent in GRIP, the Greenland Ice Core Project. EUROMET, the Meteorites European Programme, was instituted with the purpose of collecting, analysing and classifying meteorites.
Three more international programmes recently concluded, APE, Cape Roberts Project, ANDRILL, are also mentioned in the following pages.

*Long term research of marine biology in the Ross Sea have confirmed that krill is abundant here.*

# ITALY AND ANTARCTICA BEFORE PNRA

During the 19th century the main world powers, mostly European, such as the Great Britain, France, and Belgium, carried out a major policy of exploration and colonial expansion aimed at securing raw materials, new markets and overseas outposts.

The coasts of Antarctica, scarcely known, were not exempt from such interest, thanks also to progress in vessel design and navigation. The tsar of Russia and the king of Norway sent geographical expeditions while whalers and sealers from South America and USA visited frequently those waters for exploitation.

Italy was at that time still looking for its identity undergoing national unification, so none of the Italian States had enough interest in those remote lands to send a mission of its own. However, unquestionable cultural roots made sure that Italian geographers and cartographers stayed in touch at international congresses or by mail with their colleagues abroad. In this way, they worked on that continent for the benefit of a limited, select public.

The first translation of the Cook's diaries dates back to 1830, while the "Carta generale dell'Antartide", which is the first Italian map of the continent, was drawn by B. Marzolla in 1842.

Italians took part in other Countries expeditions as members, or alternatively looked for a support abroad.

Giacomo Bove at the end of the 19th century didn't gain any support at home and so carried out an expedition to the sub Antarctic islands on behalf of Argentina.

Pierre Dayné, an alpine guide from the Aosta Valley, was probably the first Italian to over winter in Antarctica. He was part of the 1903-05 Charcot expedition.

Luigi Bernacchi was not exactly an Italian citizen but a Tasmanian with Italian origin, he spent the polar night of 1900 as a scientist on the Borchgrevink expedition.

It was during the fifties of the 20th century that an Italian cinematographic mission worked at the Chilean stations; the film director was Arturo Gemmiti.

During the International Geophysical Year (1957), Lieutenant Franco Faggioni carried out seismic measurements at Scott Base. In those same years Silvio Zavatti, an enthusiastic scholar of the Arctic and Antarctic, tried to organize a national polar expedition. The time wasn't ripe, but however he succeeded in visiting Bouvet Island. The Zavatti foundation is still active in collecting documents of polar interest.

It was at the beginning of the sixties when a small team of personnel from ENEA and the CNR joined a Belgian expedition for ice coring in Queen Maud Land.

In 1962 the geologist and mountaineer Ardito Desio visited the Dry Valleys and the Amundsen-Scott South Pole Station.

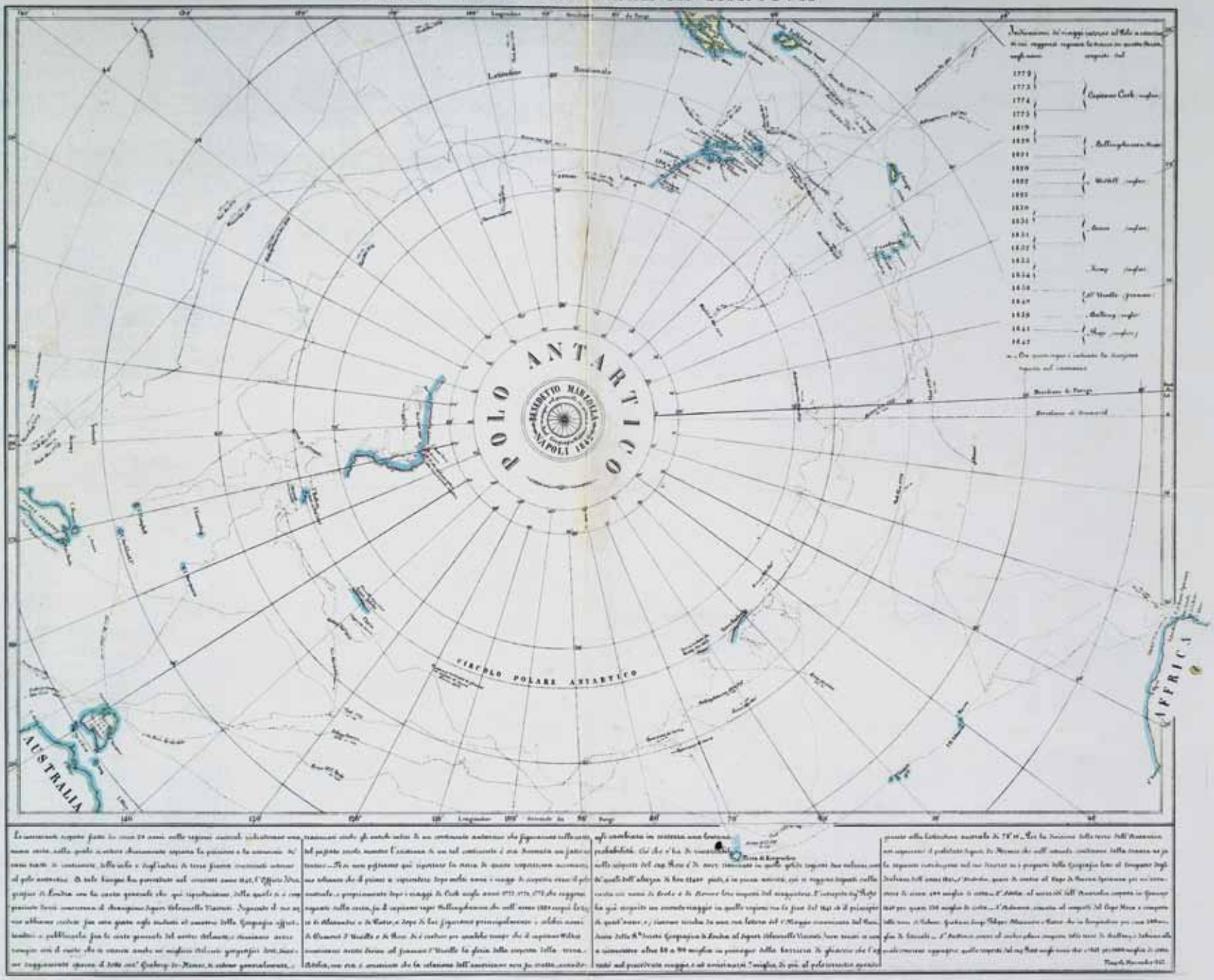
The mountaineer Carlo Mauri visited the Dry Valleys (1967) as well as a guest of the NZ expedition.

A completely independent venture was conceived by an enterprising officer of the merchant navy, Giovanni Ajmone Cat. Between the sixties and the beginning of the seventies he carried out two voyages from Italy to the Antarctic Peninsula on board of a felucca of which he was designer, owner and master. That was the first time that a vessel flying the Italian flag sailed in Antarctic waters.

All the isolated events above show that some sensitivity for the extreme south was slowly maturing in Italy, resulting in the first official expeditions.

The National Council of Research (CNR) organized three missions. The missions, although limited in resources and time, were decisive in promoting the following commitment of the government to what should eventually become the PNRA, in the eighties. The CNR's missions had to rely on the NZ Antarctic Division for support. All of them took place in Victoria Land (1968-69, 1972-73, 1975-76).

In the austral summer of 1975-76 an entrepreneur based in Milan, Renato Cépparo, devised and organized an expedition of its own, privately funded and fully self-sufficient, with the aim of carrying out scientific measurements and leaving a permanent refuge on the Antarctic Peninsula. Fifteen men were put ashore by a 900 tons displacement Norwegian vessel at King George Island where they built the station. The station however didn't last for long because soon after, it was destroyed, apparently by some Argentineans who didn't welcome such a facility in an area claimed by their homeland. The area still keeps the name Italia Valley.




*The "Carta generale dell'Antartide" drawn by Benedetto Marzolla in 1830 from an original design of the British Navy is the first Italian map of the continent.*

# THE ITALIAN NATIONAL ANTARCTIC PROGRAMME

Italy adhered to the International Antarctic Treaty in 1981. Not much later law 284 (1985) started the PNRA.

This law provided for a five-year scientific research programme with a budget of 230 billion Italian liras with the main scope, as stated in article 1, to obtain for Italy the status of Consultative Party in the Treaty.

The activities of the PNRA were put under the control of the Ministry MURST, now Ministry for Education, University and Scientific Research (MIUR), which had as consultant bodies a Scientific Commission (CSNA) and a Committee made of representatives of several ministries. ENEA was put in charge of running the Programme, acting in agreement with the CNR for the scientific content.

No mention existed in the law about continuation after the five-year term.

That's why at the end of 1991 it was necessary to pass another law (no. 380) which extended indefinitely the Italian presence in Antarctica on the basis of five-year plans.

