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Australia's East Antarctic Geostrategic Futures: Nirvana or Doom Inbound?

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Antarctic issues are becoming fashionable once more.[1] There was a long stagnation that began when the Cold War ended, easing geostrategic pressures and making Antarctica less salient to the governments of the world. Circumstances have changed, however, and an increasing number of states are again becoming deeply engaged. With this reawakened interest, Antarctica's future is becoming increasingly fluid and uncertain. This concerns Australia, for Antarctica is its closest southern neighbour; the country also claims almost half the frozen continent, a territorial declaration regarding an area equal to some 80 per cent of Australia itself.[2]

Australia's claim and those of six other nations have, however, been deliberately set aside. This has created the unusual situation according to which, in an international system apparently completely divided into individual sovereign states, Antarctica is not deemed anyone's territory. Antarctica is instead managed multilaterally through international committees based on mutually decided treaties and agreements. An increasing number of states now want to influence these treaties and agreements.

Antarctica's isolation and inhospitableness have allowed it to remain largely unaffected by humans. The resulting pristine natural environment makes Antarctica an ideal laboratory for a range of scientific activities and has led to science becoming the defining feature of contemporary

Antarctica operations. In turn, this primacy has shaped the strategic arrangements that guide interactions between the interested states.

The hallmarks of the Antarctic Treaty System (ATS) that has developed over the last sixty years are science, environmental protection, and avoiding militarization. The ATS regulates activities south of the 60 degrees south latitude, an area within which lie the Antarctica land mass, associated islands, and significant ice shelves (Secretariat of the Antarctic Treaty 1959, article 6; CCAMLR 1980, article 1). The four agreements that comprise the ATS, and their supporting institutions, have been instrumental in maintaining a stable, rules-based order in Antarctica despite the presence of multiple geostrategic changes elsewhere. It is considered to be an "unprecedented success in international law and diplomacy" (Fogarty 2011, 15).

The central institutional pillar of the ATS is the Antarctic Treaty, signed by 12 states in Washington at the height of the Cold War, in December 1959. Today, there are 54 parties to the Antarctic Treaty made up of 29 Consultative Parties, those states conducting "substantial research activity" in Antarctica and with decision-making rights within the system, and 25 Non-consultative Parties, states that are invited to observe but do not have decision-making rights. The Antarctic Treaty is unique because it is "a peace treaty not to stop hostilities but to prevent them" (Bergin et al. 2013, 5).

Three articles establish the ATS's key features. Article 1 begins with a clear statement of intent: "Antarctica shall be used for peaceful purposes only." The article goes on to prohibit "measures of a military nature," but not the use of military force for peaceful purposes. Article 2 establishes the principle of scientific freedom and co-operation, which remains the cornerstone of international involvement in the region. Article 4 freezes disputes over territorial claims. The treaty acknowledges that some states have laid claim to Antarctic territory, but neither supports nor denies these claims. Further, it prohibits the making of new claims to territory. This article of the treaty has proved resilient in the face of growing interest in Antarctica. There are only seven states with Antarctic claims, but twenty-nine states operate research bases on the continent.

Not all fifty-three Antarctic Treaty parties have signed the other three agreements that comprise the ATS: the 1972 Convention for the Conservation of Antarctic Seals, the 1980 Convention on the Conservation

of Antarctic Marine Living Resources (CCAMLR), and the 1991 Protocol on Environmental Protection to the Antarctic Treaty (the Madrid Protocol). Despite the smaller number of parties being formally bound by these three agreements, they are generally abided by.

The two agreements of concern to Australia are the CCAMLR and the Madrid Protocol. The CCAMLR is the primary mechanism for managing the Southern Ocean's under-exploited fishery resources. Various conservation measures have been adopted by the CCAMLR that cover both contracting parties and non-parties to the convention.

In contrast, the Madrid Protocol designates "Antarctica as a natural reserve, devoted to peace and science." The key clause, article 7, simply states that "Any activity relating to mineral resources, other than scientific research, shall be prohibited." If at sea, sustainable fishing is allowed; onshore, exploitation is banned.

Away from making rules in distant capitals, there is increasing activity by states on the ground in Antarctica. The big wave of accession by states to the Antarctica Treaty was during the late Cold War, in the 1980s, with others less hurriedly joining in the decades after that. Over the last fifteen years, many nations have moved beyond simply attending international meetings to building and maintaining bases on the continent.

Old, refurbished, and new Antarctic bases are now seen as allowing the participating states to be much better able to influence the development of the future rules governing Antarctica. For many of these states, the bases have a further perceived benefit in ensuring their countries are well positioned to undertake marine, genetic, and mineral resource exploitation when and if this is allowed. Lastly, for a small group of states, there is the intangible lure of national prestige, a factor most attractive to new great powers like China, India, and Brazil. There are now some eighty separate facilities open in Antarctica, with more under construction.

This chapter initially examines Antarctica today with a focus on activities in the East Antarctic region Australia claims. This is then used to look beyond twenty years to discuss four plausible geostrategic futures. The future of the Antarctic is uncertain but seems to lie within definable boundaries; a range of possible alternative futures appears discernible. It is important to note that this chapter simply discusses future possible

geostrategic environments and does not develop any strategy intended to shape the future in any particular, desired direction.

