ANTARCTIC TREATY

Report of a Joint Inspection Under Article VII of the Antarctic Treaty by United Kingdom and German Observers

January 1999

Foreign & Commonwealth Office, London
Auswartiges Amt, Bonn

Errata;

It is regretted that an error has been made in naming one of the Chilean Antarctic bases:

Instead of "Arturo Frei", please read, ***Presidente Eduardo Frei.***

CONTENTS

REPORT OF A JOINT INSPECTION UNDER ARTICLE VII OF THE ANTARCTIC TREATY

ANTARCTIC TREATY INSPECTION PROGRAMME: JANUARY, 1999

Introduction

A joint Inspection programme was conducted by the United Kingdom and Germany in the Antarctic Peninsula area during January, 1999.

The Inspection Team operated from the UK's Royal Naval ice patrol vessel *HMS Endurance* and conducted Inspections mainly with the assistance of the ship's two Lynx helicopters, though some landings were made by ship's boat.

Twenty-three Inspections were made in the period 12-28 January. These consisted of Inspections of 11 permanent stations, 6 summer-only stations (2 of which are scientific annexes to permanent stations), 4 Historic Sites and Monuments (all abandoned former stations), and 2 tourist vessels. The stations and facilities of 12 Treaty Parties (11 Consultative and 1 non-Consultative) were inspected. One of the tourist vessels inspected, the MV *Marco Polo*, was flagged with a non-Treaty Party (the Bahamas), and was Inspected with the permission of the Master.

All Inspections were carried out under the terms of Article VII of the Antarctic Treaty. Accordingly, both the UK and Germany provided Treaty Parties in advance with the names and affinities of their designated Observers. These were:

- for the United Kingdom:

  Dr M G Richardson (MR), Head, Polar Regions Section,
  Foreign and Commonwealth Office, London;

  Mr I Collinge (IC), Head of Purchasing and Shipping (Logistics),
  British Antarctic Survey, Cambridge;

  and from *HMS Endurance* the following Officers:
  Lt Cmd M Clegg (MC), Lt A Stevenson (AS),
  Lt Cmd A Jenks (AJ), Lt D Bishop (DB).

- for Germany:

  Dr H Gernandt (HG), Head of Logistics
  Alfred Wegener Institute for Polar and Marine Research, Bremerhaven.

The core Inspection Team consisted of Richardson, Gernandt and Collinge. Designated Observers from *HMS Endurance* were drawn on a rotational fashion, depending on the station or facility to be inspected. The Observers involved in any particular Inspection are indicated by the initials shown at the end of each Inspection Report.

In planning for, and conducting, Inspections particular attention was paid to the Inspection Checklists adopted by the Antarctic Treaty Consultative Meeting, eg Checklist 'A' for permanent Antarctic stations and associated installations agreed in 1994 (ATCM XVIII), and Checklist 'B' (vessels within the Antarctic Treaty area) and Checklist 'C' (abandoned

Antarctic stations and associated installations) adopted through Resolution 5 (1995) at ATCM XIX. These Checklists have a strong focus on environmental considerations. They are designed to check on compliance with the provisions of the Environmental Protocol and its Annexes.

The Checklists were not used as exhaustive questionnaires during the course of Inspections, but rather as *aides memoire* to ensure that relevant information was collected in a consistent manner.

To remove the possibility of national bias the Inspection Reports of the UK's Rothera Station and Port Lockroy were prepared by the German Observer (Dr Gernandt). Similarly, the Report on the German Receiving Station at O'Higgins, was prepared by UK Observers.

With one exception, the Inspection Team remained onboard *HMS Endurance* from the time that she departed the Falkland Islands on 10 January to her return on 31 January. The German Observer left the vessel on 26 January for Rothera Station where he undertook an Inspection, before transiting subsequently to the German station Neumayer to the east of the Weddell Sea.

The task of the Observers was assisted greatly by those stations which provided extensive background material on their facilities. This included the Argentine stations of Esperanza and Teniente Jubany, and Rothera Station (UK) which had provided information corresponding to the format of Checklist 'A', and to Palmer Station (US) which provided numerous supplementary reports and papers. The vessel MV *Marco Polo* also provided the Observers with a detailed Environmental Impact Assessment of the vessel's operations.

The Observers would like to acknowledge the hospitality and assistance they received from all stations and vessels inspected. In some instances the Inspections unfortunately coincided with other major events taking place at stations. In this respect particular thanks are extended to the Base Leaders of Chile's General Bernardo O'Higgins Station which was in the middle of its annual re-supply and a VIP visit, and Palmer Station (US) which was hosting visits from 2 tourist vessels on the day of the Inspection.

Unfortunately, due to difficulties of communication and annual re-supply at the time, the Argentine station Vice Comodoro Marambio on Seymor Island was not able to be inspected, despite *HMS Endurance* remaining in the area for four days. This was regrettable. It did not allow Inspection of the previously reported extensive waste management problems at this base, or indeed allow verification of subsequent clean-up which the Observers understand has been initiated.

The itinerary for the Inspection Programme was as follows:

Table I

Date (1999)	Station/Vessel	Country	
12 January	Gabriel de Castilla	Spain	(SO)
13 January	Esperanza	Argentina	(P)
14 January	MV Marco Polo	Bahamas *	(V)
14 January	Port Lockroy (Base A)	UK	(HSM)
15 January	Academic Vernadsky	Ukraine+	(P)
15 January	Argentine Islands (Base F)	UK	(HSM)
16 January	St Kliment Ochridski	Bulgaria	(SO)
16 January	Juan Carlos Primero	Spain	(SO)
16 January	MV Academic Ioffe	Russia	(V)
17 January	Bellingshausen	Russia	(P)
17 January	Presidente Arturo Frei	Chile	(P)
17 January	Professor Julio Escudeoro (INACH)	Chile	(SO)
18 January	Artigas	Uruguay	(P)
18 January	Henryk Arctowski	Poland	(P)
19 January	Great Wall	China	(P)
19 January	Teniente Jubany	Argentina	(P)
21 January	General Bernardo O'Higgins	Chile	(P)
21 January	Receiving Station, O'Higgins	Germany	(SO)
22 January	T/N Ruperto Elichiribehety	Uruguay	(SO)
23 January	Swedish Hut	Sweden/ Argentina	(HSM)
25 January	Palmer Station	US	(P)
27 January	Rothera Station	UK	(P)
27 January	Whalers Bay, Deception	Chile/Norway/UK	(HSM)

* vessel registered with a non-Treaty Party

\+ station operated by a non-Consultative Party

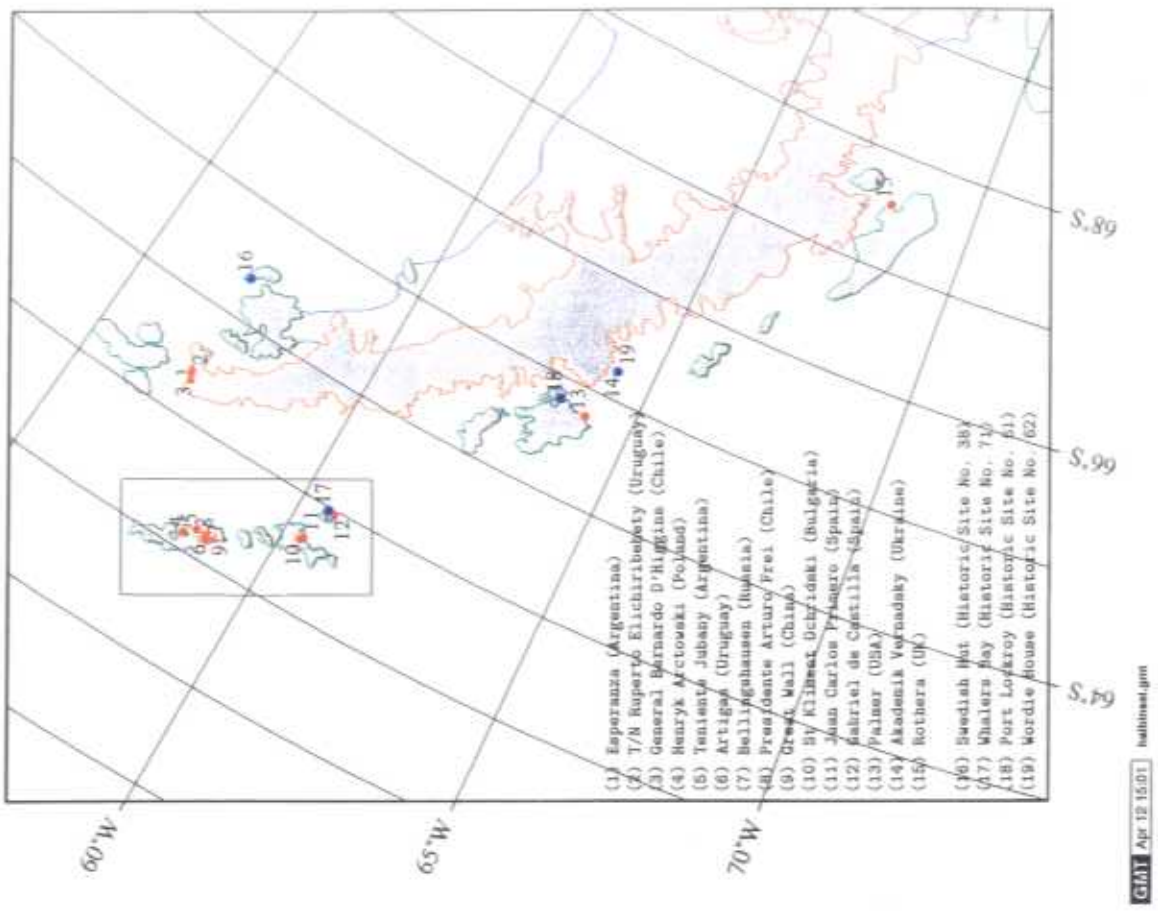
P (Permanent Station); SO (summer-only station);

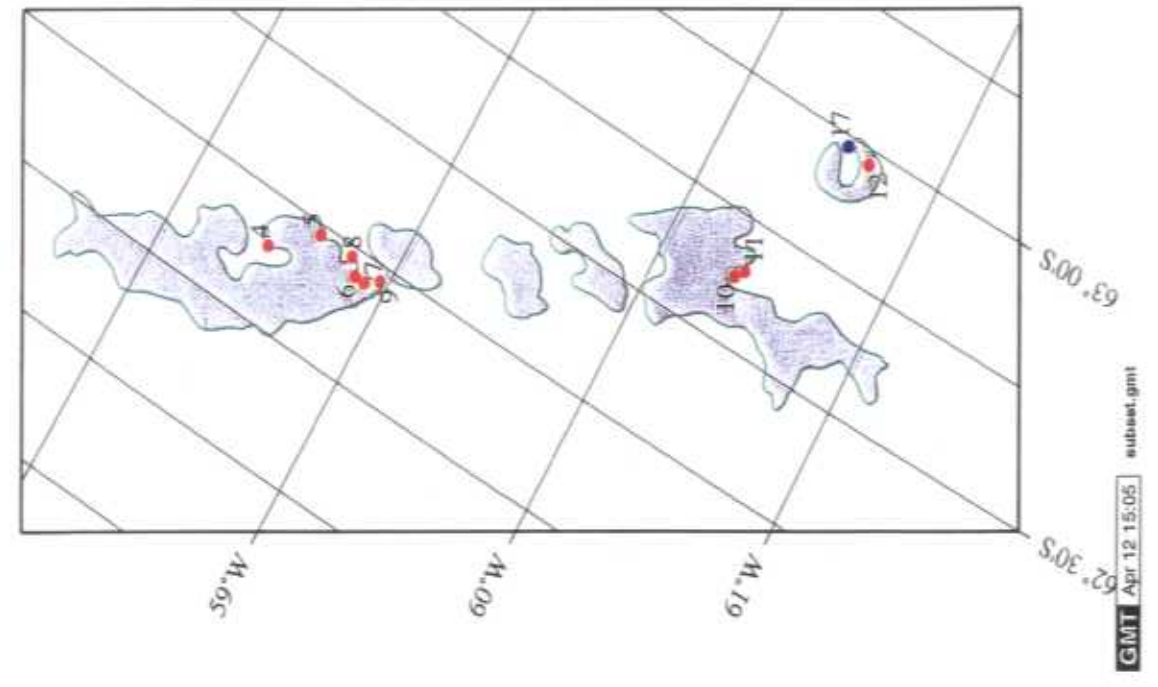
HSM (Historic Site and Monument);

V (vessel)

The location of stations and Historic Sites and Monuments inspected is shown in Fig.1 (page 6).

Fig 1. The location of stations and Historic Sites and Monuments inspected.
(a) the Antarctic Peninsula (b) the South Shetland Islands





ESPERANZA (ARGENTINA): INSPECTED 13 JANUARY, 1999

Aerial view of Esperanza from the west

General

Esperanza Base was established as a permanent station in December 1953, and is operated by the Argentine Ministry of Defence through the Dirección Nacional del Antártico which co-ordinates the Argentine activities of the military, and the Instituto Antartico Argentino. Esperanza Base was enlarged considerably in 1978 to accommodate incoming families.

The station is situated inland from the NE facing sheltered anchorage of Hope Bay on rising gravel/rocky ground at Lat. 62° 24'S; Long. 57° 00'W. The former UK Hope Bay base 'Trinity House', now being refurbished by Uruguay as T/N Ruperto Elichiribehety Station, lies 500m to the south.

The Chilean station General Bernardo O'Higgins is 45km to the west.

Esperanza was last inspected in 1993 (UK/Italy/Korea) and previous to that in 1980 and 1964 by the US.

Personnel

The station has a capacity to accommodate a maximum of 79. The majority occupy the 13 chalet/houses, whilst up to 14 staff can be housed in the main station building. Personnel numbers are relatively constant throughout the year (more so than in any other permanent station inspected).

At the time of the Inspection the base complement was 64 including 14 children, and a 4 man Japanese TV crew.

Wintering numbers had been only slightly below this at 58, including 10 wives and 14 children. The majority were army personnel acting in a logistic/support capacity and the base Commander was an Army Lt Colonel. Length of tour in Antarctica was normally 1 year with changeover in January/February. Numbers at Esperanza had reduced in the past few years from for example 72 in the 1997/98 season to 64 in 1998/99.

At the time of the Inspection only 4 scientific staff were present, though the Observers were informed that this would rise to 11 in the coming winter. These staff were currently on the Argentine naval vessel *Almiranti Irizar* off Seymor Island, and due to arrive shortly.

Scientific Research

Science projects being undertaken at the time of the Inspection were confined to: seismology (in co-operation with Italy), meteorology, penguin biology and monitoring to standard CCAMLR-CEMP parameters, marine and limnological chemistry and tidal observations.

Relative to the size of the base, scientific facilities were modest. They consisted of only two small containerised laboratory units, one where water chemistry (on Boekella Lake and the inshore marine environment) was conducted, and a tent-shape building (constructed in 1992) housing the (Italian) seismograph. In addition, the station had a meterological building and a permanent satellite-linked tide gauge installed by the US Government Agency NOAA. Other science activities were performed in the domestic accommodation buildings.

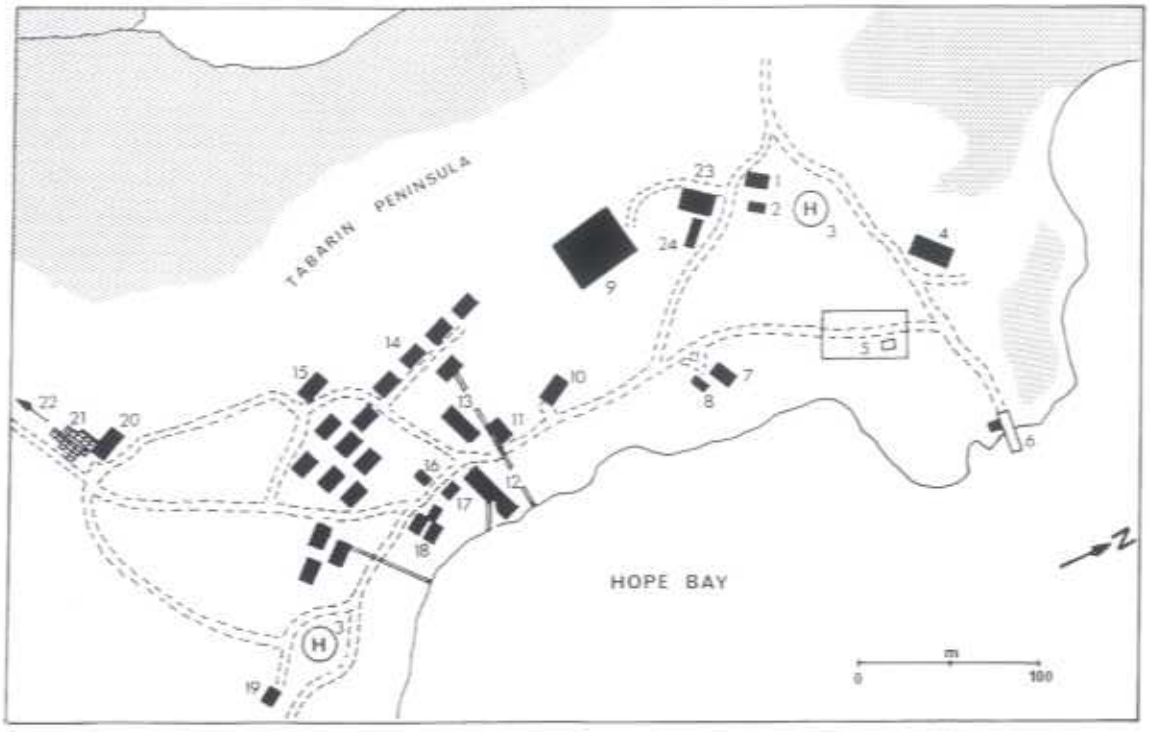
Synoptic meterological data were passed to the Argentine Station Vice-Commodoro Marambio every 3 hrs.

Physical Description

An extensive base set around 5-20m above sea level. The station has 39 buildings including 13 chalet/houses, built to the same design, to accommodate family units. The main two storey station building (casino) houses the dining room, bar, kitchen and also accommodates, in its basement, 14 staff. A hot water heating system is installed here. Other buildings include a waste management building, carpenters' workshop, garage, clothing/mountaineering equipment store, radio communications and post office building, school and generator building.

The age of some buildings (eg that housing waste management) was considerable and date back to 1952 onwards. The family accommodation units had been built in 1978, when the base extended in size greatly. The seismograph building had been installed in 1992 and the substantial garage constructed in 1993. More recent building was confined to the small laboratory block.

Around 1.5 km of bulldozed gravel track are present within the base area and connect all the principle buildings. The track extends in the east to the small pier and in the west to the generator building and tank farm, and beyond to the water intake at Boekella Lake. Esperanza is ringed to the north and west by substantial penguin colonies. In an effort to reduce disturbance from aircraft a new prominently marked helipad had been constructed around 200m to the south of the main station building. This also was linked to the track. The former helipad, set very close to the dense penguin colonies just north of the base, has been taken out of commission. The new location should create no impact on wildlife.



Esperanza, station layout

Layout of Esperanza Base:

1. Carpenters' Store, 2. Mountaineering Store, 3. Helipads, 4. Waste Store, 5. Historic Site including Nordenskjold's Expedition Hut, 6. Pier, 7. Store, 8. Cold Store, 9. Hangar/Garage, 10. Proposed Museum, 11. Back-up Generator, 12. Main Building (Casino), 13. School, 14. Chalet/Houses, 15. Radio Communications, 16. Chapel, 17. Store, 18. Incinerators, 19. Waste Store, 20. Generator Shed, 21. Bulk Fuel Tank, 22. Track to Bockella Lake, 23. Garage, 24. Store.

The station also contains a marked off historical area, which in addition to the stone hut built by Nordenskjold's wintering team in 1903 also contains vehicles (Sno-cat) and sledges of historical value. Although exposed to the elements this equipment and artefacts were well maintained. Plans are in hand to transfer part of this outside museum to one of the buildings in the centre of the station where other historical artefacts have been brought together.

Numerous refuges had been installed in the vicinity of Esperanza but only 4, within a radius of 40 km were now in active use. These were:

Christo Redentor (Lat. 63° 33'S; Long. 57° 22'W)
Grl Martin de Gûemer (Lat. 63° 29'S; Long. 57° 08'W)
Independencia Argentina (Lat. 63° 27'S; Long. 57° 10'W)
Islas Malvinas (Lat. 63° 25'S; Long. 56° 58'W)

Logistics

Annual re-supply of the station was by means of the Argentine naval vessel *Almiranti Irizar* which visited 2-3 times each season. Bulk stores and fuel were usually delivered in January/ February by Sea King or Super Puma helicopters. At the time of the Inspection, base personnel were awaiting the imminent arrival of the *Irizar* for the annual switch-over of wintering personnel.

Transfer of bulk fuel was achieved using helicopter underslung 'rolling tanks' of 2,000 litre capacity. These were delivered to a reception area just to the east of the tank farm. This discharge zone was bunded on three sides by an elevated gravel earthworks to contain any potential spillage. On average re-supply required the movement of 333m^3 of bulk fuel, 8m3 of other combustibles (Nafta, JP1 and oils), 10m^3 of gas in cylinders, and 200m^3 of general cargo and other provisions.

In addition, personnel and light stores are delivered by fixed-wing aircraft (dH Twin-Otter) from Vice Commodoro Marambio Station (95km away). These use the ski-way on the nearby glacier. Flights were on a monthly basis.

Power generation was provided by 3 Caterpillar generators (two of 140kVA, one of 180kVA) with an emergency unit (Deutz) of 140kVA. The bulk fuel farm was situated adjacent to the generator building to which fuel was gravity fed to header tanks. Total fuel capacity was 310,000 litres held in 29 single-skinned horizontal tanks each of just over 10,000 litre capacity. All tanks were inter-linked by top-fed pipeage. The tanks, in good condition, were however not bunded. Each was set on its own individual concrete base. Although signs of diesel spillage were not evident, had spills occurred then the area between and around the tanks would have been difficult to clean-up. The Observers were informed that plans were in hand to concrete over the gaps between the individual tank beds so providing the tank farm with one integral concrete platform, and to construct a concrete bund around the whole set of tanks. This is a commendable move, but it may generate the sort of oily-water problem experienced by the bunds at Teniente Jubany. However, without sloping snow covers over the bunds, or having all fuel tanks within a building (neither of which options are particularly feasible in this situation) little else can probably be achieved.

Quantities of drummed fuel were stored on the elevated rack adjacent to the tank farm. Small quantities of oil were also depoted at the refuges with 700 litres of petrol at Islas Malvinas, and 600 litres of petrol and 200 litres of JP1 at each of Independencia Argentina and Grl Martin de Güemes.

Fuel management procedures at Esperanza were clearly efficient and oil spill measures were the responsibility of the senior diesel mechanic.

No alternative energy generation was practised except for solar panels powering automatic instrumentation.

Potable water was extracted from Boekella Lake around 300m to the SW of the station. The pump house here had been constructed in 1997 and water was taken from a depth of 4 metres by an overhead gantry arm. The pipeline to the base was heat-traced. Although supply was plentiful, potable water required treatment through both primary and secondary filtration

before passing through a purification plant in the casino. Storage capacity in two tanks was 30,000 litres.

Transport and Communication

Radio communications were provided by HF, VHF and SATCOM and housed in a separate building.

The station had an extensive fleet of vehicles. This consisted of the following tracked vehicles: 3 Muskegs, 3 Weasels, 10 snow mobiles, a Sno-cat and Caterpillar tractor. In addition 2 Mercedes Unimogs and two 4x4 ATVs were present. All vehicles were housed in the substantial garage or workshop which had servicing and pit facilities. Although some of the vehicles were venerable (for example the Caterpillar tractor dated from 1953) all were clearly well maintained. The Sno-cat was used principally to visit the aircraft ski-way on the adjacent glacier.

In addition, the station held 4 Zodiac inflatable boats plus accompanying (25-30 hp) outboard engines. These boats were used primarily for inshore marine biological sampling.

Safety, Training and Emergency Procedures

Extensive pre-deployment training is provided for both military and civilian personnel in mountaineering/winter survival and fire-fighting.

The base was equipped with medical facilities with a 2-bed ward and an operating/emergency room. In addition the infirmary which was in the charge of a senior nurse was equipped with an x-ray room, dental surgery and medical laboratory. Equipment held included an autoclave, resuscitation unit, suction, anaesthetics machine and gas. The unit was thus capable of basic surgery, gynaecology (8 babies had been delivered in the unit), radiology, dental surgery and the treatment of trauma. More serious medical cases could be evacuated year-round via Twin-Otter to Vice Commodoro Marambio and Argentina.

Search and rescue capability was provided more generally by the co-operative shipborne arrangement between Argentina and Chile which saw the Chilean vessel *Lautero* and the Argentine *Gurruchag* taking month about SAR patrols in the northern Peninsula area.

The base had a fire emergency plan and extensive fire-fighting equipment. Personnel received fire-fighting training both during pre-deployment and whilst on base. Fire-fighting exercises were held.

Environmental Management

Environmental awareness was high. The Base Commander and all personnel were well versed in the requirements of the Enviromental Protocol, and were clearly implementing its provisions.

The base possessed a well defined waste management plan with wastes carefully separated at source into four categories. The Observers were shown a very detailed log of the amount of wastes either incinerated (combustible organics) or retrograded as glass, metals, waste oil etc. Waste materials for retrograding were stored in drums or boxes and kept inside, either in the hangar or the waste storage building to the SE of the helipad. The incinerator is a

modern two-stage burner operating at 300° and 1200° C. Metal wastes, including all tins, were compacted before retrograding.

Sewage was macerated and along with grey water discharged direct to sea. The station had an extensive sewerage network connecting the radio communications building, the thirteen chalet/houses and the infirmary. This discharged onto the shore at two points, directly to the east of the laboratories and to the north of the casino which also had its own sewerage discharge pipe. The inshore waters were monitored to determine the degree of contamination, though dispersal was assessed as being adequate.

The immediate area of Esperanza Base contains substantial colonies of breeding penguins and evident means to reduce disturbance had been introduced:

i) by roping off the penguin rookeries to the north of the station, so preventing access by both vehicles and personnel, particularly tourists to the breeding areas, and

ii) by constructing a second helipad to the SE of the station well away from any wildlife concentration. The northern most helipad, close to the carpentry store had previously been a source of major disturbance but is no longer used. A large pictorial sign was fixed to the side of the building on the pier (Puerto Moro) setting out the regulations on wildlife protection.

Esperanza also contains two Historic Sites and Monuments: Nos.39 and 40. The former is the stone hut built in January 1903 by three members of the Nordenskjold Swedish South Pole Expedition; the latter is the bust of General San Martin, a grotto, graveyard and stele. The area around the Nordenskjold Hut has been designated as a local historic site and contains a range of historic artefacts and old vehicles. The whole area is roped off and well maintained.

SSSI No. 31, Mount Flora (520m) lies 3km to the immediate SW of the station. This site has been designated for its rich fossil flora. Base personnel are made well aware of the boundaries of this site and are not allowed to enter unless under permit.

Tourism

Esperanza is visited by tourist vessels with the principle interest being the station complex, the Nordenskjold Expedition Historic Site, and the extensive penguin colonies in the immediate base area.

So far this season 4 tourist vessels had called with 214 visitors onboard. More comprehensive figures were available from the 1997/98 season when 14 ship visits had been made (some repeat visits by the same vessel) landing some 1073 visitors in total. Landings were made at the small pier at the north of the station.

The policy of the station was that advance permission to land was required, and that the maximum numbers ashore at any one time were 60-70 persons. Tourists were directed away from the main base complex to a circular route at the north end of the station that allowed them to visit the penguin colonies (though these were roped off to prevent actual access into the breeding areas), to take photographs from the more elevated ground to the west of the hangar, and to visit the Historic Site.

The view was that tourists had a relatively minor impact on base operations or the environment.

A large prominent display at the pier set out the regulations relative to wildlife. This was clearly directed at visiting tourists. The post office was also apparently a focal point of interest for tourists.

Summary

An extensive permanent station with a substantial number of dispersed buildings; some quite old, but all well maintained. Station personnel are predominantly military (Army) and their numbers remain relatively constant throughout the year (ie there is no appreciable decrease during the winter period). Around 35% of the base complement is accounted for by spouses and children. Reflecting this balance, the station has more the appearance of a 'village' with numerous individual chalet/houses, a chapel, school and infirmary.

Base operations were efficient, with particular emphasis placed on stringent waste management procedures, and fuel transfer and storage. The decision to provide a bund and integral foundation bed for the bulk fuel farm, is commended. Given the complement at Esperanza, consideration could however been given to the introduction of a sewage treatment plant, rather than as at present relying only on maceration and discharge direct to sea.

Of all the stations visited Esperanza has the greatest concentration of wildlife in the immediate proximity to the base. Environmental management was clearly a high priority and means to reduce disturbance to the penguin rookeries by roping them off, and relocating the station's helipad were evident. The base's policy in relation to tourist visits appeared sound.

Unfortunately, less prominence is given to scientific research at Esperanza. Relative to the overall complement, few scientific staff were present. Scientific facilities (laboratories) and equipment were modest. The Observers noted however the stated future plans for the base which gave high priority to intensifying scientific activities at the station, particularly during the winter. There is also the stated intention commensurate with this to develop better facilities for science.

MR, HG, IC, AJ.

T/N RUPERTO ELICHIRIBEHETY (URUGUAY): INSPECTED 22 JANUARY, 1999

T/N Ruperto Elichiribehety Station Building

General

A single building summer-only station situated in Hope Bay, Trinity Peninsula, Lat. 63° 24'S, Long. 56° 59'W. The base is situated on elevated rocky ground around 600m to the south of the Argentine station Esperanza.

The station building formerly known as Trinity House, was established as Base D, Hope Bay by the UK's (Falkland Island Dependencies Survey) in 1952, and closed in 1963. Ownership of the building and its contents was transferred to Uruguay by means of a formal agreement between the UK and Uruguayan Governments in December 1997.

Refurbishment of the base began in the 1998/99 austral season and was continuing at the time of the Inspection. The station is operated by the Uruguayan Antarctic Institute (IUA), under the direction of the Uruguayan Ministry of Defence.

This station had not been inspected previously.

Personnel

A seven man team was present on the station at the time of the Inspection visit. (The building had been visited briefly on 13 January, when an Inspection had been conducted on the nearby Esperanza Station, but the hut had been still boarded up then for the winter). The summering crew consisted of a station leader (Naval Lieutenant), 5 builders and a scientist from the Uruguayan National Fisheries Laboratory.

Scientific Research

No science was being undertaken at the station at the time of the Inspection visit. However, the visiting scientist was examining the potential for science programmes. It was anticipated that scientific research would include microbiology, glaciology, penguin biology, and ongoing environmental studies. By the 1999/2000 season Uruguay hopes to be in a position to deploy a 10 person team for 2½–3 months during the summer period (December through to March). This would consist of 8 scientists and 2 support staff (the maximum capacity of the station is 12).

Physical Description

The fabric of the former UK's Trinity House remains in a sound condition. The 10x39m building contains a relatively large bar/lounge/dining area, kitchen and food store and a number of bunkrooms. Plans for the refurbishment project had been drawn up by the IUA. New oil-fired heating had been installed along with a new toilet/shower/bathroom. At the time of the visit potable water tanks were being installed inside the building and a concrete base pad had been laid for a new diesel generator. New metal profile cladding was on site to re-roof the building (re-roofing material laid last season had been severely damaged by winter storms).

Logistics

At the time of the visit the Chilean naval vessel *Oscar Viel* was at anchor in Hope Bay. Materials for the refurbishment project had been delivered however the previous week by the Uruguayan naval vessel *Vanguardia*. Vehicular assistance had been provided by the Esperanza Station to transport building materials from the pier to T/N Ruperto Elichiribehety. The adjacent Argentine station also apparently provided an informal caretaker service for the Uruguayan building during the winter period. Some summering personnel had been delivered by Bell 212 helicopter from Artigas Station . It was anticipated that in future re-supply of the base would be once per year by ship with additional personnel movement by helicopter (a former building foundation 50m to the east of the hut had been marked as a helicopter landing area).

At the time of the Inspection power was being provided by a temporarily installed diesel generator (28kVA). A new engine bed had been recently laid and a new generator (64kVA) was on site awaiting installation. This power plant was provided with purpose built sound proofing and exhaust filtration (the only station of all those inspected to employ such techniques). A new bulk diesel tank was also ready for installation. Temporarily, fuel (consisting of 20,000 litres of JetA1/diesel, and 200 litres of petrol for the 4 wheel all terrain vehicle (ATV)) was being held in 205 litre plastic drums stored 150m from the station. Fuel was being hand pumped, and there was no sign of spillage.

Water was being pumped from a lake 400m away into a 2,000 litre header tank. The quality of this water was questionable and water for consumption was being boiled. New water storage inside the building, in the form of four 1,000 litre insulated tanks, was being installed.