The law provided for the possibility of carrying out scientific research in the Arctic region as well, if aimed at complementing that in Antarctica. A national museum was established to conserve and to exploit samples and results brought back by the expeditions.

The three specialized branches of the Museo Nazionale dell'Antartide (MNA) are seated in Genoa, Siena and Trieste. The MNA is presently headed by glaciologist Giuseppe Orombelli.

In 2003 the continuation of the Programme was entrusted to an association (the so-called Consorzio PNRA S.C.r.l.) of four scientific Institutions, all already active during the previous expeditions: ENEA, CNR, OGS, INGV.

OGS is the Istituto Nazionale di Oceanografia e Geofisica Sperimentale, based in Trieste. INGV is the Istituto Nazionale di Geofisica e Vulcanologia which, among many other tasks, runs the seismic stations network of Italy.

The four Institutions had different views on how to balance the budget and the Consorzio did not last for long.

As a consequence, in 2010 the management of the Programme was drawn again. After a Cabinet order of the Ministry MIUR, the CNR is presently entrusted with the general activities of programming and coordinating whilst ENEA is tasked with putting into effect the Programme.

The task of the Scientific Commission CSNA, which is to indicate the main lines the research and to evaluate the results, has been confirmed. The present membership of the Commission, chaired by Carlo Alberto Ricci, expired at the end of 2015.

To summarize, in the 30-year history of the Programme four phases can be singled out.

The first six years run according to the founding law, the continuation of the Programme under the law of 1991 (twelve years), the seven years of the Consorzio; and finally the present phase, in which the CNR and ENEA share responsibility for the Programme.

Several Ministries are involved in the fulfilment of the PNRA. The Ministry of Foreign Affairs coordinates the presence of Italy at the Antarctic Treaty and CCAMLR meetings and keeps formal relationships with the Treaties Secretariat.

The Ministry of Defence contributes in several areas. It provides for the preliminary medical and psychological screening of the expedition candidates, afterwards it provides the training under realistic conditions.

In addition it assigns seamen, alpine guides, meteorologists and other military specialists to the expeditions.

The Ministry of Defence also has specific duties such as charting (Istituto Idrografico della Marina, Genoa).


*The L-100/30 is a commercial version of the well-known C-130, which is the military version of the Hercules' family. It carries a load of 11 tons or 45 passenger from New Zealand to Victoria Land in 8 hours.*

# THE INTERNATIONAL FRAMEWORK

Here below are the main steps, which have progressively linked Italy to Antarctica.

On November 29th, 1980, the Italian Parliament passed law no. 963 by which Italy acceded to the Antarctic Treaty.
On March 18th, 1981, Italian accession became operative with the deposit of the instrument of accession with the USA Government.
On June 10th, 1985, law no. 284 started the PNRA which brought to Italy as the main political result the status of Consultative Party in the International Treaty (ATCM, October 1987, Rio de Janeiro).
From that time onwards, Italy takes part regularly in the Treaty meetings, with one of them being held at home (Venice, 1991).
Italy ratified the convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) in March 1989 and the Convention for the Conservation of Antarctic Seals (CCAS) in April 1992). It signed the Madrid Protocol on Environmental Protection, which entered into force in January 1998.
In 1988 Italy became a Full Member of SCAR. The first Permanent Delegate of Italy at SCAR was Renato Funiciello. Antonio Meloni followed him in that position.
Until 1988 one of the Working Groups of SCAR was entrusted with logistic and operations. Italy had a role in the transformation of the former WG into what has become the Council of the Managers of National Antarctic Programmes (COMNAP). The Italian representatives in COMNAP (the so-called MNAP's) have been in succession Mario Zucchelli, Nino Cucinotta, Massimo Frezzotti, and Vincenzo Cincotti.

Italy is particularly sensitive to the environment and its protection. The first activities in the continent and the construction of the Station itself at Terra Nova Bay (now MZS) took place during the mid-eighties, a period of increasing environmental awareness. It was easy for the PNRA to benefit from the longer experience of many other Countries.
At present Italy is taking care of several Antarctic Specially Protected Areas (ASPAs) in Northern Victoria Land.
ASPA #161 is a marine ASPA contiguous to MZS that extends 11 km along the coast and 7 km offshore;
ASPA #165 is on the contrary an essentially terrestrial area surrounding Edmonson Point.
Italian expeditions control and safeguard both areas (#161 and #165).
In addition there are ASPA's where Italy actively cooperates with other countries: for example with the USA for #173 (Cape Washington/ Silverfish Bay); and with NZ for # 118 (Mt Melbourne/Cryptogam Ridge).
The Italian Programme also cooperates with USA and NZ in the management of the Antarctic Specially Managed Area (ASMA) of the Dry Valleys..
Entry permits to Cape Adare and Cape Hallett areas are also released by the Italian Environmental Officer (Sandro Torcini) who also prepares the annual report on the taking of samples.
Among many bilateral or multilateral agreements signed with other Countries to carry out specific Projects, the one signed between the PNRA and IPEV of France in 1993 has an outstanding importance.
As a consequence of the agreement it has been possible to plan and to build Concordia Station, one of only three Stations year-round open on the Antarctic plateau.
The first agreement was then followed by another, focused on the joint management of the Station (October 2005).
Mario Zucchelli Station (MZS) and Concordia Station were inspected under article VII of the Treaty or article 14 of the Protocol. Inspections were carried out in seasons 1988-89, 2006-07, 2011-12.
Italy, in turn, was present in the joint team which inspected several vessels and Stations of the Peninsula in 1992-93.

*Antarctica offers breathtaking views. This photo was taken in the Dry Valleys,*
*from the ridge of the University Valley. In the foreground the Beacon sandstone of the Paleozoic Era.*

# ANTARCTICA AND THE WORLD

**CP =** Countries (29) with the right of voting in the Antarctic Treaty (Consultative Party)
**NC =** Countries (23) adhering to the Treaty (Non Consultative Party)
**IS=** Initial signatories of the Treaty (12)
**CL =** Claimant Country (7)
**FM =** Full Member of SCAR (31)
**AM =** Associate Member of SCAR (8)

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|---|---|---|---|---|---|---|
| ARGENTINA | CP | | IS | CL | FM | |
| AUSTRALIA | CP | | IS | CL | FM | |
| AUSTRIA | | NC | | | | |
| BELARUS | | NC | | | | |
| BELGIUM | CP | | IS | | FM | |
| BRAZIL | CP | | | | FM | |
| BULGARIA | CP | | | | FM | |
| CANADA | | NC | | | FM | |
| CHILE | CP | | IS | CL | FM | |
| CHINA | CP | | | | FM | |
| COLOMBIA | | NC | | | | |
| CUBA | | NC | | | | |
| CZECH REPUBLIC | CP | | | | | AM |
| DENMARK | | NC | | | | AM |
| ECUADOR | CP | | | | FM | |
| ESTONIA | | NC | | | | |
| FINLAND | CP | | | | FM | |
| FRANCE | CP | | IS | CL | FM | |
| GERMANY | CP | | | | FM | |
| GREECE | | NC | | | | |
| GUATEMALA | | NC | | | | |
| HUNGARY | | NC | | | | |
| KAZAKHSTAN | | NC | | | | |
| INDIA | CP | | | | FM | |
| IRAN | | | | | | AM |
| ITALY | CP | | | | FM | |
| JAPAN | CP | | IS | | FM | |

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|---|---|---|---|---|---|---|
| KOREA (DPRK) | | NC | | | | |
| KOREA (ROK) | CP | | | | FM | |
| MALAYSIA | | NC | | | FM | |
| MONACO | | NC | | | | AM |
| MONGOLIA | | NC | | | | |
| NETHERLANDS | CP | | | | FM | |
| NEW ZELAND | CP | | IS | CL | FM | |
| NORWAY | CP | | IS | CL | FM | |
| PAKISTAN | | NC | | | | AM |
| PAPUA NEW GUINEA | | NC | | | | |
| PERU | CP | | | | FM | |
| POLAND | CP | | | | FM | |
| PORTUGAL | | NC | | | | AM |
| ROMANIA | | NC | | | | AM |
| RUSSIAN FEDERATION | CP | | IS | | FM | |
| SLOVAK REPUBLIC | | NC | | | | |
| SOUTH AFRICA | CP | | IS | | FM | |
| SPAIN | CP | | | | FM | |
| SWEDEN | CP | | | | FM | |
| SWITZERLAND | | NC | | | FM | |
| TURKEY | | NC | | | | |
| UKRAINE | CP | | | | FM | |
| UNITED KINDOM | CP | | IS | CL | FM | |
| UNITED STATES | CP | | IS | | FM | |
| URUGUAY | CP | | | | FM | |
| VENEZUELA | | NC | | | | AM |

*Sources: 38 th ATCM (Sofia, 2015) ; XXXIII SCAR (Auckland 2014)*

*Several penguin roockeries are found in the coastal area of the Mario Zucchelli Station (MZS).*
*A huge Emperor Penguin colony is located near Cape Washington.*

# THIRTY YEARS OF COMMITMENT

*Following the approval of the law, which set up the National Programme for Research in Antarctica, and up to austral winter 2015, thirty national scientific campaigns were carried out, a permanent station was established in Antarctica, a European co-operation was activated for operating a new station on the plateau, and many scientific and technological activities have been carried out.*
*Details can be found in the annual expedition records, in the reports to SCAR, and in the exchanges of information under Art.VII of the Antarctic Treaty. Here below a few facts, which, characterize the individual expeditions are recalled. They are mostly logistical achievements. For the scientific achievements, which fall under the CNR's competence, other publications should be consulted.*


**The first expedition** (1985-1986) to Terra Nova Bay has the goal of identifying a site suitable for the establishment of the permanent Station; the second goal being to carry out a preliminary scientific survey in the area. To this purpose a charter vessel, the Norwegian Polar Queen, sailed from Genoa with a team of 29 aboard. In the meantime some personnel of the Italian Programme associated with the Argentinean and Australian national expeditions in order to visit their Stations and gain experience.

