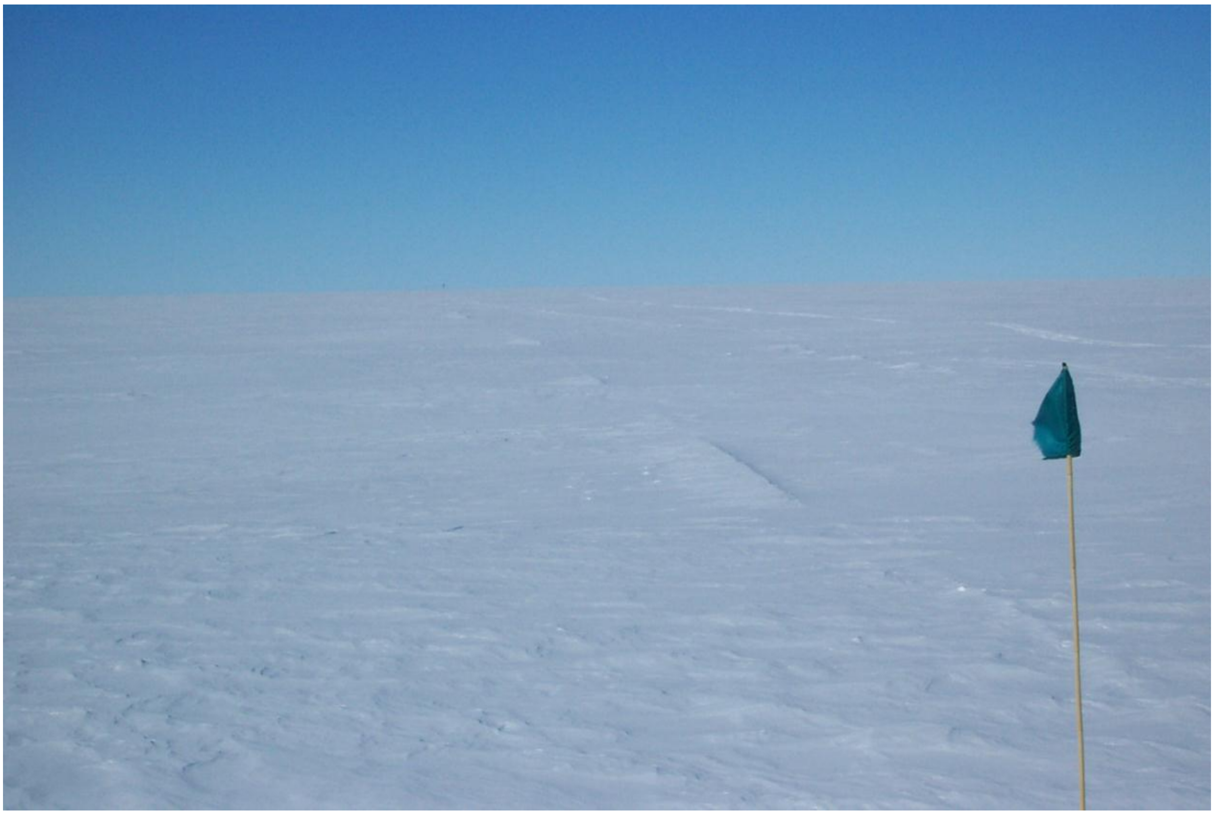
The South Pole Route; a Necessity or a Scar on the Landscape?



Syndicate Project
Graduate Certificate in Antarctic Studies
2003 / 2004

Authors: Stefan Beaumont
Mike Chilton
Lloyd Godson
Neville Wright
Olaf van der Beek

TABLE OF CONTENTS

1 INTRODUCTION

Controversy surrounds the United State's National Science Foundation's (NSF) current construction of a route between McMurdo Station, Ross Island, and Amunsden-Scott South Pole Station.

Attitudes to the Route cover a wide spectrum. Proponents of large-scale science consider it a necessity, in that it satisfies logistical demands and frees projects from the constraints of air-cargo space. Others argue that, rather than a necessity, it is a cost-cutting exercise dictated by the primacy given to science in Antarctica.

Some view the Route as a potential scar on both the physical landscape and the ideological landscape of the Antarctic Treaty System (ATS), through the compromising of the aesthetic and wilderness values that the ATS seeks to preserve; or the creation of national boundaries. Yet others regard the NSF's approach to the requisite Environmental Impact Assessment (EIA) with suspicion. These varying attitudes focus attention on issues of contemporary importance to the ATS.

This report seeks to establish which of the opinions is closest to the truth. The importance of the name chosen for the Route is considered together with its geopolitical connotations attached to the choice of name. Difficulties in the construction and the project's feasibility are analysed. Environmental effects are an essential consideration, and the relevant issues are therefore weighed and balanced in discussing the merits of the Route's construction. In literature relating to the South Pole Route, there is little mention of how its construction affects wilderness values.

Finally, the report turns to the legitimacy of the project in the context of the international obligations requiring environmental impact assessments. This report uncovers the challenges with respect to the physical and administrative obstacles the NSF faces. As will be seen, the NSF has had difficulty with both.

2 WHAT'S IN A NAME AND GEOPOLITICS; APPLIED TO THE SOUTH POLE ROUTE

The name South Pole Route conjures up an image. The image that is created is When one asks, "what's in a name" what words are loaded and what reaction is the promoter wishing the reader to experience? For some people, their opinion formulating may go no further than the literal meaning of the words, for others, the name South Pole Route conjures up an image. This image can be changed by thoughtful language substitution. The South Pole Route could easily be called The South Pole Highway, however this may not convey the message of the proponent.

The question of 'what's in a name' is asking what words are loaded, and what reaction is the promoter wishing the reader to experience? For some people, the opinion formulated may go no further than the literal meaning of the words, for others the chosen words may elicit suspicion about the real nature of the activity. Therefore, the proponents of a controversial endeavour are mindful of the words describing their project. This also appears true for the words chosen in the name South Pole Route.

Successful geopolitics relies on the manipulation of words for gathering support. The concept of 'what's in a name' may well be an example of this. Geopolitics has two elements, discourse and order. The discourse refers to the language and dialogue used in promoting an event such as the South Pole Route; the order is the enactment, in this case the construction of the South Pole Route.

Bearing in mind the importance of entering a debate with an open mind, the following serves as a useful introduction to forming an opinion on the South Pole Route. Consider the following terms for which the name 'Route' could be substituted.

1. Crossing,
2. Continental Transport System,
3. Trail,
4. Highway,
5. Traverse,
6. Scientific Corridor.

The connotation attached to the terms above may include: heroic, necessity, practical or perhaps eye sore. It appears that the choice of name for the South Pole Route has been chosen carefully, which is reflected by the authorities protective attitude to the name.[1] The connotations of the name reflect the geopolitical discourse, of the NSF. The South Pole Route development itself reflects the geopolitical order of the NSF.

3 The Physical Characteristics of the South Pole Route

3.1 What is the South Pole Route?

The Route is a flagged trail being constructed between McMurdo Station on the north-western edge of the Ross Ice Shelf that will traverse the ice shelf southward to the South Pole Station.[2] The Route will carry tractor trains containing fuel and supplies to the South Pole Station; a task currently completed using Hercules LC-130 aircraft.[3] Along the Route, one to two metre

[1] For example, during the documenting of this report, various proponents of the Route were sensitive to others referring to the project as road building.
[2] See Annex I, figure 1 below.
[3] S Anandakrishnan, 'Science advantages of an oversnow traverse to resupply S. Pole' p 1. <http://www.geosc.psu.edu/~sak/traverse.pdf >, 2 December 2003.

high flags will be placed every 300 metre (m) and large three metre high poles every two kilometres to mark the Route for navigation purposes.[4]

At this stage, the aim is for completion by the end of the 2004 / 2005 field season. The Route traverses several crevassed regions, firstly the McMurdo shear zone, and secondly the lower area of the Leverett Glacier. All crevasses along the Route will be identified, using ground-penetrating radar (GPR), and filled using explosives and heavy machinery. The total length is 1600 kilometres (km) and is envisaged to take between 10-14 days to traverse using heavy tractor trains carrying full loads.[5] The Route begins at sea level and reaches a maximum height of 3000 m on the polar plateau.[6] It heads southeast, crossing the shear zone south of McMurdo Station, then traverses the Ross Ice Shelf to the Leverett Glacier, located at the south-eastern edge of the ice shelf. From the Leverett Glacier the Route heads southwest towards the Pole.

3.2 The Physical Characteristics of the Route

The four main areas, which have differing physical characteristics, are the Ice Shelf, The Shear Zone, The Leverett Glacier and The Polar Plateau. Each will be addressed in turn (See Annex I figure 1(a)).

3.2.1 The Ice Shelf

The Ice Shelf region of the traverse route covers a total distance of 1050 km (Table 1, See also Annex I figure 1(a) and (b)). A shear zone running between Minna Bluff and Ross Island

---

[4] L Copeland, personal communication, Scott Base, 1 January 2004.

[5] G L Blaisdell, et al, 'Development of a modern heavy-haul traverse for Antarctica' (1997) ISOPE-97-KR-6, p 529.