Radio communications consisted of HF, VHF, and SATCOM.

Environmental Management

This was clearly being given a high priority. The fact that a scientist had been detailed to carry out Environmental Impact Assessment, including a clean-up programme was evidence of this commitment. Clear information sheets on environmental pollution and waste management, similar to those displayed prominently at the Uruguayan station Artigas were on base though had yet to be posted up. All base personnel, including the construction team, were well aware of the need for sound environmental management practices.

Wastes were being separated at source for retrograding back to Montevideo. Separate insulated 205 litre tanks had been installed temporarily to collect grey water and sewage. These wastes were also due to be removed at the end of the season. A permanent sewage treatment plant, similar to that at Artigas was apparently to be provided.

Although no large elements of rubbish were present, the area surrounding the station was littered with small scale waste material. This had been left over from the former UK occupation, and activities on the site since. Items included broken glass, small scale rusted metal, wire and the remains of seals which had been killed for sledge-dog food. A meticulous clean-up to remove this material will require no more than a thorough manual cleaning, with waste bagged up and removed from the site. A more major clean up of the former Hope Bay station burnt down in 1948 could be considered. In addition waste from the former occupation was evident along parts of the shore to the east of the station, including adjacent to the navigational day mark.

The Observers were informed that the intention is to renovate the small wooden hut 60m to the SE of the station and to use it for the storage of wastes.

Summary

A modest summer-only station in the process of refurbishment having been transferred from the UK to Uruguay in 1997. Although a cosmetic clean-up of the area surrounding the base is needed, the base itself remains in a sound condition. With a degree of refurbishment, which will take two summer seasons, the building should provide accommodation for up to eight scientists and two support staff. New laboratory facilities were being installed and active consideration was being given to future scientific projects.

Awareness of environmental management issues was high and in the refurbishment process particular attention had been given to power generation, including exhaust filtration.

MR, HG, IC, AS.

GENERAL BERNARDO O'HIGGINS (CHILE): INSPECTED 21 JANUARY, 1999

General view of General Bernardo O'Higgins

General

One of the oldest permanent stations in the Antarctic Peninsula area, General Bernardo O'Higgins was established in February, 1948. The base is situated on an island around 80 metres off-shore from Cape Legoupil on the north coast of the Trinity Peninsula at Lat. 63° 19'S Long. 51° 54'W. The base is compact, with all but one building grouped together on the island. This is connected to the mainland by a pedestrian suspension bridge. General Bernardo O'Higgins is operated by the Chilean Army. All personnel are military. The only science conducted at the base was meteorological, tidal and seismic observations. Scientific activities on the site have since broadened with the establishment of the adjacent German Geodetic Observatory.

Although the German facility is located almost within the Chilean base, and receives logistic support from Chile in the form of personnel and stores re-supply (and caretaker provisions in winter) in all other respects the Chilean and German installations are discrete. They have separate staffing and functions. Importantly, they also operate different management regimes, and entirely separate utility provisions (eg accommodation, food, fuel, power generation, water production and sewage disposal). In consequence the two elements have been addressed separately within this Report, albeit under the common name of O'Higgins.

The German facility is a scientific annex to the Chilean Station, although operated by a different Treaty Party.

At the time of the Inspection, General Bernardo O'Higgins was undergoing its major annual re-supply. The Chilean Naval vessel *Oscar Viel* was anchored off-shore. Equipped with two Balco 105 helicopters, the vessel was also undertaking geodetic surveying in the locality. Onboard at the time was also the Chilean Government Minister with responsibility for women.

General Bernardo O'Higgins was last inspected in 1980 (USA).

Personnel

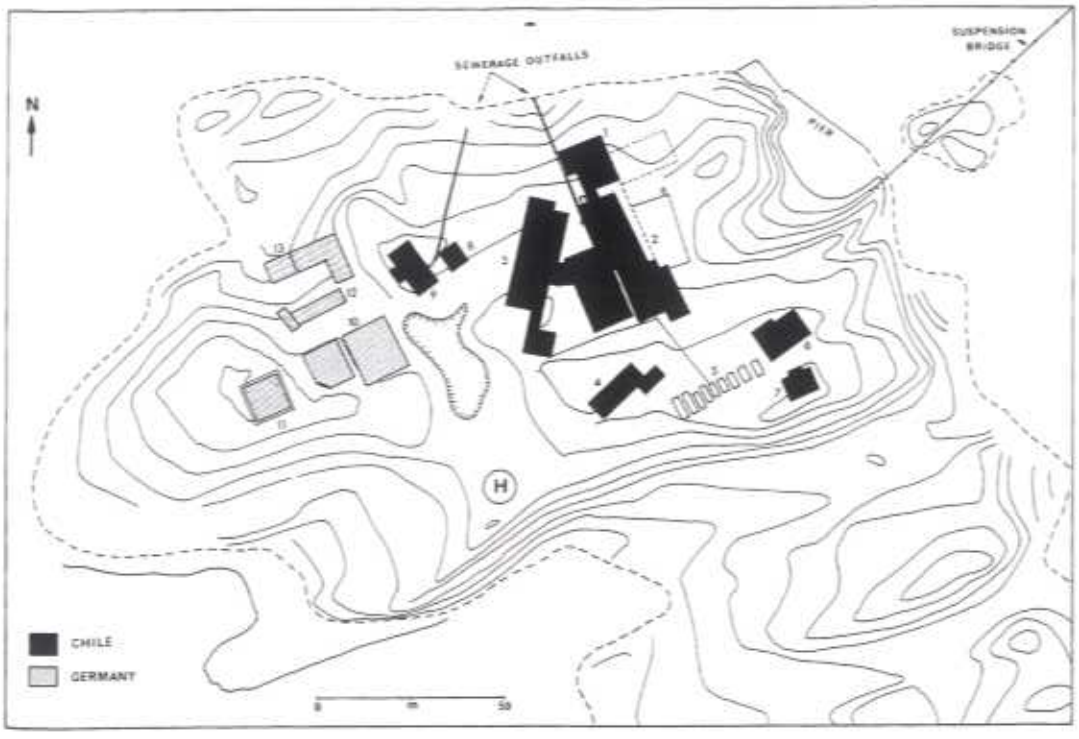
Fifty Army personnel (maximum capacity of the Station) were present at the time of the Inspection. The Station Commander was an army Lt.Col. No civilians were present. Scientific staff were not evident.

The complement decreases to 15 during winter. The length of tour was variable with most personnel only present for the summer months. The over-wintering crew did a one year tour.

Scientific Research

Measurements were restricted to daily sea temperature and 3 hourly meteorological observations with synoptic data passed to Frei Station. A seismograph was operated in co-operation with the US (see also German Observatory).

Physical Description



Bernardo O'Higgins station layout

The Plan of General Bernardo O'Higgins and German Receiving Station:

1. Generator Building, 2. Main Accommodation Building, Meteorology Laboratory, Offices, Dining Area etc, 3. Dormitories, 4. Workshop/Stores/Waste Management, 5. Bulk Fuel Tanks,

6. Stores and Museum, 7. Seismic Station, 8. Water Tank, 9. Summer Accommodation.

German Receiving Station

10. Main Accommodation and Laboratories, 11. Parabolic Disc, 12. Diesel Generator, Workshops, 13. Fuel and Water Tanks.

H = Helipad.

A compact station composed largely of buildings of some considerable age which have been progressively added to, and altered, over time. There has been no recent construction. The base is composed of buildings in 5 groups. The main building houses the living accommodation, 2 dining rooms (for officers and other ranks), kitchen, recreation room, library, meteorological office, administrative office, gymnasium and generators. Immediately to the west lay an accommodation annex (for summering personnel) and fresh water tank. Waste management, stores and workshops were provided in a set of buildings/containers to the south of the main building, with a museum and further stores to the SE. Behind this was located a building housing the seismograph. A separate garage/store housing the Sno-cats was located on the mainland around 400m away and accessible only via a pedestrian suspension bridge of tensile wire and wooden planking.

Maintenance to the buildings is carried out annually. However, given the age and design of most of the structures, maintenance is not easy, and the age of the buildings is evident.

A helipad was located to the SW of the Station. Its presence was not however clearly evident from the air. A wharf with a frontage of 20m was present. Water depth was not determined, though a landing craft was unloading here from the *Oscar Viel*.

Associated with the base is a hut at the nearby ski-way on the mainland. In addition, the ex-UK Viewpoint Hut (transferred to Chile in 1996), 45 km to the SE is used as a refuge. This had been refurbished in 1997 and renamed *Ramon Montalava*.

Logistics

Re-supply of the station was carried out twice annually by the Chilean Navy. Personnel and light stores were transported to General Bernardo O'Higgins throughout the year by dH Twin-Otter, operated by the Chilean Airforce from Frei Station. Logistic support was also provided to the adjacent German Observatory with all stores (fuel, food etc), personnel and retrograded wastes being handled either by the Chilean Navy (in terms of bulk materials) or the Chilean Airforce linked to Frei (for personnel and lightweight equipment).

Power supply was provided by 4 generators: 2 of 185kVA and 2 of 295kVA. The generator plant was housed within the main accommodation building. Electrical power was also supplied to the German Observatory during most of the year when it was unmanned, to maintain the scientific equipment and enable automatic data transmissions to continue. Annual fuel consumption was around 220,000 litres. Bulk diesel fuel was held in 8 single-skin tanks of 20,000 litres capacity each. The tanks were surrounded by a bund, with each tank having sloping bund covers to protect against the ingress of snow and meltwater. Any oily-water in the bund was periodically pumped out, passed through a separator, and the diesel recycled. The tanks and their valves were serviced once per year. There were significant signs of spilled

diesel in the immediate vicinity of the tanks. Whether this had been derived from previous, or the present, tankage was not clear. The bunds at General Bernardo O'Higgins were the only ones to be seen during the course of the Inspection programme with covers to prevent snow accumulation.

Bulk Fuel Tank with Bund Covers

The pipework for the fuel tanks was all above ground, with the capability to shut off the whole system, as well as individual tanks. Re-supply of bulk diesel from ship to shore was by means of a flexible hose. This was cleared by pumping through with seawater. Oily water was collected in a sump and passed through a separator. The hose was kept onboard ship.

The intention was to install permanent refuelling pipes and a manifold this season to assist with bulk re-supply.

In addition, relatively small quantities of petrol were held on the station for the snow-mobiles (10 x 200 litre drums). 200 litres each of petrol and diesel were held at the Ramon Montalava refuge. Old diesel fuel tanks were being used to form a windbreak to the SATCOM dome.

Potable water was derived from glacier melt water in summer, and from melting snow and ice in winter. The desalination plant was not in operation. Water supply was plentiful and the quality adequate, though there were plans to install a purifier. Consumption was around 12-15,000 litres per day in summer and water was held in a 35,000 litre tank. A separate tank of 2,800 litres was housed adjacent to the summer accommodation annex.

Transport and Communications

Radio communications were provided by HF, VHF and UHF (short range capability), and SATCOM.

Vehicles held consisted of 3 snow-mobiles and two Sno-cats. The latter were used on the mainland glacier, and housed in a separate garage/workshop. In addition, the station possessed a crane and bucket loader for handling cargo and for earth moving.

Two inflatable boats (Zodiac Mk III) were present.

The 1,000m ski-way was located on the glacier 2 km from the station. Twenty-seven dH Twin-Otter flights had used the facility during the previous year. Most flights took place in the summer. There had been 6 such flights so far this season.

Safety, Training and Emergency Procedures

Five months comprehensive pre-deployment training was provided in association with the Chilean Antarctic Institute (INACH).

The base had search and rescue capability in terms of expertise from the mountaineering troop who were trained in snow mobile rescue. The Station was supplied with an infirmary and two Army paramedics, though no resident doctor. A telemedicine link-up with Chile was available, and had been used. More serious medical cases would be evacuated to Chile, via Frei Station.

General Bernardo O'Higgins had a fire emergency plan, and fire fighting team trained by the Navy. Fire fighting exercises were undertaken once or twice every month. Comprehensive fire fighting equipment in terms of water, foam and powder extinguishers was also present, though apparently no actual fire alarm.

Emergency provisions were held in the separate summer accommodation block which carried a stock of 3 months food, an emergency generator and medical store.

The Station had an appointed hazardous substances officer. To reduce the risk of oil spills, each bulk tank had its own separate valve systems. However, there was no Spill Response Plan, nor were spill response exercises carried out. No anti-spill equipment was held on base.

Environmental Management

Station personnel were made aware of the provisions of the Antarctic Treaty and its Environmental Protocol. Waste was separated at source into metals, plastics, glass and paper/cardboard. Material was compacted for retro-grading and around 20-40 m^3 (2 containers) of waste was returned to Chile each year. Waste disposal was the responsibility of the Station Commander. No log was kept of waste materials. Instead, reference was made to the outgoing ship's manifest. Waste from the German Observatory were also handled for retro-grading.

Sewage was not treated but discharged to sea directly via 2 partially covered channels. One from the accommodation annex, the other from the main accommodation building. It was not apparent whether sewage was even macerated, as required by Article 5(i) of Annex III to the Environmental Protocol. Apparently, consideration was being given to the installation of

a sewage treatment plant.

It was clear that considerable efforts had been made to clean up and retro-grade a former waste dump to the SW of the main building. It was presumed that this had been achieved using the bucket shovel. Precisely how this material had been dealt with, and what quantities had been involved, was not however clear.

Personnel received training regarding the conservation of flora and fauna. There were however no designated wildlife sites nearby. There were restrictions, including prohibited access, enforced for local wildlife areas eg penguin rookeries. Gentoo penguins were breeding successfully, despite being in very close proximity to the base buildings and associated installations, for example the parabolic disc, the flag-posts, and directly in front of the access to the suspension bridge. Penguins close to the Observatory were also not it seems greatly disturbed by the helicopter landing close by.

Small scale hydroponics were being conducted apparently as an experiment.

No Environmental Impact Assessments had been undertaken, nor were any new buildings or radically different activities planned.

Tourism

There were infrequent visits from tourist vessels. Last year a single vessel with 80 persons onboard had called. This season a commercial charter yacht had disembarked 12 visitors. Advance permission was required to visit the Station, but no operational problems were caused by visiting tour ships.

Summary

A long established Station set on a restricted site (in terms of potential expansion) and with a compact arrangement of buildings. These are mostly old and, despite an active programme of ongoing maintenance, consideration may need to be given to new investment in the Station's fabric, if standards of operation are to be ensured into the future. For example, fire at the Station, given the complex arrangement of buildings, and the sharing of accommodation and power generation, could have serious implications. The Station's personel are wholly military. Science is restricted to some routine measurements. However, the juxtaposition of the Chilean and German facilities, with the former providing the re-supply and personnel logistics for the latter, is a noteworthy example of co-operation between Treaty Parties. The German Observatory acts as the science "annex" to General Bernardo O'Higgins. It was noted however that, other than providing a caretaker electricity supply for the German facility, when unmanned, no on-site utilities (eg accommodation, food, power generation, water production or sewage treatment) were shared. Duplication in all elements was evident.

Although standards of environmental management were generally sound, and the efforts to clean up and retro-grade former waste sites were commendable, the disposal of grey water and sewage needs attention. Particularly in view of the numbers of personnel on the station, it is recommended that a sewage treatment system should be installed.

MR, HG, IC, DB.

O'HIGGINS, GERMAN ANTARCTIC RECEIVING STATION, INSPECTED 21 JANUARY, 1999

German Receiving Station

General

The German Antarctic Receiving Station is co-located with the Chilean station General Bernardo O'Higgins. It is operated by the German Centre for Aeronautical and Space Research (DLR) and the Federal Agency for Cartography and Geodesy (BKG) which are responsible to the German Science and Education Ministry.

The scientific observatory was established in 1988/89. The main construction and commissioning phase was completed in September 1991 and was followed by regular campaigns to acquire remote sensing data in the run-up to the launch of the European Remote Sensing Satellite (ERS) (ERS1 and ERS2), the station is operated only during periods when data are required by the European Space Agency and European Space Research Institute (ESRIN) which represent the user community, and are responsible for ERS satellite operation.

Between periods of data acquisition the station is reduced to a survival mode, and is unmanned. Winterising and re-commissioning the facility takes around two days.

The base operates independently of the Chilean station for all major services on site (staffing, accommodation, food, fuel, power generation, water production, sewage treatment and radio communications). Mainstream logistic co-operation is however provided by Chile for re-supply of stores and personnel and would be available in the case of medical evacuation. The Receiving Station also receives residual power from the Chilean station to maintain scientific instrumentation when the Station is not manned.

Planning and establishment of the station had been a joint exercise between DLR and the Alfred Wegener Institute. However, that link had diminished since the Observatory had become operational. The German Antarctic Receiving Station has not been inspected previously.

Personnel

The Observatory was operated by a civilian crew of 5, with 3 scientists and 2 maintenance technicians present. Normally, the latter number 3 – 4. The station has a maximum capacity of 9. The staff were all employees of German Federal institutes (rather than universities).

No visiting scientists of other nationalities were present.

Scientific Research

The main task of the Satellite Receiving Station is the acquisition of data from European Remote Sensing Satellites (ERS) for a wide range of scientific applications. The lay out of the telemetry especially for Synthetic Aperture Radar (SAR) data made it necessary to locate the receiving station within the area of investigation. The station design also includes Very Long Baseline Interferometry (VLBI) capability for geodetic research.

The ability to receive satellite data is possible from any location on the Antarctic Peninsula, but to use those data for geodetic application requires a geological stable position on the Antarctic Continental Plate. This requirement resulted in co-operation with the Instituto Antartico Chileno (INACH) to gain access to the O'Higgins site, and operate the Observatory as an annex.

During 9 years of operation data acquisition from 3787 orbits of ESR 1 and ESR 2, for 609 days had been obtained. The Antarctic areas within the visible circle were the Bellingshausen Sea, Weddell Sea and Drake Passage. SAR data are mainly available for Antarctic summer seasons. Relevant morphological changes such as the movements and break up of the ice shelf have been analysed. Geodectic applications are focussed on VLBI, permanent GPS and tide gauge observations, in order to measure continental drift and to contribute to ice mass-balance studies.

Additionally, satellites such as JERS, LANDSAT 5 and NOAA are also recorded regularly.

The Observatory is part of the International Ground Network for Remote Sensing. It is supported by the German Processing and Archive Facility (DPAF), this generates standard remote sensing products according to ESA specifications, and under ESA contract. In addition special products are provided under co-operation with national and international users. For example, data are transferred to the international centre for geodynamics in Paris.

Physical Description

The installation consists of 6m steel clad containerised units grouped together into three building complexes. All structures date from 1988/89 and were in good condition, though with some external superficial corrosion due to the exposed maritime location.

The main building (300 sq m), connected to the satellite parabolic dish by a walkway, contained three bunk rooms (two of 3 beds, and a single bed), living space and kitchen and

the two main laboratories.

The two other building units consisted of:

i) (200 sq m) the emergency store and emergency power generator, further accommodation for two persons, fresh and saltwater tanks, oil storage and separation, and

ii) (65 sq m) the generator shed, workshop, plumbing, electrical and general stores.

The striking feature of the Observatory is a parabolic main dish with a diameter of 9m. The hyperbolic sub-reflector has a diameter of 1.33m, the antenna receives in the X/S and L bands. The fully encased panel-work of the main reflector is heated to reduce icing. The high precision tracking pedestal is designed especially for extremely high wind speeds. The overall height of this facility is about 12m.

Logistics

Re-supply was provided by Chile (the Chilean naval vessel *Oscar Viel* was anchored off -shore at the time of the visit) and personnel were transported by Chilean Airforce dH Twin-Otter from Frei Station. (Aircraft can land on the glacier ski-way on the adjacent mainland).

All on-site logistics were however entirely separate from those of the Chilean base.

Power was supplied by two140kVA diesel generators. Externally, these were heavily corroded due to the salt air, even though housed in a steel container. Bulk fuel (30-40,000 litres) was also housed inside 3 containers in banks of 7 double-skinned fibreglass tanks each of 1,500-2,000 litre capacity. A substantial bund/drip tray with accessible drain plug was integral to each set of 7 tanks. To ensure power supply a sophisticated centrifugal fuel separation system was installed along with multiple filters. The whole fuel management system was extremely well designed and effectively operated. Responsibility rests with the technician.

Potable water was provided by a reverse osmosis (RO) plant. Salt water was stored in a 25,000 litre fibre glass tank, fresh water in a 3,000 litre fibre glass tank in adjacent containers. Normally the RO plant was operated sub-optimally to produce "saline" fresh water – for showers, cooking etc. Drinking water was produced on demand from the RO plant

The Receiving Station had no transport, medical facilities or search and rescue capability. For these the installation was reliant on the adjacent Chilean station. There was however a fire emergency plan and the base were well stocked with fire fighting equipment. Staff were trained. Overall, no special training was provided by DLR and BKG for Antarctic service.

Communications were provided by SATCOM.

Environmental Management

Although base personnel had an understanding of Antarctic Treaty and Environmental Protocol provisions, no details were available on the station.

Wastes were separated at source and passed to the Chilean station for subsequent retrograding. Sewage and grey water were treated in a three chambered septic tank in an aerobically enriched bacterial process. Clear effluence was discharged to sea.

Gentoo penguins were nesting directly next to the parabolic dish. They had apparently only begun to do so after its installation, and perhaps due to the shelter it provided.

Although tourists visit the Chilean Station, the German facilities were not included in any tourist itinerary.

Overall, management practices were exemplary. The facility was largely self-contained. Environmental impact was considered negligible.

Summary

A successful example of long-term co-operation on the same site between two Treaty Parties. Although operating entirely separate utility facilities on site, the German Receiving Station was reliant on Chile for its "macro" logistics (re-supply, personnel movements, mede-vac etc). The German Receiving Station is a sophisticated, largely automated, scientific facility gathering important data from remote sensing satellites. It is the science annex of the O'Higgins Base.

It was evident that dialogue between the operators of the O'Higgins facility (DLR and BKG) and other German governmental Antarctic elements (eg the Alfred Wegner Institute and the MFA) had diminished since the Receiving Station had become established. It is recommended that closer dialogue be re-established amongst these bodies to ensure that the operators of the Receiving Station are fully cognisant of the latest provisions regulating Antarctic activities.

MR, HG.

HENRYK ARCTOWSKI STATION (POLAND): INSPECTED 18 JANUARY, 1999

Aerial view of Henryk Arctowski from the north

General

Located at Lat. 60° 15'S, Long. 58° 26'W, Henryk Arctowski is a year-round station lying on the north shore of Admiralty Bay, King George Island between Point Thomas and Rakusa Point. The station was established on 26 February, 1977 and has been in constant occupation since.

The area between the station and the foreshore is low lying (less than 5m above sea level), flat, subject to periodic flooding, and covered by an extensive sward of vegetation.

The nearest wintering station is Comandante Ferraz (Brazil) on the Keller Peninsula 9.6km to the NNE. Machu Pichu Station (Peru) at Crepin Point lies 7.5km to the north and the Ecuador refuge at Henequen Point 6km to the NE. The US refuge, Pieter J. Lennie Station, (Copacabana) is positioned within SSSI No. 8 (Western shore of Admiralty Bay), 2.5 km to the south.

Henryk Arctowski Station is operated by the Department of Antarctic Biology of the Polish Academy of Science (PAS). Its primary purpose is scientific research.

The station was last inspected in 1993 (UK, Italy, Korea) and prior to that in 1990 (Chile), 1989 (NZ, UK), 1987 and 1985 (Chile) and 1980 (US).

Personnel

The maximum capacity of the station is 30-40. At the time of the Inspection the complement was 15 and due to decrease to 13 over-wintering personnel. Around 50% of the staff were scientists and the complement also included a cook, doctor, electrician, radio engineer and diesel mechanic. The station leader was a cartographer.

A further number of short term scientists was due to arrive shortly on a Russian-registered tourist ship. All station personnel were civilian. There was no military involvement in either the running of the station or its logistic support.

Scientific research

A wide range of scientific studies had been conducted at Henryk Arctowski over the past 22 years. These included geology and geomorphology, glaciology, geophysics, oceanography, meteorology, and in particular ecology. The present Polish biological programme 'Variations in the Antarctic coastal ecosystem' is undertaken by the Department of Antarctic Biology in co-operation with many Polish Universities and Institutes belonging to the Polish Academy of Sciences.

At the time of the visit studies were being conducted into freshwater ecology, geophysics, medical research, geodetic cartography and botany. Meteorology measurements for local use were also being taken. These were not however being fed into the world meteorological net.

Facilities to support science consisted of a new containerised laboratory close to the lighthouse point for chemistry/biology, a meterological laboratory and three separate magnetics buildings on the hill behind the base. (These last were due to be removed).

Scientific co-operation in the past at Henryk Arctowski has involved a number of other Sates including Hungary, Germany and the Ukraine. One student from the Czech Republic was present on the base carrying out botanical studies.

Physical Description

A substantial, dispersed station occupying an L shape in the low lying gravel/sand back-beach area. More than 12 buildings make up the complex which stretches more than 1.2km from the structures on Point Thomas to the prominent rock and lighthouse on the unnamed point in front of the station. Buildings included a T shaped 40x34m accommodation block with kitchen and dining area, an 18x6m meterological laboratory and library, a 20x7m biology/chemistry laboratory, a 10x18m greenhouse, two substantial warehouses (one 29x26m the other 22x24m), an 18x50 generator shed, three further accommodation blocks (two measuring 8x7m, one 24x7m) and a radio building at 9x9m. Various containerised units act as cold/freezer store rooms and waste storage areas. Five old buildings full of waste material were situated close to the single bulk fuel tank on Point Thomas.

A newly constructed wooden building adjacent to the lighthouse on the point acted as a tourist information centre. This building had been built out of wood salvaged from the rebuilding programme.

The buildings were in variable condition. Most date from the original occupation of the site.

Some of the older buildings require external maintenance. Internally the accommodation was attractive and comfortable. The three accommodation blocks at the base of the slope behind the base had been completely refurbished internally to a high standard, though none possessed toilet or washing facilities.

The 1993 Inspection Report (UK/Italy/Korea) indicated that no expansion of Henryk Arctowski was planned. However, buildings have been erected in the recent past. In addition to the tourist building these included a replacement to the main accommodation block in 1998/99 and the biology/chemistry laboratory (1997/98). Both are covered in yellow metal profile cladding .

2km of gravel track connects Point Thomas to the station complex and extends out to the lighthouse.

The dispersed nature of the buildings at Henryk Arctowski reflects the availability of stable land on which to build. Much of the land in the immediate vicinity of the base though flat, is apparently unstable for building purposes and could not support large heavy structures. The bulk fuel tank was located on the headland at Point Thomas because the site provides greater shelter for off-loading fuel and stores.

Logistics

The base is re-supplied once a year by ship. Every two years by a dedicated vessel from Poland, otherwise by using a ship transiting from South America. Personnel are transported to the base using tourist and governmental vessels. Off-loading recently took 10 days for 300 tonnes of stores.

Power is provided by 2x125kVA diesel generators with a wheeled 36kVA generator as standby. Annual fuel consumption is around 100,00 litres. Previously oil had been transferred ashore by using 2 x 16 tonne (5x2x7m) double-hulled barges, manouvered by 2 x 11m (180hp) ex-military steel tugs (pushers). These barges were ashore on Cape Thomas along with a new barge/pontoon which was capable of self-propulsion. This method has since been superceded by a ship to shore floating fuel line. At the time of transfer a boom is deployed around both the vessel and the fuel line as contingency against an oil spill. Fuel is pumped direct into the large (830,000 litre) capacity fuel tank on Point Thomas, 800m to the north of the station. The tank is double-walled, but not bunded. Its integrity is inspected at the time of re-supply apparently every 2-3 years. Fuel lines are cleared using compressed air.

Diesel fuel is held on the station in 4 x 2,000 litre working tanks adjacent to the generator building. These are replenished from the bulk fuel tank using a similar 2,000 litre tank mounted on an ex-military DUKW. The base mechanic is responsible for fuel management.

An adequate supply of water is obtained from a dammed melt stream and stored in a heated 2,500 litre tank in the generator building. Water is plentiful in summer and would provide a ready supply if needed for fire fighting. In periods of extreme cold there can however be a shortage of water from this source.

Around 520m of insulated pipeline connect the pumphouse to the generator building and thence to the biology/chemistry laboratory. Similarly, 420m of power line connect the generator shed to the accommodation and laboratory buildings.

Transport and Communication

Radio communication was provided by HF and VHF (with a repeater) and SATCOM.

Base vehicles included 2 cranes (one around 8 tonne capacity), a caterpillar-type tractor and tracked sledge for boat launching, a 4-wheel drive vehicle, two bucket loaders, 1 forklift and 2 DUKWs (one no longer servicable as an amphibious vehicle is dedicated to transporting fuel, the other is used for off-loading stores (10 tonne capacity) within Admiralty Bay). Other boats comprised two 11m tugs equipped with their own heavy gauge trailers for launching, a 9m fishing boat *Slon morski* (Elephant Seal) for inshore marine biological work (on a cradle at Point Thomas), a combined fuel barge/container pontoon which can be self propelled, 5 zodiacs with outboard engines and two 'dumb' fuel barges.

The station was equipped with 2 helipads 50m apart. These were used principally by Chilean helicopters from Frei Station.

Safety, Training and Emergency Procedures

All personnel are provided with one month's pre-deployment training in all aspects of environmental management, first aid, and fire fighting.

A resident doctor was present and medical facilities included a treatment room, with suction and x-ray.

Emergency response was apparently limited, and medical evacuation would have to rely on air transportation from Frei Station to Punta Arenas (Chile). The station was well provided with fire-fighting equipment and a fire emergency plan was available. Fire fighting exercises were carried out once per season . Similarly the base had a prepared oil spill response plan and personnel were trained in how to deal with spills. Exercises took place, and oil spill contingency equipment was on site with booms deployed, absorbents and dispersants on standby during the period of fuel re-supply.

Environmental Management

The base implemented a sound waste management policy and waste was separated into plastics, metals, glass and organics. Base personnel were trained in waste management. A compactor was present, and combustible organics were burnt in an incinerator. All other wastes were stored in metal containers and retrograded to Poland.

Sewage and grey water was treated in a three-chambered septic tank situated 40m in front of the accommodation block, with effluent discharged to the sea. Solids were pumped out of each of the 2,000 litre chambers in the septic tank rotationally once every three years, and retrograded to Poland.

Notices relating to the protection of flora and fauna were evident on the station, and SSSI No. 8 (Western shore of Admiralty Bay) lies just 400m to the south of the station. This protected area was marked prominently by a 'no entry' sign erected two years ago at Rakusa Point. (One of the few examples of such a protected area sign). Poland had issued permits for entry to this protected area, including to non-Polish nationals, within the past year. Tracks are present within the SSSI to, for example, provide access to the US refuge at Copacabana, and via the Warsaw Icefield to the Argentine station Teniente Jubany 14km to the SW.

Monitoring and management of the SSSI was undertaken principally by the US who were conducting ornithological studies in the site. Several observation hides were evident near Rakusa Point. The 0.12 sq km area of flat botanically-rich sward adjacent to the base had been indicated as a 'protected zone' in 1991. However, it was understood that there were no plans to propose extending the SSSI to include this area on the grounds that it had been subjected to too much human impact, and similar, though unimpacted, floristically-rich areas existed within the SSSI.

A greenhouse has been present at Henryk Arctowski since the early days of the establishment of the station. It has been used extensively for botanical studies. At the time of the visit studies were being conducted on the Antarctic hair-grass *Deschampsia antarctica*. However, the greenhouse was also being used extensively for growing vegetables such as tomatoes. Imported house plants were also in evidence on the base. Previously, plants in the greenhouse had apparently been grown in imported soil. Now guano-enriched soil from nearby penguin rookeries was used.

Imported plants constitute a problem and the northern hemisphere grass *Poa anua* has been reported as growing at Henryk Arctowski (pers.comm. R I Lewis-Smith) apparently the product of escapes from the greenhouse. There have been concerns that this species might invade the local sward of *Deschampsia/Colobanthus* if not eradicated.

It was not apparent whether the newly constructed buildings, and the new science programmes had been subject to an Environmental Impact Assessment. A descriptive environmental assessment of the base had however been undertaken in 1991 (Rakusa-Suszczewski and Krzyszowka).

Tourism

Visits by tourist vessels to Henryk Arctowski have declined in recent years. For example in 1992/93 2,996 tourists had visited on 32 tourist vessels. By 1996/97 the figure had dropped to 1,051 and by 1997/98 to 888. So far this season 670 tourists on 9 vessels had called at Henryk Arctowski. The station has an active policy towards tourist management, and, in an effort to divert visitors away from the scientific and accommodation elements of the base, has constructed a wooden purpose-built tourist information centre adjacent to the lighthouse. However, this contained relatively little interpretative material though a useful information booklet on Henryk Arctowski had been produced recently. Only 50 visitors are allowed ashore at any one time and a tourist 'nature trail' had been devised extending along the beach. Here, extensive amounts of whalebone and plant communities could be viewed, as well as, from a distance, the penguin rookeries within SSSI No. 8.