**The second expedition** (1986-1987) accomplished the building of the Station, or more exactly what would become the main core of it. The construction process mainly consisted of assembling the units (modified ISO 20 containers) previously prepared in Italy. Research activities grew considerably. The results achieved allowed Italy to be admitted as a Consultative Party of the international Antarctic Treaty (October 1987).

**The third expedition** (1987-1988) was aimed at extending both the Station facilities and the scientific research, especially in marine biology, (the first oceanographic campaign in the Ross Sea is carried out) and in geophysical marine prospecting. For Geophysics, the vessel Explora carried out her first campaign. She is subsequently acquired by the Experimental Geophysical Observatory of Trieste and renamed OGS Explora.
In September 1988, during the XX SCAR Meeting held at Hobart (Australia) Italy becomes a member of SCAR

On **the fourth expedition** (1988-1989), the Station at Terra Nova Bay is further expanded while the research activities are especially active this season in the Earth Sciences.

On **the fifth expedition** (1989-1990), a major investigation is carried out again in the field of biological oceanography (Ross Sea) and in geophysics (Weddell Sea and Ross Sea). The astrophysical observatory OASI is installed. New facilities are the Digital Vax 3800 processor connected either via satellite or short waves to the ENEA-Casaccia Centre (Rome) and the receiver terminal for AVHRR signals which convey information on the sea-ice coverage.

The **sixth expedition** (1990-1991) sees the remarkable success of a long marine geological campaign, the collection of meteorites, and an accurate measurement of local gravity. A new logistical facility is installed, consisting of an automatic unit for the operational control of scientific observatories (five at that time). The unit allowed for the fully automated collection, processing and transmission of data to Italy, also during the austral winter. The fuel tank capacity of the Station, which was already 600 cubic meters, is doubled by the construction of a twin 600 cubic meter reservoir.

*Meteorites hit continuously the Earth everywhere since millions of years. Most of them are lost. However, surprisingly enough, there are places in Antarctica where meteorites tend to concentrate. One of the so called meteorite traps is found at the Frontier Mountain in North Victoria Land. Here the black body in the foreground is a meteorite. The skilled hunters distinguish it easily from rock fragments coming from outcrops nearby.*

# THIRTY YEARS OF COMMITMENT

**The seventh expedition** (1991-1992) is the conclusion of the first Italian multi-year research plan. It is rather scanty in terms of people and duration. Accordingly the work at Terra Nova Bay is focussed on observatory activities. During the course of the expedition, Terra Nova Bay is visited by a US tanker and it was possible to fill up the kerosene reservoirs of the Station, to store more than one million litres.

**The eighth expedition** (1992-1993) should heralded new multi-year plan, but - due to a delay in financing – it turned out to be a limited one. Data were gathered from the observatories; in addition, the airborne magnetic survey GITARA (German Italian Aeromagnetic Research in Antarctica) was carried out. An Italian-French mission goes for 350 km onto the glacial plateau from the Ross Sea towards Dome-C, using tracked vehicles. The Italian representative Pietro Giuliani visits several Stations of the Antarctic Peninsula as a member of an inspection team under the provision of the Antarctic Treaty.

**The ninth expedition** (1993-1994) had a rather multidisciplinary character, with the main emphasis on Earth Sciences. A series of geophysical surveys (traverses) are performed both on land and sea at 76° latitude south. Some geological and glaciological research programmes are successfully concluded; among them the investigation of the Lanterman Range turned out to be a particularly painstaking job. A team of glaciologists obtained a new collection of meteorites. A sledge convoy, left from the French Station Dumont d'Urville, and succeeded in reaching Dome-C, more than 1000 km from the coast.

**The tenth expedition** (1994-1995) involved a large number of people, it was the largest Italian expedition to date, showing the management maturity achieved after ten years of experience. The expedition had an oceanographic flavour, with research work in the Ross Sea aimed at ecology (ROSSMIZE, i.e. Ross Marginal Ice Zone Experiment) and climate. The research ship OGS-Explora performed a geophysical survey from the Antarctic Peninsula to the Chilean coast. In collaboration with Australian biologists, research was started on the penguin colony at Edmonson Point. With the setup of base camp, the Cape Roberts Project began. The Project was an international collaboration on paleoclimate entailing seabed drillings. A first air delivery of goods (no landing) was made to restock the teams operating at Dome-C and in the Lanterman Range.

**The eleventh expedition** (1995-1996) was essentially the continuation of programmes begun in the previous years, with relevant developments in terrestrial biology (the BIOTEX international programme), glaciology and climatology (preliminary surveys before ice coring at Dome-C). In the framework of the EUROMET programme Italy provided the European community with a new collection of meteorites. In addition to the usual logistical support given by helicopters, the light aircraft Twin Otter was employed by the PNRA for the first time.

**The twelfth expedition** (1996-1997) concentrated upon international agreements with priority given once again to Earth Sciences. The construction of the French-Italian Concordia Station at Dome-C was planned and the deep ice drilling, as part of EPICA, the European Programme for Ice Coring in Antarctica, began. The coring of marine sediments by means of a rig installed directly onto the pack ice commenced offshore of Cape Roberts.

**The thirteenth expedition** (1997-1998) was marked by bad weather, which affected many activities. An oceanographic campaign was carried out with the scope of understanding some aspects of the Southern Ocean, in particular the interactions between sea-ice and the atmosphere, and the ecology and biochemistry of the seawater. Research into different fields of biology were conducted. The C-130 and the light aircraft Twin Otter played a more important logistic role. A new (the third) 600 cubic meter fuel reservoir was built at TNB. It was filled up with Jet A-1 by the R/V Italica at the beginning of February.

# How to get there?


*Mario Zucchelli Station (MZS) is reached directly by air from Christchurch and by sea from Lyttelton (NZ). However, the MZS opening flight at the beginning of the summer season lands at the US McMurdo Station. Concordia Station is reached both by light aircrafts departing from MZS and by land convoys departing from the French Dumont d'Urville Station. DdU is in turn reached by a vessel sailing from Hobart. The airstrip at Casey (Wilkes Land) is also gaining importance.*

*(Courtesy of ESA, modified).*

# THIRTY YEARS OF COMMITMENT


During **the fourteenth expedition** (1998-1999) drilling operations on the ice cap at Dome-C reached the depth of 786 meters, however the drill got stuck at this depth. Other activities go on at Dome-C as well: among them a special telescope makes a preliminary measurement of the cosmic background radiation. At Cape Roberts the drilling of rocks and sediments under the sea bed brings up cores totalling 625 m for the studies of past tectonics, volcanism and climate. At McMurdo, the 260 hours flight of the stratospheric balloon of the BOOMERanG Project ends successfully and the payload is recovered. As the name of this Italian-US joint programme suggests (Balloon Observation Of Millimetric Extragalactic Radiation and Geophysics), data relevant to the origin of galaxies and to the Earths magnetic field were collected. The acronym also reminds us that the balloon was meant to return to the launching site after circling Antarctica, something that it had done by the end of the flight. In the framework of the Airborne Polar Experiment (APE) the stratospheric aircraft Geophysica M55 performs several test flights. The Russian made aircraft is equipped with instruments for the study in situ of ozone depletion. The ITASE team carries out a morphological, geophysical and thermal survey along a 1152 km route between TNB and Dome-C. Along the path the team obtains several shallow ice cores.

At the beginning of the expedition, a group of 21 politically distinguished people from different countries visit TNB under the framework of the NZ initiative called "Ministerial on Ice".