[6] J Wright, 'McMurdo to South Pole Oversnow Traverse,' Presentation, National Science Foundation McMurdo Station, October 2003.

divides this region.[7] Elevation ranges from 35 m at the northern end of the Route to 150 m at the base of the Leverett Glacier (Table 1).[8] The predominant surface type for the 38 km section before the shear zone is minor sastrugi and snowdrift with no significant crevasses. Although the upper section is assumed to be similar, it is not known whether crevasses are present along this section (Table 1). The Route will travel through several katabatic wind fields produced by cold draining off the Polar Plateau through outlet valleys like the Beardmore Glacier valley.[9]

3.2.2 The Shear Zone

The Route will have to traverse the McMurdo Shear Zone, a highly crevassed dynamic region, located 48 km southeast of McMurdo Station at the boundary of the Ross Ice Shelf and the McMurdo Ice Shelf. This region lies between Minna Bluff and Cape Crozier, a distance of 120 km in length and 22 km wide (Table 1).[10] The crevasses are produced by high amounts of shear and lateral strain and stress produced by the velocity difference between the two Ice Shelves (Annex II, figure 2). Both Ice Shelves flow towards the Ross Sea in a northern direction, but the Ross Ice Shelf flows up to 100 m per year faster than the McMurdo Ice Shelf. The resultant forces increase the lateral strains along the Ice Shelf boundary, which produce a net displacement, leading to the prevalence of crevasses in this region (Annex II, figure 2).

3.2.3 The Leverett Glacier

The Leverett Glacier is the most suitable for route construction because it has a relatively low gradient, ranging from 2–15%, allowing the tractor trains to reach the Polar Plateau from the

[7] I M. Whillans and C.J. Merry, 'Analysis of a shear zone where a tractor fell into a crevasse, western side of the Ross Ice Shelf, Antarctica. Cold Regions Science and Technology.' (2001), p 33.
[8] G L Blaisdell, et al, above note 5, p 530.
[9] W Schwerdtfeger, *Weather and Climate of the Antarctic* (1984), p 235.
[10] See Whillans and Merry, above note 7, p 34.

Ross Ice Shelf. The glacier is 101 km in length and rises from an elevation of 150 m to 2400 m on the Polar Plateau (Table 1). Unlike many other outlet glaciers in the Transantarctic Mountains, the Leverett does not have a significant katabatic wind component.[11] It is also relatively slow moving and has fewer crevasses compared to other potential routes such as the Skelton Glacier. Based on the results of airborne GPR, there have been some crevasses identified in the lower slopes of the glacier but their size is still uncertain.[12] It is also uncertain how dynamic the glacier is which could pose a problem for ongoing route maintenance and use. The glacier surface ranges from hard snow and ice through to large sastrugi and bumps produced by the glacier motion and the underlying topography. The upper section of the glacier has good examples of where topographic constraints have produced steep slopes.[13]

3.2.4 The Polar Plateau

The 443 km Polar Plateau section is the final stage of the proposed route. This section is the least dynamic in terms of ice movement, with a low probability of crevasses. The plateau has a relatively low gradient of less than two degrees climbing from 2400 m at the top of the Leverett Glacier to 3000 m at the Pole (Table 1). This part of the Route is the coldest, with mean annual temperatures of between –25°C and –30°C.[14]

[11] See Schwerdtfeger, above note 9 p 236. Compare Vostok traverse that was closed in 2003 due to high winds.
[12] See Wright, above note 6
[13] W B Patterson, *The Physics of Glaciers* (1994), p 213.
[14] See Schwerdtfeger, above note 9, p 324.

Table 1: Summary of the South Pole Route (Blaisdell et al. 1997)

Leverett Route	Length (km)	Grade (%)	Limiter	Elevation (m)
Williams Field to Shear Zone	38	0	Minor sastrugi	35
Shear Zone	22	0	Minor Sastrugi and crevasses	50
Z11 to L00 (Leverett base)	990	<2	Unknown	150
L00 to L4	57	4	Large sastrugi*	1100
L4 to L7	21	5	Hard snow and large sastrugi	1500
L7 to L8	6	-3 to 5	Bumps	1600
L8 to L9	6	6	None	1850
L9 to L12	7	2-6	Slopes	2100
L12 to L18 (Leverett top)	4	2, 10, 15	Two 0.5 km steep slopes*	2400
L18 to South Pole	443	<2	Moderate sastrugi	3000

* Crevasses appear in radar (GPR) records for some portion of the route segment.

3.3 Challenges to the Route Due to the Physical Environment

The nature of the physical environment, described above, poses several problems to the efficacy of the Route. This section covers challenges to the Route design, construction, and the Route's ongoing use and maintenance.

3.4 Challenges to Route Design

Crevasse-filling is a costly and time-consuming process, as demonstrated by the time taken to complete the Shear Zone section in this field season.[15] It is still unknown how many more crevasses will need filling along the Route, and to what extent the process of crevasse-filling will have to be repeated in the future.

[15] K Hutchison, 'Snow slows traverse ' Antarctic Sun, Jan, 18, 2004 <http://www.polar.org/antsun/snowSlowsTraverse.htm >, 22 January 2004. To date progress is 690 km South which is 360 km short of the intended goal.

Whilst the Leverett Glacier is the lowest gradient glacier for traverse construction, it is still uncertain if the maximum gradient of around 15% will be suitable for fuel-laden tractor train travel. The surface condition is varied, ranging from soft deep snow that can bog heavy tractors down, to large sastrugi that are demanding on the vehicle.

Wind flow modelling data shows that there are no significant katabatic winds near the Leverett Glacier. Only on glaciers close to the Beardmore Glacier, and glacier outlets further north, are katabatic winds an issue. The distance from these outlet glaciers makes it unlikely that the wind speeds will be as ferocious, but they could still nevertheless pose problems for route movements. The Polar Plateau, could be problematic for the vehicles, with the potential for engines freezing and mechanical breakage due to the extremely cold environment.

It is unknown whether the displacement created along the Shear Zone will complicate development and maintenance of the Route. The largest unknown is the rate at which the crevasses will re-form along this shear margin and in the Leverett Glacier region. This has the potential to create costly maintenance to ensure the Route remains useable. The use of flags to mark out the Route will require on-going maintenance due to the dynamic nature of the surface. This will be particularly noticeable in the shear zone, where the marked route will move 20 metres south each season, potentially affecting navigation and compromising safety objectives for the road trains. The cost of crevasse re-identification and refilling and the potential for hazards created by the dynamic environment make it imperative that unknowns are removed during the initial stages of construction.

4 ISSUES SURROUNDING THE SOUTH POLE ROUTE

The South Pole Route raises three issues relating to necessity, feasibility, additional development, science, the environment, and current practices established in Antarctica.

4.1 Why is the South Pole Route Considered Necessary?

The South Pole Station is totally reliant on air transport for logistical support. Currently, aircraft are the only means by which the United States Antarctic Programme (USAP) can deliver cargo and fuel to the Amundsdon-Scott South Pole Station. Cargo and fuel arrives in the main US Antarctic station of McMurdo by conventional aircraft and ship, and is then moved with specialised skied LC-130 Hercules aircraft to the South Pole Station. Alternatively, wheeled aircraft such as the C-141 Starlifter and the C-17 Globemaster III are utilised. However, they are limited to parachute drop operations because of their inability to land at the Pole.

The South Pole Route will greatly reduce the logistical reliance on aircraft thereby reducing the supply costs to the South Pole. The cost of re-supplying the South Pole Station from McMurdo using air transport is estimated to be US$6 per kilogram. The traverse costs are estimated to produced considerable savings, reducing the cost to approximately US$1.40-$1.90 per kilogram.[16] The supply of fuel is also a major issue. Approximately 470, 000 US gallons of fuel is delivered to the South Pole annually, requiring around 125 missions consuming 612 500 US gallons of aircraft fuel. The task of supplying fuel is effectively achieved by the overland tractors, which can carry twice the payload for the same amount of fuel used compared with a LC-130.[17]

[16] See Wright, above note 6. Each traverse will cost between US$32 000-$42 000.
[17] See Blaisdell, et al, above note 5, p 529.

The development of a modern heavy-haul traverse in Antarctica could also open up new areas of the continent for scientific study. New Zealand scientists investigating ice shelf sensitivity and change are already using the pioneering phase of the South Pole Route to access research sites on the McMurdo Ice Shelf.[18]

The South Pole Route provides the potential to relieve 64-86 LC-130 missions, which would then able to service other scientific projects and conduct search and rescue missions. The capacity of the land traverse vehicles is capable of delivering equipment and supplies that exceed the volumetric capacity of the LC-130. For example, certain cargo for the scientific experiment commonly referred to as Icecube, and materials for redevelopment of the South Pole Station, are predicted to exceed the 3 m x 3 m limitation afforded by the LC-130 cargo door.[19]

4.2 The Feasibility of the South Pole Route

Long distance heavy oversnow traverses are routinely used by other nations in Antarctica. The French-Italian Dome C project is successfully using surface traverse from Dumont d'Urville for all of its logistics deliveries while the inland Russian station, Vostok, has been supplied for many years by tractor-trailers following a well-marked route from the coastal station Mirny.