Henryk Arctowski's management toward tourism aims to ensure environmental protection by minimising waste, prohibiting the collection of plants, fossils and artefacts and avoiding disturbance to wildlife and research programmes. Tourists are briefed on such issues when they land.

Tourist Information Centre and Lighthouse

Summary

A well established somewhat dispersed base. Recent years have seen a programme of refurbishment of some existing buildings and also the installation of new purpose built buildings, notably the accommodation block, biology/chemistry laboratory and the tourist information centre. These provide high quality facilities. The last is interesting as an example of recycling materials. This building was constructed wholly out of re-claimed timber present on the base.

The station continues to implement an active science programme, particularly on ecological studies. Enhancement of science would probably require the provision of more laboratory space and equipment. Active management of tourism is undertaken.

The operational management of Arctowtski is influenced by the dispersed layout of the station. This entails for example complicated procedures for transferring fuel oil, and for

the size of the base, relatively long distances over which services must be transported (water, electricity, sewage etc.).

For its present complement Henryk Arctowski has extensive storage buildings and heavy mechanical plant, all of which require maintenance.

It is recommended that all non-native specimens not required for scientific study and subject to a permit, should be removed.

Ref: Rakusa-Suszczewski.S, and A Kyzyszowska. 1991.
Assessment of the environmental impact of the 'H. Arctowski' Polish Antarctic Station (Admiralty Bay, King George Island, South Shetlands) Polish Polar Research.12 (1) 105-121.

MR, IC, HG, MC

TENIENTE JUBANY STATION (ARGENTINA): INSPECTED 29 JANUARY, 1999

Teniente Jubany from the west

General

Teniente Jubany Station is located on the low-lying southern shore of Potter Cove, Maxwell Bay, King George Island at Lat. 62° 14'S; Long. 58° 38'W. It lies just to the east of the distinctive basaltic Three Brothers Peak (190m).

The base has a long history. It was established by the Argentine Navy as a summer-only presence in November 1953 and this practice continued through until 1982. In 1984 Teniente Jubany became a permanent year-round station, and although still managed by the military, the clear objective of the base has since then been scientific research.

Teniente Jubany is operated by the Argentine Ministry of Defence with logistics provided by the three joint military services (Apoyo Logistico) and scientific research by the Instituto Antartico Argentino (IAA). Co-ordination between IAA and Apoyo Logistico is provided by the interdepartmental Dirección Nacional del Antartico (DNA).

Detailed written information was provided to the Observers on the station and its infrastructure by the Base Commander. These details were set out in a format corresponding closely to ATCM Checklist 'A' for Permanent Stations. This information proved extremely useful in subsequently compiling the Inspection Report.

Teniente Jubany was last inspected in 1990 by Chile and previous to that by the US (1985).

Personnel

The maximum number of personnel on the station during the summer season varies between 62 and 78 depending on the science programmes being undertaken (numbers vary from month to month.) The maximum design capacity of the station is 80.

Base personnel consisted of around three-quarters logistic support, provided by military personnel, and one quarter civilian scientists. At the time of the inspection 16 scientists were on the station made up of 8 Argentines, 7 Germans and 1 Italian.

Unlike other Argentine stations, Teniente Jubany has a more mixed approach to military support with all three services represented. The Base Commander at the time of the Inspection was an army Lt Colonel, though this position could equally well be filled by an officer from one of the other armed services.

The working relationship between the military support and scientific civilians appeared to work well. Summering staff are on base normally between December to March. In winter the complement decreases to 19.

Scientific Research

Teniente Jubany has an active and impressive science programme and provides a valuable example of how international scientific co-operation can operate in Antarctica. Approximately half the scientific personnel on the station were from various German institutes and universities. The scientific and logistic support provided for these staff is held under an Agreement between Argentina, Germany and the Netherlands, which allows for financial, technical and equipment exchanges. Some of the laboratories on site were, for example, provided by the Alfred Wegener Institute in Bremerhaven.

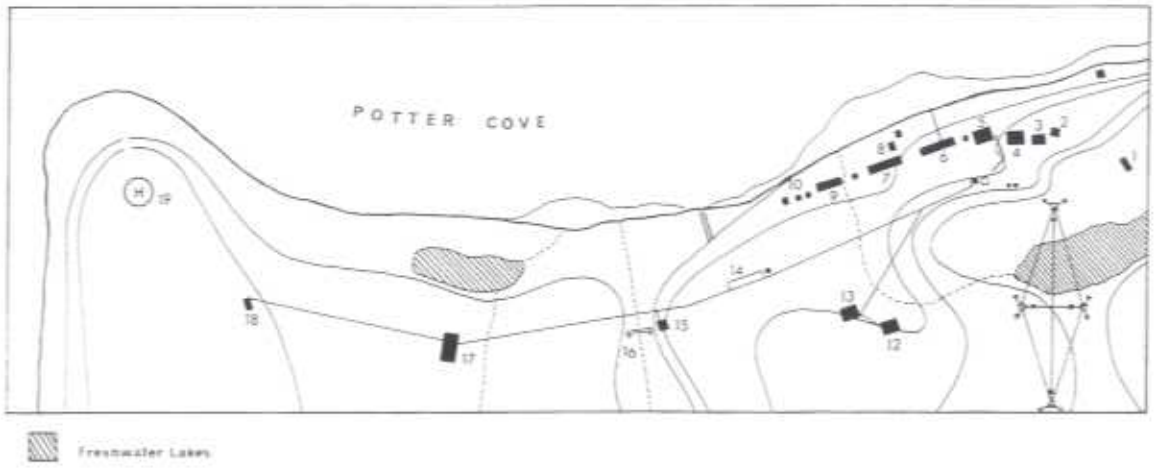
A similar Agreement had been concluded between the Argentine and Italian Governments and Teniente Jubany is one of the few sites designated in Antarctica as contributing to the global network of CO_2 monitoring sites, and data are submitted to the corresponding World Data Centre in Japan. The CO_2 laboratory was under the supervision of a senior Italian scientist.

The range of science conducted at the station was varied and included inshore marine biology (conducted largely in Potter Cove) particularly on ichthiology, benthic ecology and sediment chemistry, oceanography, vertebrate biology (seals and seabirds), microbiology, biochemistry, limnology, terrestrial ecology, seismic observations, geology and atmospheric studies. The ongoing science programmes were supported by three dedicated science technicians.

Science facilities were impressive, with the main laboratory block (Dallmann Laboratory) providing laboratory and scientific storage facilities, SCUBA diving facilities (but see under the section on Safety, Training and Emergency Procedures) and living accommodation for scientists. Additional facilities were provided in the German laboratory (4 purpose built containerised units) and individual fibreglass 'melon huts'. The CO_2 monitoring unit was housed in the old Argentine laboratory. The standard of laboratory equipment and facilities was high. The station also had a well equipped meteorological station situated towards the east of the station complex.

The degree of international scientific co-operation at Teniente Jubany was amongst the highest seen at any of the stations inspected.

Physical Description



Teniente Jubany station layout

Layout of Teniente Jubany:

1. Argentine Laboratory, 2. Radio Building, 3. Food Cold Store, 4. Meteorology Laboratory 5. Generator Building, 6. Main Accommodation Building, 7. Sewage Treatment 8. Dallman Laboratory, 9. German Laboratory, 10. "Melon" Huts, 11. Storage Container 12. Incinerator/ Compactor Building, 13. Main Food Store, 14. Bulk Fuel Tanks 15. Emergency Store, 16. Former Dam, 17. Garage/Carpenters' Store, 18. Food Store, 19. Helipad

Teniente Jubany has a roughly linear layout stretching along the south shore of Potter Cove on the ice-free land between Mirounga Point and the Fourcade Glacier. The buildings are set between 10 and 150m from the shoreline, which rises gradually to around 10m towards the east of the station. A 750m gravel track runs the length of the station from the helipad on Mirounga Point to the main station complex. The base consists of around 15 major buildings with additional containers for stores and 'melon huts' for laboratory space. The age of the buildings is variable. Some, more than 40 years old, date from the original establishment of the station. Others are more recent. These include the main Dallmann Laboratory built since 1987 (and at the time of the Inspection being sandblasted to remove corrosion) and the new German laboratories (block of 4 containerised units). The building housing the sewage treatment plant was 3-4 years old, as was the plant itself. A small church was under construction at the time of the Inspection (the founds were being prepared) to the south of the laboratory and accommodation buildings. Additional foundations had been prepared

behind the food store, and as an extension to the CO_2 air sampling laboratory.

Principle buildings from west to east were a food store, garage/workshop, emergency store, main food store, incinerator and compactor building, German (yellow) laboratories, Dallmann laboratory, main accommodation block, generator shed, meterological building, cold store, radio communications building and an older Argentine laboratory (housing the CO_2 monitoring unit).

Despite the venerable state of some of the buildings all were in an excellent estate of repair and painted a distinctive orange colour.

A stream flows down through the station into Potter Cove and the remains of a former dam are evident between the garage/workshop and emergency store.

The station also has two refuge huts, called Elefante and Albatros. These are used during the summer season, particularly by staff undertaking research on seals and seabirds.

A major (HF) aerial system is located east of the station, with the aerial arrays spanning the freshwater supply lake.

Logistics

Annual re-supply of the station is provided by the Argentine naval vessel *Almirante Irizar* with stores being landed either via boat or flown in by Sea King or Super Puma helicopters (eg to deliver bulk fuel). Re-supply is augmented by monthly fixed-wing (dH Twin-Otter) flights using the established ski-way 2.5 km to the east of the station on the adjacent ice piedmont. Personnel and light stores are transported via this aircraft link.

Power generation is supplied by 3 Caterpillar 366-D6 generators each of 180kVA. Two are housed in the generator building, the other in the sewage treatment building. Bulk diesel fuel was held in a series of eighteen 10,000 litre horizontal tanks. Each batch of 9 tanks was provided with a 60cm deep concrete bund, capable of holding the contents of a number of tanks in the event of leakage. Problems had however been encountered with these open bunds which filled up with snow during winter and resulted in large quantities of oil-contaminated water being generated following the spring melt. This was processed by passing through a centrifugal separator. Any oil recovered was returned to the bulk tanks. The separator was however not capable of reducing the oil-in-water content below 4ppm. This posed a quandary for the base management. Discharge to sea was unacceptable given that Potter Cove is a major focus of the base's scientific programme. Such action would also be contrary to the provisions of Annex III to the Protocol. Instead, as an interim measure, oily water was being stored in a bulk tank. Retrograding was being considered.

Bulk fuel oil is delivered to the station by 2,000 litre (rolling tanks) under-slung from helicopters, and then pumped from the eastern helipad to the tank-farm close by. Fuel lines were emptied afterwards by suction.

In addition to 250,000 litres of bulk diesel fuel, the station also held 10,000 litres of Nafta, 5,000 litres of JP1 and 1,300 litres of various lubricants. The majority of fuel was held in the bulk metal tanks. An additional 20,000 litre Pillow tank was available, and some fuel eg petrol for the outboard engines was stored in 205 litre drums. Overall, efficient procedures were in

place for power generation, fuel storage and transfer with responsibility for fuel management residing with the senior diesel mechanic. Oil was pumped through above ground fixed pipes from the bulk tanks to the header tanks. Inspection of the tankage and pipework was undertaken daily. Furthermore, as contingent against small spills, each diesel generator bed was surrounded by a 'moat' containing oil absorbent material. This was a feature not seen at any other station. Annual fuel consumption was 65,000 litres.

Potable water was obtained from a shallow lake just to the SE of the base. Water intake depth was only 1m and water was gravity fed to the generator building where it was stored prior to distribution around the station. This source of water was unavailable in winter. Instead water had to be pumped from an alternative (deeper) lake further to the east via a heat-traced pipeline. Water supply was sufficient and quality adequate. Consumption was around 150 litres per person per day.

Transport and Communications

The station was equipped with 2 Snow-mobiles, 4 tracked vehicles 'Muskeg-type' tractors, a lorry and 2 4x4 'landrover-type' vehicles. For transport within Potter Cove, 5 Zodiac Mk III inflatable boats plus outboard engines were available.

A track leads north-east from the station to Florence Nunatak and then via Jardine Point to the Polish Henryk Arctowski Station 14km to the north-east on Admiralty Bay.

Radio communications were provided by HF, VHF and SATCOM.

Safety, Training and Emergency Procedures

Extensive pre-deployment training is provided for both military and civilian personnel in mountaineering/winter survival and fire fighting.

The station was equipped with a modest medical unit with a single-bed ward. Equipment included X-ray facilities, a defibrillator and suction. A doctor was resident. In the event of serious medical cases evacuation would be via Vice-Commodoro Marambio. Search and rescue capability was limited to snow-mobile and inflatable Zodiac range.

The base possesses a Fire Emergency Plan and a range of fire-fighting equipment. Personnel were trained in fire-fighting both pre-deployment and whilst on base. Fire-fighting exercises were held.

SCUBA diving had been suspended on the station due to the lapse of certification of the decompression chamber. Irrespective of that, the observers were concerned that the chamber on base was only of a portable transportation type and would not easily permit treatment of a patient on site. Apparently Artigas Station (Uruguay), which informally relied on the Jubany decompression facility as emergency back-up for its diving operations, had not been informed that this chamber was out of commission.

Environmental Management

Standards of environmental awareness were high, and the station and its environs were extremely tidy. Waste management procedures were the responsibility of the Base Commander and were clearly enforced rigorously. Wastes were separated at source. Large quantities of

clearly marked, meticulously boxed-up wastes were stacked up close to the Mirounga Point helipad. These were awaiting pick-up by the *Almirante Irizar* which kept a manifest of all waste retrograded.

Stored waste ready for retrograding

A compactor and incinerator are housed in their own dedicated building to deal respectively with metal wastes and combustible organics. The emission from the incinerator could be monitored by the CO^2 laboratory 200m to the NE.

Teniente Jubany possesses a highly sophisticated sewage treatment plant, housed in its own building. This equipment, along with the loan of an expert technician for two years to operate the plant, had been provided under the Agreement with the Netherlands and Germany. The system had since been handed over to Argentine personnel to run. Treatment levels of sewage were high and dry solids from the plant were retrograded to Buenos Aires for disposal.

One element of environmental management which, in the opinion the Observers, could have been effected with greater care, was the anti-corrosion treatment being given to the Dallmann laboratory.

Corrosion of the metal frame of this building was extensive and a contracting team were, at the time of the Inspection, sandblasting the structure. No provision had however been made to shield the building with protective sheeting during this blasting process or to ensure that the paint and sand 'fines' were collected for disposal. The result may well be that some of this material, which could contain appreciable levels of heavy metals, will be washed into Potter Cove via run-off. There was no indication that this maintenance activity had been subject to Environmental Impact Assessment.

A prominent illustrated sign was displayed on the south side of the accommodation building

detailing the rules relating to wildlife conservation. Station personnel were also made aware of the provisions dealing with flora and fauna by the Base Commander. SSSI No. 13 (Potter Peninsula) is located within 800m of Teniente Jubany Station and extends from Mirounga Point to Stranger Point. The particular interests of this site are its breeding populations of penguins, seabirds and seals. Strict control over entry to this site is maintained, with access confined to the northern end at Mirounga Point. Overflying of the SSSI by helicopters is not permitted. Permits to work on wildlife are issued by both the Instituto Antartico Argentino and the Alfred Wegener Institute for their respective nationals.

Tourism

Although located within Maxwell Bay, Teniente Jubany is not visited frequently by tourist vessels. Only 4 such vessels had called in the past year with around 250 tourists. The policy of the station was to restrict the numbers of visitors ashore at any one time to 50-80 maximum. Advance permission to visit of at least 24 hrs was required from tour operators.

The view was that tourist visits did not present operational problems for the station, nor was there any adverse impact either on science activities or the local environment.

Summary

A medium sized station long established on this site. The base is staffed by a mixture of military support personnel and civilian scientists. This arrangement appears to work effectively. The scientific facilities and equipment at Teniente Jubany are of high quality and support a wide range of scientific projects. International scientific co-operation is a conspicuous feature of the station, with over half the scientific complement of the base composed of foreign scientists. The co-operative arrangements between Germany, the Netherlands and Argentina, and Italy and Argentina, had clearly been of benefit to all Parties concerned, with facilities and equipment being provided by the three States in exchange for accommodation and logistic support from Argentina, and access to good working areas for science.

Environmental management was to a high standard with great care being taken over waste management, fuel handling and power generation. A sophisticated sewage treatment plant was in successful operation. The station area was meticulously maintained. Greater environmental consideration could however have been given to the procedures for sandblasting the corroded steel frame of the main laboratory building.

Generally the station has sound procedures on health and safety. Nevertheless, urgent priority should be given to the provision of a suitable diving decompression chamber.

Overall, an impressive station with a strong focus on a varied science programme.

MR, HG, IC, AJ

ARTIGAS (URUGUAY): INSPECTED 18 JANUARY, 1999

Artigas Base

General

Artigas Station was first established by Uruguay in December 1983. It lies on gently sloping, largely gravel ground, 150m inland from Collins Bay, Maxwell Bay at a height of around 10m above sea level at Lat. 62° 11'S; Long. 58° 51'W.

Artigas is one of four stations located around the western shores of Maxwell Bay. The Russian station Bellinghsausen is the nearest lying 3.3km to the south west. It is connected to Artigas by a track.

The base is operated by the Uruguayan Antarctic Institute, part of the Uruguayan Ministry of Defence. The principal purpose of the station is scientific research. It is manned by both military and civilian personnel. The Uruguayan Air Force, Navy and Army share in the running of the station.

The base was last inspected in 1990 (Chile) and before that in 1989 (NZ/UK) and in 1987 (Chile).

Personnel

The station is manned throughout the year. An average of 14 staff are resident in winter. At the time of the Inspection the complement was 32 which included 6 scientists (the number of scientific personnel varied throughout the summer season from 6-10 depending on the month).

The Station Commander was an Army Lt Colonel. Military personnel did a one year

deployment at Artigas and the intention was that the No 2 in command would take over the running of the Uruguayan station T/N Ruperto Elichiribehety at Hope Bay in the austral spring of 1999/2000.

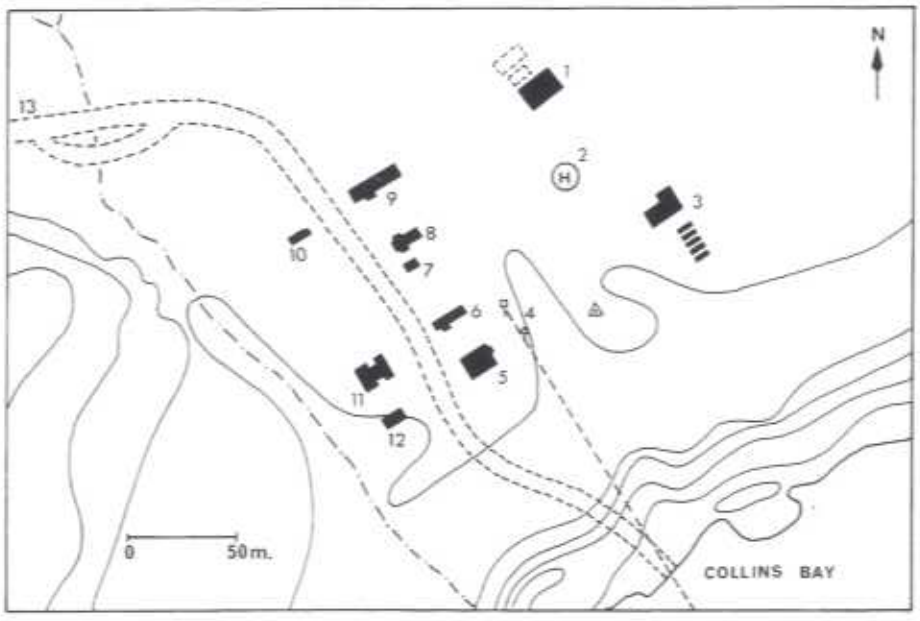
Personnel received two months pre-deployment training in first aid, mountaineering and environmental management.

Scientific Research

A variety of research programmes was being undertaken. These included ozone measurements (using a Brewer Spectrometer 155 Type Mk 2), ionospherics, glaciology, biology and medical/dental studies. In addition tidal observations and hydrographic surveying were carried out as well as meteorology with six hourly synoptic weather reports passed to Frei Station (Chile) and Montevideo. An automatic weather station was present.

Although one of the larger buildings on the station was set aside for scientific accommodation, actual working space for scientists appeared limited. Other than a meteorological/physics facility, no dedicated laboratory space was apparent. Summering scientists were expected to be self-sufficient in scientific equipment. Scientific facilities did however include an ionospherics building (around 300m north of the station) equipped with a rheometer (30m). A GPS station as a reference for glaciological work was present.

Physical Description



Artigas station layout

1. Hangar plus foundations, 2. Helipad, 3. Incinerator/Generator Building plus Fuel Tanks, 4. Navigational leading lights, 5. Main Building, 6. Medical/Administration, 7. Diving Store, 8. Food Store, 9. Carpenters' Store, 10. Radio building, 11. Laboratory Accommodation, 12. Station Commander's Accommodation, 13. Track to Lake Uruguay and Bellingshausen

Station

* (Adapted from Uruguayan Chart No. 1111, Dec. 1991) – Contours at 1m. intervals.

Artigas Station consists of eleven well separated buildings. These are generally arranged in two parallel rows 80m apart, either side of a central track with buildings aligned parallel to the slope of the ground.

Most of the buildings were of similar prefabricated construction set on concrete-filled metal drums as foundations and in a sound state of maintenance. The oldest buildings, which include a 33x8m water store/carpenters' workshop was of 'Nissen hut' type construction. Metal shipping containerised units were also in evidence, for example the building housing the station commander's office and the medical facility. Other buildings were: the 25x16m main domestic block (accommodating a pleasant dining room/lounge, a small computer library, toilets and a kitchen), a 15x5m food store, 8x4m diving store (though with no decompression chamber), radio communication, an H-shaped science complex, and the station commander's accommodation. The two largest buildings were the hangar and the generator/incinerator building. The former provided office space for the flight crew.

No buildings had been erected recently – within the past two years. Assessing the layout of the station against that shown on the 1991 Uruguayan Hydrographic Chart No. 1111 it would appear that the generator/incinerator building, station commander's accommodation and diving store are the most recent buildings to be constructed.

Apparently the foundations north of the carpenters shop are to be used. Two new buildings, one an accommodation building for 20 persons, the other housing domestic heating fuel. When these new structures would be constructed was not clear.

Around 560m of gravel track were present within the station, (extending from the shore to the water extraction point on Uruguay Lake). Thereafter, the track extends to the Bellingshausen/Fei complex 2,200m away.

Logistics

Annual re-supply was by means of the Uruguayan naval vessel *Vanguardia*. This had taken place on the day previous to the Inspection when the ship, at anchor in Collins Bay, had been overflown by the Inspection team.

Bulk fuel oil for the station was pumped ashore via a flexible hose from the vessel. Uruguay had leased one of the large bulk tanks from the nearby Russian Bellingshausen station. The 130,000 litres of fuel held there would be transported by lorry tanker (13,000 litres) to the station's 5 main fuel tanks. These have a capacity of 3 tanks at 12,750 litres and 2 tanks at 25,250 litres. The double-skinned horizontal tanks were equipped with drip trays underneath the main valves, but these trays appeared to be in poor condition. There was evidence of localised spillage of diesel. Also sited within the generator building was a fuel tank (13,095 litres) for refuelling vehicles.

It was stated that a construction team was due to arrive at Artigas shortly to replace and reposition the bulk tanks. The new tankage, also double skinned, would be positioned slightly closer to the shoreline and in line with the generator shed. The tanks would be fully bunded

and equipped with new pipage to the generators. The short pipeline for the existing tanks is underground.

Power was supplied by two 36 kVA generators (a third similar generator was in Montevideo for repair), and fed from the 2,500 litre working tank. Annual consumption of diesel was 160,000 litres and a 13% JP1/diesel mix was used in winter. Although no alternative energy sources were being used consideration was being given to 'scavenging' the waste heat from the incinerator to heat the generator shed.

Potable water for the station was gravity fed from the sizeable Lake Uruguay 240m to the west of the station. Water supply within the station was on a ring main with tanks in all main buildings, (1,000 litres in the kitchen/dining building, 800 litres in the other buildings and 500 litres in the station commander's accommodation). An emergency water supply for use during very cold weather was provided by two15,000 litre tanks housed in the Carpenter's workshop.

Logistic support for the base was provided by the armed forces in an integrated fashion. At the time of the Inspection many base personnel were engaged actively in unpacking stores which had arrived the previous day aboard the naval vessel *Vanguardia*.

Transport and Communications

Stationed for the summer months was a Bell 212 helicopter operated by the Uruguayan Air Force Group 5. The aircraft was provided with its own 14x25m hangar, specialist flight crew experienced in Antarctic conditions, and flight office accommodation in the hangar.

Flights are made to the summer-only station T/N Ruperto Elichiribehety at Hope Bay (flying time around one hour).

The nearby helipad was well marked out, in a safe location and provided with landing lights (the only pad seen so equipped). Two more major landing lights were positioned to one side of the hangar with a rotating hazard light on the gable end of the hangar.

Vehicular transport within the station was provided by 2 BV tracked vehicles, 2 tractors, 1 aircraft towing tractor for the Bell 212 and one lorry. An obsolete Sno-cat had been cannibalised for spares for nearby stations' vehicles and was due to be shipped out as waste.

The station was also equipped with 2 inflatables and 2 outboard engines.

Radio Communications were provided by HF, VHF and SATCOM.. The station was supplied with a Local Area Network (LAN). HF aerials were located near the communications building along with a satellite dish. A TV satellite dish was positioned close to the station commander's accommodation.

Safety, Training and Emergency Provision

Staff were provided with a two month pre-deployment training in first aid, mountaineering and environmental management.

The station was equipped with modest medical facilities which included a treatment room, with anaesthetic machine. There was a resident army doctor. It was anticipated that more serious medical conditions could be evacuated rapidly by helicopter to Frei Station (Chile)

and then by aircraft to South America. Although SCUBA diving was undertaken at Artigas, and the station had a dedicated diving store, there was no decompression chamber on site. The Observers were informed that in the case of a diving emergency a patient would be transported to the nearby Argentine station Teniente Jubany where a small decompression chamber unit was located. (It subsequently transpired however that this chamber was not certificated and in consequence diving projects by German scientists at Teniente Jubany had been suspended). A more rigorous approach to dive safety and medical provision may require examination.

The station was equipped with a fire emergency plan but the apparent lack of fire extinguishers at the time of the visit was explained by the fact that most were being serviced in Montevideo. Fire fighting exercises were held monthly.

With its helicopter support the station had good search and rescue capability (during the summer period).

Environmental Management

Environmental management was to a high standard. Wastes were separated at source into metals, plastics, organics, batteries, and glass, and prominent notices on waste separation were evident in every building. Monthly reports on waste management were prepared. Waste metal was compacted, and baled and this plus glass was retrograded to Montevideo. Large scale metal scrap was stored in a bunded waste area behind the generator shed. The base employed a strict waste minimilisation policy with extensive use of re-usable plastic boxes for importing stores, including food, onto the base. This was a commendable practice which could be usefully employed on other stations.

Despite this rigorous policy the practice of burning all organics and plastics on site was questionable. The apparently newly installed incinerator was equipped with a two-stage burner and air particulate filtration. However, at the time of the Inspection, excessive amounts of smoke were being emitted and the stated operating temperature of 700° C may not be sufficiently high to ensure a wholly efficient burn.

Sewage was treated in a septic tank with clear effluent discharged by pipe to the sea. The solids are retrograded back to Uruguay for disposal. Overall the area of the station was exceptionally tidy and devoid of debris. Weekly rigorous cleaning of the outside area was carried out.

There was a high awareness of wildlife conservation. Notices on the protection of flora and fauna were displayed. Knowledge of the protected status of Ardley Island (SSSI No. 33) was evident and overflying by helicopters was either avoided or kept to an acceptable height.

However no mention was made by station personnel of the nearby SSSI No. 5 (Fildes Peninsula) which is only 1km from Artigas, and it was not clear to the Inspection team whether the station had a policy towards this protected area. The track between Bellingshausen and Artigas has indeed been constructed through the northern block of SSSI No. 5. Such action was clearly not consistent with the management objectives of the protected area.

Tourism

Although Maxwell Bay is visited frequently by tourist ships, Artigas had experienced only one cruise ship visit this season with 35 personnel ashore. Visitors are closely supervised when at the station, and no difficulties had been experienced with tourists.

Summary

A medium-sized permanent station operated in an efficient and tidy manner. Environmental management was to a high standard and certain practices, such as re-usable packaging are to be commended. It is however recommended that the policy towards incineration be re-examined particularly in view of the apparent inefficiency of incineration. The track between Artigas and Bellingshausen Stations passes through SSSI No. 5 (Fildes Peninsula) in contravention of the site's management plan. A re-assessment of this protected area's interests and management objectives should be undertaken as required by Resolution 1 (1998).

Although a range of sciences are performed, dedicated laboratory space is limited. Commensurate with the planned expansion in personnel accommodation at Artigas the provision of extra laboratory space and equipment may benefit the scientific output of the station.

MR, HG, IC, MC

BELLINGSHAUSEN (RUSSIA): INSPECTED 17 JANUARY, 1999

General view of Bellingshausen with Presidente Frei Station in the backgound

General

Bellingshausen is sited on gently sloping ground inland from Ardley Cove in Maxwell Bay, King George Island. The station's location is Lat. 62° 12'S; 58° Long. 58'W, at an elevation of 5-10m above sea level and 100m from the sea. Extensive tracks exist in the neighbourhood of the station, and to the bulk fuel tanks which lie 1,400m to the NE.

Bellingshausen was established in January 1968 and has been in permanent occupation since. However the complement of the base is now far smaller than it had been during the 1970s and 80s. The station is run by the Arctic and Antarctic Institute in St Petersburg. The primary purpose of the station is scientific research.

Bellingshausen was last inspected in 1990 (Chile). Before that by NZ/UK (1989), Chile (1987), and the US (1985, 1980, 1977 and 1975).

Personnel

Although the maximum capacity of the station is around 50, only 26 personnel (including 7 scientists) were present on the base at the time of the Inspection.

All staff, other than the station commander, were civilian. The commander was an Army Surgeon, Lt Colonel, and acted also as the station's principal doctor. Support staff included a radio operator, cook, radio engineer, 3 mechanics (for the diesel generators) and an additional mechanic for the heavy vehicles (including amphibians). A two-man German TV crew, and a German tourist/philatelist were also present on the base.

In recognition of the importance of environmental management and the scale of the waste management problem at Bellingshausen, the summering crew included a 10 man clean-up team, headed by a chief ecologist. This team was made up of waste maintenance technicians, mechanics, handymen and a diver. One member of the team had particular responsibility for the dismantling of the aerological ground station. Two Russian clean-up volunteers were present, and three more (from the NGO expedition 'One Step Beyond') were due to arrive shortly.

The new wintering base leader (chief radio operator) was on base in an extended hand-over. Replacement wintering staff were due to arrive in March on the MV *Multanovsky*. The normal length of tour was one year, though some station personnel had been present for 2 or 3 years.

The normal wintering complement in recent years has been around 13 with 4 scientists. However, shortage of funds meant that this was now due to reduce to 9 with no science or maintenance being undertaken during the 1999 austral winter.

Scientific Research

Principal scientific programmes being undertaken were upper atmospheric physics and meteorology, with a summer-only biological programme. Medical research based on a drug trial comparison between Antarctic wintering personnel and Russian cosmonauts, although planned for, had not materialised. The programmes were supported by 2 aerologists, 2 meteorologists, 1 satellite technician and 2 visiting German ornithologists.

Regular aerological radio soundings were taken along with surface meteorological observations. There was satellite data reception for meteorological and glaciological research.

The base possessed a meteorological station, a satellite data receiving station and facilities for balloon launching with a ground-station for receiving and evaluating balloon-derived data. The electrolytic hydrogen generator, although recently in use, was awaiting repair. Hydrogen (production 0.5 m^3 per hour) was instead being produced chemically (a solution of NaOH mixed with Aluminium). Hydrogen was stored in three 5 cub m bladder tanks.

The station was awaiting imminently a decision as to whether the aerological programme at Bellingshausen would be discontinued. If so the ground-station for the aerological soundings would be dismantled and transferred to Novolazarevskaya via the MV *Multanovsky*. Given the length of data set for the aerological soundings at Bellingshausen it would be unfortunate if this programme was to be discontinued through lack of finance. It would also weaken significantly the overall science programme undertaken at Bellingshausen. *(see footnote)

The German biologists were undertaking ornithological studies on nearby Ardley Island (SSSI No. 33) on a range of species, including penguins. This was part of a programme which had taken place over a number of years.