During the **fifteenth expedition** (1999-2000) the Cape Robert Project came to an end reaching a final depth of 940m, a record for Antarctica. The APE GAIA Programme carries out 5 stratospheric flights inside the polar vortex. The aircraft was equipped with 13 instruments to perform complementary analyses. The team, 100 people of 12 different countries, was based at the airport of Ushuaia. At Dome-C a second perforation in the ice was started anew because it was impossible to recover the drill stuck in the first hole. The British TV broadcaster the BBC, in cooperation with the Italian network RAI, worked at Edmonson Point to make a documentary film on the penguin colony and the research going on there. The scientific Italian programme for the season 1999-2000 was the first of a three-year plan approved after consultation of an international referee body.

Low temperatures at TNB (-25°C) and mechanical troubles with the C-130 aircraft characterised the beginning of the 2000-01 **sixteenth expedition**, so that activities such as a geological camp at Cape Hallett had to be put off until the following year. On the other hand the automatic system PAT, besides collecting data, activated the pre-heating of the Station by switching on the main electric generators two weeks before the arrival of the expedition members, thus easing the start-up of operations. During the winter, PAT provides - totally unmanned - electric power, a computerised data management and a satellite link with Italy. The Italian ambassador to New Zealand visited the Station , as did two members of the Italian Parliament, a journalist of an outstanding Italian newspaper and two tourist vessels. An oceanographic campaign is carried out on board the R/V Italica, the main programmes were: Pied, connected with the biology of the surface waters and the effect of UV radiation; Bioseso II, an interdisciplinary project in hydrography, chemistry and sedimentation; and Clima, which operated under the framework of international programmes (WOCE and IPAB).

*Two light aircrafts Twin Otter wait at night on the fast ice in front of Mario Zucchelli Station. In the photo the round temporary shelter "apple" (bottom left) and the air strip (center) are also visible. In the background, the volcano Mount Melbourne.*

At Dome-C the ice coring went on, reaching the depth of 1460m; on the surface two cylindrical metal frames for the permanent Station Concordia were erected.

**The seventeenth expedition** (2001-02) should be regarded as the conclusion of a three year scientific programme. The activities were the continuation, and whenever possible the conclusion, of previous expeditions, with some emphasis on life sciences. A new cruise in the Ross Sea was carried out to continue research in oceanography, biology and marine geology.
The structure of Concordia Station at Dome-C was completed. Further ice drilling was performed there, and the overall length of the ice core eventually obtained exceeded 2800 m. The regions north of TNB and around the remote field camp of Cape Hallett were investigated using a multidisciplinary approach covering geomorphological, geological, and


geophysical (airborne) observations. The M/V Hesperides, in the framework of an Italy--Spain co-operation, performed a high resolution seismic survey along the western coast of the Antarctic Peninsula. As part of the ITASE programme, new traverses linking the sites of TNB, Dome-C and Talos Dome were made. Data were continuously recorded from observatories and periodically retrieved from oceanographic moorings. Meteorites were collected once more; among the 153 specimens recovered one weighed about 5 kg.

During the **eighteenth expedition** (2002-03) work continued on Concordia Station where the skeleton and the roof of both buildings were installed, the plants and inner parts were left for the following summer. A stone's throw from the Station, the deep ice coring carried out for the European Project EPICA reached the depth of 3201 metres. North of Terra Nova Bay and around Cape Hallett a new campaign of geological studies was performed. ITASE, the Programme for a continental scale survey of the ice cap, collected data in the triangle TNB - Dome C - Talos Dome on paths totalling 1600 km.

In 2003, the task of putting into effect the National Programme was taken over by the newly born Consorzio PNRA. **The nineteenth expedition** (2003-04) was accordingly the first expedition launched under new management. It came out as a demanding one, both in terms of expedition numbers (308) and remote camps set up (9). The M/V Italica carried out two return voyages to TNB while the geophysical vessel OGS-Explora accomplished two legs, a third one was cancelled due to damage to the ship. Support was given to research teams from the US (at Edmonson Point) and NZ (at Cape Hallett).
At the end of 2003 Mario Zucchelli passed away. He was the Consortium's Chairman and a tireless, enthusiastic promoter of almost all of the previous story.

During the **twentieth expedition** (2004-05) EPICA's drilling activity reached the bed rock at a final depth of 3270,20 meters where the age of the ice was almost one million years old. In the meantime, Concordia Station was completed so that starting with the austral winter of 2005 the Station became continuously inhabited, during summer and winter. The first French-Italian crew was made up of 13 people. At TNB Station, now renamed after Mario Zucchelli, a new incinerator for a better treatment of waste becomes operative. Here the earlier break-up of the fast ice forced the diversion of some C130 flights to McMurdo's airfield.

Also the **twenty first expedition** (2005-06) suffered from short lived fast ice, so that aircraft operations could only occur at the bottom of the Gerlache Inlet. Four Twin Otter aircraft were serving MZS that season, two chartered by PNRA with two more supporting international projects. Among the seven seasonal remote camps, the one at Talos Dome for ice coring stands out because of its size: a team of 18 people


*Temperatures at Dome-C, where the French-Italian Station is situated, go often down to -70°C.*

and 76 days of activity. The new crew of Concordia, which spent the winter of 2006, was only 10 people.
The OGS-Explora carried out a geophysical survey off Oates Land and was refuelled by Italica. A series of geophysical surveys was also obtained with the support of the vessel Strakhov in the area around Bouvet Island where three oceanic ridges meet (triple point).

From the twenty-second (2006-07) to **the twenty-fourth** (2008-09) expedition, the PNRA's budget shranks progressively. At the beginning, materials, instruments and contingency funds left over from previous years allowed mitigation of budgetary constraints; nevertheless, it was necessary to cut the size of the expedition progressively from 139 members to 105, then 88. Similarly, the opening period of MZS was shortened from 110 days to 96, then 64. The ratio of scientific personnel/ support personnel decreased, as a reduction of the logistic staff under a critical number was not feasible.
Under these expeditions the M/V Italica is used essentially for transporting to and from Terra Nova Bay goods and personnel, her scientific activity was limited to maintenance of the oceanographic instruments at sea (moorings) and to dropping data transmitting buoys. Italica was not chartered for the 24th expedition. The activities at Concordia and the Project Andrill, bound by international agreements, continued with no relevant cuts. In the Project Andrill, Italy joins, with a share of 20%, Germany, NZ and USA, in the common effort to sample the sea bottom in the area of McMurdo Sound. Two deep drillings were carried out, one from the ice shelf, the other from the sea ice. The Project had an overall cost of about 20 million euro and was mostly accomplished during the 22nd and 23rd expeditions.

During the **twenty-fourth expedition** Concordia, which had been already inspected under the provision of the Antarctic Treaty (22nd expedition) was visited again by a delegation of the Principauté de Monaco. On the small wharf of MZS, which was repaired and reinforced after a violent sea storm during the 23rd campaign, a new crane was installed for loading/unloading the barges and for hauling the boats. One of them, the Malippo, weighs about 27 tons. Among the scientific activities preserved in spite of the budget cuts, the geophysiscal and meteorological observatories collected data with no interruption and two new GPS stations for the detection of slow crustal movements were installed.

The **twenty-fifth expedition** (2009-10), with about 100 members, saw the continuation of most of the previous Projects. Mario Zucchelli Station was opened in November with the usual support of the US Antarctic Programme, which allowed the first seasonal landing on the continent and transport from McMurdo to TNB. The cost of naval support was abated by sharing the M/V Italica with the German BGR Institute (Hannover). By unloading 1600 cubic meters of fuel at MZS, stocks were resupplied. A light aircraft links MZS with Concordia. With the first flights it allowed the homecoming of the team of 12 which had spent the winter 2009 while sending up the new crew for the sixth over wintering (2010, or DC6).

In 2010 the Consorzio PNRA stopped acting as the Programme's manager. The budget allocation was raised to 18 million euros: allowing **the twenty-sixth expedition** (2010-11) to recover its usual size. 149 people attend the expedition, MZS was open for 103 days, with summer activities at Concordia lasting 83 days.
A new collaboration began with the Korean Antarctic Programme which was going to build the scientific Station Jang Bogo in the neighbourhood of MZS. In the framework of such a collaboration some members of the Italian expedition, which lacked naval support, returned to NZ aboard the Korean icebreaker Araon.
The French vessel L'Astrolabe was delayed due to a broken propeller. As a consequence the supply trips over the ice (traverses) to Concordia were reduced from three (as planned) to two. A new search of meteorites collected 117 specimens.

The **twenty-seventh expedition** (2011-12) found damage at MZS due to a severe winter. In addition, there were delays in funding which caused delays in drawing up of contracts, e.g. charters, with negative fallout on the scientific programmes, particular in biology, which are heavily dependent upon an appropriate seasonal window.