In 1993, the US conducted research into a more effective mode of transportation due to increased logistical requirements to service the reconstruction of the South Pole Station.[20] The strain on existing air operations necessitated the use of either larger 'wheeled' aircraft or the

[18] See Copeland, above note 4.
[19] J Wright, cited in 'The South Pole Route,' Antarctic, volume 20, number 3 & 4, 2003, p38. Icecube is the scientific research program of the Antarctic Muon and Neutrino Detector Array (AMANDA).
[20] S Den Hartog, and G Blaisdell 'Delivery of Fuel and Construction Materials to the South Pole' US Army Corps and Engineers; Cold Regions Research and Engineering Laboratory, Special Report 93-19, July 1993.

use of land based traverses to relieve the pressure and reliance on LC-130 air transport. Four alternatives were proposed:

a) Construction of a snow runway at the South Pole capable of supporting wheeled aircraft.[21]

b) Development of an inland blue-ice runway capable of supporting heavy wheeled aircraft, located as close as possible to the Pole for overland traverse between the landing site and the Pole.

c) Overland traverse between a coastal station (approximately 67º south) that has easier access to the Pole.

d) Overland traverse between the main US station at McMurdo and the Amunsdon-Scott Station at the Pole.

Option d) is the subject of this review but interestingly it did not initially receive the support that it currently enjoys. The 1993 review considered the areas of feasibility, cost and risk, and voiced concerns over the feasibility of option d), the McMurdo-South Pole traverse. It considered that the "Antarctic has a supreme ability to disguise its treacherous nature even from experts and experienced veterans,"[22] and viewed the feasibility of the overland traverse as 'unlikely' when reviewing the rate of success in crevasse detection. At the time of writing, only ground based impulse radar was being tested rather than the GPR technology now available. The report regarded real-time feedback with sufficient warning for the vehicle to stop as being the minimum standard required for incorporation of the radar device on any vehicle.[23]

[21] Currently only LC-130 Hercules are capable of landing at the South Pole. Their cargo weight is limited by the additional weight afforded by the skis.
[22] See Den Hartog, et al, above note 20, p 10.
[23] The report envisaged a scout vehicle to undertake the detection operations during critical periods.

The risk to personnel was viewed with obvious concern. A trip of such long duration would put personnel beyond the effective reach of land rescue for much of a journey that unavoidably leads them through crevasse-strewn areas and steep slopes. 'The long distance from safe havens makes this option dangerous by any standard.'[24]

Comparisons of cost were made between the various methods over four and eight year operating periods. The blue-ice runway situated at the Mill Glacier was considered the most cost effective with the McMurdo-South Pole traverse costing 1.21 times as much. Of note in the analysis is the non-accounting of 'enroute service depot' construction. Art Brown of the NSF considers that such facilities will be a necessary inclusion to the South Pole Route operations. Accordingly, the additional construction of enroute facilities should be considered. The cost of preparing a landing facility suitable for a C-130 worked out cheaper, at 1.03 times the cost of the combined air/land delivery. Unfortunately, the report omitted the current cost of LC-130 operations for a complete picture of the comparisons. Inclusion of such information would permit the reader to consider whether the cost savings were significant enough to warrant such drastic overhauls of the current *modus operandi*.

In 1997, the overland traverse was reconsidered in light of new GPR and improved traverse equipment.[25] The report recommended two alternative routes through either the Skelton or Leverett Glaciers, the latter being preferred.[26] The report seemingly reverses the findings earlier seen in 1993. However, unlike the earlier report, it omitted to address human safety factors that were of great concern in 1993. Regardless of technological improvements, the concerns of human isolation remain, but appear not to have been revisited.

[24] See Den Hartog, et al, above note 20, p 12.
[25] See Blaisdell, et al., above note 5, p 531.
[26] Refer Table 2 where the Leverette Glacier shows a 19% greater payload while taking 16% less time. The average speed over the Leverette route is almost one km/h faster and consumes 20% less fuel than the Skelton route.

Table 2. Comparison of potential traverse routes and aircraft. (Blaisdell et al, 1997).

	Leverett Glacier	**Skelton Glacier**	**LC-130 Hercules**
Round trip distance (km)	3450	3800	2060
Operating time (hrs)	336	402	6.5
Delivered load (kg)	25 910	22 780	11 360
Fuel used (kg)	12 727	15 855	14 960
Fuel used (L)	15 590	19 420	18 320
Overall speed (km/hr)	10.27	9.45	320
Efficiency 1 (kg/hr/L)	0.0049	0.0029	0.095
Efficiency 2 (tonne-km/hr)	266	215	3600

The USAP plans to establish and demonstrate the traverse capability by the 2004-2005 austral summer season. However, progress has been slowed during the 2003-2004 austral summer season due to unexpected problems encountered with traction in soft snow.[27] The development of the Route will be continually monitored and results compared with routes such as the Dome C traverse, in order to try to overcome these challenges.

4.3 The Potential for Additional Development

The initial idea is to construct a flagged route from McMurdo station to the South Pole, but there are many other potential developments. The Route is likely to require enroute service depots, providing accommodation, fuel stores, parts and servicing for the machinery. It is likely that one will be positioned at the base of the Leverett Glacier and it may be relatively large, containing permanent summer quarters for the Route.

[27] Discussion held with personnel working on the project, 2 January 2004, McMurdo Station.

If such midway and enroute development occurs, there is the possibility that such infrastructure can service more than just traverse based activity, for example, the use of a Leverett midway camp to service research in the nearby Siple Coast.[28] Similarly, the Route will not be exclusively used to service the South Pole. Already there are scientific users of the Route in the region.[29] With the increase in use by other scientific groups, there is the potential for side routes to be constructed. An expansion of such routes would allow the transportation of scientific material that could not otherwise be deployed using air transport.

4.4 Science

Science can benefit greatly from the establishment of the South Pole Route. Presently, many of the LC-130 flights to the Pole are re-supply missions. The new route will free up these flights for other scientific endeavour. The McMurdo Area Users Committee estimates that one third to one half of the current Pole re-supply flights could be made available for other missions.[30]

The science that will emerge from the opportunities the Route provides is not to be underestimated. Obvious examples are based on the large payloads capable of being transported. The International Trans Antarctic Scientific Expedition (ITASE) considers that the ability to conduct large-scale experiments, without the constraints of air cargo space, "will produce the most comprehensive record of temperature, precipitation and atmospheric circulation of any continent on Earth over the past 200 to 1000 years."[31]

[28] See Anandakrishnan, above note 3, p 3.
[29] A recent example includes New Zealand personnel on event number K053 in 2003 /2004 season.
[30] McMurdo Area Users Committee (MAUC)., 'Science advantages of an over snow traverse to re supply South Pole'(2001) July issue, p 12.
[31] Office of Legislative and Public Affairs (OLPA), 'International Trans Antarctic Science Expedition' (2003). <http://www.nsf.gov/od/lpa/news/03/fsitase-03.htm >, 8 December 2003, p 3.

4.5 Environment

Traditional heavy oversnow traverses used steel-track tractors coupled with rugged sledges, resulting in a high ratio of empty weight to delivered load, and significant terrain impact.[32] This impact has been mitigated by the design of a new rubber-belted tractor and trailer system, developed specifically for high-speed heavy-haul oversnow traversing. The resulting impact is limited to the vehicular tracks, which is commensurate with the environmental principle of leaving only footprints to mark your presence. The tracks, once made, are covered very quickly by wind blown snowdrifts. Whilst the poled route may be considered an eyesore by some, such marked tracks are not uncommon in New Zealand and the USA.

Limiting traffic to one established route has benefits by reducing the aesthetic degradation associated with multiple routes. It is intended that the Route will only be used during the summer season, thereby further limiting the overall vehicular impact on the environment. Each traverse will have the resources and equipment necessary to refuel the tractors, carry out routine maintenance and collect all hazardous and non-hazardous waste, for subsequent disposal at supporting stations.[33] The risk of fuel spills is reduced through secondary containment tanks, regularly scheduled daily tank inspections, and a trained quick-response clean up team.[34]

The explosives used for blasting snow bridges will be an additional source of environmental pollution introduced into the atmosphere and glacial ice. Overcoming hazardous crevasses has required up to 2 565 kg (5 700 pounds) of dynamite thus far.[35] Thirty-two crevasses were

---

[32] See Blaisdell, above note 5, p 530.
[33] See Wright, above note 6.
[34] Ibid.
[35] National Science Foundation; Polar Press Clippings ‘US Begins Building Road to South Pole,’ P West, ed, 2003, p 128.

blown up and filled on the McMurdo Shear Zone.[36] Of these, about five were substantial, the largest about eight m wide and 34 m deep, requiring 9 000 cubic metres of snow to fill.[37] The impact of constant maintenance will significantly increase if blasting occurs annually.

The NSF argues that there are advantages to be gained from the lower fuel emissions emitted during an overland traverse compared to the same tonnage transported by LC-130 aircraft.[38] However, the environmental impacts are likely to increase as more LC-130 aircraft are made available for other missions.[39] No documentation has been sighted as declaring a reduction in air transport operations, implying that air emissions will actually increase because the freed air support will continue to operate.

4.6 Current Traverse Practices Within Antarctica

Overland traverses have long been used in Antarctica. Currently the traverse from DuMont d'Urville to Concordia at Dome C covers 1200 km [40] and is utilised up to three times per year.[41] The Mirny to Vostok covers 1400 km[42] and is traversed once a year. Both the Dome C and Vostok routes are similar in distance to the South Pole Route of 1600 km. The NSF plans to complete one 'swing' per year. One swing equals three round trips and the NSF intends to increase the swings per year to three by the 2006-2007 summer.