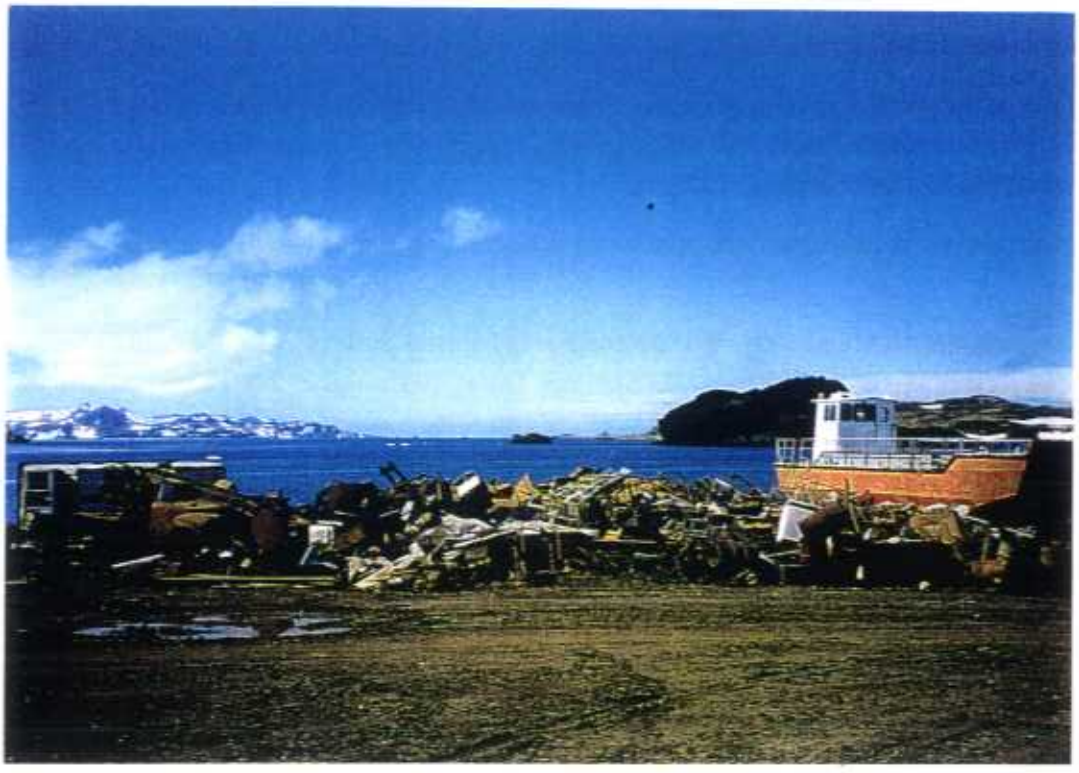
Physical Description

Covering an extensive area, Bellingshausen is made up of more than 15 substantial buildings and a number of shipping containers. Most buildings are located on the flatter ground inland from Ardley Cove. None are of recent construction, and most require a degree of

maintenance. Principal structures include: 2 main accommodation blocks, the administration offices and radio communication room, a hospital, food store, existing and alternative generator buildings, garages, incinerator building, former SATCOM and accommodation building, numerous shipping containers and a shop.

At the top of a distinct slope to the north lie the aerological ground station and the balloon launching building. 1.4km to the NE, and connected to the station by a number of tracks, are the station's bulk fuel tanks.

Although most of the station lies to the NE of the stream flowing from Kitezh Lake to Ardley Cove, the stream itself does not provide a clear-cut boundary between Bellingshausen and the neighbouring Chilean station Presidente Arturo Frei. In practice the two merge together and it is not possible to define precisely where one station ends and the other begins. To the SE of the stream lie the Russian DUKW garage, shipping containers and a shop, and the former SATCOM and accommodation buildings. Set amongst them is the Chilean pump station which extracts water from the same dammed freshwater pond as the Russian intake 20m away.



Scrap Metal collected for retrograding

Large quantities of scrap metal were present throughout the station. This ranged from obsolete heavy vehicles to lighter grade waste materials. Considerable efforts had been made to gather these wastes together and a large pile of scrap metal had been accumulated on the back-beach area just north of the stream. Three similar waste dumps had been created elsewhere on the station.

Logistics

Base re-supply was effected by a number of Russian registered vessels with food supplies from Chile along with the in-going wintering crew being delivered via the MV *Multanovsky*. The MV *Fedorov* was due to pick up shipping containers, the outgoing crew, and waste material for retrograding to Russia in March. (The journey back to St Petersburg taking 45 days).

Power generation was supplied by three 200kVA diesel generators. Plans to install 3 new Deutz generators had been postponed for financial reasons, though the housing and beds for these new engines had been prepared. Fuel consumption was around 160,000 litres per year. Fuel for immediate use was stored in five 8,000 litre tanks close by the generator building. Those tanks were not bunded and the pipework was above ground. The working tanks were replenished from the bulk fuel tanks by bowser. These large tanks are located inland from the small bay to the NE of Ardley Cove and at a distance of 1.4km from the station. The bulk tanks were not inspected, simply overflown. They consisted of two sets of 3 x 40,000 litre and 3 x 20,000 litre capacity. The southern most tanks painted silver looked to be in the best condition. The others showed significant signs of rusting. One bulk tank (120,000 litres) was being leased out to the neighbouring Uruguayan station Artigas. Oil is pumped from ship to shore via a floating hose and this was evident, laid out on the ground adjacent to the northernmost tanks.

It was not ascertained whether the bulk or the working fuel tanks were single or double-skinned. The second mechanic had responsibility for fuel management. No special provisions were installed to protect against spillages.

Alternative power supply was restricted to an aerogenerator supplying the meteorological station.

Potable water was obtained from the dammed pond on the outlet stream from Kitezh Lake (the same supply as for the adjacent Frei Station). Water intake was at 2-3m. Russian demand for freshwater at 1,000 litres per day was very modest. This was principally due to the lack of hot water on base and the provision of only one toilet per building. Water consumption rose to 2,000 litres per day if the sauna (housed in the generator building) was used.

Transport and Communications

Radio communications were via HF, VHF and SATCOM.

Eight vehicles were held on the station. They comprised a range of ex-military heavy plant including a large (1952) and small amphibious DUKW, lorry, tractor, caterpillar type tractor, car, 4x4 wheel drive, and crane. The last was however obsolete and due to be removed. Instead, use was made of the crane from the neighbouring Chinese Station, Great Wall. Similarly, the large amphibian vehicle was apparently much in demand by other adjacent stations. Boats were restricted to one large cargo tender. This was hauled up on the beach.

There was no helicopter pad marked out at the station though a safe, accessible landing area was available to the east of the accommodation block.

Safety, Training and Emergency Procedures

On site monthly training was provided, and a training log maintained. Fire fighting capability was probably limited with only a 5,000 litre water tank dedicated to the purpose. Stocks of other fire fighting equipment appeared modest. Fire practices were conducted every 3 months.

Emergency response capability, including search and rescue, was probably limited. There did not appear to be any risk assessment of oil spills, spill response plan or training of personnel to deal with oil spills. There was no mobile spill response capability.

Medically the station was equipped with a two bed ward with dental and surgical equipment. This included x-ray and suction apparatus. Two doctors were resident (including the station commander).

Environmental Management

The Station Commander was aware of the provisions of the Antarctic Treaty and held a copy of the Environmental Protocol. Despite the continuing presence of large amounts of scrap metal around the base, it would appear that considerable efforts have been made in the recent past to clean up the immediate environs of Bellingshausen. Large quantities of waste metals (the product of years of obsolescence and subsequent dumping) had been stockpiled on the beach and at three other locations around the station, and the Station Commander had attempted to instill a clean-up attitude in base personnel. Previous discarded wastes, such as broken glass, were being picked up for retrograding. There was also ongoing clean-up of a large quantity of waste aluminium oxide from the production of hydrogen. This was packaged in both drums and crates for retrograding.

On base at the time of the Inspection was a 10 man waste clean-up team. This was due to be joined by a further group of volunteers. Precisely how far this clean-up process could be taken in the short term was not clear. Overall around 2,000 tonnes of waste metal, including heavy vehicle plant to the NE of the station, was estimated as present at Bellingshausen. This amount of waste material would require extra resources to effect its removal.

Of the stations inspected Bellingshausen demonstrated the greatest localised impact on the environment. But this is largely the product of past, and not existing practices. For example there is very severe ground damage from heavy vehicles around the whole base area. Extensive tracks extend to the NE and to Artigas base. Vehicles are now required to confine themselves strictly to the recognised tracks, unlike practices in the past when vehicles were used extensively, and without restriction, in the surrounding terrain, causing ground damage over a wide area.

Conservation regulations towards flora and fauna were recognised. Russian scientists were however not working in nearby Ardley Island SSSI (No. 33). The German ornithologists at Bellingshausen were subject to relevant permits from the German authorities.

The northern element of SSSI No. 5 (Fildes Peninsula) had been designated for its unique fossils with the stipulation in the management plan that vehicles should not enter except in an emergency. Despite this, some of the bulk fuel tanks to the NE of the station had been built within the SSSI along with extensive tracks, including the track between Bellingshausen and the Uruguayan base Artigas. Whether, and to what extent, damage had been caused to the scientific interest was beyond the expertise of the Inspection team to ascertain.

Wastes were separated at source into glass, metal, plastics and organics for retrograding back to Russia. 30 small shipping containers had been set aside for waste storage. 10 were due to be shipped out on the MV *Multanovsky* with the remaining containers uplifted by the MV *Fedorov*. Estimated annual waste production was 25 tonnes (setting aside the accumulated historical waste) – ie 5-8 kg per person per day.

Although there was an incinerator on base, incineration had now ceased. All combustible materials were retrograded.

Sewage was treated through a biological, oxygenated septic tank with the effluent being discharged to sea.

Tourism

A number of tourist vessels call at Bellingshausen each season with approximately 5-600 persons. The station contained a small shop for tourists. Prior permission to visit the station was always obtained, and the view was that this level of tourist pressure did not impact on the operational efficiency of the station.

Summary

A station undertaking a useful scientific programme, particularly in atmospheric physics and biology. But one which unfortunately has witnessed inadequate investment over a sustained period. Most buildings are in need of maintenance, at least externally. Past operational practices at Bellingshausen have left a legacy of environmental problems of considerable dimension. Waste materials are prolific and apparently estimated at 2,000 tonnes of metal scrap including obsolete heavy plant. Ground damage from heavy vehicles is extensive.

Despite this, and considerable financial burdens, major efforts are being undertaken to rectify the problem. A dedicated clean-up team was on site and the station's management was clearly determined to address the problems. A positive attitude toward environmental management was evident. Nevertheless, environmental clean-up will take some time to effect and will require considerable extra resources.

Bellingshausen's complement is already well below the design capacity of the station. Concerns must be that the planned further reduction in the wintering complement (from 13 to 9) may not provide sufficient capacity for routine maintenance. This in turn may see further deterioration in the station's fabric.

The potential reduction of the science programme, for example the possible cessation of the balloon-borne aerological soundings, must also be of concern. The net result of the above might well lead to a base with a diminishing scientific rationale yet a continuing environmental burden.

*Footnote: Subsequent to the Inspection, this science programme had been discontinued at Bellingshausen.

MR, HG, IC, MC

PRESIDENTE ARTURO FREI STATION (CHILE): INSPECTED 17 JANUARY 1999

Presidente Arturo Frei – general view

General

The largest and most complex of the stations visited during the Inspection programme, Presidente Arturo Frei lies immediately to the south of the Russian station Bellingshausen. The administrative and residential section of the station is sited on gently sloping ground immediately inland from Ardley Cove in Maxwell Bay. The station's location is Lat. 62°11'; Long. 58°58'. The base area stretches over 2.4km from the shore of Ardley Cove in the SE to the western end of the runway in the NW. This whole area lies in a low-lying saddle in the Fildes Peninsula.

Frei Station was established in 1968 with the intention of providing a major presence by Chile in the South Shetland Islands and subsequently acting, by means of its runway, as the logistics support hub both to Chilean activities in the Peninsula area generally, and to other Treaty Parties in King George Island.

It was apparent to the Inspection Team that although superficially one entity, Frei Station is composed of 4 distinct elements:

i) the main station operated by the Chilean Airforce;

ii) the runway complex, and associated meterological station operated by civilian authorities but responsible to the Chilean Ministry of Defence;

iii) a small separate naval contingent;

iv) the Chilean Antarctic Institute (INACH) occupying the base 'Professor Julio Escudeoro'.

The third element was not visited by the Inspection Team. It consists of a discrete group of inter-connected buildings in the extreme SE of the station occupied by a small naval contingent. This is under the command of a Naval Lieutenant, and distinct from the Air Force command structure.

Frei Station was last Inspected in 1989 (NZ/UK) and prior to that in 1985 (US), 1977 (Argentina) and 1975 (US).

Personnel

The number of personnel present on the station was 78. This included 13 families with 22 children of elementary school age or younger. The majority of personnel were Airforce and the Base Commander a Lt Colonel (Airforce). He was supported by a small cadre of officers up to major rank. In addition, 4 Naval staff (one officer and three ratings) were present though under a separate command structure from the Airforce. Their responsibility was to manage the navigational system (navigational lights, beacons etc) in the Ardley Cove/Ardley Island area and to operate small boats (Zodiac inflatables). The runway, control tower and meteorological station was operated by staff from the DGCA (Dirección General Civil Aeronautics)

The maximum capacity of the station was approximately 100.

Scientific Research

No scientific personnel, other than meteorologists were present. (But see the following Report on INACH).

Frei Station provides an important function for Antarctic meteorology acting as a regional meteorological centre. Not only does the station conduct its own meterological observations, but it also acts as one of the major collation and transmission points for Antarctic meteorology. It collects data from other stations in the Peninsula area and transmits them to Chile for input to the World Meteorological Net. Frei Station provides a synoptic weather forecasting service to neighbouring stations.

Physical Description

Frei Station consists of more than 40 buildings. In the SE complex these give the impression of a colourful village with 15 substantial chalet/houses painted different colours set up the slope of the hill. The age of buildings is variable dating from the establishment of the station in the late 60's onwards. The central core of older buildings are painted a distinctive red orange. These included 2 large garages, the generator building, radio communications building, hospital, incinerator/waste building, school, bank, post office, tourist shop, fire fighting store and the original base complex of some age, housing a supermarket/canteen/kitchen/recreational area. A number of smaller buildings and containers painted the same colour are also present. Other buildings in this sector of the station included a chapel, large gymnasium, 2 major accommodation blocks for unmarried service personnel and the main administrative centre/Base Commander's office. Additionally, the 3-4 buildings of the Naval

contingent were present close to a single building used by the NGO tour operator Adventure Network International. The INACH complex at the extreme south of the base consisted of 6 buildings, plus associated containers.

Around 1,200m of gravel track joins Frei Station to the runway. Here, substantial buildings include the aircraft hangar, garage, hostel accommodation and dining area and meteorological facilities and control tower. Altogether around 4,900m of gravel track was present within the Frei complex. Tracks also connect through Bellingshausen to Artigas 3.6km to the NE and 2,200m of track also connect with the Chinese station Great Wall 1.9km directly to the south.

The compacted gravel runway is one of the largest in the Peninsula area. It trends SE/NW and is 1,300m long and 45m wide. Hard standing for aircraft up to the size of a dH Twin-Otter is provided directly in front of the hangar. A well marked helipad is positioned on the flat back-shore area 60m NE of the main recreational/canteen/supermarket building. Close by to the north is a radio homing beacon.

No distinct boundary exists between the Chilean station Frei and the Russian station Bellingshausen. The stream flowing between the dammed freshwater intake pond and Ardley Cove does not de-mark the boundary. The Chilean water intake building lies effectively within the boundary of the Russian base.

Logistics

Base re-supply is effected between October-April by a variety of Chilean vessels. At the time of the Inspection 3 Chilean Naval vessels *Lautaro, Micalvi* and *Isaza* were at anchor, rafted up in Ardley Cove.

In addition, a considerable amount of stores, and all personnel were transported by C-130 Hercules direct from Punta Arenas. Eleven such flights had occurred so far in January (not including local Twin-Otter and other flights). These included not only Chilean Airforce aircraft but also similar machines from other Antarctic Treaty Parties with bases in the Maxwell Bay/Admiralty Bay areas. Such Parties may effect passenger and freight movements through the Frei facility.

Bulk diesel re-supply was delivered from ship to shore by a submarine pipeline which extended out to the small island in Ardley Cove. The integrity of this pipeline was checked by SCUBA divers twice a year, and, due to ice damage, the pipe had been replaced on two previous occasions.

Power generation was supplied by three generators of 290kVA capacity at Frei, and two of 285kVA at the runway. Annual fuel consumption was 950,000 litres of diesel and 100,000 litres of JP1.

Bulk fuel storage was distributed in batches of tanks around the base, primarily as a means to reduce potential pollution risks. Total bulk diesel held amounted to 950,000 tonnes, split between 5 tanks (124m^3) the bulk of the remainder held in two large single tanks of 500m^3 and 250m^3. 100m^3 of JP1 was held in 4 tanks adjacent to the runway, and 10m^3 of petrol held in individual tanks.

All tankage and pipework could be isolated to minimise spillage. None of the bulk tanks were however bunded. In the event of leakage, fuel could be transferred to one tank, or batch of tanks, to another. All pipelines are above ground. Lines were blown clear after bulk re-supply.

Pipes and tanks were checked on a regular bases and ultrasonic tests made on tank integrity.

By means of such regular monitoring, and the ability rapidly to transfer bulk fuel, it was hoped to minimise oil spillages.

The base water supply was obtained from the dammed melt water pond on the exit stream from Kitezh Lake. Potable water was pumped from a water intake depth of 3m. Water consumption was around 189,000 litres per week. Water supply was plentiful, and its quality was monitored by the resident doctor. Water was transferred around the station in a ring-main, with major storage tanks (8,000 litres) in most of the major buildings.

Transport and Communications

A variety of vehicles were present on the station. These included a fire-engine, several earthmoving Caterpillar tractors, 2 Sno-cats, 6 snow mobiles, 2 4x4 vehicles, 1 truck, 1 van and 2 DUKWS. Vehicles were maintained and stored in the 2 large garages.

The station also has 2 inflatable Zodiac boats (operated by the Navy) and a large floating pontoon for off-loading heavy stores. This was also used to move sea containers to other stations within Maxwell Bay (eg Great Wall).

At the time of the Inspection 3 dH Twin-Otters were present on the hard-standing adjacent to the hangar. A Balco twin-engine 105 helicopter is kept at the station. A military Black Hawk helicopter had also flown in from Chile and was due to make a flight direct to the US Ammundsen – Scott Base at the Pole. One reported disadvantage of the runway operation was the inadequacy of the hard-standing to accommodate aircraft to the size of a C130 Hercules. These had to be parked on the runway itself, so then preventing its use by other aircraft.

Radio communications were sophisticated with HF, VHF and SATCOM. Preferential pay-phone facilities direct to Chile and international dialling were available.

Safety, Training and Emergency Procedures

Very comprehensive pre-deployment training is provided to all personnel. The station had a resident Airforce doctor and was well equipped with medical facilities including a two-bed ward and dental and surgical facilities. Equipment included a defibrillator, monitor and pharmacy. Despite the presence of doctors at neighbouring stations, Frei had also provided medical treatment for around 100 patients from the local area. Serious medical cases would however be mede-vaced to Punta Arenas via the air-link.

With its logistic capabilities, Frei Station has very considerable emergency response capability particularly relying on its helicopter and Twin-Otter aircraft. This was more generally augmented by the bilateral SAR facility operated by the Chilean and Argentine Navies in the Peninsula and South Shetland areas.

A comprehensive fire emergency plan was available, and considerable fire-fighting equipment, including a fire-engine, held. Extensive training was provided and fire-fighting, fuel spill and rescue exercises carried out monthly.

The helicopter was kept on standby during landing and take-off by Hercules C-130.

Environmental Management

The station Commander and his officer cadre were well appraised of the requirements of the Environmental Protocol. The base area was tidy and clean with procedures in place for waste management. Waste was segregated at source and the station possessed a glass crusher, metal compactor and plastic shredder as well as an incinerator for combustible organics. This last however had a maximum operating temperature of only 500° C, and a new two-phase burner had been indented for.

Wastes were retrograded by vessel back to Chile. Such wastes were stored in empty 205 litre drums in the vicinity of the waste management building. The Observers noted however that a number of these drums were in poor condition, that none were fixed shut, nor were their contents identified.

Major efforts had been made to clean-up the station area and large amounts of waste materials had been removed. An amount of scrap metal, including damaged sections of the concrete-sheathed submarine pipeline, were stacked on the back-shore area awaiting pick-up, as were former bulk fuel tanks.

Sewage was treated bacterially and chemically in a septic tank, and the effluent discharged to sea.

Airforce personnel did not appear to be fully conversant with the Environmental Impact Assessment requirements of the Environmental Protocol.

Station personnel were conversant with the rules relating to the conservation of flora and fauna. Two protected areas lie relatively close to Frei Station: the southern most rectangular section of SSSI No. 5 (Fildes Peninsula) and Ardley Island (SSSI No. 33) where large numbers of penguins breed. SSSI No. 5 lies very close to the track joining Frei Station to the Chinese Station, Great Wall.

Despite stipulations that aircraft landing at, or taking off, from Frei Station should avoid over-flying Ardley Island, problems of disturbance to penguins from helicopters over-flights were reported to the Observers. These problems appeared to stem not from aircraft operating locally out of Frei Station but rather from larger military helicopters arriving from outside Antarctica and which are presumably not fully conversant with local conditions and regulations. The recommended height (300m) for helicopters over-flying Ardley Island may need to be reconsidered.

Tourism

Few tourists visit Frei Station and only 100-200 had visited so far this season, mainly arriving via the adjacent Russian Bellingshausen Station. Visitors on the base at any one time were limited to 10-20. The NGO tour operator Adventure Network International uses one small building in the extreme SE of the station complex but this is not often occupied. A tourist

shop and post office at Frei Station also provide a focal point for visiting tourists.

Advance permission is required to visit the station but the view was that tourism created no problems either for operation of the base or for the local environment. Visits by tourists were made to nearby SSSI No. 33, Ardley Island, where a section of the northern coastline of the island was identified as a tourist area (see Annex 1 to ATCM Recommendation XVI-2).

Summary

A very extensive and complex station which, in the time available to the Observers, could not be examined in the detail given to other bases.

Frei Station and its associated runway complex provides one of the major logistic hubs in the Antarctic Peninsula area. Logistic support, in the form of personnel and stores transportation, SAR and mede-vac is available not only to Chilean Antarctic activities generally, but also to a number of the stations in the neighbourhood of Maxwell Bay and Admiralty Bay. Indeed, without the facilities of Frei Station many of these neighbouring stations might need to reconsider the viability of their operations, and re-appraise their own national logistic capabilities.

Frei Station, through the civilian meteorological services annexed to the airport facilities, is operated as a regional meteorological centre collecting meteorological data from a wide range of Antarctic stations, and then transmitting those data to the World Meteorological Network. A synoptic weather forecasting service is also provided. Frei Station with its predominantly military (Airforce) personnel does not itself undertake scientific research. That function is vested in the INACH facilities, which although located on the Frei site, are virtually entirely separate both in their management structure and logistics. For this reason INACH was the subject of a separate Inspection (see following report).

Waste management procedures were in place, with segregation at source. However, some improvement could be considered with waste material for retrograding being identified (no annual waste report exists) and the low-burn incinerator being taken out of commission.

The removal of large quantities of scrap metal and other wastes was commendable.

Overall, this large complex was being operated efficiently, though it was not clear to the Observers why basic logistic functions (accommodation, food supply, power generation, fuel storage, and waste management and sewage treatment) were duplicated on site between Frei Station and INACH.

MR, HG, IC, MC

BASE PROFESSOR JULIO ESCUDEORO (INACH), FREI STATION (CHILE): INSPECTED 17 JANUARY, 1999

Base Professor Julio Escudeoro (INACH)

General

Base Professor Julio Escudeoro consists of 5 modern, purpose built buildings constructed since 1993, plus associated shipping containers. The facility is located along the base of the steep hill to the SE of Frei Station. The base is operated, both in its management structure and logistic requirements, largely independently of Frei Station by the Chilean Antarctic Institute (INACH) which is responsible to its parent body the Chilean Ministry of Foreign Affairs.

The base operates during the summer period only (December through to March). Its function is scientific research. In that respect the INACH facility can be considered as the scientific annex to Frei Station.

This facility has not been inspected previously.

Personnel

The maximum design capacity of the base is 16 (6 scientists and 10 support personnel). At the time of the Inspection no scientific staff were present, but were expected shortly. The intention is to extend the base in due course up to a capacity of 20 beds for scientists.

Scientific Research

An active scientific research programme was in place with scientists drawn from a number of Chilean institutes and universities. The Chilean Antarctic Institute provides accommodation

and logistic facilities and co-ordinates the science programme, to which institutes and universities contribute financially. Only such sponsored research projects are provided with INACH support.

The major areas of scientific investigation include: oceanography and inshore marine biology (eg on macroalgae), seal, whale and penguin biology (the last on Ardley Island), telemedicine experiments, atmospheric chemistry, palaeobotany (plant fossils) and geology (plate tectonics). Some scientific co-operation (eg on bryozoans) with Spain was underway.

Additional facilities for scientific field work (eg on penguin biology) are present on nearby Ardley Island (SSSI No. 33) where INACH operates the Julia Ripamonti Station and the separate Julia Ripamonti Refuge. (Argentina operates the Balve Refuge close by on the island).

Physical Description

A compact unit, occupying around 4,000 m^2, the INACH facility consists of 5 buildings plus a group of 4 shipping containers. All are of modern, purpose-built construction and consist of 2 accommodation blocks around 10x20m (one with an extension at the rear), built in 1993 and 1998, a generator building (8x16m) built in 1995, a sewage treatment plant, and an administration and laboratory block which was still being finished off internally. Work was due for completion in 1999.

All buildings are of the same distinctive design, covered with plastic-coated metal profile cladding, white for the walls, blue for the roofs. The laboratory and accommodation blocks are 2 storey with the upper, supported on galvanised metal legs, providing the living and working quarters, the inset lower storey storage for water and other services. The buildings appear well designed both functionally and aesethically. The pleasing appearance of the base was off-set by the group of 4 old shipping containers immediately to the west, acting as storage units.

Logistics

Logistics in the form of re-supply of fuel and stores, accommodation and food, fuel storage, power generation, water supply, waste management, and sewage treatment are largely separate from the adjacent Frei Station though personnel transportation and any mede-vac are effected through the runway facility. Emergency response and some accommodation (in the hostel) are also provided by Frei Station.

Base re-supply occurs twice per season through the Chilean Navy with the naval vessel *Micalvi* leased by INACH for the summer season for this purpose.

Temporarily, bulk diesel fuel was being delivered in plastic 205 litre drums, and stored on site in this fashion. 12,000 litres had been delivered with a further 10,000 due. The intention was to construct a 30,000 litre double-skinned, and bunded, bulk tank close to the Frei Station tanks on the back-shore with an above ground pipeline direct to the generator's 1,500 litre header tank. Until then, fuel was being hand pumped to the header tank. Perhaps largely because of this, small scale diesel spillages had occurred in the immediate vicinity of the header tank.

Power generation is provided by 2 generators of 50 and 60 kVA.

Water was plentiful, of good quality and piped from an elevated lake 200m to the SW. 8,000 litres of water was stored in fibreglass tanks in the lower storey of each of the three 2-storey buildings.

Training, Safety and Emergency Procedures

All personnel received extensive pre-deployment training.

Emergency response capability was provided by Frei Station. The INACH facility had no medical facilities of its own. A Fire Emergency Plan was made available to the Observers and there was training for personnel in fire fighting exercises. The base was well equipped with fire fighting equipment. Similarly an Oil Spill Response Plan was available and staff were trained in spill response.

Environmental Management

Environmental management was to a high quality. Personnel were instructed in waste management procedures when they arrived on the base. All waste was separated at source, and glass, metals, organics, waste oil and plastics were retrograded back to Punta Arenas.

All waste was stored separately in empty plastic 205 litre drums suitably marked.

Sewage was dealt with in a sophisticated treatment plant housed in its own building. Treatment included a heated biological plant with aerobic injection. Effluent was discharged to sea and solid residues retrograded.

Base staff were briefed on flora and fauna rules on arrival. Awareness was high. Scientific staff working on Ardley Island (SSSI No. 33) were issued with permits by INACH.

Environmental impact assessments had been made for each of the research projects, and copies were made available to the Observers. Similarly, any new scientific projects would be subject to EIA.

Tourism

Tourism was not actively encouraged, but some visitors (to Frei Station) also visit the INACH facility. The numbers were small and not sufficient to disrupt base activities.

Summary

Base Professor Julio Escudeoro operated by INACH is a compact summer-only scientific research facility designed to a high standard. It is a scientific annex to the Frei Station. Accommodation is of high standard and laboratory facilities were nearing completion.

Given the very close proximity of Escudeoro to Frei Station, it was not clear to the Observers why the decision had been taken to install separate logistic functions such as water supply, fuel storage, power generation and sewage treatment. Such duplication of basic facilities had the potential to generate additional environmental impact.

Environmental management standards are high. Fuel management is at present adequate but early installation of bulk fuel storage to obviate the need for drummed fuel is required.

For the size of the facility the range and scale of science projects was noteworthy, and its operation efficient.

MR, HG.

GREAT WALL STATION (CHINA): INSPECTED 19 JANUARY, 1999

Aerial view of Great Wall Station

General

Great Wall Station is located on the Fildes Peninsula, King George Island on the west shore of the bay partially enclosed by Ardley Island. Its position is Lat. 62° 13'S; Long. 58° 58'W. This large station is around 250m from the shoreline at 10-15m above sea level. The Chilean station Frei lies 1.9 km due north and is connected to Great Wall Station by 2,700km of track.

Great Wall Station is operated by the Chinese National Polar Expedition Office, with responsibility residing with the Polar Science Institute of China. The station was established in February, 1985.

Great Wall Station was last inspected by Chile in 1990 with Inspections prior to that in 1989 (NZ/UK), 1987 (Chile) and 1985 (US).

Personnel

19 persons were present on the station at the time of the Inspection. These included 3 scientists and a three man TV film crew. In addition, the base complement included the station leader, 3 diesel mechanics, cook, logistics officer, doctor and plumber.

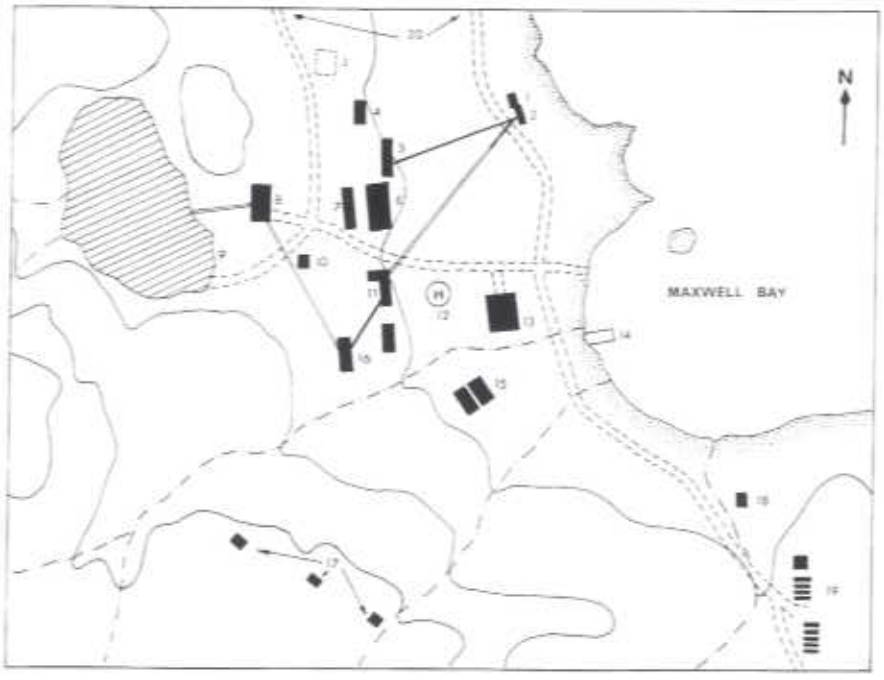
It was stated that the wintering crew would comprise 13 personnel, including 4 scientists. These numbers were well below the maximum capacity of the station which had been designed to accommodate 50.

There was no military involvement on the base. All personnel were civilian.

Scientific Research

At the time of the visit the range and scale of scientific activities were somewhat limited. Summering-only scientists comprised 2 geoscientists and a GPS surveyor. The former were undertaking a programme of studies into lake sedimentology in the Fildes Peninsula area. Other measurements being taken were for ionospherics, seismology and geomagnetism. Meteorological measurements were both for local purposes and synoptic data were transmitted to nearby Frei Station (Chile) for contribution to the World Meteorological Network. Adjacent to the meteorological laboratory was an extensive array of fenced off meteorological instruments with a GPS survey point close by. The station possessed an ionosonde, magnetometer, seismometer, and a receiving system for a NOAA satellite. Although the laboratory block was of reasonable size (9x33m) a significant proportion of its rooms were not being used for science. The range of available scientific equipment also appeared limited. One laboratory was being used as a darkroom.