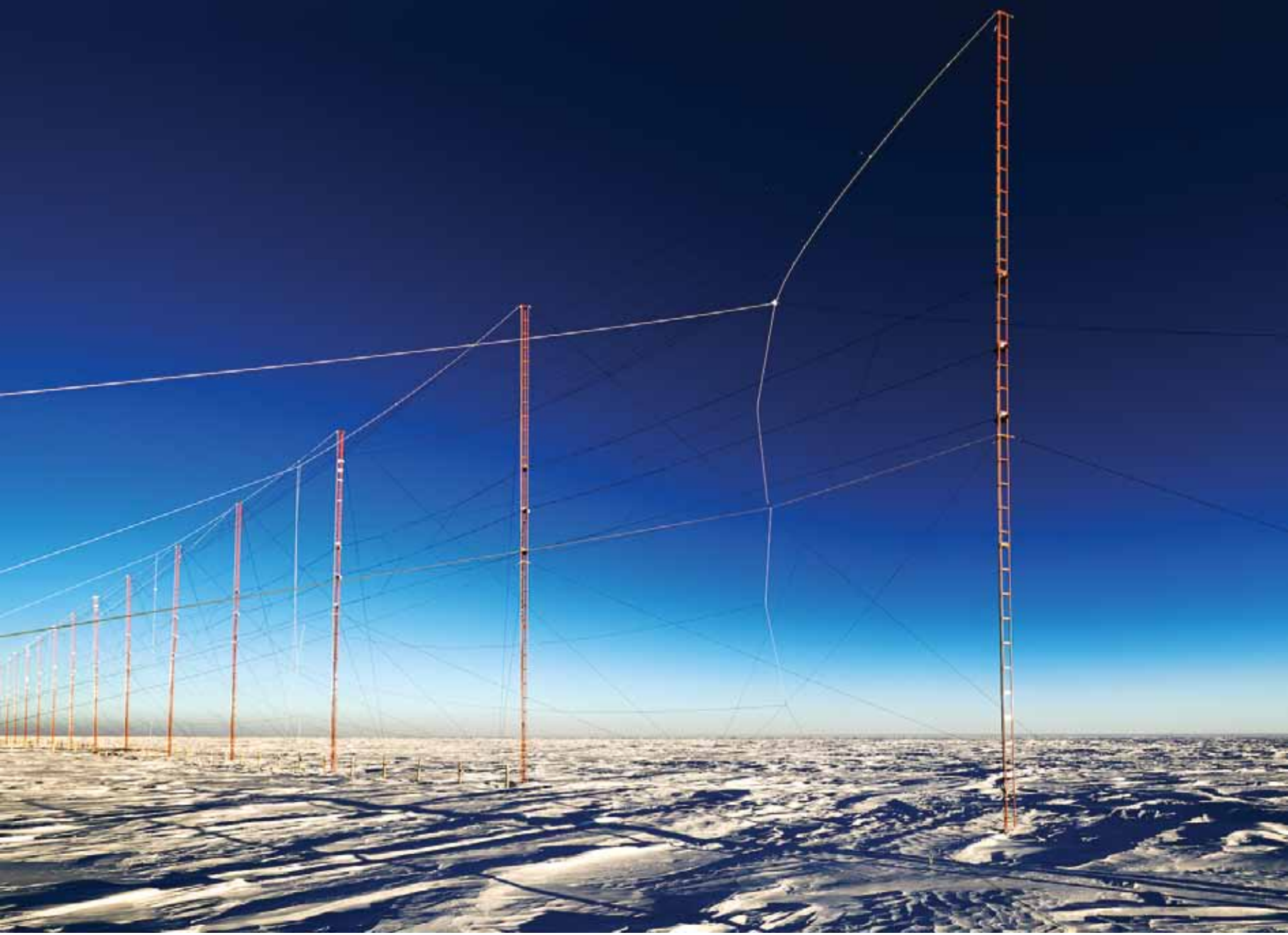
*Emperor penguins surround the aircraft just arrived. The DHC-6/300 Twin Otter, equipped with skis, is particularly suited for intracontinental flights, e.g. from the coast to Dome-C. It carries one ton load or 8 passengers.*

# THIRTY YEARS OF COMMITMENT

To obtain complete air support it is necessary to draw up 7 different contracts. The size of the expedition was large in terms of both number of participants (186) and duration.
Concordia was fitted with a large parabolic satellite antenna, which allowed a data connection speed of 512 kb/sec.

The **twenty-eighth expedition** (2012-13) was similar in size to the previous one. The scientific activity was substantially a continuation of the 27th. Air activity was quite busy, recording 6 round trips from NZ to Antarctica by the Hercules and many flights of the Twin Otters.
A couple of minor accidents to the T.O.'s required that an additional aircraft be sent to the Italian expedition via South Pole Station. Unfortunately, this aircraft crashed while flying to MZS, with the loss of the crew of 3. At the same time the Wissard Project, which drilled from the ice surface down to the subglacial lake Whillans, reached the water. The lake is shallow and buried under 800 meters of ice.
Samples collected by an Italian scientist were sent home for analysis.
The collaboration with the Korean group which was building the new Station Jan Bogo in the vicinity of MZS became relevant.
In the outskirts of MZS, a survey ultimately aimed at the construction of an air strip on the ground continued. If the project is successful it would make possible the landing of long-range cargo/passenger aircraft.
**The twenty-nineth expedition** (2013-14) was the first of the new triennial plan. It took advantage of full air support in addition to the support of M/V Italica. This year the vessel was equipped with a new Vsat antenna. The scientific programme of marine biology was delayed by the impossibility of using the landing jetty that was damaged by rough sea in the spring. Afterwards, a scuba-diver biologist, Luigi Michaud, loses his life in the waters of MZS.
This was the first fatal accident ever suffered by the Italian Programme. It understandably made a grim mark on the expedition.
The Project GV7, a contribution to a larger international effort to understand the climate of the last 2000 years, went on successfully: at a remote field camp, 500 km from MZS and 1900 m above sea level, shallow samples of snow and ice were obtained. MZS stays open for 114 days and closes on 14th February 2014. The last flight from Concordia leaves the Station on the 9th of February: from that time the Station was cut off for the tenth consecutive winter season (DC10).

**The thirtieth expedition** (2014-15), in line with the previous one, put an emphasis on marine biology at Terra Nova Bay. Meso - and top-predators such as the Adelie penguin, Weddell seal and killer whale are studied with regards to their populations, impact on the trophic chain, and migration. Seals are sampled and released, whales are followed with satellite transmitters up to New Zealand. The biodiversity of the benthos was studied along with the effects of ocean acidification.
Sediment dynamics were studied at the West Antarctic Rift System. Meteorites (41) are collected at Mt DeWitt and in other areas. At Concordia some maintenance was necessary for the SuperDARN station (HF radar) which operates jointly with similar systems for the bipolar study of auroral phenomena.
A sophisticated spectrometer (CASPER) measured the atmospheric emissions in the bands useful for the future QUBIC telescope. All observatory activities both sites (MZS and DC) go on as usual, including the assessment of pollutants.
The thirty years of Official Italian activities in Antarctica were celebrated in Rome with an exhibition and a scientific symposium.



*SuperDARN stands for Super Dual Auroral Radar Network. The network consists of more than 30 low-power HF radars that look into the Earth's ionosphere at polar regions to provide information relevant to communication systems, GPS and power grids. The radar in the photo is the one operating at the French-Italian Station.*

# MARIO ZUCCHELLI SCIENTIFIC STATION

The site chosen for the permanent Italian base was Terra Nova Bay, a bay that is often ice-free, about 60 km long, and lies between Cape Washington and the Drygalski ice tongue, on the coast of Northern Victoria Land. The Station was called Baia Terra Nova until 2004 and is found at the following -coordinates: 74° 41' 42" S, 164° 07' 23" E.

The Station is built right on the shore, on a granite rocky peninsula with a north-south orientation. At the back of the Station, the Northern Foothills rise gently. Deep water is found in the Gerlache Inlet. The area with buildings has easy access to and from the sea from both the east and west sides.

The small inlet on the east shore is particularly suited for unloading cargo at the beginning of the season, when the sea is totally covered with ice. The shore of Tethys Bay in the Gerlache Inlet is an alternative landing place.

On the north-east side of the coast there is a small cove, from which sea water is taken for desalination. The sewage is discharged after being treated, in a cove further south.

The Station has the following main facilities/ functions:

- housing personnel during summer expeditions
- supporting summer parties operating in remote areas
- maintaining laboratories and equipment for scientific research
- housing the management, service, and technological plants
- Stop-over for parties bound for Dome-C.

Present needs mean that the base is approximately 7500 square metres of covered surface.

The available space is assigned as follows:

- 2400 square metres as labs (chemistry, biology, geology, electronics and computing, observatories, etc.), aquarium, offices, telecommunication stations, operational control centre, sick-bay and first-aid, library, canteens, lounge and leisure area;
- 600 square metres for accommodation of approximately 70 people;
- 650 square metres for technical service equipment (i.e., power station, fresh water plant, incinerator, water-treatment plant, gasoline pump, helium and nitrogen liquefying plant);
- 720 square metres for carpentry, electrical and mechanical workshops;
- 3200 square metres for storage of goods and heavy equipment.