---

36 Ibid.
37 Ibid.
38 See Wright, above note 6.
39 For example, the increased aircraft availability provide extensive logistical support to re-supply existing facilities, establish or decommission temporary field camps, and provide specialised support to scientific research at numerous field sites that would not have otherwise been possible.
40 L. Simion, 'Concordia: The New French Italian Station <http://www.polar.org/antsun/oldissues2001-2002/2002_0120/concordia.html> 16 January 2004.
41 J. Storey, 'South Pole Diaries 2003/2004', <http://www.phys.unsw.edu.au/astro/southpole2004/jwvs/2003_12_03_archive.html>, 16 January 2004.
42 Russian Antarctic Expedition, Environment Impact Assessment (Preliminary Stage), <http://www.dpc.dk/PolarNews/NewsArchive/NewsMar.html> 16 January 2004.

ITASE is a conglomerate of 19 nations that use long distance overland traverses.[43] The ITASE research carried out the first overland crossing of the West Antarctic Ice Sheet covering 1200km from Byrd Station to the South Pole. The equipment used was similar to that intended for the South Pole Route, namely Caterpillar Challenger 55 tractors.[44]

5 The South Pole Route and the Loss of Wilderness Values

The development of the South Pole Route may signal the beginning of future developments that seriously threaten the wilderness values of the 'untouched continent'. The following discusses the meaning of wilderness and aesthetic values, and how the development of the South Pole Route relates to these concepts in the Antarctic context.

The concept of preserving wilderness is provided for in the United States Wilderness Act of 1964 (The Wilderness Act) that was considered landmark legislation and is influential in many other parts of the world. Its purpose is 'to preserve the wilderness character of areas' and this core concept is described in detail in a US Fish & Wildlife Service Draft Wilderness Stewardship Policy of January 2001 (FWS).[45] The attitudes to wilderness, embodied in these documents, relate to the following discussion.

5.1 What are Wilderness and Aesthetic Values?

Wilderness values are attributes of wilderness, which are generally regarded as land that is 'unmodified, wild, uninhabited, remote from human settlement and untamed'[46] and an antidote to modern urban pressures. Wilderness areas are 'places that forever remain in contrast to modern civilization, its technologies, and contrivances…Humans can only ever be

[43] The nations contributing include: The United States, United Kingdom, China, France, Germany, Italy, Japan, Norway, Australia, Sweden and Russia.
[44] National Science Foundation, Office of Legislative and Public Affairs, January 2003. www.nsf.gov/od/lpa/news/03/fsitase_03.htm, 2 December 2003, p 2.
[45] Zahniser, 1962: cited in Committee for Environmental Protection, 'The Antarctic Protected Areas Archive,' <http://www.cep.aq/apa/> 4 January 2004
[46] H. Keys, 'Principles of Wilderness Stewardship: Wilderness Character,' Wilderness Watch, <http://www.wildernesswatch.org/Wild%20Library/Concepts/Character.htm>, 4 January 2004

visitors in wilderness: some wilderness areas have no visitation but their intrinsic value remains high.'[47]

Wilderness and aesthetic values are complex concepts comprised of 'values as yet not captured by language.'[48] For instance wilderness character consists of tangible physical components including, 'a lack of human structures, roads, motor vehicles or mechanized equipment…' and intangible, psychological and spiritual components including, 'solitude; immediacy; opportunities for reflection; freedom; risk, adventure, and mystery; places where safety is a personal responsibility; untrammelled, wild and self-willed, where natural processes occur without intentional human interference.'[49]

Effectively they are more than the sum of their component parts and include inspirational qualities. Wilderness experience produces 'strong or deep feelings of wholeness and oneness such as rapture, awe, more alive feelings including improved concept of one's self and a higher state of consciousness.'[50]

Antarctic wilderness values include remoteness, few or no people, an absence of human made objects, traces, sounds and smells, and not travelled, or infrequently travelled, terrain.[51] This implies 'remoteness from permanent or semi-permanent habitation, an absence of related human artefacts, and disturbance and an absence of motorised transport.'[52] Given its

---

[47] Ibid.

[48] A. Leopold, Wilderness Watch., 'Principles of Wilderness Stewardship: Non-degradation Principle,' <http://www.wildernesswatch.org/Wild%20Library/Concepts/Nondeg.htm>, 4 January 2004.

[49] Committee for Environmental Protection, 'The Antarctic Protected Areas Archive' <http://www.cep.aq/apa/>, 4 January 2004

[50] Keys H., 'Towards additional protection of Antarctic Wilderness Areas,'(1999) XIII ATCM/IP 80 Committee for Environmental Protection. <http://www.cep.aq/MediaLibrary/asset/MediaItems/ml_376356650578704_ip080e.doc>, 5 January 2004, p 4.

[51] See Keys, above note 50, p 6.

[52] Ibid.

remoteness and other special characteristics, Antarctic wilderness values 'should imply more remote, unpopulated and 'wild' feelings than wilderness values elsewhere.'[53]

Wilderness character and aesthetic values have important value to people who will never directly experience them.[54] This is particularly relevant in the Antarctic context, since the vast majority of individuals interested in Antarctica will only experience it via a remote medium such as the media or a computer. Antarctica is perceived by many to be Earth's last great wilderness, yet Jenkins considers the completion of the South Pole Route will render it 'conquered by the internal combustion engine.'[55]

Motorised transport is widely regarded to be an anathema in wilderness areas. However, the harsh climate makes Antarctic science dependent on motorised support. Such support has been provided throughout the Continent for many years but the South Pole Route, as a major logistical transport route, has the potential to open up previously inaccessible areas to future development. Any infrastructure development and proliferation of inroads into the interior will undoubtedly benefit science but represent an ongoing human encroachment, which continues to diminish the total area of Antarctic wilderness.

5.2 The Treaty System: An Effective Tool?

Growing environmental awareness has focused attention on the environmental impact of human activities in Antarctica. This led to the adoption, by the 26 Antarctica Treaty Consultative Parties, of the Environmental Protocol to the Antarctic Treaty (the Protocol).[56]

---

[53] Ibid.

[54] Ibid. Studies have shown that even non-users of national parks and wilderness feel better knowing these areas exist.

[55] S Jenkins, 'Liberate Antarctica from science's deep freeze,' National Science Foundation, Polar Press Clips (2003).

[56] Entered into force in January 1998, the Madrid Protocol is the latest addition to the Antarctic Treaty System that comprises four other conventions; Antarctic Treaty 1959, Convention of Antarctic Seals 1972 (CCAS), Convention of Antarctic Marine Living Resources 1980, (CAMLR), Convention on the Regulation of Antarctic Mineral Resource Activities 1988, (CRAMRA).

The Protocol establishes a legal obligation to protect wilderness and aesthetic values[57] and to plan and conduct activities to avoid degradation of, or substantial risk to, areas of aesthetic or wilderness significance.[58] However, such protection is only formally afforded to those areas officially designated under Annex V as Antarctic Specially Protected Areas (ASPA) and Antarctica Specially Managed Areas (ASMA).[59]

According to Annex V, any area may be designated as an ASPA to protect aesthetic or wilderness values, whilst any area where activities are or may be conducted, may be designated an ASMA to minimise cumulative environmental impacts. However, certain considerations listed under Annex V, Article 3(2) provide guidance on the type of area worthy of obtaining such a status. If the area in question contains unique wildlife, unusual geographical characteristics, or has recognised historical value, then it may indeed warrant specialised protection. Protection of these areas is achieved through the implementation of mandatory management plans. However, the Committee of Environmental Protection data on existing ASPAs[60] and ASMAs[61] reveals that only two ASPAs have been designated on the grounds of aesthetic values.[62] A single ASMA has been designated on the grounds of scenic values.[63] No designations have been made based on wilderness values.[64] This suggests that

[57] Article 3(1).
[58] Article 3(2)(b)(vi).
[59] Activities in ASPAs and ASMAs ‘shall be prohibited, restricted or managed in accordance with Management Plans’ (Article 2) adopted under the provisions of the Annex. Entry into an ASPA requires a permit issued under Article 7.
[60] Committee for Environmental Protection, ‘Antarctic Specially Protected Areas Summary’ <http://www.cep.aq/apa/aspa/index.html> 6 January 2004
[61] Committee for Environmental Protection, ‘Antarctic Specially Managed Areas’ <http://www.cep.aq/apa/asma/index.html> 6 January 2004
[62] 120. 'Pointe-Géologie Archipelego', Terre Adélie and 159. Cape Adare, Borchgrevink Coast, Northern Victoria Land.
[63] 1. Admiralty Bay, King George Island, South Shetland Islands.
[64] See Keys, above note 50, pp 3, 8. Keys suggests that the fact that formally protected areas are not large enough to protect wilderness areas, means that the Antarctic Treaty System has not thus far actively protected wilderness values sufficiently.

the Antarctic Treaty System (ATS) ‘has not so far actively protected wilderness values very well and is slow to adopt proven environmental management techniques.’[65]

The Environmental Impact Assessment (EIA) process under Annex I provides for identification of the physical environmental impacts and appropriate monitoring where possible through responsible management. However, the EIA is not drafted to consider concepts of wilderness or aesthetic value. Rather, Annex I focuses on quantitative information.[66] Accordingly, the forthcoming comprehensive environmental evaluation will evaluate physical environmental impacts such as disturbance to the snow and the environment.