Physical Description



Great Wall station layout

Layout of Great Wall Station

1. Incinerator, 2. Sewage Treatment Plant, 3. Meteorological Instruments, 4. Meteorological Building, 5. Infirmary/Recreation Building, 6. Main Accommodation Building, 7. Accommodation Building, 8. Generator Building, 9. Water Extraction Lake, 10. Communications Building, 11. Accommodation Building, 12. Helipad, 13. Garage, 14. Pier, 15. Old Garages, 16. Laboratory, 17. Magnetometer/Seismograph, 18. Laboratory (Marine Biology), 19. Bulk Fuel Tanks and Pump House, 20. Tracks to Frei Station (Chile), 21. Food Store.

A well laid out station made up of more than 12 substantive buildings. The buildings comprise 1 main accommodation block (2 storey) 40x15m, and two older accommodation buildings 11x14m and 20x40m. Both of these were no longer being used for their original purpose. Accommodation block No. 2 was empty, and block No. 1 housed a small scale shop and recreational centre. Also present were a large garage/workshop/store of 35x32m, a laboratory building (39x11m), a two-storey generator building (30x15m) and a food store (14x25m). Smaller buildings housed the sewage treatment plant and incinerator, communications hut, meteorological building and old garages.

A substantial concrete pier with a frontage of 8 metres and equipped with a light was located due east of the station buildings. The maximum depth of the water here at high tide was 3 metres.

The station buildings had obviously been constructed during two phases. Within the past 2-3 years three major buildings had been erected: the large garage/workshop close to the pier, the two storey accommodation and living block, and the food store. These building were constructed for low maintenance and designed to reduce weathering. For example, the concrete foundation piers were all clad, as were the external walls and roofs.

In contrast the older buildings, built presumably soon after the station's establishment, were showing severe signs of ageing despite the fact that none of the buildings were more than 14 years old. The metal cladding on the buildings was in places heavily corroded, concrete foundation piers were very severely eroded, and some of the roofs, notably those on the generator and medical buildings, appeared to be in a poor state of repair.

With some buildings, particularly the generator building, the decline in their condition appeared to be more than cosmetic and might well have implications for the integrity of the structure.

Three magnetometer seismograph huts plus 4 large ionosonde arrays were sited to the south of the base.

Around 1,350m of gravel tracks have been constructed within the station and to its immediate north. These lead from the generator building to the shore, thence south to the pier and bulk fuel tanks. A track leads northwards out of the station to Frei Station (Chile) 1.9 km away.

Logistics

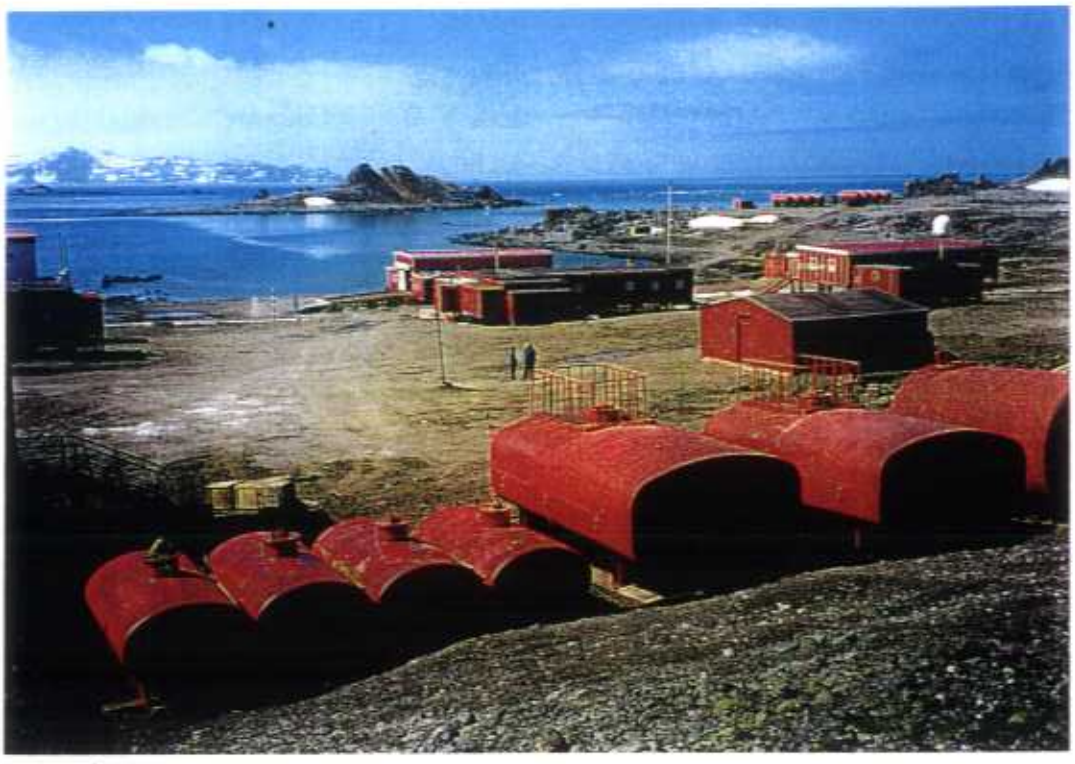
The station is re-supplied with food, fuel and building materials every two years by a cargo vessel *The Snow Dragon* direct from Shanghai in China. Supplementary material is delivered each summer via a sea container shipped from China to Chile, then by Chilean vessel to Frei Station. Containers are finally delivered to Great Wall Station by means of a towed pontoon. Two such containers were present on the pontoon, just offshore from Frei Station, on the afternoon of 17 January, and in the process of being unpacked during the Observers' visit to Great Wall Station on the 19th.

Personnel on the base did a normal tour of one year and they, plus summering staff, were transported to King George Island by Chilean C-130, or similar aircraft of other Parties.

The next major re-supply of the base was due in December, 1999

Power was supplied by three 120kVA generators. Annual consumption of diesel fuel was around 170,000 litres. Fuel was stored at two locations on the station: (i) eight 50,000 litre bulk tanks were located to the south of the jetty. These tanks were not bunded, nor was it clear whether they were single or double-walled. The water depth offshore is apparently not adequate to allow the re-supply vessel itself to carry out the refuelling operation. In consequence, fuel is pumped ashore from a fuelling barge to the tanks, but there was no sign of the flexible coupling hose. The pumps for this operation were housed in a shipping container. This was heavily corroded, had no floor, and there were signs of spilled oil; (ii) Seven working tanks were located adjacent to the generator building; four of 50,000 litres capacity and three of 20,000 litres capacity. One large tank was positioned simply on the ground, the others were supported by wooden sleepers. The only apparent pipage was an underground feed from these tanks to the power plant. Fuel is transferred from the bulk to working tanks by means of a bowser lorry with a 5,000 litre tank. This was also heavily corroded.

The practice of fuel management at this station was of some concern. It was evident that oil was dripping from the valves of the feeder tanks whilst oily-water was seen to be dripping constantly through the floor of the generator building onto the ground underneath. Cosmetic attempts had been made to address this problem by bulldozing fresh gravel and soil over an extensive area of ground adjacent to the generator building. However, the substrate underneath was contaminated extensively with diesel fuel.



Fuel tanks at Great Wall

The condition of the generator shed left something to be desired with the engines at the time of the Inspection smoking badly. This contrasted with the building's control room which

was well laid out. Three diesel mechanics operated a day-round shift system. Their accommodation within the generator building contrasted markedly with that seen in the accommodation block.

Potable water was pumped from the lake directly to the west of the generator shed. Water intake was at a depth of 5m. Water holding tanks were present in the generator building; (two of 5,000 litres and two of 2-3,000 litres). Water supply was both high quality and plentiful.

Transport and Communications

The station was equipped with 3 snowmobiles, 1 bowser lorry, 1 tracked flexmobile, 1 bulldozer, 2 earthmovers, 2 small forklift trucks, 1 4x4 vehicle, and a crane used to off-load stores at the pier. This machine was also much in demand by neighbouring bases. In addition 2 inflatable boats (one damaged) were present.

The helicopter landing pad, in front of accommodation block No. 1, was marked prominently, and in good condition. This was used occasionally by visiting aircraft.

Radio communication was by HF, VHF and SATCOM.

Safety, Training and Emergency Procedures

One month's training was provided in northern China to personnel before their Antarctic deployment. This included aspects such as environmental management, and fire fighting.

The base was equipped with a single bed ward and consulting room/surgery with equipment such as an autoclave and suction. A doctor was resident.

A fire fighting plan was evident and the base was well equipped with fire fighting apparatus. Training in fire fighting was provided, but fire practices on the station were limited. In the event of a fire the base buildings were dispersed and plenty of contingency accommodation and facilities would be available. Search and rescue capability was limited, as was the ability to provide a mobile medical emergency response. In the event of medical evacuation the services of nearby Frei Station (Chile) would be used.

Environmental Management

The station leader was well aware of Antarctic Treaty provisions and the regulations of the Environmental Protocol. Waste management on the base was practised with all wastes being separated.

Waste mineral oil for retrograding was stored in around sixty 205 litre drums close to the bulk fuel oil tanks, whilst waste vegetable oil was similarly drummed up (seven 205 litre drums) and kept in the food store. A hydraulic compactor was present in the garage/workshop along with quantities of baled-up metal scrap and plastic wastes in bags. Two containers on the shore, close to the sewage treatment plant/incinerator, were also full of metal scrap to be removed in December, 1999 along with an obsolete trailer/low loader adjacent to the old garage.

Organic material was apparently being stockpiled since the decision had been taken in December, 1998 to stop using the incinerator. However, there was no evidence of this material. The incinerator building had inorganic combustible wood, cardboard, etc to hand as though

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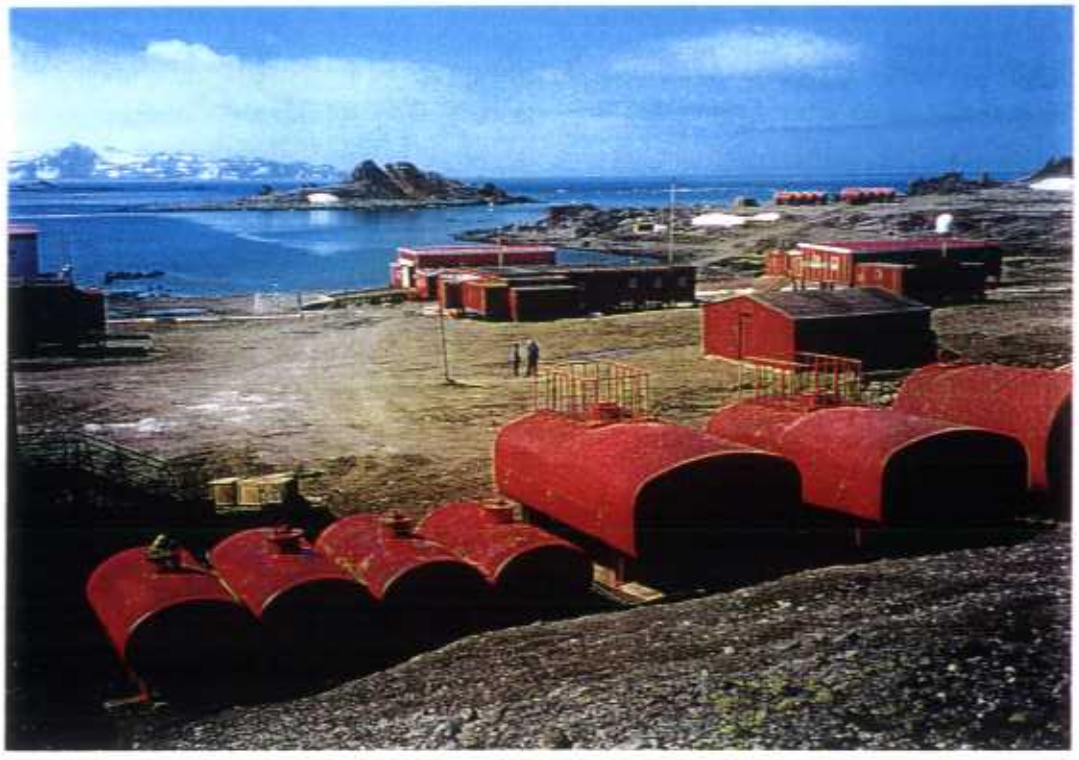

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Personnel

At the time of the visit the station was occupied by an advance party of just 2 persons, a builder/mechanic and a radio operator whose job it was to prepare the station for the main summering party of 6 scientists, including a doctor. These were to arrive shortly on the Spanish naval vessel MV *Hesperides*. Maximum capacity of the station, which operated from December to March was 15. All personnel were civilian.

Scientific Research

Since its establishment 11 years previously a number of science projects had been undertaken. These included biology, geology and glaciology. There was ready access from the station to the adjacent ice cap where glaciological studies including small scale ice-coring were undertaken. The station was equipped with standard meterological instruments, and surface meterological observations were made for local purposes only. They were not however incorporated into the World Meteorology Network. Some medical/human physiology investigations had also been undertaken. The modest buildings of the station did not however include dedicated laboratory facilities except for a small medical store housing the pharmacy. This lack must clearly limit the range and scale of scientific investigations on site.

Physical Description

Prior to 1997 the station had consisted of just two containerised buildings, one providing accommodation for 7 persons, the other acting as a general storeroom for equipment. The station had been unoccupied during the summer seasons 1993-96.

Facilities had been considerably enhanced in March 1997 with the erection of a purpose built accommodation block. Measuring 11x6m this prefabricated building, externally clad in insulated rendered panels, was set on a metal frame and legs. Rock in-fill walls beneath the building provided additional storage space and housed an emergency heating system. Internal construction and finishing off was still being done to the interior of this building which provided sleeping accommodation for six along with a kitchen/dining room, small medical store/ pharmacy and toilet/shower.

The two containers were located around 150m SE of the main building and 20m apart. The northernmost container, set on 1m high legs was principally the communications centre though its bunkrooms had been retained for overspill accommodation from the main building. The southernmost container, set on skids and designed for arctic conditions, looked to be nearing the end of its useful life and may require replacing before too long.

Logistics

Re-supply of the base was via the Spanish naval vessel MV *Hesperides* which visited three times per season. All materials were transported ashore by boat with landings being made 600m SW of the base.

Piped melt water from the glacier behind the base was used as the water supply. Facilities for power generation were fairly rudimentary with a number of generators present behind the main building. None were enclosed, and as a consequence open to the elements. Principal power supply was from a 10kVA diesel generator only semi-covered in a makeshift housing

with further power capacity provided by a 6.5kVA petrol generator. A 1kVA generator on skis for glaciological field work and a 18kVA diesel power plant for radio communications were also present. A replacement larger 20kVA generator was on site and work had begun on the construction of a small (6.5x4m) steel-framed generator building to house it. This was planned to be located behind the main accommodation building. The precise design of this building was not evident in terms of whether the generator would be sited on concrete founds, and whether a diesel fuel header tank would be installed. Fuel consumption per season was around 2,000 litres of diesel. This was stored in 205 litre drums. Around 1,000 litres of fuel were left on site over winter. A limited amount of petrol was also present. All fuel was hand pumped; no fuel pipelines were evident.

Transport and Communications

A temporary helicopter landing area was marked out on the foreshore 150m from the accommodation building and occasional visits were apparently received from Uruguayan and Chilean aircraft.

There was no mechanised transport, either boat or land vehicles, on site. Access to the nearby Spanish station Juan Carlos Primero was by skis/foot and took around 1.5 hours. The acquisition of a snowmobile might well enhance the station's science capabilities, and should be considered.

The station's radio communications were housed in the former accommodation container.

They consisted of HF, VHF and SATCOM. Power for the radios was supplied by a dedicated 18kVA generator.

Environmental Management

The two station personnel were well aware of the requirements of the Environmental Protocol. Wastes such as glass, plastics, waste oils, and metals were separated at source and retrograded from the station back to South America via the MV *Hesperides*. Care was being taken with regard to wildlife conservation and an area rich in mosses and lichens approximately 20x20m and to the south of the base had been marked off.

Grey water and sewage were however not treated at all, and were being discharged directly from the main accommodation building via an insulated pipe into an ice pit in an adjacent snow bank. A number of empty 205 litre drums on the foreshore appeared as though they were still being used for burning combustible waste materials.

Whilst recognising that building works were still taking place at the station, numerous materials (including old radiators, wire, wood etc), and which appeared surplus to requirements were present around the site. These should be either stored more permanently or removed. A cosmetic clean-up of the base environs would enhance the general appearance of the station.

Summary

A modest summer-only facility with an emphasis on science. Bulgaria's commitment to its Antarctic science programme is evident by the expansion of the station in 1997. Consideration could however be given to enhancing science facilities at the station through, for example, the provision of a containerised laboratory unit. Vehicle support (ie a snowmobile) might

also assist science projects, particularly glaciology. Some sound environmental management procedures are being practised but further improvements should be made through a general tidy up of the immediate base area, ceasing burning in open 205 litre drums, and giving consideration to adequate treatment of sewage and grey water.

MR, HG, IC, DB.

JUAN CARLOS PRIMERO (SPAIN): VISITED 16 JANUARY, 1999

Juan Carlos Primero from the east

General

The largest of the summer-only stations visited during the Inspection programme, Juan Carlos Primero is situated on the Hurd Penninusla, Livingston Island at Lat. 62° 39'S, Long. 60° 23'W. The Bulgarian station St Kliment Ochridsky lies 1.7 km to the NE. The station, though moderate in size, is well equipped with living, laboratory and support facilities provided largely in containerised units.

The base lies in a shallow, floristically rich valley around 100m from, and 20m above, the shoreline in a small bay within South Bay. The coastline is relatively sheltered from the prevailing SW seas and grades into a sandy intertidal area to the north of the main station complex where a new boatshed was under construction.

The station was established in January 1988 in one containerised laboratory, three storage containers and an accommodation building roughly a third of the present size. Additions, mainly in the form of further containerised units have been made since. The station is operated by the Spanish Antarctic Programme. The station was last inspected in 1993 (UK. Italy and Korea). Prior to that in 1990 by Chile.

Personnel

At the time of the visit the station complement was 5 including 2 scientists (one marine biologist and a meteorologist) and three principal support staff. Additional summering staff, including a doctor, were expected shortly on the Spanish naval vessel *MV Hesperides*

(subsequently seen in Port Foster, Deception Island on the evening of 16.1.99). Unlike the Spanish station on Deception Island, all station staff were civilian. No military personnel were present. The core support staff, including the cook, base leader, communications technician and mechanic, had been present at Juan Carlos Primero Station for an extended number of summer seasons. This continuity of service had clearly developed in the station personnel a strong sense of 'ownership/belonging' regarding the station and its facilities. The Spanish Antarctic programme provided training in first aid and mountaineering prior to Antarctic deployment.

Scientific Research

It was evident that there was a tangible commitment towards a science programme with a high scientist to support staff ratio. A wide range of science was being conducted including inshore marine biology, water chemistry and sedimentology, botanical studies including micromet, glaciology, geophysics (magnetics and seismology) and synoptic meteorology. Two automatic weather stations were present; one located within the station, the other located on the adjacent glacier at 2-300m elevation. Year round measurements were made and transmitted by satellite to the European Space Agency. Alternative power supplied by solar panels and an aerogenerator provided electricity to an extensive array of accumulators to power the recording instruments during winter.

At the time of the visit no foreign exchange scientists were present. However collaborative projects have been undertaken at Juan Carlos Primero with scientists from China, Germany and Denmark.

For its complement the station was well equipped scientifically with a containerised 17x8m laboratory. This comprised a library with bench space for 4 persons plus three laboratories for biology, meteorology, and geology (including magnetics and seismics), scientific equipment and reagents. 3 separate magnetic huts were positioned around 500-600 metres to the SW of the station.

Equipment was available for inshore biological investigations including power winches for the boats and small-scale dredges.

Physical Description

The station has expanded considerably since its establishment in 1988. It was apparent that further building in the form of containerised units had been added since the Treaty Inspection of 1993. A further building (an 8x3.5m boat shed), about 400m to the NE and close to the shore, was under construction at the time of the visit, though its concrete floor had yet to be laid.

The basic structure of the station is of three main groups of buildings – the laboratory block, accommodation block, and a series of two rows of shipping containers housing various support services. A well marked helicopter landing area is located in front of the accommodation block. This consists of a well appointed lounge, dining room, kitchen and food store, bunk rooms (with accommodation for 12), bathroom, shower and communications room.

Station facilities were housed largely in six containerised units set in two rows. These provided store rooms for mountaineering equipment, inflammable materials, and the incinerator

and compactor. Also in containers were; a workshop/store, an electrical workshop with a considerable array of batteries (with power provided from solar panels and the aerogenerator), and the two generators with their fuel header tanks.

All elements of the station with the exception of the dining area were containerised, and set on metal sleds. Sliding metal shutters allow the windows to be boarded up for winter with relative ease. The station overall was well laid out, and maintenance was clearly of a high order.

Logistics

Resupply of the base was via the MV *Hesperides* which visited twice per season. All materials were transferred ashore by boat. (The shoreline appeared more sheltered than that at nearby St Kliment Ochridski). Transport between the shoreline and the station was by two Finnish 'Terri Cats' along a well defined gravel track from the area of the boatshed to the station. The station was well equipped with boating facilities with 4 Zodiac inflatables (all Mk III) and a hard-bottomed boat for scientific work, and three snowmobiles for glaciological work. (These latter were housed in a purpose-built store (which was not visited) on the nearby glacier around 1km from the station).

Considerable changes had taken place since the last Inspection, which reported that bulk diesel fuel had been stored in four bladder tanks. These had since been replaced by 3 double-skinned horizontal metal tanks each holding 6,000 litres. The tanks were mounted on metal sleds and located about 200m away from the generator shed in a flat, naturally bunded depression. Drummed petrol for outboard engines and propane cylinders for cooking were also stored in this flat, sandy area.

There was no evidence of fuel spillage around the bulk tanks each of which was equipped with an adequate drip tray beneath the connecting valves. The three tanks were not mounted on any founds, or contained within a bund. Fuel was gravity fed to the four header tanks above the generator shed via a small diameter flexible hose. This pipage was the obvious weak link in an otherwise sound fuel handling system. This fact had been recognised and materials were already on site to construct a more robust, insulated pipeline, supported above ground. This work was due to commence shortly. Bulk fuel is delivered to the station via a flexible hose system from the *MV Hesperides*. Each 60m section of hose is equipped with a pressure valve to cut off the flow of diesel if the hose is ruptured or disengaged. The hose was supported on the surface by small floats. Individual lengths of hose and the floats were stored neatly on the foreshore. With total fuel consumption estimated at 9,000 litres, the station carries two seasons supply.

Power generation was provided by two 30 kVA generators. These were used on alternate weeks. In addition, the station was equipped with two portable generators one of 15 kVA, the other of 12kVA. The latter powered the winch for the newly constructed boatshed slipway.

Juan Carlos Primero was the only station visited which had installed significant alternative means of energy generation in the form of twelve solar panels, and three aerogenerators. The former covered the complete side of a storage container. Unfortunately, only one of the aerogenerators remained functional, the other two having been badly damaged by severe winds. One of the support towers of one generator had even been ripped from its foundations.

The 1.5kVA power output from the aerogenerator, plus the power output from the solar panels was used to run the science equipment and satellite communications during the winter so providing year round continuity of measurements.

The base was supplied with adequate, clean potable water from a nearby lake. As contingency against a freeze-up, 5,000 litres were stored in an outside fibreglass tank, and a further 5,000 litres held in a pillow tank equipped with its own designated pump for fire fighting.

Grey water and sewage were treated in a double 3 tank treatment system with the injection of oxygen. Clear effluent was discharged by the foreshore and solids from the tank were retrograded from the station.

Environmental Management

Station personnel were clearly well versed in the requirements of the Environmental Protocol. All wastes were separated into glass, plastics, metals, and organics and retrograded from the site. Waste fuels and waste containing toxic material were shipped to Spain; other materials being sent to Ushuaia and Punta Arenas. Although an incinerator remained on site (referred to in the 1993 Inspection Report) it was apparently no longer used.

Environmental Impact Assessments had been made for recent construction activities, and for proposed science programmes. Documentation relating to Antarctic Treaty provisions, the Protocol and EIA were all available at the station.

Due to the amount of biological science being carried out, care had been taken to identify local areas of particular interest. Fenced and roped-off areas were evident around the station area where biological experiments were taking place.

Visits to the base were normally confined to infrequent helicopters from Uruguayan or Chilean stations. Very few tourists were reported as visiting the station.

Summary

A compact, efficiently run station which, though occupied only during the summer period, maintains data collection year-round. Scientific research is pre-eminent on the base with a low ratio of support staff to scientists. Long term continuity of key support staff was clearly advantageous to the running of the station. A highly organised and well run facility.

MR, HG, IC, DB

GABRIEL DE CASTILLA (SPAIN): INSPECTED 12 JANUARY, 1999

Aerial view of Gabriel de Castilla from the east

General

A summer only Station operated jointly by the Spanish Army and the Spanish Department of Education and Science, and open December through to March.

Gabriel de Castilla is located at the south end of Fumarole Bay, Port Foster, Deception Island at Lat. 62° 58'S; Long. 60° 40'W and 1 km SE of the Argentine summer-only station Primero de Mayo. The buildings are sited on a gently sloping area of bare volcanic ash. The base area and surrounding environs are completely devoid of vegetation and nesting birds. The base has been occupied each summer since 1992/93. (It was constructed during the 1988/89 season but apparently not used during the 1991/92 season.) The buildings lie parallel to, and approximately 80m from, the shoreline, at an elevation of around 10-15m.

The station has only been inspected once before, in 1993 by the UK, Italy and Korea Inspection programme.

Personnel

At the time of the Inspection the station was staffed by 4 personnel; an Army station leader and three scientists. Further staff were expected imminently on the Spanish Naval vessel MV *Hesperidies* which would increase the complement to 12. The maximum capacity of the station is 14. Science personnel were due to consist of 3 biologists, 2 geophysicists, 1 meteorologist, and 6 army support staff including a doctor, cook, radio engineer, mechanic and mountaineer. In this respect the operation of Gabriel de Castilla differs from that of the Spanish station Juan Carlos Primero on neighbouring Livingston Island, which was staffed

wholly by civilian personnel. (The MV *Hesperides* with the rest of the summering complement onboard was seen entering Port Forster en route for Gabriel de Castilla on the afternoon of 16 January.)

Training for personnel in first aid and mountaineering is provided by the Spanish Antarctic Programme prior to Antarctic deployment.

Scientific Research

Facilities in support of science consisted of a small biology laboratory (4x7m), with working spaces for 4-5 scientists. In addition, a seismic station was located to the SE of the base with two further seismic arrays, one 1km south of Cross Hill, the other 0.5km NW of the Argentine station Primero de Mayo.

Scientific research at the station was focussed principally on penguin biology, meteorology and geophysics.

Aspects of reproductive and behavioural biology in penguins were being studied at the Vapour Col colony 3km to the SW on Deception Island's exposed outer coastline. Meterological data (temperature, pressure, humidity, wind speed and direction) were collected by an automatic weather station. These data were not however fed into the World Meterological Network. It was unfortunate that at the time of the Inspection none of the scientific complement was present, the 2 biologists then resident were away and only returned as the Inspection team was leaving. In addition, most scientific personnel had yet to arrive. A more comprehensive assessment of the science programmes undertaken at Gabriel de Castilla was not therefore possible. However, it was apparent that, despite its small size, the station's activities were focussed very clearly on scientific research.

Physical Description

The station buildings consisted of an accommodation block (12x9m),emergency store (5x10m), food store (9x9m), laboratory (4x7m), generator shed and workshop (10x8m) and general store (3x5m). The accommodation building was a prefabricated fibreglass construction. It was set on metal legs (without foundations), and externally guyed with rope. Living quarters were relatively basic and consisted of a dining area, small lounge, kitchen, toilet, laundry and shower. Two small bunk-rooms housed 10 and 4 people. Heating was provided by electric heaters and a diesel-fired 'space heater'. Four tents were used for additional living quarters and food storage.

All buildings have been constructed since 1989/90. From the Inspection report of 1993 it was evident that additional buildings had been added since. These were the laboratory and the emergency store, which has been constructed two years previously. A further building was planned for construction during 1999/2000 and its intended location was clearly pegged out to the north of the generator shed.

Logistics

Re-supply of the station was by means of the MV *Hesperides* which visited up to three times each season during December, January and March. Stores and personnel were off-loaded relatively easily in the sheltered waters of Fumarole Bay.

Power was supplied by 2 mobile generators housed in their own building. These were of

25kVA and 50kVA output and were capable of removal at the end of each summer season for maintenance. Consumption of diesel fuel was around 5,000 litres per season. Fuel, both diesel and petrol for the vehicles, was stored in around twenty-five 205 litre drums in an area immediately behind the generator shed, and directly on the volcanic gravel. There was no storage platform and there was some evidence of small scale spillage in the immediate vicinity perhaps due to the fact that fuel was hand pumped. The generators were not run overnight.

Alternative energy sources were not employed (unlike at Juan Carlos Primero), though the nearby US seismograph was powered by solar panels.

Water was apparently of good quality and freely available fed by gravity from an adjacent lake. Early in the season, before the lake thawed, water was piped from a melt stream around 1km to the south of the station. Water was stored on site in a 1,000 litre glass fibre tank next to the accommodation building with an additional 500 litre tank located next to the generator shed.

Transport and Communications

Two 3 wheeled John Deere all terrain vehicles (ATVs) were used for transport both in the vicinity of the station and to visit the penguin colony at Vapour Col. Two Zodiac inflatable boats were hauled up on the beach. These were used to gain access to the northernmost seismic array.

Communications were housed in the accommodation building with radio aeriel arrays positioned to the south of the station. Principal communications, using HF, were with Madrid and the Spanish station Juan Carlos Primero on Livingston Island.

Environmental Management

Station personnel were clearly versed in the requirements of the Environmental Protocol. Notices relating to waste management were displayed publicly and waste was separated at source into organics, glass, metals and plastics. These were stored in 205 litre drums ready for retrograding to Ushuaia (Argentina). Eleven such drums, full and neatly wired up, were stored on the beach awaiting pick up by the MV *Hesperides*. Although still on site, the incinerator referred to the in the 1993 Inspection report was apparently now no longer used.

Grey water from the kitchen and shower unit and sewage passed into an underground 3 chambered septic tank located a few metres in front of the accommodation block. This had an above ground breather pipe and effluent discharged via the intervening volcanic gravel into the sea 50m away. There was no sign of eutrophication on the shoreline or beach.

Station staff were clearly aware of the locations of the various elements of SSSI No. 21 (Parts of Deception Island) and of the regulations relating to the conservation of flora and fauna.

Summary

A modest sized summer-only station occupied at the time of the Inspection visit by an advance team. Scientific research was the principal objective of the base and the scientific contingent arrived shortly after the Inspection. Accommodation, though adequate, was relatively basic but the station did have dedicated laboratory facilities. Expansion of the Gabriel de Castilla Station is planned in the near future to enhance scientific capability further.

MR, HG, IC, AJ.

PALMER STATION (USA): INSPECTED 25 JANUARY 1999

Aerial view of Palmer Station

General

Palmer Station is located on the rocky promontory of Gamage Point, Arthur Harbour on the south east coast of Anvers Island. Its position is Lat. 64° 46'S, Long; 64° 03'W.

A station at Arthur Harbour was first established in 1965 on a site about 1 km from the present location. Building on the Gamage Point site began in 1967 and was completed by March 1970. The station's facilities have been developed progressively since. As with the other US Antarctic stations, Palmer is operated by the US company 'Antarctic Support Associates' (ASA) of Denver, Colorado under contract to the National Science Foundation's (NSF) US Antarctic Program. The main purpose of the station is scientific research across a range of disciplines, but with particular emphasis focussed on ecology.

The station was last inspected in 1993 during the UK, Italian, Korean Inspection Programme; prior to that in 1989 (NZ/UK).

Personnel

The base has accommodation for a maximum of 43 persons. At the time of the visit 37 personnel were present. These included 22 support staff, 4 specialist waste clean-up contractors, 8 scientists and 3 visiting persons under the NSF's writers and artists program.

During winter the complement usually drops to 17 although it was anticipated that around 20 would be present during the coming winter to undertake planned refurbishment work. It was not anticipated that scientists would over-winter during 1999.

The science programme at Palmer Station operates in close conjunction with that carried out by the US research vessel *Lawrence M Gould* which calls into Arthur Harbour regularly and undertakes oceanographic and marine biological research in the Peninsula area. A further 28 scientists were present on the *Lawrence M Gould* at the time.