There are three double-walled tanks for fuel storage (total volume of 1800 cubic metres), three helipads and a jetty for mooring boats. The Station has an electrical power station with four diesel generators (two x 375 kVA and two x 175 kVA), and is equipped with an uninterruptable power supply.

Another diesel generator is used for the jetty crane power supply (300 kVA).

Finally, the Station possesses about 50 vehicles for all types of services.

These include cranes, excavators, caterpillar tracked vehicles, trucks, pickups, fire engines, and a road roller. In addition, there are about 30 specialised vehicles for ice and snow operations.

For activities at sea, two 15 m oceanographic vessels and 6 rubber-dinghies of various sizes are available. When the main cargo/ research vessel is in the bay, as can happen in the summer, additional boats and barges are available.

01) Crew accommodation
02) Bunk rooms
03) Recreational club
04) Boat shelter
05) Garage for vehicles
06) Carpenter shop
07) Electrical workshop
08) Vehicles workshop
09) Machine tools workshop
10) Fire House
11) Helicopters' hangar
12) Warehouse
13) Camping gears store
14) Laboratories and offices
15) Store room
16) Kitchen and canteen
17) Living room
18) Operations room
19) Staff housing
20) Aquarium
21) Desalination plant
22) Rock processing workshop
23) Back up power station
24) Main power station
25) Cogeneration
26) Heat generator
27) Helium liquefier
28) Nitrogen liquefier
29) Computer room
30) Refrigerated store (scientific samples)
31) Fuels (filling station)
32) General warehouse
33) Waste Incinerator
34) Wastewater treatment plant
35) Compactor for plastic waste
36) Waste containers
37) Satellite communication antenna
38) Dock crane power generator
39) Dock crane control room
40) Pier
41) Helipads
42) Laboratories (geophysics and astrophysics)
43) Laboratory (meteorology)
44) Warehouse (raw materials)
45) Fuel tanks
46) Sea water intake

# CONCORDIA SCIENTIFIC STATION

Dome Charlie, or Dome-C, is nothing more than a large gently elevated area on the boundless frozen Antarctic plateau. Here, at 1200 km from the coast and 3230 m above sea level, a deep ice core in the framework of the EPICA Project was recovered. This site was selected because of the large thickness of the ice cap, the low snow accumulation rate and because at this dome the ice hardly moves, all of which are favourable conditions for drilling into ancient ice. The drilling activity was supported by a field camp made of temporary buildings and tents. Although drilling activity has now finished (since 2005) the camp still exists and provides some lodgings and working facilities during the summer for about 50 people, the majority of which are French and Italian. The total area of the camp is 1500m$^2$. Power is provided by two 174 kVA diesel electrical generators. Fresh water is obtained by melting the snow. Long range communications (voice and data) are made via two Inmarsat stations.

Not far from the summer camp, at 75°06'S, 123°21'E, is located the French-Italian scientific Station Concordia. It was opened 15.02.2005 and has been permanently open since then. Concordia is one of the most isolated human communities in the world; the nearest human contact is at Vostok Station, 600 km away. The crew are completely isolated for nine months of the year. Living conditions are made particularly harsh by the low humidity and cold, the mean temperature being around -50°. The atmospheric pressure is low, as a consequence the oxygen available is thirds less than at sea level.

The Station is made of two main buildings (towers) joined by a sheltered passage. Each tower is a cylinder, roughly speaking, with the following dimensions: diameter 18.5 m, height 11 m. However, the total elevation above the ice surface reaches 14.5 m because six large hydraulic pylons on iron feet support each tower (totalling 200 tonnes). The feet and pylons are to counteract movement in the ice.

One of the towers is designated "quiet", the other "noisy", according to the usage. Each tower has three floors, each floor has an useful surface of 250 square meters.

The typical crew in winter is made of 16 people. Two electrical generators supply the Station with 200 kW of power, and a third generator is kept as back up. Water from cooking and washing is recycled. Sewage Waste is treated in a special composter.

Concordia Station hosts several scientific activities on atmospheric sciences, astrophysics, seismology, human biology and past climate. Most of them were started after taking advantage of the summer camp facilities, which remain available in winter as an emergency shelter to the main towers of Concordia.

ESA and NASA have identified Concordia as a relevant Earth-based analogue for space missions, and the research on medicine, psychology, as well as technologies for recycling water are of particular interest.

*The French-Italian Concordia Station, 75°06' S, 123°21'E, is about 1000 km from the coast and more than 3000 m asl. It is an ideal site for astronomical observations.*

# CONCORDIA STATION - D

## ANTARCTIC ICE CA

75°06' S - 123°21' E

Snow taking are

Footpath to the "American Tower"

astronomical lab

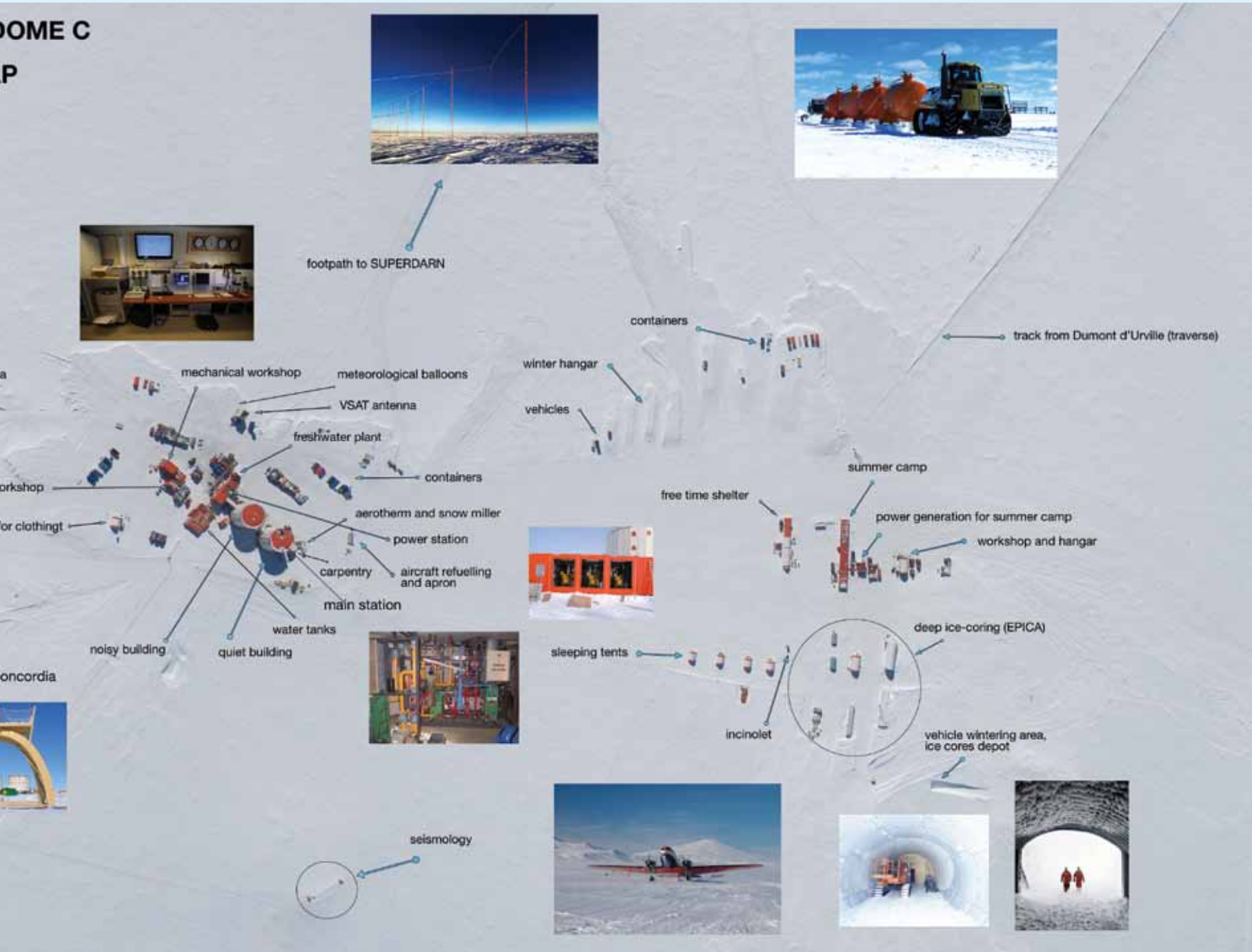
COCHISE Telescope

ITM telescope (IRAIT)

star photometer

Shelter lab, Atmospheric Physics


area for astronomy


OME C
P
footpath to SUPERDARN
containers
track from Dumont d'Urville (traverse)
winter hangar
vehicles
mechanical workshop
meteorological balloons
VSAT antenna
freshwater plant
containers
aerotherm and snow miller
power station
carpentry
aircraft refuelling and apron
main station
water tanks
noisy building
quiet building
summer camp
free time shelter
power generation for summer camp
workshop and hangar
deep ice-coring (EPICA)
sleeping tents
incinolet
vehicle wintering area, ice cores depot
seismology

# VESSELS AND AIRCRAFTS

The Italian Programme doesn't own any of the vessels or aircrafts it uses presently or has used in the past. Everything is obtained under charter, i.e. with crew and maintenance included.
The first expedition to Terra Nova Bay was supported by the Norwegian vessel Polar Queen. M/V Finnpolaris was then used the following two seasons, when she unloaded all the parts for the new Station. The Dutch vessel Barken, was used for the two successive expeditions. In the meantime other vessels, the Cariboo and Polar Queen again, were also chartered to carry out a marine biology survey programme. From 1990 until now, naval support is assured by use of the M/V Italica, which is classified as general cargo vessel.
In addition to the ships listed above, the research vessel OGS-Explora, which is entirely owned by the Italian OGS Institution and flies the Italian flag, was used by the PNRA to carry out a geophysical survey programme, which was completed in 10 expeditions. (see the table). The specifications of the vessels are outlined below.