5.3 The Need for Long-term Strategic Management Planning

Antarctica’s remoteness, vast size and frozen nature have limited human encroachment and provided a “natural” protection of wilderness and aesthetic values.[67] However, the overcoming of technological barriers suggests that their future survival can only be assured through additional protection. The opening up of inaccessible regions, in the absence of wise management of the cumulative impacts of human development, has the potential for rapid degradation of Antarctic wilderness values.

What is lacking is an overall long-term strategic responsible planning approach. Starting from a desired future state for Antarctica, decisions would be made on what activities are acceptable and how they should be managed. Such decisions could take into account

[65] See Keys, above note 50, p 3.
[66] Treaty Handbook 2002, < http://www.state.gov/documents/organization/15291.pdf.>, 5 January 2004, p 492.
[67] See Keys, above note 50, p 6.

cumulative impacts and the philosophical and ethical criteria of wilderness and aesthetic values.[68]

In the absence of such planning, there is a real risk of destruction of Antarctic wilderness and aesthetic values by insignificant increments. This is demonstrated by several regions, previously suggested for ASMA or ASPA designation to protect wilderness values, now being too close to permanent bases or out-stations or transport routes to possess or maintain high quality wilderness values.

In the process of acceptance of incremental change, such as increasing coverage by motorised transport, a gradual shift in attitude occurs, amongst managers and the public, towards the acceptance of future activities and approaches. This attitudinal shift eases acceptance of the next proposed incremental change in activities, for example, another traverse and so on. The construction of the South Pole Route has highlighted the shortcomings of the ATS and the need for formal designation and management of wilderness areas. Without such action values such as remoteness from transport routes will disappear little by little.

6 Legitimacy of the Administrative Process

The following discussion addresses the legitimacy of the South Pole Route construction under the current environmental impact assessment process as mandated by the Protocol. First, an overview of the Protocol obligations is presented, followed by the application of those obligations to the South Pole Route project. Finally, a conclusion is proffered on whether the EIA process has been adequately followed.

---

[68] Antarctica New Zealand, 'Proceedings of the Antarctic Tourism Workshop 23 June 2000,' <http://www.antarcticanz.govt.nz/DownLoadDocuments/PDF/Tourismworkshop.pdf>, 4 January 2004.

6.1 Environmental Impact Assessment Procedure

Article 3 of the Protocol establishes a number of principles considered necessary for the protection of the Antarctic environment. The principles specifically recommend that activities in Antarctica should be planned and conducted based on '...information sufficient to allow prior assessment of, and informed judgements about, their possible impacts on the Antarctic environment.'[69]

The principles in Article 3 state inter alia, that activities must avoid significant changes to atmospheric, terrestrial (including aquatic), glacial or marine environments. Furthermore, the assessment of planned activities must be conducted, within the procedures set out in Annex I.

Article 8 of the Protocol establishes obligations in the reporting of any activities to be conducted in Antarctica. The impact of any proposed activities must be considered in accordance with appropriate national procedures.[70] Article 8 provides for three levels of environmental impact; a preliminary (PEE), initial (IEE) or comprehensive environmental evaluation (CEE) will be required depending on the activities' impact being less-than, equal to, or greater than 'minor or transitory' effects.[71] The NSF is due to release a draft CEE in early January 2004, to evaluate the impact of traverse traffic on the environment using six traverses as the basis of the impact assessment.[72]

The meaning of 'minor or transitory damage' is not defined in the Protocol and neither has its meaning been established through consistent usage. There has been considerable debate

[69] Article 3(2)(c).

[70] Annex 1, Article 1. Examples of national legislation include domestic legislation such as New Zealand's Part 3 of the Antarctica (Environmental Protection) Act 1994, the United Kingdom's Antarctic Act 1994 and Antarctic Regulations 1995 and in the USA, the National Environmental Policy Act 1964.

[71] Article 8(1). See also the Treaty Handbook, above note 66, p492.

[72] P Penhale, 'Notice of Intent to Prepare a Comprehensive Environmental Evaluation (CEE) for the Development and Implementation of Overland Traverse Capabilities in Antarctica,' 68 FR 61469-02 (2003) p61470.

regarding the ambiguity of the term, and difficulties arise through the application of the EIA provisions to the many environmental variables under consideration.[73] Currently there are few examples to use as guides for interpretation. However, there is an analogous situation concerning the contaminating of glacial ice. Recommendation XIV-3 of the ATCM held at Rio de Janeiro in 1987 considered that drilling operations that released hydrocarbons into the environment required a comprehensive environmental evaluation.[74] Therefore, there appears a prima facie case for the drafting of a CEE from the project's inception rather than after the 'proof of concept' phase has been completed.

The joint efforts of the Council of Managers of National Antarctic Programs (COMNAP) and the Scientific Committee of Antarctic Research (SCAR) developed the Handbook of the Antarctic Treaty System.[75] It provides guidance on standard techniques and methodologies for a first tier of indicators for monitoring programs in Antarctica. The three fundamental steps in assessing an impact are identifying the activity, identifying the outputs of that activity to the environment and consideration of the environment.[76]

6.2 Identification of the Activity

Defining the activity requires an examination of the proposed activity and an account of possible alternatives. The purpose and the need for the activity should also be analysed together with the principles and characteristics of construction.[77] Particular attention is drawn to the requirement for precautionary measures to be taken during the construction, operational

[73] Treaty Handbook, above note 66, p 493, referring to XX ATCM/IP2 NZ; XXI ATCM/WP35 NZ.
[74] A Hemmings and R Roura, 'Antarctic Tourism. A square peg in a round hole: fitting impact assessment under the Antarctic Environmental Protocol to Antarctic Tourism,' Impact Assessment and Project Appraisal, volume 21 number 1, March 2003, p 14.
[75] The project team included members of the Antarctic Environmental Officers Network (AEON) that provides a forum for the exchange of information, experience and ideas about practical environmental management issues.
[76] Treaty Handbook, above note 66, pp 491-496.
[77] For example, methods and transportation requirements.

and decommissioning phases of the activity. The precautionary theme prevalent throughout the Treaty System is also reflected in Article 3, paragraph 2(c). The Handbook further states, 'careful consideration is required to determine the full scope of the activity so that the impacts can be properly assessed.'[78] The Handbook says the rationale for this is to '…avoid preparing a number of various EIAs on actions which indicate an apparent low impact but when taken in its entirety, the activity has the potential for impacts of much greater significance.[79] Activities that occur at the same site spatially or temporally were specifically referred to in the text.

6.3 Identification of Outputs

Outputs include sediments caused by vehicle movements and emissions.[80] The drafters have carefully worded the text to include materials that are a potential threat, rather than limiting consideration to actual release. Such provisions may be intended to cover stored materials such as fuel and other hazardous chemicals taken into the field to facilitate work. Assessing the impact is not based upon a one-rule-fits-all but is rather a balancing process designed to take into account unique features of a particular project. To assist in the process, reference can be made to the report, 'Monitoring of Environmental Impacts from Science and Operations in Antarctica.' that illustrates the specific concerns over vehicle emissions and fuel storage. [81]

6.4 Consideration of the Environment

Consideration of the environment involves a thorough analysis and characterisation of the relevant physical environment of the proposed activity's site.[82] 'Relevant' is defined as all those aspects of the environment that the proposed activity *might* influence or which influence

[78] Treaty Handbook, above note 66, p 496.
[79] Ibid.
[80] Ibid, p 497
[81] Available from the COMNAP website;
<http://www.comnap.aq/comnap/comnap.nsf/P/Pages/Environment/#4>, 18 January 2004.
[82] Treaty Handbook, above note 66, p 497.

the activity. Preference is given to *quantitative* information where appropriate.[83] Finally, any gaps in knowledge, or uncertainties encountered in compiling the information, must be identified.

6.5 South Pole Route Assessment Process

To date the NSF has seen fit only to conduct an intermediate evaluation for the development of the South Pole Route.[84] Both the 1993 and 1997 feasibility reports mentioned the need to carry out a thorough feasibility study including a pioneer traverse.[85] The NSF is carrying out such a feasibility study under the guise of a 'proof of concept'. The Route, whilst consisting of no more than flags positioned at specified intervals over the ice surface, is of significant construction in several ways. This project is a supply route for the two largest stations in Antarctica operated by the largest national investor, namely the United States. It is by far the longest of routes in Antarctica, and the NSF intends to utilise it on a regular basis during the austral summer. The Route's construction requires the use of explosives in remote areas of the continent away from any established base. The quantity necessary to effect the crevasse alterations is not insignificant. The toxicity of the explosive product is such that personnel are prohibited from entering the danger area within 24 hours of detonation to allow the 'noxious gases to dissipate.'[86]

6.6 Application of the Treaty Guidelines

The following discussion addresses the legitimacy of the South Pole Route construction under the current environmental impact assessment process as mandated by the Protocol. First, an overview of the Protocol obligations is presented, followed by the application of those

[83] *Ibid*, p498.
[84] See Penhale, above note 70, p 61469.
[85] See Den Hartog, above note 20, p 14; Blaisedell above note 5, p 535.
[86] Antarctic volume 20, number 3 & 4, 2003, p 38.

obligations to the South Pole Route project. Finally, a conclusion is proffered on whether the EIA process has been adequately followed.