ASA provide all support services other than aircraft logistics (which remain the responsibility of the New York Air Guard to the US Antarctic Program). The company operates under a six year contract, renewable for two 2 year terms. The current contract was due for expiry in April 2000. The services provided by ASA were comprehensive. The *Lawrence M Gould* was under contract from Eddison Schweist of Louisiana to ASA, whilst at Palmer Station all personnel other than scientists, visiting artists and writers, and the waste clean-up sub-contractors, were employees of ASA – for example the station manager, cooks, doctor and diesel mechanics.

Support staff at Palmer Station did a six month tour of duty (with changeovers in April and October). However, many personnel did repeat tours. Polar expertise was high amongst ASA staff with virtually all personnel holding previous wintering experience either at Palmer Station or on other US Antarctic stations.

Scientific Research

Palmer Station has an active scientific programme, and is well equipped with modern laboratory facilities. A range of scientific studies were being undertaken. These were primarily directed at oceanography and marine biology. Scientific research was being performed on the following:

- ocean and climate studies focussed on: atmospheric aerosols, trophospheric trace gases, automatic weather observations and monitoring of climate change;
- biology, including long term ecological research, UV-B impact on plants, studies on Antarctic fish and krill;
- magnetospheric studies using VLF along with a technical project within the UV monitoring network.

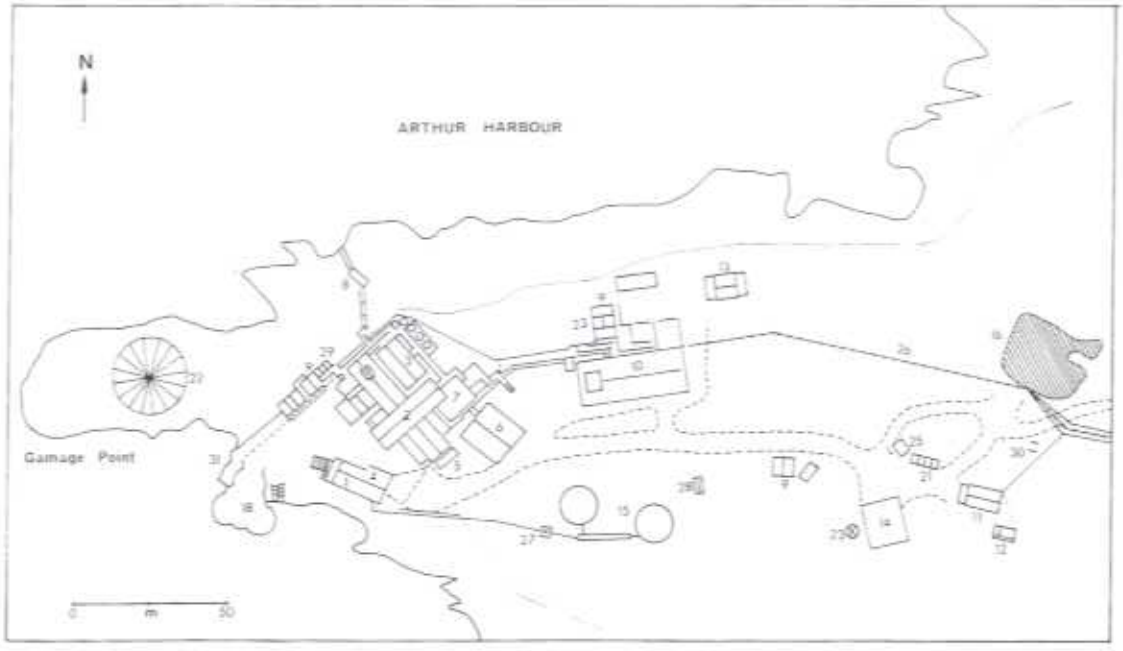
The base is equipped with extensive dedicated research facilities including biological laboratories, an aquarium with pumped seawater, an atmospheric aerosol sampling laboratory, automatic weather station, UV-B spectrometer and seismic station. VLF aerials (length over 500m each) were located on the Marr Ice Piedmont to the east of the base. A VLF data receiving and recording unit was present. Meteorological observations were undertaken, and synoptic data were passed to Rothera Station (UK) every 6 hours for input into the World Meteorological Net.

Scientists are drawn from a range of US universities and institutes with funding for scientific projects provided by the NSF. This follows a process of proposal, submission and peer review. Most projects are relatively short term in duration (3-4 years). However, the US also runs longer term programmes. One of these, 'Long. term ecological research on the Antarctic marine ecosystem: An ice dominated environment' was based on Palmer Station.

The science projects at the station are co-ordinated on a day to day basis by the senior science

leader, or NSF representative. The former post is held by one of the science project leaders and is rotated every 2-3 months.

Physical Description



Palmer Station layout

Layout of Palmer Station

1. Boathouse, 2. Biolab Building, 3. Aquarium, 4. Diving Store, 5. Volatile Material Store, 6. Carpenters' Store, 7. Sauna, 8. Sea Water Pump House, 9. Containers, 10. GWR Building, 11. T-5, 12. Clean Air Laboratory, 13. Hazardous Cargo Building, 14. Helipad (disused), 15. Bulk Fuel Tanks, 16. Fresh Water Pond, 18. Pier, 21. Condes, 22. Mono-pole, 23. Antenna, 24. Gas Storage, 25. Utility Support, 26. Fuel Line, 27. Storage, 28. Chemical Storage, 29. Seismic Vault, 30. Sewerage Pipe.

Suitable building land on Gamage Point is scarce unless extensive land preparation on the largely solid rock substrate is undertaken. In consequence Palmer Station is a compact site and the station's buildings are set relatively close together. Two main buildings dominate the site. The 'Biolab' building houses the biological laboratories, dining area, kitchen, communications facilities, administrative offices, storage areas for food and biological supplies, and accommodation for 22 persons. The 'GWR' (Garage/Workshop/Recreation) building contains the generators, garage, store room (eg for mechanical and electrical stores) library and recreational facilities. Accommodation for a further 21 persons is available, here.

Several other buildings are present. These include a boathouse, aquarium, diving store, seawater pump house, carpenters' store, clean air laboratory and hazardous cargo building. Numerous shipping container units provide storage, including for separated wastes.

A steel-piled pier with a 15m frontage is set 85m to the SE of Gamage Point, and around

500m of crushed gravel track connects the various station facilities.

The condition of the buildings was good, both internally and externally. Over the past few years all the main buildings have been covered in metal profile cladding, so reducing maintenance. The buildings within the main station complex were interconnected by a series of raised wooden staging and walkways, set above winter snow level. Painting and repair of these walkways undoubtedly incurs high maintenance.

No new major buildings had been constructed since the last Inspection in 1993. A major refurbishment programme of the GWR building was scheduled to begin during the winter of 1999, and to take two winter seasons. This would entail significant internal reconstruction with subsequent relocation of station facilities. For example the station's medical unit would be relocated in the GWR building.

Logistics

Logistic support is provided by the *Lawrence M Gould* which calls at Palmer Station every 4-6 weeks throughout the year delivering stores and personnel from Punta Arenas (Chile). Visits during winter may be more infrequent. Stores are shipped via commercial cargo vessels from California to Punta Arenas, where a ASA warehouse facility is maintained.

The *Lawrence M Gould* with a 6m draft is able to tie up to the pier and off-load stores directly ashore. Heavy items, eg shipping containers can be moved around the station by means of low trailers (MAFFIs) and Skytrack forklift trucks.

Visits by aircraft are infrequent, though fixed wing aircraft can land on a skiway on the ice piedmont to the east of the VLF aerials. No specific provisions are now provided for helicopters.

Power generation is provided by 2 x 200 kVA generators in the GWR building with a 100kVA standby in the Biolab building. Fuel consumption is around 275,000 litres per year. Bulk fuel was stored in two single-skinned tanks with a capacity of 450,000 litres each. Bunds were not present. However the total quantity of oil held was only 280,000 litres so allowing oil to be transferred from one tank to the other in the event of a tank leaking. In addition each tank had within the past two years been equipped with an inner rubber/vinyl membrane. An above ground metal pipeline connected the bulk tanks to manual valving on the pier. Refuelling could be done from ship to shore therefore without the need for lengthy flexible hosing. Refuelling was done once per year. The vessel was boomed off during the process to minimise the chance of pollution. Fuel lines were blown through by compressed air after refuelling. Responsibility for fuel management lay with the station's senior diesel mechanic.

A working fuel tank of 3,000 litres capacity was present in both the Biolab and GWR buildings. These were single-skinned and oil pollution had previously occurred from these tanks. This had seeped into the adjacent ground and thence leached into the sea. The degree of pollution was however very small and was being channelled by a boom into absorbent material. A single small scale spill had also occurred in the past year. Consideration was being given to replacing the existing tanks with double-skinned versions.

Alternative energy sources are not used except for solar panels to power the automatic weather station. In addition heat is 'scavenged' from the generators to heat the GWR building.

Potable water is provided by Reverse Osmosis (RO) with a production of 30,000 litres per week. The seawater intake which supplies the RO plant is situated on the north side of Gamage Point, and 220m away from the sewage outfall next to the pier. The flash evaporator previously used to produce fresh water had been discarded and removed from the site. Water is treated in the RO plant by UV sterilisation and stored in 5,600 litre fibreglass tanks adjacent to the domestic water heating plant. An alternative water supply is provided by a small glacial melt pond 100m to the west of the GWR building. Although relatively shallow this pond provides good quality drinking water, particularly early in the spring. It is not contaminated by bathing skuas which use the ponds further to the south.

As part of the refurbishment of the GWR building a second RO plant is due to be installed. This in effect will provide not only increased production capacity but also parallel facilities. Both the Biolab and the GWR buildings will have separate accommodation, stores, power generation and water production facilities.

Transport and Communications

Radio communications equipment was comprehensive with VHF and HF. Satellite communications were via ATS-3 for voice link and LES-9 for data transmission via the Internet with two 5 hour slots for Internet connections. In addition Inmarsat B was used. The station had a Local Area Network (LAN). In addition to the official radio communications, Ham radio facilities were also available. Although provided for recreational purposes these also acted as an emergency radio back-up.

Vehicles comprised 3 snowmobiles, 2 ATVs, 1 crane (condemned and due to be shipped out) and 2 Skytrack forklift trucks, capable of lifting empty sea containers. Fourteen inflatable boats, including Mk III and V Zodiacs were present. These are kept in the water using an overhead mooring system. Inflatables are used largely for scientific work and each is equipped with one main and one back-up outboard engine.

There is now no operational helipad at Palmer. The previous metal-floored helipad is no longer used. This is unfortunate for it was sited on one of the few unobstructed flat areas of ground. However the SATCOM aerial and the clean air laboratory are now directly adjacent to the former helipad. Landing can be effected to the east of the station but the area is rocky, close to major aerial arrays and therefore not ideal. A marked track extends up the glacier to the skiway where ski-wheeled aircraft can land. This facility is used most frequently by dH Twin Otter aircraft from Rothera Station (UK).

Safety Training and Emergency Procedures

Pre-deployment training in environmental management, fire fighting and mountaineering is provided in the USA. Well organised emergency response capability was evident with ocean and glacier search and rescue teams (OSAR and GSAR teams respectively) and two 2 person fire fighting teams. A fire sprinkler system was operational in the GWR building, and although installed in the Biolab building this had yet to be plumbed in. Extensive fire fighting equipment was evident with mains pressure hoses supplied by pumped sea water. Fire fighting exercises were held frequently.

A doctor was resident year round and the base was supplied with modest medical facilities (a treatment room equipped with x-ray, defibrillator and pharmacy). These facilities were due

to be updated and transferred to the GWR building as part of the refurbishment. Surgery at Palmer Station was not contemplated and medical evacuation was likely to be either by aircraft (UK Twin Otter from Rothera Station) or by ship to Frei Station and then by aircraft to Chile.

Notable safety features at Palmer Station were the use of seawater for the fire fighting system, and the provision of parallel services (accommodation, food, power, and water) in the station's two main building complexes.

Environmental Management

Orientation training in environmental management was provided. Regulations relating to flora and fauna and environmental standards generally were publicly available and prominently displayed in the main accommodation. The station management and personnel were well aware of nearby protected areas and their management provisions eg Biscoe Point SSSI No. 20 and Litchfield Island (SPA No. 17). US nationals were bound by the provisions of the US Antarctic Conservation Act and the Environmental Protection Act, and permits were required from NSF to enter these areas or cause harmful interference with wildlife. Details of such permits were held by the station. No non-indigenous species were present on the base, though hydroponic cultivation was being considered.

Strict adherence was also kept with the voluntarily adopted management plan for the SW Anvers Island Multiple-Use Planning Area (MPA). This provided limited access to certain offshore islands, but prohibited access to others. International recognition of the MPA was maintained by other Treaty Parties and by tourist vessels, though isolated incidents of overflying helicopters have occurred in the past. Waste disposal was strictly managed with all wastes being separated at source. Waste management was the responsibility of the laboratory manager, logistics manager and the diesel mechanic. Glass, plastics and metals were retrograded to Punta Arenas. Hazardous substances were retrograded to the US every two years. This included small quantities (around 250 millicuries per year) of radioactive waste (Tritiated water and carbon 14 were used in biological experiments).

Wastes were stored in separate containers and around 12 ISO containers containing waste were returned each year. Hazardous and inflammable materials were held in designated buildings. Recycling of waste was being considered. Waste minimisation was being practised using reusable bottles sent back to Chile rather than aluminium cans.

Sewage, grey water and kitchen wastes were not treated but discharged to sea after maceration. Sea water, rather than freshwater, was used for flushing toilets. The sewage outfall pipe was located adjacent to the pier.

A major clean-up of previous waste materials was being carried out by a specialist sub-contracted 4 man team. Metal wastes and contaminated soil was being extracted using heavy plant from a former waste dump adjacent to the former helicopter pad. Extraction was difficult in the frozen ground. 150 bags (total 1134 kgs) had been retrograded in 1997/98. At the time of the Inspection 80 bags had been filled this season. It was hoped that clean-up of this particular site would be completed this season. But other more problematic areas remain. A former dump closer to the centre of the base was smaller, but access by heavy plant would

not be possible. Other former waste sites were present around the base and were actively being examined for clean-up and retrograding.

Former waste dump: environmental clean-up

The status of Environmental Impact Assessments in respect of activities and construction was not clear. Apparently the NSF considered environmental assessment as part of the adjudication process for programmes. The US Environmental Protection Agency was not involved in this process.

An EIA was in hand for the underwater blasting that was planned to take place close to the pier to remove an underwater obstruction for berthing vessels.

Tourism

Palmer has an active policy towards the management of tourists. Tourist vessels were allowed to call at the station though the maximum was set at 12 per season (dispensation had been agreed for one additional vessel this season) and dates of visits must have been agreed beforehand. Confirmation was required within 72 hours of the intended call.

Last season 1200 tourists had visited Palmer, plus 300 other visitors. Visits from vessels were not permitted on Saturdays or Sundays and were timed so as to cause least disruption to base activities. Tourists from visiting ships were provided with an organised tour of the base. This involved up to 8 base personnel including the station manager, for a period of 3-4 hours. Scientists were not required to take part in these activities and disruption to scientific activities was deliberately minimised. The base had a small shop selling souvenirs.

On request, tourists are also permitted to visit nearby Torgesen Island, again with base personnel in attendance.

Tour vessels usually anchor in close proximity to the station in the sheltered waters of Arthur Harbour.

The Inspection Team were able to witness the station's tourist management system at first hand. Coinciding with the Inspection visit two tour vessels visited Palmer that day. The *Clipper Adventurer* (Clipper Cruise Line) had called that morning and the Russian-registered *Shuleykin* (Marine Expeditions) with 45 tourists on board anchored off Palmer Station in the early afternoon. 2 tour vessels in one day was highly atypical. Nevertheless the visits to the base from these groups of tourists were conducted in a controlled and efficient manner.

Small numbers of yachts visit Palmer Station but are normally only allowed to do so with prior permission.

Summary

A compact, well maintained base with a strong focus on scientific research, particularly ecology. Science programmes were of a high calibre. Similarly, scientific facilities (laboratories and equipment) were of high standard and efficiently utilised. High quality design and management standards were evident. Most support personnel had considerable Antarctic experience. Procedures for health and safety and emergency response were noteworthy as was the parallel provision of key facilities (accommodation, stores, power generation, and water production) in the station's two main building complexes. This would provide a high degree of contingent safety in the event of a catastrophic accident such as a fire.

The base contained a well inventoried store, though given the frequent re-supply it was noted that the stock of spares held was substantial.

Palmer operates a sound policy towards environmental management. It does however have a legacy of past wastes. It was commendable that efforts were being put into waste clean-up and retrograding. Early consideration could be given to replace the header diesel tanks with double-skinned versions.

The station has a positive, though highly controlled, policy towards tourism management. This appeared highly effective with minimal disruption to the station's science programmes.

MG, HG, IC, AS.

AKADEMIK VERNADSKY (UKRAINE): INSPECTED 15 JANUARY, 1999

Aerial view of Academic Vernadsky from the west

General

Akademik Vernadsky station is located on the NW peninsula of Galindez Island in the Argentine Islands to the south of the Lemaire Channel. Its position is Lat. 65° 15'S; Long. 64° 16'W.

Akademik Vernadsky was previously the UK station Faraday and was transferred to the Ukraine under a formal agreement signed between the Governments of the UK and the Ukraine in July 1995. The transfer was phased, with 4 Ukrainian personnel overwintering during 1995/96, and the Ukraine taking possession of the station on 6, February 1996.

The base on Galindez Island was built in 1953 as a replacement for the earlier UK station Argentine Islands (Base F) 600m to the south on Winter Island (now designated as Historic Site and Monument No. 62 under the Antarctic Treaty). Two major periods of building construction at Faraday had occurred, the last in 1978-79.

Akademik Vernadsky is operated by the Ukrainian Antarctic Centre, part of the Ukraine Ministry of Science and Technology. The primary aim of the station is scientific research.

This was the first time that the station operated by the Ukraine had been inspected. Previous Inspections of Faraday Station under UK operation had been in 1993 (UK, Italy and Korea) in 1987 (Chile), and in 1985, 1975 and 1964 (US).

Personnel

Although the station had a maximum capacity of 24, the working complement for both the summer and winter periods is now 11. This includes 5 scientists, one of which is the doctor. Other personnel were the station leader, cook, radio operator, systems mechanic, diesel mechanic and electrician.

Usually the tour of duty for base personnel is one year, with a full changeover of staff in March. Previously, some station members had however spent two, or even three years on the base. There is no military involvement at Akademik Vernadsky. All base members were civilian, though a number had previous military experience.

Scientific Research

A range of scientific programmes were being undertaken. Under the agreement with the former operator, the British Antarctic Survey (BAS), this included a range of measurements in meteorology, tidal observations and geophysics with data transmitted to both BAS and relevant international scientific bodies for a minimum period of 10 years. The site of Vernadsky/Faraday has some of the longest running data sets of basic observations for the Antarctic with meteorological and tidal data dating back to the 1940s. In addition the Ukraine has since initiated science programmes into biology (ornithology), glaciology and medical research.

The station was equipped with a number of laboratories including a medical research lab. Other scientific facilities included a magnetics building, automatic weather station, and tide gauges (both manual and automatic), the latter transmitting data back to the UK by satellite.

The geophysics programme included seismic measurements, ionosonde soundings and ozone monitoring (using a Dobson spectrometer housed in the roof of the main building). There were no scientists of other nationalities present, and other than the agreement with the UK, no international co-operation in science.

Physical Description

With the exception of building a sauna hut, no structural changes had been made to the station since it's acquisition by the Ukraine. The main station complex is compact consisting of an L- shaped double-storey working and accommodation block, a generator building, storeroom and workshops. Outlying buildings comprise a former balloon-launching shed, and an emergency store, a fluxgate magnetometer building and a VLF hut. A wooden walkway interconnected the main buildings and extended down to a small slipway 65m SW of the main building, and a small wooden jetty 50m to the south with a 6m frontage.

A refuge hut is located on Rasmussen Point, 6 km away on the mainland. Plans were apparently in hand to erect another building at this site. A hut is also present on the east side of Peterman Island 10km from Vernadsky. What Party was responsible for this structure was not clear.

The main station buildings were covered in plastic coated metal cladding and all buildings were in a well maintained condition both inside and out.

Logistics

Re-supply of the station was subject to variable arrangements. In previous years the Ukrainian-registered MV *Krenkel* had undertaken the annual re-supply of food, equipment and bulk fuel. It was however understood that an agreement had since been signed between the Ukraine and Chile to effect re-supply. Changeover of personnel was likely to take place via one of the Russian- registered tour vessels operating through Ushuaia.

Power supply was provided by three100kVA Volvo generators with emergency back up from a 16kVA engine. Annual consumption of diesel was 150,000 litres. Bulk fuel was stored in two riveted metal sectional tanks, elevated off the ground. Storage capacity in these was respectively 145,000 and 33,000 litres. Although both tanks have liners, one steel the other neoprene, the integrity of these tanks cannot be assured. The Inspection Team noted the concern expressed in the 1993 Inspection Report which recommended that the tanks and their pipework should be replaced with new double-skinned steel tanks at the earliest opportunity, given the then rate of spillage and the difficulty of spill clean-up due to the rocky terrain.

Although replacement of the bulk diesel tanks by the 1998/99 season had been a principal condition of the 1995 UK-Ukraine Agreement, the Observers understood that this work had been unfortunately delayed until the 1999/2000 season. A row of new concrete piers had however been built to the south of the main building and it was understood that a platform of double metalwork would be installed to support new double-skinned tanks. No bunding was however envisaged.

Re-supply of bulk fuel is via a ship to shore floating hose with the fuel lines being emptied by compressed air. The flexible hose was stored on a platform adjacent to Meek Channel. In the very confined waters of the Argentine Islands the re-supply operation would have to be handled carefully in terms of ship and pumping operations. Small quantities of petrol were held for the outboard engines, and a small quantity of kerosene was present at the Rasmussen refuge for heating and cooking.

Although a reverse osmosis (RO) plant was present on site with a production capacity of 1,000 litres per 10 hours this was not used frequently, perhaps because of lack of filters. Instead, potable water was being obtained from an adjacent small melt pond. Water storage capacity was 4,000 litres with daily consumption around 2,000 litres.

Transport and Communications

Communications were provided by means of HF, VHF and SATCOM with Internet connections twice a week.

Transport was restricted to 1 snowmobile, 3 small glass-fibre dinghies with 12 small outboard engines and one RIB inflatable with its own dedicated engine There are no roads or tracks within the station area.

It is not possible to land fixed-wing aircraft in the vicinity of Akademik Vernadsky, nor does the station possess a helipad. Indeed some difficulty was experienced in landing a helicopter close to the station due to the extensive radio aerial arrays present and the lack of suitable flat land.

Safety, Training and Emergency Procedures

The Observers were informed that pre-deployment training was provided in survival, first aid and environmental management. The base was equipped with a fire emergency plan and prominent, comprehensive fire fighting equipment. Fire practices were apparently held weekly.

Emergency search and rescue capability was limited given the location of the base and the vehicle/boat provision.

Oil spill equipment was on site, and oil spill response exercises were held.

A resident doctor was on base and medical facilities included a small treatment room with a single bed ward and basic, though adequate, equipment.

Environmental Management

Waste management procedures complied with Environmental Protocol provisions. Wastes were separated into plastics, metals, glass and organics, with metals crushed and stored in sealed 205 litre drums. Other material was compacted for retrograding to the Ukraine, perhaps later in 1999. A log was maintained of waste production. It was however not clear how organic wastes such as food waste were dealt with since there was neither provision for storage nor treatment. Sewage and grey water were not treated and were discharged direct to sea via an outlet pipe close to the jetty. Apparently tidal flow here was adequate for dispersion.

Information relating to environmental management did not appear to be readily available on the station. Personnel did not seem to be aware of Environmental Impact Assessment provisions or whether an EIA had been conducted for either station activities or construction. Nor was there any environmental monitoring of actual or potential environmental impacts. Rules relating to the introduction of non-native species (Article 4 of Annex II of the Protocol) were not being adhered to with tropical fish (for recreational, rather than science purposes) in the laboratories and several house plants present on the base.

In accordance with the UK/Ukraine bilateral agreement Akademik Vernadsky personnel undertook stewardship of the nearby Historic Site and Monument (No. 62) of Argentine Islands (Base F).

Tourism

Three tourist cruise vessels had visited Akademik Vernadsky so far this season. The Argentine Islands are a favourite anchorage for visiting yachts and a Norwegian-registered yacht *Taja* with two Norwegian nationals on board was at anchor in Stella Creek to the south of the station. This yacht was carrying the necessary permit from the Norwegian Government authorities, the Norsk Polar Institut, Tromso. On 26 January a further 5 yachts were seen at anchor in the area between Hovgaard Island and Pleneau Islands 11km to the north of Akademik Vernadsky.

Summary

A moderate sized permanent station with an emphasis on science including the maintenance of long standing data sets, and the instigation of new science programmes in glaciology and biology. As a new national operator in Antarctica this commitment by the Ukraine to science

is commendable. Although the facilities remain in good condition the base did not appear well resourced in terms of consumables (spares and stores). In the view of the Observers it will be important that standards of maintenance are upheld if the station's infrastructure is not to deteriorate.

Akademik Vernadsky is unusual as a permanent research station in Antarctica insofar as it is operated by a non-Consultative Party to the Antarctic Treaty, and one which has yet to accede to, or ratify, the 1991 Environmental Protocol. It was clear from the Inspection that certain aspects of the Protocol were not being complied with including the adoption of EIA, and the prohibition on imported non-native species. To ensure conformity with all standards, consideration should be given by the Ukraine to early ratification of the Protocol, and thereafter to seek Consultative status within the Antarctic Treaty.

MG, HG, IC, AS.

ROTHERA STATION (UK): INSPECTED 26-28 JANUARY, 1999

Rothera Station: aerial view from the south

General

Rothera Research Station is located at Lat. 67° 34'S; Long. 68° 07'W on Rothera Point, Adelaide Island off the west coast of the Antarctic Peninsula. This extensive year-round station is operated by the British Antarctic Survey (BAS), one of the research institutes of the UK's Natural Environment Research Council (NERC). Rothera was established in 1976 and has been considerably expanded since, particularly in the periods 1981-1987 and 1991-1996. The station's main purpose is scientific research both on site, and logistic support for scientific deep-field parties operating in the area between the South Shetland Islands and the east coast of the Weddell Sea. Rothera Station regularly maintains two summer-only bases at Fossil Bluff (Lat. 71°20'S; Long. 68°17'W) and Sky Blue (Lat. 74°51'S; Long. 71°34'W), though neither base was visited during the Inspection.

The station shares logistic co-operation and support with the Italian, German, Dutch and US Antarctic programmes.

Rothera was last inspected in 1995 (Argentina), and prior to that in 1993 (UK, Italy, Korea), 1989 (New Zealand), and 1980 (US).

Personnel

The station has a maximum capacity of 124, accommodated in 4 person bunk rooms in the main and transit buildings. During the 1998/99 season, 159 persons were on base including 10 in transit to, or from, Halley Station and 20 visitors to the station.

Scientists and scientific technicians numbered 52, logistic support staff 78. The great majority of staff are civilian with only 4 military personnel present. These consisted of 3 aircraft mechanics and 1 radio operator seconded to BAS for flight operations and aircraft servicing.

The actual number of persons on base at any one time during the summer period fluctuates considerably depending on flight operations and the movement of scientific field parties.

Scientific Activities

Science at Rothera is conducted both on the station and in deep-field operations. In the 1998/99 season field parties were operating at 16 locations spread between the South Shetland Islands, the Weddell Sea and the Pensacola Mountains. Co-ordination and logistic support for these parties was provided by Rothera. Scientific activities are focussed on glaciology, geology, biology, geodesy and geophysics. These programmes comprise airborne gravity, magnetic and radio-echo survey, continental break-up studies, eco-system survival strategies and UV impact, palaeo-environmental change, ice climate and global change and meteorological studies.

Meteorological surface observations were taken at the station. In addition Rothera collects data from a network of bases consisting of Halley, Neumayer, Vernadsky, Fossil Bluff (summer-only), two research ships (RRS *James Clark Ross* and *Bransfield*) and several automatic weather stations. These data are fed into the World Meterological Network via Frei Station (Chile) and the UK. The station also provides synoptic weather forecasting for field parties and flight operations.

The satellite tracking antenna and the receiving equipment (Sea star) for high resolution picture processing regularly provide high resolution pictures of NOAA satellites for the project on Antarctic Reception of Imagery for Environmental Studies (ARIES). The station has a permanent GPS receiver. Regular ozone observations are made by a SAOZ spectrometer. Studies of upper atmospheric processes have been performed with the partial reflection technique (mesospheric radar, 1.98MHz). These observations were co-ordinated with a German/UK rocket campaign during 1997/98.

During the last two years a comprehensive in-shore marine and terrestrial biology programme has been initiated. This includes projects on in-shore marine biology by SCUBA, deep water benthos using remote operating vehicles (ROVs), micro-climate studies and plant and invertebrate physiology including the effects of climate change (UV-b radiation, temperature) on biochemical processes.

Most of the scientific programmes have some international input. US collaboration takes place in airborne geophysics, German collaboration in the GPS survey network and ROV cruises for deep benthic observations, whilst the Netherlands co-operates closely on long-term ecological research in terrestrial biology. Eight visiting guests scientists were present in 1998/99 (Germany 3, Netherlands 4, Norway 1). BAS' policy is to enhance scientific exchange by inviting internationally referenced scientists to work at Rothera.

Scientific research on the station is undertaken in the main Bonner laboratory which incorporates analytical working spaces and an environmental controlled laboratory with climate chambers. Specialist laboratories are also present for microbiological studies and

work with radioisotopes.

This science facility is augmented by a seawater aquarium, SCUBA diving store, a biological store, library, and working places for visiting guest scientists. A boat shed, hazardous chemicals store and constant temperature refrigeration unit complete this laboratory complex.

Physical Description

An extensive station set to the east of the Wormald Ice Piedmont on the flatter area of Rothera Point. The station has 12 major buildings, two of which date back to 1976. Most buildings are of modular construction, foam insulated and covered in plastic coated metal profile cladding.

The central part of the station consists of eight buildings. The two storey main building houses the living quarters, communication and meteorological offices, computer facilities and working rooms for scientists. This building is interconnected to the reverse osmosis (RO) plant and garage whilst adjacent is the generator building with control room and maintenance workshop.

The older buildings dating from 1976 are used as carpentry and electrical workshops and storage. A metal arched garage accommodates a large number of Snow-mobiles, and stores waste for retrograding. A further building provides accommodation for 48 persons.

To the west of the main station buildings and oriented NNE/SSW is the crushed gravel runway 900m long and 45m wide with ancillary facilities adjacent (parking apron, bunded fuel farm and aircraft hangar, with offices). In addition a ski-way is present on the Wormald Ice Piedmont, 5km from the base. A ski-way is also present at Fossil Bluff and a 'blue ice' runway at Sky Blue.

Refuges are located on some of the islands in Ryder Bay including Lagoon, Leonie, Blaiklock and Horseshoe.

A new building to accommodate 78 personnel is planned. This would allow the existing accommodation to be improved for living and recreational facilities.

Around 600m of crushed gravel track exists within the station. A wharf with a frontage of 60m and capable of accommodating vessels up to 10,000 gdw is located near the southern end of the runway. This is faced with interlocking sheet piling and back-filled with concrete. A slipway is situated adjacent to the wharf and used for inflatable boats for marine research.

Logistics

Re-supply of the base takes place annually, early each austral summer season, with stores and fuel off-loaded from BAS research vessels directly ashore at the pier. A second re-supply is normally scheduled at the end of the summer.

Power generation is provided by three diesel generators of 460kVA each. At any one time, one generator is under load, one on standby and one undergoing maintenance. Two 175kVA generators provide emergency backup. An independent heating system for each building relies on heat exchangers. Annual fuel consumption is around 490,000 litres. The planned new accommodation building will be designed to incorporate alternative engery sources.

Bulk fuel is stored in 6 tanks of 240,000 litres capacity each. Three tanks hold aviation fuel (avtur) the other three marine gas oil (light diesel) for the generators, boilers and vehicles. All tanks are set within a bunded tank farm. Fixed pipelines provide aviation fuel to the adjacent aircraft fuelling station. The underground diesel pipelines are heat traced and insulated.

Smaller working tanks are present within the station. These consist of a single-skinned generator day tank ($4.9m^3$) set in a bund, a vehicle re-fuelling tank ($1.9m^3$) which also is only single-skinned but not bunded (its replacement is due at the end of the 1998/99 season) and the main boiler tank which is also bunded with a $2m^3$ capacity. The transit accommodation boiler tank ($2m^3$), laboratory fuel tank ($4m^3$) and emergency generator tank ($2m^3$) are all double-skinned and bunded. These tanks are refuelled from a small bowser.

Lubrication oil tanks and waste oil tanks are installed in the garage and generator buildings. All are protected against spillage with a bund or double-skinned construction.