The M/V Italica, is 130 meters long from bow to stern, with a beam of 17 meters and has a gross tonnage of 5800 tons. She has been modified to transport goods and expedition members, as well as being able to support some oceanographic research. She can now carry 800.000 litres of fuel Jet A-1 in her tanks, which is about twice the annual consumption of MZS. Usually Italica sails from the port of Ravenna on the Adriatic Sea and reaches in about five weeks the austral ports of Hobart (Tasmania), or more often Christchurch (NZ). Instead of the shorter route through the Red Sea, the route through the Panama Canal is now preferred. From NZ to MZS is an additional 3000 km partially through pack ice that may require ten or more days of navigation.

The specialized vessel OGS-Explora has a tonnage of 1400 T, a length of 70 m, and a beam of 12m. She is fully equipped to prospect the geological layers of the sea floor by using multichannel seismographs, together with local gravity sensors and magnetometers. Additional sampling devices on board support a variety of biological or oceanographic research. Echo-survey devices such as multibeam and sub-bottom profilers provide sea bottom imaging.

# VESSELS AND AIRCRAFTS

The air link from New Zealand to Antarctica is operated by an L-100/30 Hercules cargo/ passenger aircraft. The L-100 is the commercial version of the most famous C-130, which is the military version of the Hercules family. The L-100/30 can carry a load of 11 tons or 45 passengers. For about ten years the Italian Air Force put a C-130/H at the expedition's disposal. Afterwards the aircraft was chartered from a South-African Company.
The Hercules can land onto the fast ice in the neighbourhood of MZS with two important constraints.
1-The first group of the expedition that opens the Station after winter and readies the sea-ice landing strip for flight operations, has to reach Terra Nova Bay in advance.
Until now, this was done with the support of the US Programme, which allows the first seasonal landing at the McMurdo air field.
2--The airstrip on the sea-ice is safe for only about one month (November).
That sets an upper limit of the number of return flights to about ten per season.
This highlights the relevance of the project, presently under way, to provide MZS with a permanent ground based airstrip.

Intracontinental airfreight is carried on flights connecting Concordia, Dumont D'Urville, McMurdo and Mario Zucchelli Stations. These are carried out using lighter aircrafts such as the Twin Otter DHC-6/300 or the Basler BT-67, which have skis on their landing gear. On the routes from MZS to Concordia or to DDU the Twin Otter can transport a one ton load or 8 passengers; the second, derived from the historical DC-3, has more than twice the capacity.
These aircrafts, are usually operated by a Company based in Canada, and reach the operational zone by flying a few legs over the Antarctic Peninsula.

For the short or medium range operations, helicopters are used.
They are usually the AS-350/B2 Squirrel, in a numbers typically ranging from two to four per season.
A Squirrel can carry 5 passengers or an equivalent cargo.
The cargo, for a short range at sea level, can be up to one ton if it is carried beneath hanging from a barycentric hook.

| EXPEDITION n. | I | II | III | IV | V | VI | VII | VIII | IX | X |
|---|---|---|---|---|---|---|---|---|---|---|
| **AUSTRUAL SUMMER** | **1985-86** | **1986-87** | **1987-88** | **1988-89** | **1989-90** | **1990-91** | **1991-92** | **1992-93** | **1993-94** | **1994-95** |
| **PERSONNEL** | 40 | 70 | 148 | 169 | 243 | 247 | 89 | 33 | 225 | 340 |
| **VESSELS** | Polar Queen | Finnpolaris | Finnpolaris OGS Explora Polar Queen | Barken OGS Explora (E) | Barken OGS Explora Cariboo | Italica OGS Explora Cariboo | Italica OGS Expora | ----- | Italica OGS Explora Ak. Strakhov | Italica OGS Explora |
| **HELICOPTERS** | 2 Squirrel | 2 Squirrel | 4 Squirrel | 3 Squirrel 1 Bell 212 | 4 Squirrel | 4 Squirrel | 2 Squirrel 1 Bell 212 | 1 Squirrel | 3 Squirrel | 4 Squirrel |
| **AIRCRAFTS** | | | | | C-130 H | C-130 H | | | C-130 H | C-130 H |

| EXPEDITION n. | XI | XII | XIII | XIV | XV | XVI | XVII | XVIII | XIX | XX |
|---|---|---|---|---|---|---|---|---|---|---|
| **AUSTRUAL SUMMER** | **1995-96** | **1996-97** | **1997-98** | **1998-99** | **1999-00** | **2000-01** | **2001-02** | **2002-03** | **2003-04** | **2004-05** |
| **PERSONNEL** | 205 | 203 | 288 | 233 | 270 | 237 | 264 | 245 | 308 | 249 |
| **VESSELS** | Italica Gelendzhik | Italica OGS Explora | Italica | Italica | Italica | Italica | Italica | Italica | Italica OGS Explora | Italica |
| **HELICOPTERS** | 2 Squirrel | 2 Squirrel | 2 Squirrel | 2 Squirrel | 2+ (2) Squirrel | 2 Squirrel | 4 Squirrel | 4 Squirrel | 4 Squirrel | 2 Squirrel |
| **AIRCRAFTS** | L-130 H 1 Twin Otter | L-130H 1 Twin Otter | L-130H 1 Twin Otter | L-130 H 1 Twin Otter | L-100 1 Twin Otter | L-130 H 1 Twin Otter | L-100 1 Twin Otter | L-100 1 Twin Otter | L-100 1+2 Twin Otter | L-100 1 Twin Otter |

| EXPEDITION n. | XXI | XXII | XXIII | XXIV | XXV | XXVI | XXVII | XXVIII | XXIX | XXX |
|---|---|---|---|---|---|---|---|---|---|---|
| **AUSTRUAL SUMMER** | **2005-06** | **2006-07** | **2007-08** | **2008-09** | **2009-10** | **2010-11** | **2011-12** | **2012-13** | **2013-14** | **2014-15** |
| **PERSONNEL** | 283 | 139 | 105 | 82 | 131 | 148 | 186 | 189 | 195 | 176 |
| **VESSELS** | Italica OGS Explora | Italica | Italica | --- | Italica | --- | Italica | --- | Italica | --- |
| **HELICOPTERS** | 4 Squirrel | 2 Squirrel | 2 Squirrel | 2 Squirrel | 2 Squirrel | 2 Squirrel | 2 Squirrel | 4 Squirrel | 2 Squirrel | 4 Squirrel |
| **AIRCRAFTS** | L-100 1 Twin Otter | L-100 1 Twin Otter | 1 Twin Otter | L-100 1 Basler | L-130 1 Basler 1 Twin Otter | L-100 2 Basler 1 Twin Otter | L-100 2 Basler 1Twin Otter | L-100 2 Basler 1 Twin Otter | L-100 2 Basler 1 Twin Otter | L-100 2 Basler 1 Twin Otter |


CARIBOO


OGS-EXPLORA


POLAR_QUEEN


BARKEN


FINNPOLARIS
FINNPOLARIS


ITALICA

# THE YEARS TO COME

**A few questions, first of all**

In the thirty years since the beginning of the PNRA to 2015, Italy has invested around 700 million euros in and on Antarctica. Money was spent on organization of the expeditions, building the national Station at Terra Nova Bay and the Italian-French Station at Dome-C, as well as supporting science.

All the technologies and procedures needed for operating in a polar environment were organized and developed from scratch. At the same time a multidisciplinary scientific programme was born, aimed both at understanding distinctive aspects of the continent and phenomena of global significance. In so doing Italy shared most of the goals set forth by the international community.

It is quite possible that the budget of the Programme in the coming years will grow steady to an annual figure that the Government will allocate after having taken into account all other priorities. The Programme to remain active will have to match this figure.

Relevant questions that can now be asked are:-
What have been the advantages of the activities carried out until now?
What advantages will there be in the future?
Are the results obtained commensurate to the investment applied?