6.7 Environmental Impact Assessment Procedure

Article 3 of the Protocol establishes a number of principles considered necessary for the protection of the Antarctic environment. The principles in state inter alia, that activities must avoid significant changes to atmospheric, terrestrial (including aquatic), glacial or marine environments.[87] Furthermore, the principles specifically recommend that activities in Antarctica should be planned and conducted based on '...information sufficient to allow prior assessment of, and informed judgements about, their possible impacts on the Antarctic environment.'[88]

Article 8 of the Protocol establishes obligations in the reporting of any activities to be conducted in Antarctica. The impact of any proposed activities must be considered in accordance with appropriate national procedures.[89] Article 8 provides for three levels of environmental impact; a preliminary (PEE), initial (IEE) or comprehensive environmental evaluation (CEE) will be required depending on the activities' impact being less-than, equal to, or greater than 'minor or transitory' effects.[90] The assessment procedures must be applied in the planning process.[91] Should a CEE be necessary, no activity may proceed unless there has been an opportunity to consider the proposal.[92]

[87] Article 3(2)(b)(iii)
[88] Article 3(2)(c).
[89] Annex 1, Article 1. Examples of national legislation include domestic legislation such as New Zealand's Part 3 of the Antarctica (Environmental Protection) Act 1994, the United Kingdom's Antarctic Act 1994 and Antarctic Regulations 1995 and in the USA, the National Environmental Policy Act 1964.
[90] Article 8(1). See also the Treaty Handbook, above note 66, p492.
[91] Article 8(2).
[92] Annex I, article 3(5). Article 3(6) further states that the CEE must be publicly available 60 days prior to the activity commencing.

The meaning of ‘minor or transitory damage’ is not defined in the Protocol and neither has its meaning been established through consistent usage. There has been considerable debate regarding the ambiguity of the term, and difficulties arise through the application of the EIA provisions to the many environmental variables under consideration.[93] Currently there are few examples to use as guides for interpretation. However, there is an analogous situation concerning the contaminating of glacial ice. Recommendation XIV-3 of the ATCM held at Rio de Janeiro in 1987 considered that drilling operations that released hydrocarbons into the environment required a comprehensive environmental evaluation.[94] Therefore, there appears a prima facie case for the drafting of a CEE from the project’s inception rather than after the ‘proof of concept’ phase has been completed.

The joint efforts of the Council of Managers of National Antarctic Programs (COMNAP) and the Scientific Committee of Antarctic Research (SCAR) developed the Handbook of the Antarctic Treaty System.[95] It provides guidance on standard techniques and methodologies for a first tier of indicators for monitoring programs in Antarctica. The three fundamental steps in assessing an impact are identifying the activity, identifying the outputs of that activity to the environment and consideration of the environment.[96]

6.8 Identification of the Activity

Defining the activity requires an examination of the proposed activity and an account of possible alternatives. The purpose and the need for the activity should also be analysed

[93] Treaty Handbook, above note 66, p 493, referring to XX ATCM/IP2 NZ; XXI ATCM/WP35 NZ.
[94] A Hemmings and R Roura, ‘Antarctic Tourism. A square peg in a round hole: fitting impact assessment under the Antarctic Environmental Protocol to Antarctic Tourism,’ Impact Assessment and Project Appraisal, volume 21 number 1, March 2003, p 14.
[95] The project team included members of the Antarctic Environmental Officers Network (AEON) that provides a forum for the exchange of information, experience and ideas about practical environmental management issues.
[96] Treaty Handbook, above note 66, pp 491-496.

together with the principles and characteristics of construction.[97] Particular attention is drawn to the requirement for precautionary measures to be taken during the construction, operational and decommissioning phases of the activity. The precautionary theme prevalent throughout the Treaty System is also reflected in Article 3, paragraph 2(c). The Handbook further states, 'careful consideration is required to determine the full scope of the activity so that the impacts can be properly assessed.'[98] The Handbook says the rationale for this is to '…avoid preparing a number of various EIAs on actions which indicate an apparent low impact but when taken in its entirety, the activity has the potential for impacts of much greater significance.[99]

6.9 Identification of Outputs

Outputs include sediments caused by vehicle movements and emissions.[100] The drafters have carefully worded the text to include materials that are a potential threat, rather than limiting consideration to actual release. Such provisions may be intended to cover stored materials such as fuel and other hazardous chemicals taken into the field to facilitate work. Assessing the impact is not based upon a one-rule-fits-all but is rather a balancing process designed to take into account unique features of a particular project. To assist in the process, reference can be made to the report, 'Monitoring of Environmental Impacts from Science and Operations in Antarctica.' that illustrates the specific concerns over vehicle emissions and fuel storage.[101]

6.10 Consideration of the Environment

Consideration of the environment involves a thorough analysis and characterisation of the relevant physical environment of the proposed activity's site.[102] 'Relevant' is defined as all those aspects of the environment that the proposed activity *might* influence or which influence

---

[97] For example, methods and transportation requirements.
[98] Treaty Handbook, above note 66, p 496.
[99] Ibid.
[100] Ibid, p 497.
[101] Available from the COMNAP website; <http://www.comnap.aq/comnap/comnap.nsf/P/Pages/Environment/#4>, 18 January 2004.
[102] Treaty Handbook, above note 66, p 497.

the activity. Preference is given to *quantitative* information where appropriate.[103] Finally, any gaps in knowledge, or uncertainties encountered in compiling the information, must be identified.

6.11 South Pole Route Assessment Process

To date the NSF has seen fit only to conduct an initial (IEE) evaluation for the development of the South Pole Route.[104] Both the 1993 and 1997 feasibility reports mentioned the need to carry out a thorough feasibility study including a pioneer traverse.[105] The NSF is carrying out such a feasibility study under the guise of a 'proof of concept'. The NSF is due to release a draft CEE in early January 2004, to evaluate the impact of traverse traffic on the environment using six traverses as the basis of the impact assessment.[106]

6.12 Application of the Treaty Guidelines

The precautionary principle suggests that, if there was doubt in determining the proper level of evaluation, then a CEE was the appropriate level of EIA prior to the project commencing.

The Protocol expressly states that activities should be 'planned and conducted…to avoid…significant changes to….glacial …environments.'[107] The Route, whilst consisting of no more than flags positioned at specified intervals over the ice surface, is of significant construction in several ways. This project is a supply route between two of the largest stations in Antarctica operated by the largest national investor, namely the United States. It is by far the longest of routes in Antarctica, and the NSF intends to utilise it on a regular basis during

[103] *Ibid,* p498.
[104] See Penhale, above note 70, p 61469.
[105] See Den Hartog, above note 20, p 14; Blaisedell above note 5, p 535.
[106] P Penhale, 'Notice of Intent to Prepare a Comprehensive Environmental Evaluation (CEE) for the Development and Implementation of Overland Traverse Capabilities in Antarctica,' 68 FR 61469-02 (2003) p61470.
[107] Article 3(1) and (2).

the austral summer. The Route's construction requires the use of explosives in remote areas of the continent away from any established base. The quantity necessary to effect the crevasse alterations is not insignificant. The toxicity of the explosive product is such that personnel are prohibited from entering the danger area within 24 hours of detonation to allow the 'noxious gases to dissipate.'[108] Considering the scale and destructive nature of the crevasse alterations, there is a strong case for preparing a CEE under Annex I, article 3(1) to include the construction phase of the project.

A feasibility study of the Route's construction is a sensible process when considering the project's magnitude. The NSF has determined that the proof of concept is an acceptable means of achieving the feasibility study. However, the adopting of a 'proof of concept' approach, arguably, goes beyond the meaning of 'planning' in Article (8) which says that *all* assessment must be complete prior to commencing the activity. Furthermore, 'proof of concept' is not defined anywhere in the ATS, nor in the associated documents. Regardless of whether feasibility is achieved by proof of concept, a pioneering phase or simply a trial run, it is the *impact* of the activity the EIA focuses on, not the *label* attached to it. Should the use of such labels remain unchallenged, their acceptance will lead to similar avoidance of comprehensive evaluation in other projects.

If the NSF determined that the operation of traverse vehicles constitutes a more than minimal or transitory effect, thus requiring a CEE, then it is logical to assume that the use of explosives to alter the Shear Zone warrants a similar conclusion. The construction, or 'proof of concept' phase of the Route, has arguably a greater environmental impact than traversing over the completed project. If the forthcoming CEE includes the construction phase, then there are breaches of a), Annex I article 3(5), in that no activity can proceed without prior

[108] Antarctic volume 20, number 3 & 4, 2003, p 38.

consideration of the CEE, and b), a breach of article (3)(2)(c) requiring prior assessment of the activity.

Conversely, if the construction phase is not evaluated, then there appears an inconsistent interpretation with the Treaty Handbook guidelines requiring *full* assessment of the activity, namely, construction, operation and decommission. The Treaty handbook asks environmental project managers to take a broad view and assess the 'full scope of the activity so that impacts can be properly assessed.'[109] Preparing an IEE for the development of a route, and then a CEE for its use, is not taking into account the full scope of the activity. Such an interpretation appears to be precisely what the Handbook drafters sought to avoid.