However, aviation fuel, petrol and kerosene for use by field parties are stored in 205 litre drums at two sites within the station area. This stock of 1,100 drums does not however have any protection against spillages, or even regular monitoring, and is stored on flat gravel areas. With an average storage time of around 2 years there was some evidence of corrosion on these drums. In 1998/99 the total stock of aircraft fuel held at field party camps was 927 205 litre drums.

Drummed aviation fuel

Monitoring of fuel tanks, pumps and pipework is made by flow gauges, weekly check of pipework and monthly checks of the fuel levels in the bulk tanks.

Bulk oil is transferred direct from ship to the bulk tanks once per year by fixed pipework over a distance of approximately 600m. There are two separate pipelines for aircraft fuel and diesel fuel. The fixed pipework ends close to the laboratory from where flexible hoses are used to connect to the ships pumps and tanks. Fuel lines are emptied by compressed air from the ship.

Potable water is produced from a reverse osmosis (RO) plant. Water is also obtained from a small glacier melt-water lake. Water production is $16m^3$ per day with storage capacity of up to $24m^3$. Water consumption is $8m^3$ per day or roughly 110 litres per person per day.

Transport and Communications

Communications are provided by VHF, HF and SATCOM.

The station uses a local computer network for scientific and management purposes, and all maintenance schedules, fuel management as well as storage and spare parts management are computer controlled.

The station has a large number of small and heavy vehicles. Altogether 62 snow-mobiles provide support for scientific field parties as well as being used in the station area during winter. Small rubber wheeled vehicles are used in summer. Seventeen heavy vehicles are available for station and runway maintenance, construction work, cargo handling and earth moving. These consist of bulldozer, excavator, low-ground pressure crane, snow miller, mini-blower, Sno-cats, vacuum tanker, tractors, container lifter/transporter etc. A number of these vehicles have been in operation for 5-10 years.

The station also has six inflatable boats plus outboard engines. One of these is a semi-rigid inflatable with specialist equipment for diving. The boats are used principally for research and rescue purposes for up to 203 days per year.

During the summer, 4dH wheel ski equipped Twin-Otters operate out of Rothera to support scientific field parties. Each aircraft operates approximately 400 flying hours per season. In addition a dH Dash-7 is used for direct flights for essential cargo and personnel transport between Stanley, Falkland Islands and Rothera and also for depot laying at 'Blue Ice' runways. Around 16 return flights per season taking around 400 flying hours are made.

Safety, Training and Emergency Procedures

BAS personnel and guest scientists receive special pre-deployment training on first aid, field safety, environmental protection and Antarctic Treaty issues. Further briefing on regulations governing diving, boating and sea-ice travel as well as safety regulations to be observed on the station and at field camps is given on site. Technical personnel have regular exercises in Search and Rescue, fire fighting, and oil spill response. A SAR unit is held on stand-by, and its equipment checked regularly.

The station has well elaborated safety and emergency response plans and comprehensive safety equipment. Incidents are responded to on site and reported to BAS in the UK.

Approximately 300 hand held extinguishers are held at five strategic positions on the station and augmented by a mobile fire tender and water hoses in case of fire at outlying buildings or associated with aircraft operations. Areas at particular risk (such as the kitchen, generator

building and its internal fuel storage and communications room) are fitted with automatic fire suppression systems. Monthly fire fighting exercises are held.

An oil spill contingency plan exists and two training sessions to deal with oil spills had been held during 1998/99; one during summer the other winter. Mobile spill response equipment consisting of skimmer, holding tanks, booms, absorbents, protective clothing and equipment is held in a container close to the wharf. Despite all precautions an oil spill of approximately 4 tonnes of diesel had occurred in July 1998 whilst refuelling the boiler tank of the main building. Response action consisted of the removal of fuel contaminated snow to bunds. This was subsequently skimmed and stored in drums. Contaminated gravel was removed and cleaned using steam pressure cleaners and dispersants. 18m^3 of gravel had been cleaned. A further 6m^3 remained to be treated. Oily-water from the spill was due to be retrograded to the Falkland Islands.

The station has a well equipped hospital with a resident year round doctor. A second doctor is present during the summer. Medical evacuation would be effected to the Falkland Islands.

The station does not hold firearms. However, explosives are held for glaciological and seismic work. The components are stored separately. Detonators, primers and fuses are held in magazines at the NE of the station well away from the buildings. Accurate logbooks are kept on the use of explosive materials.

Environmental Management

A detailed waste management plan exists for the station as well as for all field parties. Waste management is the responsibility of the station support manager. In addition, two technical staff are designated to deal with waste management year round. Briefing is given to all personnel on waste management during pre-deployment training in the UK. This is augmented by further briefing on site. Notices and updates are displayed on boards in the station.

An annual waste management report is prepared. This details wastes from Rothera itself as well as from the field parties. Waste is separated at source into 5 categories. Sewage is disposed into the sea after maceration. No other treatment is made. Similarly, grey water is discharged direct to sea. Other liquid wastes and chemicals, including fuel and lubricants are retrograded back to the UK or the Falkland Islands. Combustible and all other solid waste is treated by shredder, crusher and compactor for retrograding. Most food scraps (95%) are macerated and flushed to sea; the remaining 5% are incinerated on site.

Waste material from field parties is returned to Rothera and treated accordingly. The clean-up of past activities at the station is strictly observed. For example all equipment in relation to the 1997/98 rocket launching campaign had been removed, and the site cleaned up. The small concrete foundation remaining had been used to mark the SSSI. All waste and equipment from the 3 year construction period 1993-1997 had been removed. The station area was in an exceptionally tidy state.

Environmental Impact Assessments had been prepared for the construction of the runway at Rothera Point (1989), the expansion of Rothera Research Station (1995), the erection of a medium frequency space antennae (1996) and the use of mesospheric micro rockets during

the summer season 1997/98. Currently an EIA is in preparation to address the construction of an additional accommodation building at Rothera.

Several impact studies had also been carried out to assess the impact of the station's operations on the environment. SSSI No. 9 (Rothera Point) had been designated specifically to monitor the impact of station activities on the local environment. The parameter employed is the heavy metal content of lichens. In addition, in 1993 a study was undertaken to assess the ecological impact of sewage disposal on the benthic community, whilst a base line environmental study at Sky Blue had been undertaken.

Station personnel were well briefed on environmental regulations. The BAS Handbook, provided to all personnel, deals with these items in a special section. Marine and terrestrial invertebrates had been collected for scientific research during the summer of 1998/99. No permits are required for this task and therefore no formal records are kept. Special regulations are observed for food storage and disposal of used food eg incineration of bones, eggshells and other poultry products. Special regulations deal with the micro-organism laboratory housed in the Bonner laboratory building. Permit No. 1/98 issued by the Director, BAS allows for the keeping of non-indigenous micro-organisms within the context of approved scientific research projects.

SSSI No. 9 (Rothera Point) lies 0.5km from the station. Its boundary is marked clearly by yellow painted drums to which are affixed small signs. Two more major signs indicating a map and description of the SSSI stand at each shore side. Permits for BAS personnel to enter the site are issued by the Director, BAS. Last year 5 such permits had been issued for scientific purposes. The SSSI is used for long-term monitoring to assess the station's impact on the local environment.

Additionally, a number of vegetated sites on Rothera Point, parts of the marine environment of Ryder Bay along with sites on Leonie and Lagoon Islands are used for scientific purposes. Access to these sites is restricted through control by the station management.

Tourism

No tourists visits were reported and BAS does not encourage tourism activities at Rothera or provide facilities for tourist or NGO operators.

Summary

Comprehensive documentation on key logistic activities and station management such as fuel handling, waste management, environment impact assessment and protected area management was provided to the Observer. These indicated full compliance with the Antarctic Treaty and the Environmental Protocol.

The station is maintained in an exceptionally tidy state. Buildings and facilities are well maintained. The removal from the station of material from previous activities such as the 1997/98 rocket programme is highly commended.

However, the storage of large quantities of drummed aviation or other fuel is not wholly satisfactory. It is recommended that additional measures are introduced to prevent possible spillages from drummed fuel. The station's grey and black water are discharged to sea

untreated, except for maceration. In consequence, and given the station's complement, cumulative impact on the inshore benthos is possible. Consideration should therefore be given to repeating the study on the impact of sewage discharge performed in 1993.

The recently established Bonner Laboratory provides excellent facilities for marine and terrestrial biological studies. The comprehensive equipment store and workshop building along with the aircraft provide the station with ideal facilities to support scientific field projects.

The consideration, in the design of a new accommodation building, of alternative engery generation is an important development towards using alternative energy to heat and power Antarctic stations.

HG.

HISTORIC SITE AND MONUMENT NO. 38. SWEDISH HUT, SNOW HILL ISLAND: INSPECTED 23 JANUARY, 1999

Location of the Swedish Hut

General

Historical Site and Monument No. 38 is located on the north-west coast of Snow Hill Island at Lat. 64° 22'S; Long. 56° 59'W.

The principle focus of the Site is the 'Swedish Hut' erected by the Swedish South Pole Expedition of 1902. It stemmed from the international conventions of London (1895) and Berlin (1899) which were designed to promote international Antarctic expeditions.

The Swedish South Pole Expedition led by Dr Otto Nordenskjold established its winter scientific station on the northern shore of Snow Hill Island. Here, in their prefabricated wooden hut, 3 Swedish and 1 Argentine scientist remained for 2 years. The second year was enforced due to the expedition's ship *Antarctic* being wrecked around 100km away from Snow Hill Island.

This Historic Site and Monument has not previously been inspected. The listed description of the Site is set out in the footnote.

Physical Description

The Swedish Hut (measuring 6x8m) stands on a small knoll overlooking a flat, sandy foreshore 50m away. The ground in summer is snow free and the area to the south of the hut rises steeply in heavily gullied terrain. The interior of the hut consists of 3 double-bunk rooms, a

small kitchen/work area and a small central living area. The whole design is very compact. The remaining furniture consists of simply constructed cupboards, a table, and cooker and stove in the living area. Remaining artefacts from the wintering party are stored outside the hut and include the keel, keelson and clinkered planking of a traditional Scandinavian doubled-ended boat (around 5m o.a.l). Remains of seal skins were also present.

The structure of the Hut is in excellent condition, and the building remains wind and watertight. The door to the small entrance porch was closed but not locked. Swedish and Argentine flags on a flag-pole were present inside the building.

Conservation and Management

Historic Site and Monument No. 38 has been curated and maintained to a high standard by the Argentine Dirección Nacional del Antartica (DNA) and the Instituto Antartico Argentino (IAA). The site area is tidy and well maintained. Protective shutters were in place over the windows and the north-east facing wall of the hut remained reinforced by the two substantial

Nordensjold's Swedish Hut

original wooden props. It is presumed that the condition of the hut and its surroundings are kept under surveillance by personnel from the Argentine station Vice-Commodoro Marambio 21km to the north-east on neighbouring Seymour Island

Visitor Management

It was not evident to the Inspection Team as to how many people visit the Swedish Hut. Its location on Snow Hill Island is away from the normal tourist vessel route, and visitors from the DNA, IAA and Vice-Commodoro Marambio are likely to be the most frequent. A visitors' book was not present. Therefore it was not possible to gauge the extent or frequency of visits.

Recent footprints were however present on the adjacent foreshore and on the approaches to the hut.

Interpretative material is provided in the form of two metal signs in Spanish. These give basic information on the historical importance of the Site. This is augmented by a supply inside the hut of informative leaflets in English prepared by the IAA. A further information sheet in Spanish details the guidelines and principles of environmental protection in Antarctica.

The route from the foreshore to the hut is marked clearly with wooden arrows on small posts. This trail skirts the hummock on which the hut stands. This has been reinforced to prevent erosion. To reduce waste material and litter at the site from visitors and maintenance personnel, two 205 litre drums are provided close to the hummock.

Summary

Historic Site and Monument No. 38 remains in excellent condition and has been maintained to a high standard. Restoration has been sympathetically achieved to ensure the survival of one of the oldest and most important expedition huts in Antarctica. The efforts of the DNA and IAA are acknowledged and commended.

Footnote — Description adopted by the ATCM 'Hut on Snow Hill Island, built in February 1902 by the main party of the Swedish South Pole Expedition, led by Otto Nordenskjold (Lat 64° 24'S; Long. 57° 00'W*)'.

* NB corrected position is as given in para 1.

MR, HG, IC, AS.

WHALERS BAY, DECEPTION ISLAND: INSPECTED 27 JANUARY, 1999

Remains of the Whaling Station, Deception Island

Including Historic Site and Monument Nos. 71, 31 and 58, Whaling Station at Whalers Bay and the Abandoned British Base Deception Island.

General

Historic Site and Monument No. 71, the ruins of the Norwegian Whaling Station established in 1912 is located at Lat. 62° 59'S; Long. 60° 33'W at Whalers Bay, Port Foster, Deception Island.

It is likely that Deception Island was used by sealers of many nationalities from the early part of the 19th century. The British expedition of Captain Henry Foster on *HMS Chanticleer* of 1829 carried out gravity and magnetic observations, left maximum and minimum thermometers and compiled the first accurately surveyed map of an Antarctic landmass at Deception Island during the first scientific expedition to Antarctica. The history of whaling activity at Deception Island dates back to 1906 with the operation of a factory ship moored in Whalers Bay by Adolfus Andresen a Norwegian born immigrant to Chile. In 1912 Hvalfangerselskabet Hector A/S of Norway established a shore-based whaling station in Whalers Bay and by 1914-15, 13 floating factory ships in addition to the shore station were in operation. The Hector whaling station closed in 1931 as a result of the slump in whale oil prices. On 16 November, 1928 the first powered flight in Antarctica took off from Whalers Bay, piloted by Carl Ben Eielson a Norwegian-American.

Within and adjacent to the Whaling Station are buildings either used, or built, by the Falkland

Islands Dependencies Survey (FIDS) later to become the British Antarctic Survey (BAS). Base B Deception Island was established in 1943 by the UK's Royal Navy during "Operation Tabarin" the forerunner of FIDS, using three of the abandoned whaling station buildings. In 1946 the main accommodation building used by FIDS burnt down.

The main activities carried out at Base B were meteorology and the operation of an air facility to support survey work and the other UK stations in the Peninsula region. An accommodation hut for the Falkland Islands Dependencies Aerial Survey Expedition (FIDASE) was built in 1956. The aircraft hangar was built in 1961 and a new accommodation and laboratory block (subsequently removed by persons unknown from its foundations) was built in 1965.

The base was continuously occupied from 1944 until 1967 when it was evacuated because of a volcanic eruption. It reopened in 1968 but finally closed in 1969 following another eruption. This resulted in a mud flow destroying and damaging most of the buildings. This mud flow dramatically changed the topography and coastline of Whalers Bay and also engulfed the Norwegian whalers' graveyard.

This site had been previously inspected in 1993 (UK/Italy/Korea).

Physical Description

Much of the abandoned UK Station and the whaling station remains today. The main group of buildings stretch over 350m in the centre of Whalers' Bay; the British hangar is sited a further 300m to the west. Around the east side of the bay are various relics of the whaling operations including water boats, timber barrels and quantities of whalebone.

Adjacent to the site is SSSI No. 21 area E, Kroner Lake including the land within 50m of its shore approximately 1.7 sq km.

The significant buildings that remain are, from west to east:

Aircraft Hangar

A steel framed corrugated steel structure 16.7m wide by 22.3m deep, it stood alongside the runway (no longer evident) that ran north-south. The building also includes offices and workshops that still contain various debris. Various other artefacts both inside and outside the building include an aircraft fuselage, wings and other parts together with sundry pieces of steel and timber. The general condition is good although corrosion is evident on the steelwork and the cladding, and the building is no longer totally weather proof.

Magistrate's House

The Magistrate's House (9.3x5m) is now in derelict condition the roof having blown off in recent years.

Biscoe House

This was the main Base B building though originally the main whaling station accommodation block. The Norwegian timber structure measures 30.6 x 10.4m and has a linked timber generator shed, 7.6 x 6.8m. This building was badly damaged by the mud slide in 1969 which took away whole sections of wall, both exterior and interior, and pushed the remaining walls

out of vertical. The roof remains intact and the generator shed still houses two Lister generators. Large quantities of debris litter the floor of this building.

Boat shed

This Norwegian timber building 12.3 x 8.3m is now derelict having also been engulfed in the 1969 mud slide and subsequently collapsed further.

FIDASE Building

This timber UK building 19.3 x 6.3m was erected in 1965. The interior has been stripped of most of the internal linings, the framework and cladding of the hut is mostly intact. However the structure is severely distorted at the east end by erosion of the foundation. A large quantity of waste material litters the floor of this building.

Whaling station

There are other numerous structures and relics of the Norwegian whaling station, the most prominent are the tanks, boilers and their associated pipework. In addition to this there are waterboats, timber barrels and quantities of whalebone to the east of the whaling station.

The only remaining evidence of the Norwegian whalers graveyard is an empty coffin on the surface. The memorial plaque marking the position of the cemetery (Historic Site and Monument No. 31) was not evident neither was the cairn with plaque (Historic Site and Monument No. 58) erected to honour Captain Adolphus Amandus Andresen, the first person to establish a whaling operation at Deception Island.

Conservation and Management

Whalers Bay is important both historically and scientifically. The historic period can be divided between the sealing and early exploration period from around 1820 to whaling history from 1906 to 1931 and the Tabarin and FIDS history from 1943 to 1969. Scientifically the volcanic activity and the continuing topographic change is of great geological interest. In addition to this the site is one of the most heavily visited by Antarctic cruise ships attracted by its volcanic nature and historic background.

The British Antarctic Survey have already undertaken two clean up programmes in 1990-91 and 1991-92 at Base B removing a large quantity of debris and some hazardous material. However despite this, exacerbated by the severe wind and weather damage, the ongoing deterioration of the structures on the site continue to produce wind blown debris. The structures themselves, notably the Magistrate's House and the boatshed have significantly deteriorated in the last 5 years.

Graffiti evident on the fuel tanks does not seem to have been added to in recent years, however visitors continue to add graffiti to the building interiors.

Conservation of the site is clearly a difficult problem. The ruined state of the buildings and continuing topographic changes make restoration impossible, and stabilization very difficult. Detailed recording of the existing site should be made a priority together with management to ensure minimisation of wind blown waste, and to present the site to visitors safely.

Visitor Management

Port Foster, Deception Island is an excellent safe, sheltered anchorage which attracts many visits from cruise ships. Safe landings from small boats are not normally difficult to achieve to enable visitors to see the volcanic activity and historic site.

Visitor reaction to the dereliction of the structures around Whalers Bay has often been reported as one of concern that clean up, conservation and considerations of health and safety should be undertaken by the appropriate authorities.

British Antarctic Survey have mounted interpretative signs on the hangar, Biscoe House and the FIDASE building describing in English and Spanish the history, geology and clean up operations of the site. The signs also disclaim liability in the event of an accident as a result of the base buildings being entered.

The Instituto Antartico Chileno have since erected a series of five prominent signs each fixed to two metal posts describing in Spanish and English Historic Site and Monument No. 71 the Norwegian whaling station and some of the individual components, the tanks, boilers and graveyard.

Summary

Whalers Bay is the second most heavily visited site in Antarctica. The area as a whole is important scientifically, historically and aesthetically. The condition of the former UK base buildings and structures of the Norwegian whaling station are derelict, deteriorating, and hazardous to visitors. The area is strewn with wind blown debris from the buildings. Further clean-up of the site is required to remove waste materials and present the site safely to visitors.

Whalers Bay contains three designated Historic Sites and Monuments, however the continuing existence of two of these sites is now questionable. It is recommended that Treaty Parties give further consideration to the historic values of Whalers Bay with a view possibly to rationalising its historic status within one unified Historic site and Monument. This should reflect all national interests involved.

Given the multiplicity of interests in Deception Island consideration in the longer term might also be given as to how the management of Whalers Bay and Deception Island might best be effected.

MR, IC.

HISTORIC SITE AND MONUMENT NO. 61: PORT LOCKROY, BASE A: INSPECTED 14 JANUARY, 1999

Bransfield House, Port Lockroy

General

Historic Site and Monument, Port Lockroy, Base A, No. 61 is located at Lat. 64° 49'S, Long 63° 29'W on Goudier Island, off Wiencke Island, Antarctic Peninsula.

Base A, built in February 1944, was one of the first permanent stations to be constructed as part of the UK's war time 'Operation Tabarin' mounted by the British Royal Navy. The station remained occupied almost continuously until January, 1962. Scientific research carried out at the station included topographic survey, geology, meteorology and botany. From 1950 onwards Port Lockroy played an important role in ionospheric research and was a key monitoring site during the International Geophysical Year (IGY) of 1957/58.

Prior to 1943 the sheltered waters of Port Lockroy had been used as an anchorage for a whale factory ship and its catchers.

Port Lockroy was included in a comprehensive survey in 1994 of the UK's abandoned former scientific stations on the Antarctic Peninsula. In view of its age and importance as an early UK scientific research station, the site was identified as having particular historic interest. Port Lockroy, Base A, was listed formally as Historic Site and Monument No. 61 under the terms of the Antarctic Treaty by means of Measure 4 adopted at the XIX Antarctic Treaty Consultative Meeting in 1995. The listed Description of the Site is set out in the foot-note.

This site has not been inspected previously.

Physical Description

The Port Lockroy Base consists of the main accommodation and working building ('Bransfield House'), a boat shed/store, a ruined store hut, an anemometer tower and an aerial mast. However, the whole of Goudier Island (around 0.24ha) has historic interest. Other artefacts remain from the earlier whaling era including whalers' water boats and large gauge anchor chains for mooring the factory ship and its catchers. Although not stated in Measure 4 (1995), it is presumed that Historic Site and Monument No. 61 encompasses the whole of Goudier Island.

Conservation and Maintenance

The decision to restore Port Lockroy to its 1962 condition (the date when it was abandoned) was made in 1994 by the UK Antarctic Heritage Trust (UKAHT), and during the austral summer of 1995/1996 a 4 man building team and a conservator, employed by the UKAHT with support from the British Antarctic Survey (BAS) and UK Government, carried out a major conservation project. This was undertaken in strict accordance with the recommendations set out in the earlier survey report and conservation plan.

Particular care was taken to avoid any impact on the Gentoo penguin colony which surrounds the abandoned buildings. (Gentoo penguins had re-colonised Goudier Island when Base A was abandoned, and now number around 700 breeding pairs.)

The base has been returned to its 1962 condition. Artefacts from that period, including scientific instruments and equipment as well as the original diesel generators, are set out on display. Interpretative wall boards outline the history of Port Lockroy. The former boatshed/store contains original items such as tinned food and boxes dating back to the 1950s. This building also acts as a store for maintenance materials and for food and equipment for the summering staff.

On site management and maintenance is provided by 2 persons who also supervise the large number of tourists who now visit Lockroy. The summer team is resident from November to March and employed by the UKAHT with all costs being defrayed by the sale of merchandise. The personnel at Lockroy are deployed to the site by BAS and regular radio communications are maintained between Port Lockroy and the UK's Rothera Station.

The former laboratory in Bransfield House is given over to a shop/post office. The former bunk room is used for the living quarters.

In addition to maintaining the buildings and dealing with visitors, the personnel monitor the Gentoo colony to determine any impact from visitors. Despite the large number of tourists, and the close proximity of nesting penguins to the station's buildings, no discernible impact on breeding success or numbers present has been observed since 1996.

A waste management plan for the site exists. All wastes are separated at source into glass, metals, plastics and organics for retrograding to the Falkland Islands at the end of each season.

Visitor Management

Within the past three seasons since the site was restored, the numbers of visitors to Port Lockroy, mainly ship borne tourists, have escalated rapidly. Port Lockroy is now the most visited site in the Antarctic. In 1997/98 4,500 tourists* visited Port Lockroy. This represents around 60% of the total ship-borne tourist numbers then visiting the Antarctica Peninsula.

Port Lockroy employs an active tourism policy to deal with the large number of visitors in order to minimise impact both on the structure of the Historic Site and on the adjacent wildlife. Tourist and NGO expeditions wishing to visit the island must seek permission in advance. Unsheduled visits are not accepted. Each visit is supervised carefully with not more than 30 persons allowed on the island at any one time, and similarly no more than 10 visitors at a time allowed to enter Bransfield House. Detailed records of all visits are maintained.

Summary

Port Lockroy on Goudier Island is the most heavily visited site in Antarctica. The experiment of a manned Historic Site is novel, but appears to be highly successful. Port Lockroy provides an opportunity for tourists to experience the conditions of an early Antarctic station. It also offers a unique opportunity to collect not only detailed records of the numbers of tourists that visit the site, but also to monitor any impacts on the resident penguin colony. To date there have been none.

The example of Port Lockroy as a means of managing tourism may be one that could be adopted elsewhere in Antarctica.

The structure of Historic Site and Monument No. 61 remains in excellent condition. The work of the UKAHT and BAS in restoring and maintaining this site is highly appreciated and acknowledged, as is the motivation of the summering personnel resident on site who live in very modest conditions.

Footnote:

Listed Description from Measure 4 (1995)

'Port Lockroy, Base A, on Goudier Island, off Wiencke Island, Antarctic Peninsula (Lat. 64° 49'S, Long. 63° 31'W). Of historic importance as an Operation Tabarin Base and for scientific research.'

* *Postscript*: Figures provided by the UK Antarctic Heritage Trust since the Inspection indicate that during the 1998/99 tourism season 5,800 visitors from 72 tourist vessels and 30 yachts visited this Historic Site and Monument.

MG, HG, IC, MC, AS.

HISTORIC SITE AND MONUMENT No. 62: ARGENTINE ISLANDS, BASE F (WORDIE HOUSE): INSPECTED 15 JANUARY, 1999

Aerial view of Argentine Islands, Base F from the east

General

Historic Site and Monument No. 62, Wordie House is located on the south-east of Winter Island, one of the Argentine Islands at Lat. 65° 15'S; Long. 64° 16'W. It is positioned at the point where Skua and Stella Creeks meet Cornice Channel.

Wordie House (Base F), built in 1947 by the Falkland Islands Dependencies Survey is of historic importance, representing as it does the early post-war period of British exploration on the Antarctic Peninsula. The building was occupied permanently until 1954 when the station closed down, and was replaced by a larger facility (later re-named Faraday) 600m away on Gallindez Island. Faraday operated as a UK scientific station until 1996 when it was transferred to the Ukrainian Academy of Science, and re-named Academic Vernadsky.

This Historic Site and Monument has not previously been the subject of an Antarctic Treaty Inspection.

Description and Maintenance

Base F consists of a single 12x20m wooden building, and former HF aerials. The building provided accommodation for up to 10 wintering personnel as well as a radio communications room, workshop, laboratories and generator shed.

Wordie House was included in a comprehensive survey of abandoned former UK stations on the Antarctic Peninsula in the summer of 1994 and identified as worthy of conservation. Restoration was undertaken by the British Antarctic Survey (BAS), and Base F was listed as

Historic Site and Monument No. 62 by means of Measure 4 adopted at the XIX Antarctic Treaty Consultative Meeting, 1995. Its listed description is as given in the footnote. The site has no defined boundaries.

The building is now preserved in its original form with its rooms restored to their appearance in the early 1950s. They contain artefacts and furniture of that period. These convey an impression of the former over-wintering conditions, and the scientific work undertaken then at the station. In addition, interpretative material outlining the history of the station has been provided on wall boards.

The structure of the building remains in a sound condition and is wind tight. Some leaking of the roof is evident and a small puddle of water was present on the floor of the corridor. The area round the building was in a clean and tidy state though a new VHF aerial had been erected beside the building.

Maintenance work on the building is carried out regularly by personnel from the nearby Ukrainian station Academic Vernadsky. Such management is one of the conditions included in the Agreement between the UK and Ukraine Governments in 1995 on the transfer of Faraday/Vernadsky.

Visitor Management

The building is secured, but not locked to allow visitors the opportunity to visit. A visitors' book is available though no details were noted as to the numbers of persons recorded as visiting the site.

There was no evidence however that large tourist groups had visited the building, though tourist vessels do visit the Ukrainian station Academic Vernadsky. The site is visited by the crews of yachts which anchor regularly in the Argentine islands, normally in Stella Creek. The Norwegian yacht *Taja* was at anchor there during the Inspection visit. A guidebook provides information to visitors on the regulations relating to damage, pollution and protection of the Antarctic environment.

Summary

Historic Site and Monument No. 62 remains in a sound condition and continues to meet the criteria for which it was originally listed. The building and its artefacts provide an illustration of early UK activities in this area. The efforts of BAS, and subsequently the Ukrainian Academy of Science, in maintaining the site are to be highly commended.

Footnote — Description in Measure 4 (1995) 'Argentine Islands, Base F (Wordie House, south-west* corner of Winter Island, one of the group known as the Argentine Islands (Lat. 65° 15'S, Long. 64° 16'W. Of historic interest as an example of an early British scientific base.'

NB should read south-east

IC, HG.

INSPECTIONS OF VESSELS UNDER THE ANTARCTIC TREATY

Introduction

Article VII of the Antarctic Treaty provides for 'all ships ..... at points of discharging or embarking cargoes or personnel in Antarctica shall be open at all times to inspection by any Observer designated in accordance with paragraph 1 of this [VII] Article'.

This provision has been rarely employed during previous Inspection Programmes though three tourist vessels (2 flagged with Treaty Parties, one with a non-Treaty Party) had been inspected in 1993 (by the UK, Italy and Korea Inspection Programme). For the second time only tourist vessels were inspected as part of the 1999 Inspection Programme. Both vessels were inspected whilst they were discharging their tourist passengers ashore. The vessels concerned were the Academic Ioffe (Russia) and the Marco Polo (Bahamas). To minimise interference with the ships' itineraries, advance notice of the Inspections were provided, and in the case of the vessel inspected with a non-Treaty Party the permission of the Captain (a Swedish national) was sought.

MV AKADEMIK IOFFE (RUSSIA): INSPECTED 16 JANUARY, 1999

MV Akademik Ioffe *in Whaler's Bay, Deception Island*

General

The research/tourist vessel MV *Akademik Ioffe* was inspected on 16 January 1999 in accordance with the provisions of Article VII of the Antarctic Treaty whilst she lay at anchor in Whalers Bay, Deception Island, and discharging passengers ashore to the former Whaling Station (Historic Site and Monument No. 71) and the UK base B.

The MV *Akademik Ioffe* is registered in Kaliningrad, Russia and owned by the Russian Institute of Oceanology, the Russian Academy of Sciences. At the time of the Inspection she was chartered by Marine Expeditions (Canada) who are IAATO members, and sub-chartered for 26 days to Doug Cheeseman Ecological Safaris, a US tour operator. The vessel was built in Finland in 1989 and is 6450 gross registered tonnes, 117m overall length and with an ice classification of L-1 ice strengthened C2 Canadian navigation in broken ice. The vessel is equipped with 2 Pielstick 5,00kVA engines each driving through a gearbox and shaft generator constant pitch propeller. It is equipped with a 700kVA bow thruster and a 600kVA stern thruster both CPP. Navigation aides include Racal Decca ARPA with Russian backup, Russian echo sounding equipment, US weather Navtex weather information, 2 Trimble GPS and a NMS 2000. The vessel held on board both Argentine and UK hydrographic charts, and the UK Admiralty Antarctic Pilot all of which were current.

Communications equipment included SATCOMs, HF and VHF radio, and a full OS Seacall GMDSS suite. Emergency beacons fitted were EPIRB and GMDSS, two x band radar transponder and two Satsat radio beacons.

The vessel has a crew complement of 43, a high proportion of whom have Arctic and Antarctic experience, particularly the senior officers. The cruise staff from both Marine Expeditions and Doug Cheeseman also have considerable Antarctic experience (Cheeseman Tours had run similar cruises in 1994 and 1996). The vessel undertakes 12 – 15 cruises each Antarctic season, mainly of 8 or 10 day duration out of Ushuaia. The passenger capacity had been increased from 89 to 117 in 1998 by the addition of an additional deck of cabins. The number of passengers on board at the time of the inspection was 86.

Transportation ashore for passengers was provided by 8 Zodiac inflatable boats powered by 40 hp engines.

The MV *Akademik Ioffe* was designed as an oceanographic research vessel and remains equipped with sophisticated sonar research equipment deployed through a 'moon pool', together with a CTD winch and 'wet' laboratory forward and trawl winch aft. The vessel's research capability has not been used for the past six years.

During the 1998/99 season the only planned visits to operational Antarctic stations were to Palmer Station (US) and Henryk Arctowski (Poland).

MV *Akademik Ioffe* has in recent Antarctic seasons provided some logistical support to national Antarctic operators in the form of the transportation of personnel and shipping containers from South America to Antarctic stations.

The MV *Akademik Ioffe* had not previously been the subject of an Antarctic Treaty Inspection.

Waste Management and Disposal

The vessel operates in full compliance with MARPOL 73/78. Waste that is not incinerated is stored unsorted in a skip and discharged during visits to Ushuaia. The incinerator is only used outside the Antarctic Treaty Area. The vessel is equipped with a compactor and a sewage treatment plant. Sewage is discharged only outside the 12 mile limit. Oily water is passed through a separator and water with less than 15ppm oil is discharged offshore whilst underway. Oily sludge is retained onboard and discharged in Ushuaia and logs of the discharge maintained. There was a clear understanding of the Antarctic Treaty Environmental Protocol but the Observers were shown no evidence of documentation on board.