These are difficult questions that don't have easy answers. While counting the overall cost of the Programme is an elementary exercise, assigning a value to the research carried out, for a cost benefit analysis, is much more subjective. Questions of this kind are of outstanding relevance, not only for Italy, but also for all Countries involved in Antarctica.

**Turning back**

A noteworthy success of Italy has undoubtedly been gaining the status of Consultative Member of the Antarctic Treaty in just a couple of years, and becoming soon after, a full Member of SCAR. These were political and scientific acknowledgments allowing Italy to recover from years of delay. Soon after, scientific research in many fields started. After an initial phase for guidance most of it turned towards qualified international collaborations.

The European Project for Ice Coring in Antarctica (EPICA) recovered a deep ice core at Dome-C from the surface to the bedrock. This ancient ice has been analysed and has helped us to understand the past climate.
We know from this core that in the past 800.000 years, five complete glacial-interglacial cycles occurred. In addition, we have learned something about the speed of change from cold to the warm climatic stages. As well as understanding how astronomical parameters correlate to these cycles.
Cape Roberts and the ANDRILL Programmes were aimed at improving knowledge of the geological evolution in the Cainozoic. They involved a qualified international cooperation and have obtained good results in a short period. The ANDRILL core is 1200 meters long, and records climatic history going back to 25 million years BP, set a record for Antarctica to the depth of sediments sampled.
The BOOMERanG experiment provided new hints about the birth and structure of the Universe, achieving great from the scientific world and the media.
Italy helped monitor the ozone hole with ground and "in situ" measurements in the stratosphere, with Project APE.
The geological structure of the continent has been investigated by remote camps, extensive sample collection and airborne geophysical surveys. Results have often been represented as thematic maps.
The continental shelf has been sounded along lines totalling more than 30.000 km by the OGS-Explora geophysical vessel.
As to its physical and biological aspects, the Ross Sea is now much better known than it was thirty years ago. How the fast ice helps during the developmental larval stage of fishes is a mechanism now deciphered. The complex seasonal interactions between seawater and sea-ice and their long-range effects on the three Oceans are topical studies.


*Cargo operations and refuelling at Terra Nova Bay.*

# THE YEARS TO COME

Many scientific results are waiting to be fully exploited, and some are simply of minor importance. Small science can coexist with big projects, as some may contain a winning idea that need to be expanded before gaining recognition.
Nevertheless, there are Projects, such as those just mentioned, which have gained official recognition in international scientific journals and have been awarded prestigious prizes: such as the Balzan and Dan David prizes for BOOMERanG, and the Cartesio prize for EPICA.
The names of a coastal glacier (Vacchi) and two glaciers in the Ellsworth Mountains (Cervellati, Ramorino) have been assigned Italian names by non-Italian geographical Authorities to honour Italy's commitment.

At home, not only the scientific community benefits from the Antarctic Programme. Ministries, air, land and naval forces, and industries have the opportunity to do the best they can. Companies which manufacture instruments, vehicles, clothes and other goods useful to the expeditions have been involved as well.
The public, especially school children, are kept informed by press releases, TV reports, and meetings with scientists (that continue when the scientists are in Antarctica, via videoconference). Further outreach includes temporary exhibitions or permanent exhibitions such as the three sections of the National Museum of Antarctica, Felice Ippolito (MNA). The live information on the expedition (see e.g. www.italiantartide.it) turns into a general awareness of the problems on a global scale.

**Thinking of the years to come**

The scientific highlights recalled above come from the fact that Antarctica offers an endless variety of subjects worth studying.
Those highlights are not the answer to the question about the cost/benefit ratio but provide the raw material for an answer. A difficulty of the same kind arises with the question on how long, and at which level, should Italy continue its engagement in Antarctica.

The Madrid Protocol binds the Signatories to scrupulously respect the Antarctic environment until 2041. Is seems obvious that a Country, which in 30 years has acquired specific competences, infrastructures and international standing will not squander them, at least before that date.

Antarctica is a sort of crossroads where scientists of all nationalities can meet, either physically or in the pages of specialized journals. Working in Antarctica, or for the Antarctic, means comparing a national scientific project with others often carried on by the best polar Institutions of the world.
The harsh environment of the continent is particularly attractive for young scientists who receive extraordinary training and incentives to go down there, where the frontiers of science and the Earth meet.
The collection of data and samples will certainly go on, generating additional studies at home and becoming a source of international collaboration.
An international database encompassing all science done in Antarctica, where a scientist may find all the data collected in the past, has proved until now to be utopian.
However careful and open-handed accounts of studies, jointly with the power of modern search engines may prove to be an effective alternative.

What science will be developed in the next future? Nobody can say, because the imagination of scientists is boundless. It would had been impossible as well, at the beginning of the Italian Programme, some three decades ago, to foresee what scholars of Antarctica would propose and accomplish. Concordia Station itself was not planned at the beginning of the Programme.
Problems and trends pointed out in the future by the world scientific community will be considered with maximum attention.
The "Science Horizon Scan" coordinated by SCAR and concluded in 2014 goes perfectly in this direction.

As to the future logistical support, it will


*Helicopters are the most valuable means of transport in Antarctica for missions in the range of 200 km. Usually a scientific expedition is provided with at least two helos, so that one of them can intervene in support of the other in case of emergency landing in a remote area.*

obviously proceed from the needs of the science. There are however points which, from the time being, appear already clear.
Mario Zucchelli Station is 30 years old. It has been progressively enlarged starting from a small initial core.
That means that some structures are quite old and most plants, such as electric installation, plumbing, waterworks, and heating system, have grown as the result of a continuous process of additions and modifications.
A thorough maintenance is becoming more and more necessary. For a few historical Stations other countries have found it preferable to build another one anew instead of repairing the old one. In that case, the problem of decommissioning has to be confronted. The ten-year-old Concordia Station is comparatively much younger; but, on the opposite side, the reliability of all systems there, in such an isolated location, is of outstanding importance.
Speaking of obsolescence, the main vessel of the expedition is another point to be taken into account.
The M/V Italica has served the Programme for two decades. At various times she has been refurbished in order to meet growing needs, e.g. the capacity to load enough fuel for the resupply of the coastal Station and a set of facilities used for marine biology and oceanography.
It is highly probable that the vessel will be chartered again in the near future. However, a medium term plan cannot overlook the item "vessel". After all, the ownership of a polar vessel had been put forward since the very beginning of the Programme.

Marine vessels have been the only means to approach Antarctica for more than a century. In the last decades, the air link has taken a relevant share of the total transport capability to and from the continent.
Italy has been particularly active in this field achieving a modern air connection that Countries with a longer tradition have never afforded. The link between Terra Nova Bay and Christchurch is however, limited to a handful of flights at the beginning of each expedition because an airstrip built on the fast ice lasts for a small fraction of the spring.
The obvious way out will be to build an airstrip on the ground. Luckily enough such a possibility exists, on the outskirts of MZS.

Timing is exceedingly relevant to all activities in Antarctica, due to the tight constraints set by the seasonal accessibility to the continent. Correct timing presupposes that the annual scientific plan is ready in due time and that the funding follows accordingly.
Timing has been however a weak point in the past. Much more could be done to improve adherence to a preset time schedule.
As to the economics of an expedition, it has been already made clear that in terms of money the balance is hopelessly passive. However, some Countries obtain a return from the continent and the Southern Ocean from fishing and tourism, a possibility which should be taken into account when looking at the Antarctic from a more general standpoint.

In the previous sections several aspects of the Italian activities in Antarctica have been reviewed: science, technology and logistics; highlights and limits, past and future.
As a conclusion, let's stress that perhaps the main spin off from such a relevant national undertaking is in a simple word: knowledge. Knowledge is one the highest values of mankind and a powerful antidote against the lowest instincts.
Scientific research does not necessarily bring immediate results. As with a plant, its fruits, if any, come in time. Often the reward comes out from the merging of observations, measurements, devices apparently not related, developed in the context of different disciplines and by scientists who speak different languages. In spite of that, it is quite possible that eventually from the overall acquired knowledge the solution to old or new problems of the Planet, concerning its history, our presence, even our survival on it, comes out.

*The Weddell seal is the most common species of seal that dwells at Terra Nova Bay.*

# Further readings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*Traverses from Cape André Prud'homme to Concordia Station are planned every year to take place in the framework of the French-Italian cooperation for the Concordia Project.*

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*The French-Italian scientific Station Concordia was opened 15.02.2005 and has been permanently open since then.*
*The crew stays completely isolated for nine months a year.*

**ENEA UTA (Unità Tecnica Antartide)**
**Centro Ricerche Casaccia**
*Via Anguillarese, 301 - 00123 Roma, Italia*
*tel.: +39 06 30 48 48 16 | fax: +39 06 30 48 48 93*
*e-mail: direzione@enea.pnra.it*