To summarise the issues, there appears inconsistent interpretation with the Protocol and Treaty handbook beyond the ambiguity of certain terms. The misinterpretation of express terms, and the use of a feasibility construct, has led the NSF to bypass certain procedures of environmental assessment. As stated above, EIA focuses on environmental impact not the label to which it is attached. The contents of the forthcoming CEE will be of interest concerning both scope and timeliness.

7 CONCLUSION

Undoubtedly, the NSF faces a formidable challenge. The project's scale and the difficulties inherent in traversing the McMurdo Shear Zone and the Leverett Glacier, make it one of the most dangerous in the Continent's history. Route can be justified when comparing cost of air and land transport. Despite the project's scale, the visible characteristics leave minimal evidence of a physical scar, with surface disturbances healing quickly in the strong and

[109] Treaty Handbook, above note 66, p 496.

regular winds. The Route will facilitate increased payload capacity and free up flights for additional logistical requirements required by large-scale Antarctic science projects.

However, while the Route is not a physical scar on the landscape there is arguably a scar on the Antarctic Treaty System ideology. Wider environmental and procedural issues need consideration. The NSF's use of the 'proof of concept' construct is problematic and is inconsistent with the purpose of the Protocol. Such an interpretation needs challenging on the grounds of legitimacy in order to assure a healthy prognosis for the EIA regime. Little is known about the long-term effects of the blasting required for on-going maintenance nor the possible development of enroute depot stations and the additional impacts they will create.

The NSF's approach to the environmental impacts of the South Pole Route has put the spotlight on the ATS and found it flawed. The EIA framework requires clarification and tuning to address the intangible components of Antarctic wilderness and aesthetic values. Currently, consideration of such values is missing from the EIA obligations and the NSF's forthcoming CEE is unlikely to have addressed them. The Protocol's ASPA and ASMA framework provides a mechanism affording formal protection to wilderness and aesthetic values, yet designation on the grounds of protecting wilderness values appears to be non-existent. The NSF's technological advances make the proactive designation of such areas more important than ever.

Addressing the current issues, proactively adopting ASPAs and ASMAs and, in the longer-term, adopting a strategic responsible planning approach, will ensure that future developmental impacts in Antarctica are wisely managed and the special and necessary relationship between motorised support and the Antarctic environment accommodated.

Within such a framework the South Pole Route, and any resultant development, will deliver benefits to science while successfully co-existing with the Antarctic environment.

8 ANNEXES

Annex I

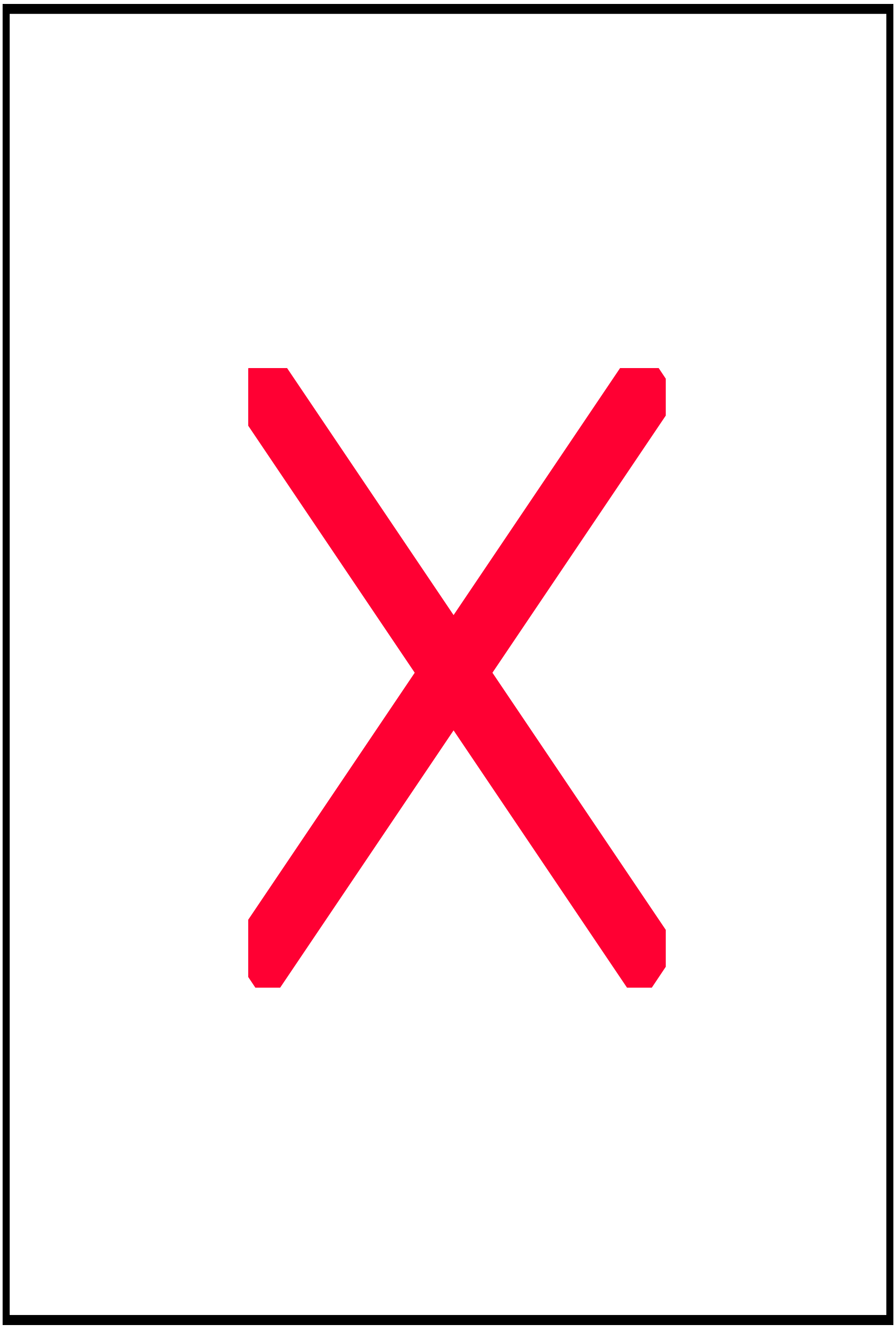


Figure 1(a): The proposed South Pole Route (Source; NSF presentation, John Wright).

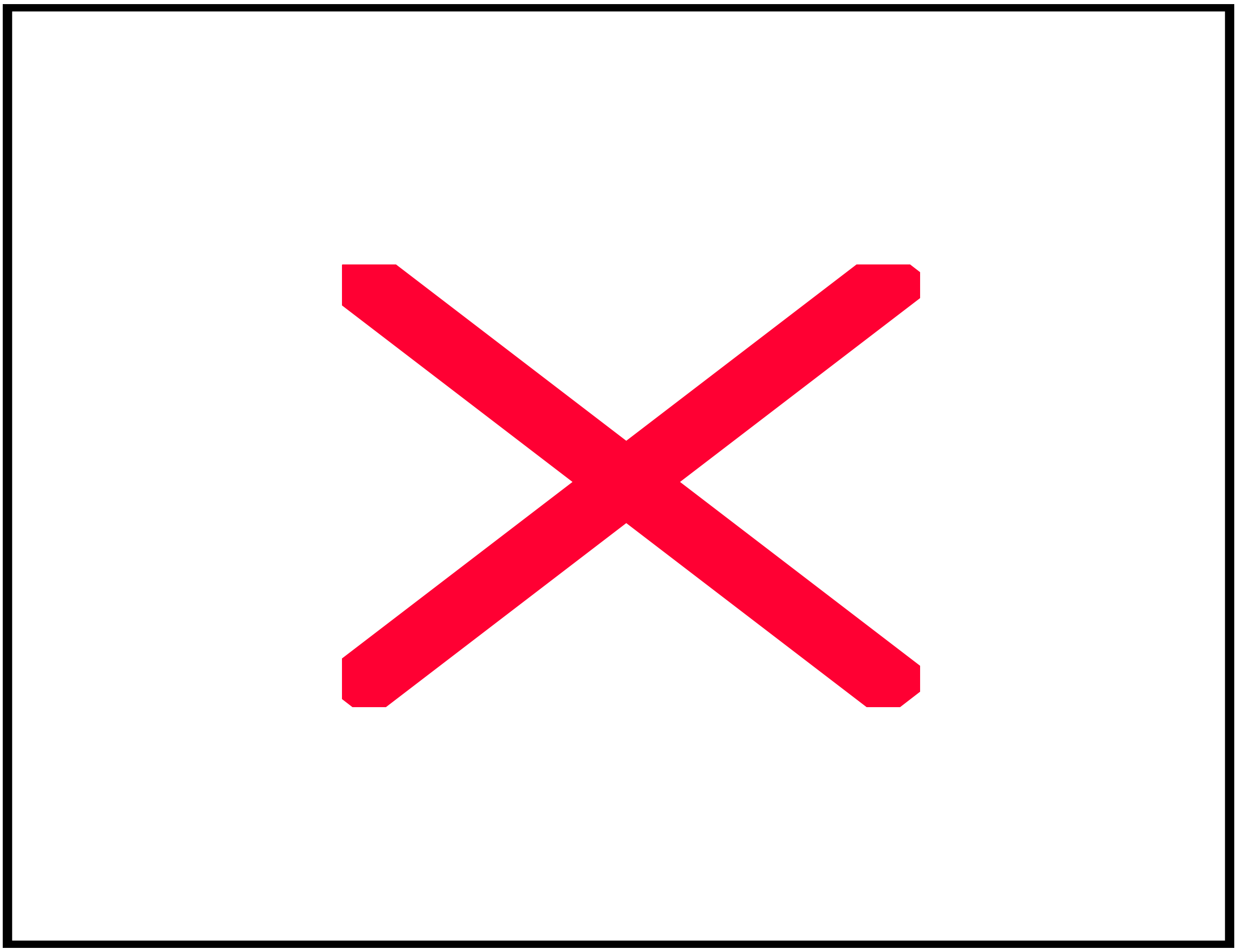


Figure 1(b): The proposed South Pole Route (Source; NSF presentation, John Wright).