Prevention of Oil Pollution

A maximum of 1,000 cu m of marine gas oil is carried in double-bottom tanks. The fuel management system is equipped with overflow monitoring. A shipboard oil contingency plan was in place and specific crew trained. The provision of oil spill response equipment and materials was limited.

Emergency Response Plan and Ship Safety

The vessel was equipped for both medical and dental care and had a doctor on board. In the event of a patient requiring repatriation an agreement was in place with the tour operator *Adventure Network International* for evacuation by air to South America.

The MV *Akademik Ioffe* had both fire emergency and shipboard pollution emergency plans, and training of specific crew was ongoing.

Conservation Policy

Marine Expeditions have in previous years produced an EIA covering their Antarctic operations. However an EIA was not shown to the Inspection Team during the course of the Inspection.

Both crew and passengers are briefed on Antarctic conservation rules and there was a clear awareness of the provisions of the Environmental Protocol.

Although the management of tourists onshore was not inspected, it appeared that the vessel and tour operators employed effective control over tourists whilst onshore with a staff to passenger ratio of 1:7. IAATO Guidelines and Antarctic Treaty Recommendations were applied to the conduct of passengers ashore.

Conclusions

The MV *Akademik Ioffe* is a moderate sized well found Antarctic cruise ship that has considerable experience vested in her Captain and crew. She is similar to a range of Russian ex-research vessels which are currently employed in the Antarctic tourist industry. The tour operators, both Marine Expeditions and Cheeseman Safaris, are well versed in conducting tourism in the Antarctic and were complying fully with both IAATO and Antarctic Treaty Recommendations.

MR, HG, IC, MC, AS.

MV MARCO POLO (BAHAMAS) INSPECTED 14 JANUARY, 1999

MV Marco Polo

General

The Bahamas-registered tourist vessel MV *Marco Polo* was inspected on 14 January, 1999. As a non-Treaty flagged vessel, the approval of her Master (a Swedish national) was obtained prior to the Inspection which was carried out while the vessel lay at anchor in Port Lockroy, Wiencke Island, and discharging passengers ashore to Jougla Point.

The vessel is owned by Orient Lines (Bermuda). The MV *Marco Polo* formally the MV *Alexandr Pushkin* was built in 1965 in the former East Germany. The vessel was extensively rebuilt as a passenger cruise ship in 1991-92. MV *Marco Polo* is 22,080 gross registered tonnes, length overall 176m with an ice classification of Deep Sea-Ice III. The vessel has twin propellers and is powered by two Sulzer engines with an output of 10,500bhp each. The bow thruster is a 12,000KW CPP system. Navigation aids include 3 modern Sperry radar, auto radar pilot, 2 GPS, a modern echo sounder and 2 weather faxes. Up to date UK Admiralty charts and the UK Admiralty Antarctic Pilot were present.

Communications equipment included SATCOM, HF, VHF and UHF. The vessel was fully equipped with GMDSS and EPIRB, two SARTS and hand held VHF GMDSS for lifeboats.

A high proportion of the crew of 339 have Antarctic experience as do the 17 expedition staff. The vessel was scheduled to make 4 Antarctic cruises. The first 14 day cruise sailing from Buenos Aires on 29 December and docking at Ushuaia. The two subsequent 9 day cruises were scheduled to sail from and return to Ushuaia. The last scheduled cruise of 22 days was due to sail from Ushuaia to Christchurch via the Ross Sea. The maximum capacity

of the vessel was 850 passengers, however Orient Lines policy quoted in the EIA is to limit the capacity for Antarctic cruises to 50% – 60% of the vessel's capacity. At the time of the Inspection 587 tourists were embarked, 69% of the vessel's capacity. The MV *Marco Polo* is the largest tourist vessel currently operating in the Antarctic. Because the passenger numbers (even with the reduced complement) exceed the maximum (400) set by IAATO, Orient Lines is not a member of the Antarctic Tourist Association.

Passengers were transported ashore in groups of 12 8 MK V Zodiac inflatable boats were available on board driven by 6 experienced drivers.

During the 1998/99 season the only planned visit to an operational Antarctic station was to President Gonzalez Videla (Chile), Terra Nova (Italy) and McMurdo Station (US). A possible visit to Scott Base (NZ) would possibly be undertaken but would be limited to New Zealand nationals only.

The MV *Marco Polo* had not previously been the subject of an Antarctic Treaty Inspection.

Waste Management and Disposal

The vessel operates in full compliance with MARPOL 73/78 regulations. Waste is separated into burnables (incinerated at night but not inshore), tins and plastics, and organic or wet waste discharged to Ushuaia. The vessel is equipped with compactors and dedicated waste storage and detailed logs are maintained. Oily water from the bilge tanks is passed through a separator with the effluent discharged to sea whilst on passage outside the Antarctic Treaty Area, and the sludge stored in tanks. This is discharged ashore every 3 months and records maintained.

Prevention of Oil Pollution

The MV *Marco Polo* has a maximum bunker capacity of 1,327 tonnes of IFO180 (heavy fuel oil) for main propulsion and 848 tonnes of MDO for generating plant and motor launches. In addition there is a maximum capacity of 5,400 litres of A1 aviation fuel for the onboard helicopter. The main fuel tanks are located in the double-bottom of the vessel.

The MV *Marco Polo* has a shipboard oil pollution emergency plan and is provided with a approved SOPEP manual. Oil pollution containment booms and clean-up dispersants are held on board and the crew trained in the relevant emergency procedures.

Emergency Response Plan and Ship Safety

The vessel had a well equipped hospital comprising a 2 bed ward, consulting room and emergency room and was staffed by a doctor and 2 nurses. In the event of a serious injury or illness requiring evacuation from the Antarctic, an agreement with the tour operator Adventure Network International was in place for an air evacuation.

Comprehensive on-going emergency response training was given to the crew, and passengers were given a safety briefing prior to sailing.

The MV *Marco Polo* was equipped with 10 semi-enclosed lifeboats, two rescue boats and two tenders.

An Aerospatiale AS350B Squirrel helicopter, along with pilot and flight engineer, was

embarked for the sole purpose of ice reconnaissance. The aircraft was not used for tourist flights.

Conservation Policy

An Initial Environmental Evaluation for the 1998/99 Antarctic programme had been carried out and was made available to the Inspection Team. A continuing programme of 'teach-ins' to both passengers and staff was conducted on board, and there was a clear awareness of the requirements of the Environmental Protocol.

Groups of passengers ashore were limited to 100 in each group and both passengers and crew were managed by a computerised tagging system with the staff to passenger ratio ashore planned to be 1:10 or less. IAATO guidelines and the Antarctic Treaty Recommendation XVIII-I, comprising the "Guidance for Visitors in the Antarctic" were applied and notice of plans given to the US National Science Foundation. Post-visit reports were routinely completed.

Specific mention was made in the EIA for the 1998/99 programme of preventing passengers entering SSSI No 21, the designated boundaries of Kroner Lake, Deception Island, and Area D of SSSI No 21, Pendulum Cove, Deception Island. Specific instructions were given to not anchor the vessel within SSSI No 27, the benthic habitat in Port Foster, Deception Island.

Conclusion

The MV *Marco Polo* is the largest Antarctic tourist vessel operating in Antarctica with a total of 943 persons onboard at the time of the Inspection. The vessel is well found, ice strengthened and her operations efficient. The vessel's itineraries are designed with few landings because of the time taken to transport large numbers of tourists onshore. These landings are however efficiently conducted in groups of 100 people with a high staff to passenger ratio of supervision. The impact on the landing site is not likely to be significantly more than that of smaller vessels and the number of landing sites is significantly less. A vessel of this size must however be regarded as constituting a greater pollution risk in the event of an accident because of the quantity and type of bunker oil carried. The MV *Marco Polo* would also present greater difficulties of search and rescue in the event of a serious emergency simply because of the numbers of people onboard. These are significantly greater than the capacity of other vessels operating in the vicinity.

MR, HG, IC, MC, AS.

GENERAL REMARKS AND CONCLUSIONS

The Inspection Team inspected 15 occupied stations in the Antarctic Peninsula area (Fig 1); 11 permanent stations and 4 summer-only stations plus two summer-only facilities which are scientific annexes to permanent stations. In addition, 4 Historic Sites and Monuments were inspected along with 2 tourist vessels. This was only the second time that such vessels had been inspected under Article VII(3) of the Antarctic Treaty.

Advanced notification of the designation of Observers, and the forthcoming Inspection programme had been made by the United Kingdom and Germany through diplomatic channels as required by Article VII(1) of the Treaty.

The Inspection Team was welcomed at all stations inspected, and Base Leaders and their personnel were helpful and constructive in providing information. The Inspection Team was however hampered in planning Inspections by lack of up to date information on stations, their facilities, personnel and activities. Of the 12 Treaty Parties whose facilities were inspected very few had submitted within the deadline their Exchanges of Information as required by Article VII(5) of the Antarctic Treaty and Recommendation VIII-6, and its Annex. In some cases the only prior information available to the Observers was that from previous Inspection Reports or from out of date Exchanges of Information, up to 4 years old.

Despite using the most up to date COMNAP list of contact details for Antarctic stations, the Inspection Team experienced considerable difficulties in contacting stations via HF, VHF, or other means, and notifying them in advance of intended Inspections. In consequence at a number of stations the Inspection Team arrived unannounced, or was only able to give minimal advance notice.

Few communication difficulties were encountered actually during Inspections. Russian was used during two Inspections. The Inspection Team recognised that the lack of a fluent Spanish speaker was however a disadvantage.

The Checklists adopted by the ATCM were used during all Inspections, viz:

Checklist 'A' for permanent Antarctic stations and associated installations;

Checklist 'B' for vessels within the Antarctic Treaty Area; and

Checklist 'C' for abandoned Antarctic Stations and associated installations.

Checklists were used as no more than *aides memoire* to ensure both consistency between Inspections, and that all crucial information was collected.

The Observers were assisted greatly during some Inspections by the provision of written, supplementary information on base infrastructure or activities. The various reports and papers provided by Palmer Station (US) proved invaluable. A detailed Environmental Impact Assessment was provided to the Inspection Team by the Captain of the tourist vessel MV *Marco Polo*. Of particular note were the dossiers that had been prepared by the Argentine stations Esperanza and Teniente Jubany and by Rothera Station (UK). These contained very detailed information on the respective bases, set out in the precise format of Checklist 'A'.

Compliance

Antarctic Treaty

No infringements of the Antarctic Treaty were witnessed at any of the stations, facilities or vessels inspected, with the exception of Vice-Comodoro Marambio (Argentina), which the Inspection Team was unable to inspect.

Environmental Protocol

The most striking finding to emerge from the Inspection Programme was the degree of understanding, and implementation of the Environmental Protocol. Strenuous efforts were being made at all stations to comply with elements of the Protocol though operational practices were variable, and gaps in implementation were evident. Considerable efforts had been made by most Parties to train their personnel in operating procedures that met the standards of the Protocol. High levels of awareness were most apparent in the areas of waste management and the conservation of flora and fauna. Conversely, the Protocol's requirements for Environmental Impact Assessment appeared less well understood. This, and other elements where compliance fell short of the Protocol's requirements, are indicated in the sections below.

Specific Issues

i) Station Infrastructure and Maintenance

The complement at some stations inspected was far less than their maximum, or operational, design capacity. Over-wintering numbers in some instances were predicted to fall to very low levels, amounting to no more than a minimal skeleton crew.

Where existing maintenance requirements are already high, as at medium to large-scale facilities, such reductions may well have implications for the integrity and future management of these stations

ii) Scientific Research

A wide range of scientific research was being undertaken at the stations inspected. However, considerable duplication of effort also seemed to be evident, with some stations within close proximity undertaking very similar work often of a mechanistic (rather than innovative) scientific nature, ie requiring the use of scientific technicians, rather than scientists, to conduct routine measurements.

Under utilisation of science facilities was evident at some stations. However, other Parties stated their intention to enhance their science programmes, increase the complement of scientists and provide new scientific facilities (eg laboratories) and corresponding logistic support. This was commendable, particularly in relation to those stations where at present science has a low profile.

iii) Fuel Management

Transport and storage of bulk diesel fuel for generators presents one of the most serious risks to the environment in Antarctica. Oil spillage is either the result of loss of integrity of a tank, pipeline or valve, or due to human error. Risk of spillage is increased by the number of

times fuel is transferred from one container to another, and the potential severity of impact to the environment increases if such transfer involves ship to shore operations.

- fuel transport and storage methods are highly variable between stations. Ship to shore re-supply via floating hose is common place. Argentina employs successful fuel re-supply at its Peninsula bases by means of helicopter under-slung, 2,000 litre 'rolling tanks' (but this is an expensive option). Chile's Frei Station is unusual in having a fixed submarine pipeline for re-supply. Few stations are able to re-supply directly ashore to fixed pipelines connected to bulk tanks (examples being Palmer Station (US) and Rothera Station (UK)). At least two stations transfer diesel fuel five times from re-supply vessel to generator (viz from ship to barge, barge to bulk tank via floating hose, and then from bulk tank to header tank by multiple journeys of a motorised oil bowser). The risk of oil spillage is increased by each oil transfer;
- tankage can be double or single-skinned. Many examples of the latter remain evident;
- bunding around tankage is not commonplace though that around the tank farm at Rothera (UK) is a good example. But problems can arise from snow-filled open bunds which create substantial quantities of oily-water at the spring melt then requiring separation. Sloping bund covers are installed at General Bernardo O'Higgins (Chile) to prevent such ingress of snow. Only at small stations (eg the German Receiving Station at O'Higgins) can bulk tanks be both bunded, and installed inside a building so eliminating such problems;
- unsatisfactory fuel management practices were evident at one station where chronic contamination was occurring. However, acute spillages had occurred at other stations despite apparently stringent precautions. Further attention should be paid to alarm systems and fail-safe shut-off mechanisms;
- bulk tanks are now invariably of metal construction. Of the stations inspected, few examples of pillow or bladder tanks remain. They appear to have been largely phased out over the past 5 years;
- few stations carry significant quantities of oil spill contingency equipment, none carrying enough to cope with a large spill. (Spill equipment requires major investments in capital, training of personnel, maintenance, and inevitably has a high redundancy rate). Spill containment equipment is deployed during re-supply at some stations eg Henryk Arctowski (Poland) and Palmer Station (US).

iv) Power Generation

Power production is invariably by means of diesel generators at all stations. None of the inspected stations were using alternative power production either as a substitute for diesel generation or to reduce dependence on diesel eg through the use of solar panels for domestic heating.

- alternative power production is limited to solar panels powering remote, small scale automatic instrumentation. Only Juan Carlos Primero (Spain) had applied more extensively alternative energy generation with a large solar panel array and wind generator to enable the station's instrumentation to function year round.

Bellingshausen (Russia) also employed a small-scale wind generator;

- little attention is given to exhaust filtration or monitoring. T/N Ruperto Elichiribehety (Uruguay) was installing a generator with both soundproof housing and exhaust filtration. Henryk Arctowski (Poland) also filtered generator exhausts. Monitoring programmes to determine the biological effects of exhaust emissions were being conducted at Henryk Arctowski (Poland), Rothera (UK) and Juan Carlos Primero (Spain).

v) **Waste Management**

Waste management procedures in line with Annexes III and IV of the Protocol were being practised at all stations, though to variable degrees:

- wastes in all cases were being separated at source into metals, glass, plastics and organics. The majority of wastes, including all non-combustibles were being retrograded;
- the practices of storing waste for retrograding were variable. Sometimes wastes were unmarked, or containers secured inadequately. Exemplary methods were being employed at Teniente Jubany (Argentina). In general it was felt that the standard of waste recording (waste logs) could be improved, though clear details were for example being kept at Esperazana (Argentina), Palmer Station (US) and Rothera Station (UK).
- some stations had decommissioned their incinerators. However, some incinerators were still in operation with either too low a burn temperature or for some other reason were not operating efficiently. With one possible exception, no open burning was being practised;
- storage and disposal of organics, especially wet organics, is a problem at stations, in particular those with infrequent re-supply;
- sewage treatment is variable and not necessarily related to the size of a station. Some small stations operate efficient treatment plants. Conversely, some large stations rely only on maceration and discharge direct to sea, or indeed even only the latter. A highly effective treatment plant had been installed at Teniente Jubany (Argentina) with assistance from Germany and the Netherlands;
- large quantities of scrap or waste metals had either been removed from some stations eg Frei station (Chile) or brought together for intended removal eg Bellingshausen (Russia). In other cases considerable efforts had been made, or were being made, to extract and retrograde former waste dumps eg General Bernardo O'Higgins (Chile) and Palmer Station (US). Often such work was difficult, costly and requires excavating materials in permafrost.

The approach to waste management was far from uniform. In some instances directly contrasting methods were employed at closely adjacent stations. The result of this might well be self-cancelling. For example, station 'A' might be storing and retrograding all organics and plastics but discharging sewage untreated direct to the sea; whereas close by station 'B' was doing the opposite – by incinerating plastics and organics yet treating sewage efficiently and even retrograding its solid residues. Greater consistency in waste management procedures

is needed.

Adequate attention has yet to be paid to the numerous abandoned former stations present in the Peninsula area, and whether such stations should be transferred, or cleaned-up or removed, as required by Article V of Annex III of the Protocol, and if so, within what timescale.

vi) Emergency Procedures and Health and Safety

Generally, high levels of Health and Safety were evident. Nearly all stations had resident doctors and medical facilities. Arrangements were in place for mede-vacs, relying if necessary on the infrastructure of other Parties, for example the dependants of some of the stations in Maxwell Bay, King George Island on the Presidente Arturo Frei (Chile) airlink.

Well established emergency response capability (eg fire-fighting) was in place at most stations. The ability to respond to SAR (either terrestrial, marine or aerial) was highly variable and depended on vehicle, boat or aircraft support. Those stations with aircraft, and particularly helicopters, have the greatest capability and flexibility to respond to SAR.

- emergency provisions (power, food, clothing, fuel, and communications etc) were available at all stations. Notable however were the duplicate facilities provided at Palmer Station (US) where the principle utilities (accommodation, power generation, food, and RO water production) had been installed in the two, well separated major building complexes on the base. Complete loss of any one would not be catastrophic to the station's survival;

- SCUBA diving operations were reported to be taking place at four of the stations inspected. But only one had a fully serviced and certificated decompression chamber. Given the remoteness of Antarctic diving, consideration should be given by each of those stations to install chambers, which are large enough to allow treatment, and to maintain them within certification.

vii) Wildlife (flora and fauna) and Protected Areas

Rules relating to the conservation of flora and fauna and to the protection of protected areas were generally understood, adhered to, and indeed appreciated. At some stations eg Esperanza and Teniente Jubany (Argentina) prominent pictorial boards were displayed setting out guidelines and rules on wildlife.

Some problem areas however remain. For example:

- introduction of non-Native Species. At least two permanent stations had non-native species present in the form of house plants. One of these stations was also growing vegetables, the other breeding tropical fish;

- Artificial Feeding. At one station the Observers saw Brown Skuas being fed raw meat from the base kitchen;

- Disturbance. Reports of disturbance to penguin colonies from helicopter overflights of Ardley Island (SSSI No. 33) were received by the Observers. The problem appeared to stem from 'non-local' aircraft using the nearby Frei Station facility.

It was also apparent to the Observers that disturbance of penguins and seals by helicopters

could be appreciable even when aircraft were at some considerable height, and lateral distance from wildlife. This issue needs further investigation with a view to setting recommended flying heights.

Conversely, disturbance had been reduced at some sites, eg at Esperanza (Argentina) penguin colonies had been roped off to prevent human access, and the station's helipad had been re-located away from wildlife sites.

- Protected Areas. Inappropriate entry into protected areas was occurring and was witnessed by footprints at Deception Island (SSSI No. 21). The reason appears to be largely a product of ignorance of the site's existence, coupled with the lack of adequate sign-posting of boundaries. There are few instances of signs marking protected areas. One such example is that at Rakusa Point, Henryk Arctowski (Poland) marking the NE corner of SSSI No. 8 (western shore of Admiralty Bay).

- Conversely, inappropriate signs were also evident. For example at Whalers Bay, Deception Island (Historic Sites and Monuments Nos. 31 and 71) where a number of signs had been erected. These appeared to contain misleading information and could be construed as visually obtrusive.

viii) Tourism

Tourism, particularly ship-borne tourism, continues to rise. Around 10,000 tourists visited the Antarctic Peninsula in the 1998/99 austral season. Tourist vessels were encountered frequently at sea, or embarking/disembarking tourists at landing places. Thirteen tourist vessels were operating in the Antarctic Peninsula area, and seven of these were actually seen, during the course of the Inspection Programme.

- Stations: tourists, in variable numbers, visited a number of the stations inspected. None reported any impact from tourists on either station activities (but see below), or the local environment. Some, particularly summer-only stations, received no tourists. Five permanent stations and one Historic Site and Monument were providing commercial facilities (shops) for tourists. Postal services were also a focus of interest. Three stations (Palmer (US), Henryk Arctowski (Poland) and Esperanza (Argentina) had developed tourist management policies for station visits in an attempt to minimise impacts on station activities. Esperanza had a defined tourism route, and had roped-off penguin colonies to prevent human access. Henryk Arctowski had constructed a Visitor Information Centre (from recycled timber) and a nature trail. The largest number of tourists visit the Historic Sites of Whalers Bay, Deception Island (un-manned), and Port Lockroy (UK) (manned). The latter on a very small site (0.24 ha Goudier Island) received 5,800 visitors during the 1998/99 season. Monitoring indicates no discernible impact on the resident breeding penguins.

- Yachts: The number of yachts visiting Antarctica continues to increase. Eight yachts en route to Antarctica, some under commercial charter, were seen in Port Stanley, Falkland Islands between 6-9 January. Yachts were seen by the Inspection Team at Deception Island, Port Lockroy (NZ yacht) and Academic Vernadsky (Norwegian yacht). Five yachts were at anchor south of the Lemaire Channel on 26 January.

Thirty yachts visited Port Lockroy during the season.

– Tourist Vessels: Two tourist vessels were inspected; one large (MV *Marco Polo*), one much smaller (MV *Akademik Ioffe*). This was the second only Inspection of vessels within the Antarctic Treaty Area under Article VII of the Antarctic Treaty. One vessel, the MV *Marco Polo*, flagged with a non-Treaty Party, was inspected with the permission of her Captain. Both vessels were operating to high standards, in terms of vessel operations and the management of their tourists.

The advantages and disadvantages of large ship versus small ship were evident. The former are relatively inflexible in relation to the numbers of sites that can be visited. Guaranteed easy and safe access for landing is imperative. In consequence few landings are made at few sites, although large numbers of tourists are put ashore, albeit in relatively small groups (not more than 50 persons) under strictly controlled management. Conversely, smaller ships, though carrying fewer tourists, are more flexible in operation and can land at numerous sites so widening potential impacts.

Concerns relating to large vessels (up to 1,000 persons on board) are the large quantities of heavy fuel oil carried (Bunker C as opposed to diesel), and implications for SAR in the event of a major accident.

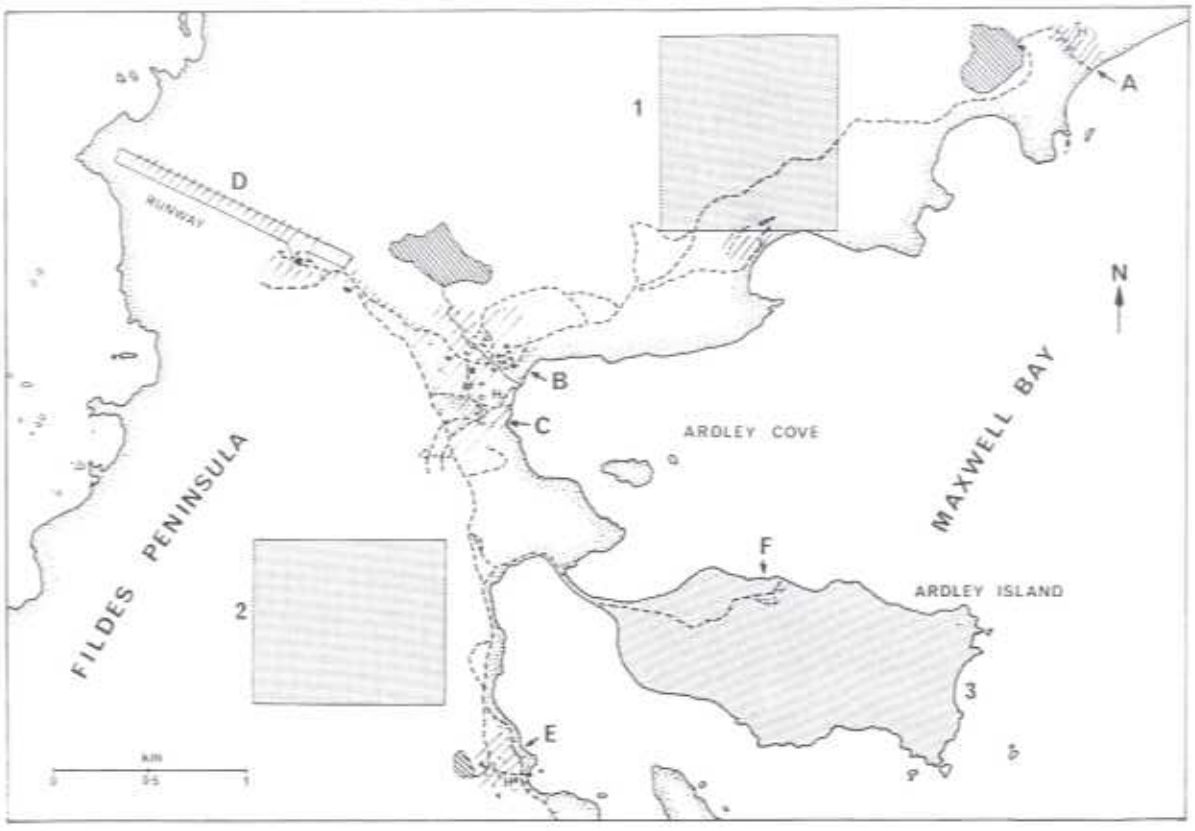
ix) Concentrations of facilities: King George Island

The South Shetland Islands, because of their proximity to South America, relative ease of access, and largely ice-free seas, have the greatest concentration of stations in the Antarctic Peninsula area. In consequence, the impact on the environment is greater here than elsewhere on the Peninsula.

The majority of stations are located in Maxwell Bay and Admiralty Bay. The latter contains stations and refuges of five Parties (the bases of Henryk Arctowski (Poland), Comandante Ferraz (Brazil) and Machu Pichu (Peru) and refuges belonging to Ecuador and the US).

Maxwell Bay has an even more developed infrastructure with 6 moderate to large permanent stations located around its shores from east to west being: Teniente Jubany (Argentina), King Sejong (Republic of Korea), Artigas (Uruguay), Bellingshausen (Russia), Presidente Arturo Frei and its major runway facility and Great Wall Station (China). In addition, numerous other facilities are present including refuges (eg in the vicinity of Teniente Jubany, and on Ardley Island, and the large bulk fuel tanks associated with Bellingshausen and used partly by Artigas). This aggregation of facilities, along with the very considerable logistic support in terms of aircraft and shipping movements, is unique in Antarctica.

The effect of these developments has been an impact on the environment of the Maxwell Bay area far greater than the combined sum of the actual areas of the stations themselves. For example, the 4 westernmost bases are interconnected by well defined tracks. Combined, these amount to over 16.5 km. In addition, huge swaths of ground have been severely impacted by heavy ground vehicles. Power generation, fuel farms, pipelines and sewage input, all combine to add to the scale of impact. Overall figures relating to the infrastructural development of Maxwell Bay are set out in Table II on page 127, and the relationship of the stations in western Maxwell Bay shown in Fig.2 (page 126).



Site of Special Scientific Interest

Water Extraction Lakes

Developed Areas

Fig.2: ***Development on Fildes Peninsula, western Maxwell Bay, King George Island***

A. Artigas (Uruguay);
B. Bellingshausen (Russia);
C. Presidente Arturo Frei (Chile) plus its runway D;
E. Great Wall Station (China).

Areas 1 and 2: SSSI No. 5 Fildes Peninsula
Area 3 SSSI No. 33 Ardley Island

Table II — Maxwell Bay: Developmental pressure

Number of stations *	6
Number of refuges/field huts	9
Area covered by stations	200 ha
Length of track	18km
Maximum capacity of stations	480 persons
Operational complement: Winter	140 persons
Summer	275 persons
Number of buildings	125
Number of fuel-farms	13
Quantities of bulk fuel (diesel)	2,882,000 litres
Annual consumption of fuel	1,687,000 litres

* includes details taken from the 1993 Inspection Report for King Sejong (Korea) which was not inspected during the present Inspection programme.

Other important information was unfortunately not available eg for the tonnages of materials being imported and retrograded, the frequency of aircraft and vessel movements etc.

The cumulative effect has clearly been a derogation on the quality of the local environment. Quantified changes, eg of the numbers of breeding birds within Maxwell Bay, attributed directly to the impacts of the stations and their logistics, have occurred. Considerable impacts have occurred to protected areas, and the Fildes Peninsula protected area (now SSSI No. 5) has in this respect been a casualty of this pressure. In the process now underway to revise Management Plans for protected areas consideration will need to be given as to whether this SSSI warrants retention as a special site, and if so, which area should be designated, given the considerable amount of damage that has occurred since the late 1960s.

Co-location of stations offers considerable advantages in terms of mutual support eg co-operative logistics, the possibility of shared facilities, inter-dependence for emergencies including SAR, and a number of these elements are clearly put into practice in the Maxwell Bay area. Overall, however, duplication rather than integration of facilities appears more evident.

In this respect consideration could be given towards further enhancing co-operation for example in logistic support, consistency in waste management procedures and a critical examination of scientific programmes to optimise productivity and minimise duplication.

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Particular thanks go to the Captain, officers and crew of the Ice Patrol vessel *HMS Endurance* which provided the logistic support for the Inspection Programme. The use of *HMS Endurance's* two Lynx helicopters were invaluable in this respect, providing flexibility, and ease of access to stations.

Recommendations (not ascribed any particular priority)

1. That those Parties, with stations and active programmes in the Antarctic, which have not already acceded to the Environmental Protocol should do so without delay, and if appropriate seek Consultative Status.

2. That Parties, in association with SCAR, review co-operatively their science programmes against scientific priorities, particularly for those stations in close proximity, to ensure optimum productivity and minimum duplication.

3. That further attention is given by operators to fuel transfer and storage with a view to reducing the potential for spillage. Critical issues include minimising the number of fuel transfers, and upgrading bulk storage (such as tank bunds, double-skinned walls, further phasing out of bladder/pillow tanks).

4. That increased consideration be given both to maximising energy efficiency, and to alternative energy production with further experimentation using wind and solar energy under Antarctic conditions.

5. That greater efforts be directed towards former work places (abandoned stations) with a view to their clean-up, removal, conversion to refuges or designation as Historic Sites and Monuments. Transfer of redundant stations to other Parties for continuing use should also receive greater consideration.

6. That the ATCM should identify boundaries for Historic Sites and Monuments, as appropriate. This is particularly relevant for those sites which contain buildings and artefacts distributed over a wide, yet undetermined area.

7. That greater consistency of waste management procedures for Annex III of the Protocol should be developed.

8. That moderate or large-scale stations lacking sewage treatment (other than maceration) should give consideration to upgrading their facilities.

ANNEX 1

Some Examples of Best Practice seen during the course of the Inspection Programme

Issue	*Station*
Waste Management	
Sewage Treatment	Teniente Jubany
Waste handling for retrograding	Teniente Jubany Rothera Station
Public Notices of Waste Management Procedures	Artigas Station
Recyling/minimisation of wastes	
Re-usable packaging	Artigas Station
Recycling	Palmer Station Rothera Station
Removal of: past wastes	Palmer Station
contaminated wastes	Rothera Station
Fuel Management	
Transfer (ship to shore)	Palmer Station Rothera Station
Tank Bunding	
(open bunds)	Rothera Station
(covered bunds)	General Bernardo O'Higgins
(fully enclosed)	Receiving Station, O'Higgins
Power Generation	
Alternative Energy Generation	Juan Carlos Primero
Emergency Provisions	
Duplication of Utilities	Palmer Station
SAR capabilities	Frei Station Rothera Station
Tourism Policy/Procedures (including monitoring)	
(i) Permanent Stations	Henryk Arctowski Palmer Station Esperanza
(ii) Historic Site and Monuments	Port Lockroy

Provision of documentation

Environmental Impact Assessment	
Permanent Station	Palmer Station Rothera Station
Summer-only Station	Juan Carlos Primero INACH (Frei Station)
Tourist Vessel	MV *Marco Polo*
Inspection Checklist documentation	Esperanza Teniente Jubany Rothera Station