Annex II

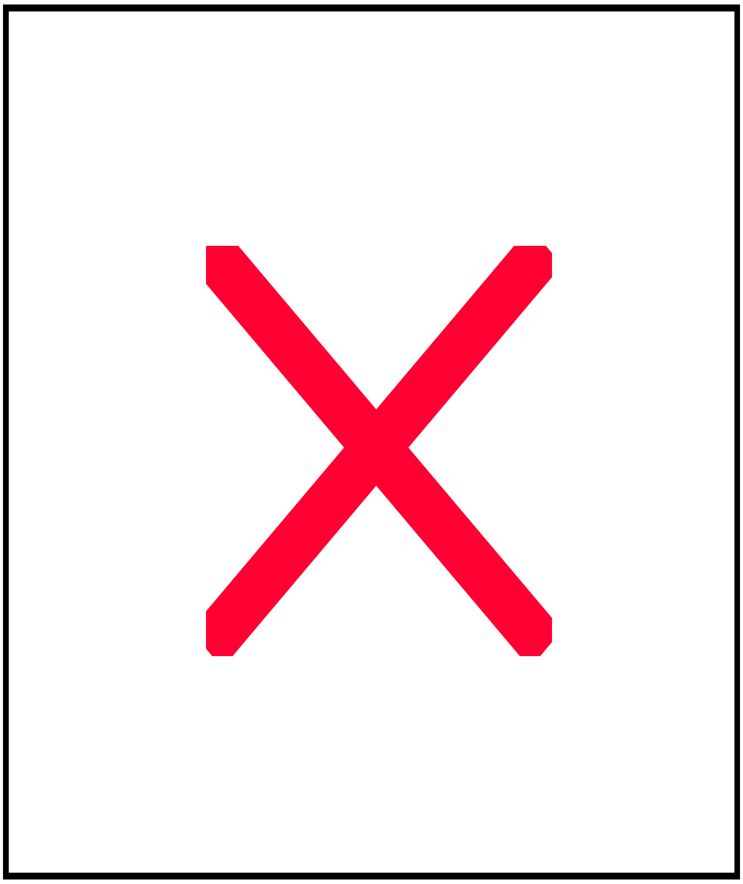


Figure 2. The McMurdo Shear Zone, a region where the faster moving Ross Ice Shelf meets the slower moving McMurdo Ice Shelf. Minna Bluff is the long feature in the bottom centre of the image. (Whillans and Merry, 2003).

9 Bibliography

International Conventions

Antarctic Treaty 1959.

Convention of Antarctic Marine Living Resources 1980.

Convention of Antarctic Seals 1972.

Convention on the Regulation of Antarctic Mineral Resource Activities 1988.

Statutes

New Zealand

Antarctica (Environmental Protection) Act 1994.

United Kingdom

Antarctic Act 1994.

Antarctic Regulations 1995.

United States of America

National Environmental Policy Act 1964.

Books

Fogg, G E, *A History of Antarctic Science. In A History of Antarctic Science* (1992).

National Science Foundation, *Polar Press Clips 2003* (2003).

Paterson, W S B, *The Physics of Glaciers* (1994).

Schwerdtfeger W, *Weather and Climate of the Antarctic* (1984).

Reports and Articles

Anandakrishnan, S 'Science advantages of an oversnow traverse to resupply S. Pole' p 1. <http://www.geosc.psu.edu/~sak/traverse.pdf>, 2 December 2003.

Antarctica New Zealand, 'Proceedings of the Antarctic Tourism Workshop 23 June 2000,' <http://www.antarcticanz.govt.nz/DownLoadDocuments/PDF/Tourismworkshop.pdf>,4 January 2004.

Blaisdell G L, Richmond P W, Kaiser F.C. and Alger RG., 'Development of a modern heavy-haul traverse for Antarctica. Proceedings of the Seventh International Offshore and Polar Engineering Conference Honolulu,' (1997).

Committee for Environmental Protection, 'The Antarctic Protected Areas Archive,' <http://www.cep.aq/apa/>, 4 January 2004.

Committee for Environmental Protection, ‘The Antarctic Protected Area System,’ <http://www.cep.aq/apa/introduction/index.html>, 5 January 2004.

Committee for Environmental Protection, ‘Antarctic Specially Managed Areas,’ <http://www.cep.aq/apa/asma/index.html>, 6 January 2004.

Committee for Environmental Protection, ‘Antarctic Specially Protected Areas Summary,’ <http://www.cep.aq/apa/aspa/index.html>, 6 January 2004.

Council of Managers of National Antarctic Programs, ‘Protocol on Environmental Protection to the Antarctic Treaty,’ <http://www.comnap.aq/comnap/comnap.nsf/P/PDF/5/$FILE/MadridPr.pdf?Open&ext=.pdf>, 6 January 2004.

Den Hartog, S L and Blaisdell G L, ‘Delivery of Fuel and Construction Materials to South Pole Station,’ US Army Corps of Engineers, Cold Regions Research & Engineering Laboratory (1993) Special Report 93-19.

Global 500 Forum (United Nations Environment Programme), ‘Who was Chico Mendes?’ <http://igloo.gsfc.nasa.gov/wais/ACAN.htm>, 12 January 2004.

Hemmings A and Roura R, ‘Antarctic Tourism. A square peg in a round hole: fitting impact assessment under the Antarctic Environmental Protocol to Antarctic Tourism,’ Impact Assessment and Project Appraisal, volume 21 number 1, March 2003.

Hutchison, K ‘Snow slows traverse’ Antarctic Sun, Jan, 18, 2004 <http://www.polar.org/antsun/snowSlowsTraverse.htm >, 22 January 2004.

Jenkins S, ‘Liberate Antarctica from Science’s Deep Freeze,’ Polar Press Clips, (2003).

Keys H, ‘Towards additional protection of Antarctic Wilderness Areas,’(1999) XIII ATCM/IP 80 Committee for Environmental Protection. <http://www.cep.aq/MediaLibrary/asset/MediaItems/ml_376356650578704_ip080e.doc>, 5 January 2004.

Leopold A, ‘Principles of Wilderness Stewardship: Non-degradation Principle’ Wilderness Watch, <http://www.wildernesswatch.org/Wild%20Library/Concepts/Nondeg.htm>, 4 January 2004.

McMurdo Area Users Committee (MAUC), ‘Science advantages of an over snow traverse to re supply South Pole’(2001), July issue.

Melendy and Blaisdell G, ‘Summary report: Antarctic Traverse Workshop’ (1994).

National Science Foundation, ‘Notice of intent to prepare a Comprehensive Environmental Evaluation (CEE) for the development and implementation of overland traverse capabilities in Antarctica’ (2003). <http://www.257.g.akamaitech.net/7/257/2422/14mar20010800/edocket.access.gpo.gov/200>, 11 December 2003.

New Zealand Antarctic Institute Ross Sea Region, ‘A State of the Environment Report for the Ross Sea Region of Antarctica,’ (2001).

Office of Legislative and Public Affairs (OLPA), ‘International Trans Antarctic Science Expedition’ (2003).
<http://www.nsf.gov/od/lpa/news/03/fsitase-03.htm>, 8 December 2003.

Penhale P, ‘Notice of Intent to Prepare a Comprehensive Environmental Evaluation (CEE) for the Development and Implementation of Overland Traverse Capabilities in Antarctica,’ 68 FR 61469-02 (2003).

The Australian, ‘US wants ice road to the South Pole’ (2003).
http://www.careerme.co.au/newsviews/story/0,8523,5878764-22561,00.html>,12 January 2004

Whillans I M and Merry C J, ‘Analysis of a shear zone where a tractor fell into a crevasse, western side of the Ross Ice Shelf, Antarctica,’ Cold Regions Science and Technology, (2001).

World Conservation Union (IUCN), ‘Guidelines for Protected Area Management categories’ (1994).

The Australian., ‘U.S wants ice road to the South Pole’ (2003).
http://www.careerme.co.au/newsviews/story/0,8523,5878764-22561,00.html>, 12 January 2004.

Wright J, Cited in ‘The South Pole Route,’ Antarctic, volume 20, number 3 & 4, 2003.

Personal communication

Brown A, Personal Communication, Antarctica New Zealand, 24 November 2003.

Copeland L, Personal Communication, Scott Base, 1 January 2004.

Wright J, Presentation, National Science Foundation McMurdo station, October 2003.