East Antarctica Today

In broad terms, Antarctica comprises three major areas: the Antarctic Peninsula, which snakes up toward South America and is an extension of the Andes; the small West Antarctica region, which is relatively low in elevation; and the much larger East Antarctic region, which is mostly a very high plateau. West and East Antarctica are separated by the 3,000-kilometre-long, 4,000-metre-high Transantarctic Mountain range. The range is punctuated by volcanoes, with the best known, Mount Erebus, still active (Talalay 2014, 5–8).

Although Antarctica is almost totally covered by glacial ice, this is not a single sheet. The East Antarctic glacial ice sheet flowing east is much larger, thicker, and older than the West Antarctic glacial ice sheet flowing west. This ice cover ensures Antarctica has the highest average surface elevation of any continent at around 2,000 metres above sea level, albeit with distinct differences between West and East Antarctica. In West Antarctica, the average elevation is 1,300 metres; in East Antarctica it averages 2,200 metres. Inland East Antarctica's ice is very thick; at Dome A the surface elevation is more than 4,000 metres. As these figures suggest, in East Antarctica the low-lying coastal area is very narrow with the ice sheet rising steeply from it (Press 2018, 129–32).

East Antarctica, by global standards, is very cold and very dry. Staff at Russia's inland Vostok Station recorded –89.2 degrees Celsius with recent satellite-collected data revealing a temperature of –93.2 degrees Celsius in some small valleys elsewhere in the East Antarctic plateau (Fischetti 2013). Australia's East Antarctic territory is almost completely covered in thick, permanent ice with only some small ice- and snow-free coastal areas. While 0.4 per cent of the Antarctic is free of ice and snow, almost all of this is outside Australia's claimed area, mainly in the Antarctic Peninsula (Australian Government 2021). Being ice free on land does not mean sea ice is not present, only that the land areas are very dry. Sea ice forms seasonally around Antarctica, which means ship access to the coast is only possible during two or three months of summer.

Within the territory that Australia claims there are several bases operated by a range of countries. The most active new participant in East Antarctica base development is China.

China in East Antarctica

China initially joined the ATS in 1983, became a Consultative Party in 1985, signed the Madrid Protocol in 1998, and agreed to the CCAMLR in 2007. Today, China has undertaken some thirty-eight national Antarctic expeditions and runs five research stations in Antarctica; the newest is on Inexpressible Island, within New Zealand's claimed Antarctic territory, and was completed in 2022 (Lei 2021).

In 2005 China's top polar scientist advocated for his country to become a "polar great power"—that is, a power strong in military, scientific, and economic terms in both the North and South Polar regions (Brady 2017, 3). President Xi Jinping first publicly embraced this idea when visiting Hobart in 2014, giving the polar great power expression his imprimatur and consequently wide Chinese public usage. The president further outlined that the guiding principles for Chinese polar activities should be "understand, protect, and use" (Liu 2019, 126).

In this, the ATS has some real advantages for great powers. Any country with the requisite economic strength can have unfettered access across the whole of the Antarctic landmass and littoral without having to consider other nations' rights. With such access, great powers can assess the continent's resources, locate important natural assets, and develop the latent capabilities to extract them when circumstances change. In 2017, Chinese vice-premier Zhang Gaoli noted there was a "need for a proper balance between the protection and utilization of Antarctica in order to achieve green and sustainable development of the continent and unleash its potential and value" (EFE-EPA 2017).

In the Chinese political system, polar affairs are part of maritime affairs, thus, becoming a polar great power falls within the ambit of China's maritime strategy. The State Oceanic Administration informally distributed China's first white paper on Antarctic matters in May 2017 during the fortieth Antarctic Treaty Consultative Meeting in Beijing. Titled "China's Antarctic Activities," the white paper noted that China had made

"significant progress in its Antarctic activities in terms of integrated logistic support" (Liu 2019, 123).

In the last ten years, China has worked to extend its presence over a relatively narrow triangular area of East Antarctica. Three of China's Antarctic bases, three of its airfields, and two field camps are in this sector. China's main East Antarctic base, Zhongshan, opened in 1989 near Russia's older Progress facility. Zhongshan has doubled in size in recent years, and is now a medium-sized, year-round base that acts as both a research facility and a coastal support base for activities further inland. It can support twenty-five staff in winter and sixty in summer.

Inland Taishan was opened in 2014 and is a summer-only base that supports the much further inland Kunlun facility, together with expeditions into the nearby Grove Mountains. Opened in 2009, the summer-only Kunlun Station is the second-southernmost research base in Antarctica, behind only the United States' South Pole Station. Taishan and Kunlun have 600-metre ice runways and can accommodate twenty and twenty-eight staff, respectively, over summer. Illustrating the protracted nature of building infrastructure in the harsh Antarctica environment, automatic meteorological stations began operating at Taishan and Kunlun in December 2021, some five and nine years, respectively, after building commenced on each station (Global Times 2021).

Kunlun, being well inland and at high altitude (some 4,000 metres), has excellent clear air and dark sky qualities, perfect for imaging telescopes used for astronomical observations and space debris monitoring. The latter is becoming increasingly important for a nation's civilian and military space operations as near-earth orbits become more crowded (Layton 2019, 33–36). Maintaining the complex equipment needed for space situational awareness across winter would be difficult and require Kunlun becoming a year-round facility, but the location is nearly perfect for polar orbiting satellite and debris detection.

China previously used Russian airfields as part of the logistical support of its Antarctic activities. In recent years, however, China has begun developing its own air hub infrastructure. In 2014 it built an ice runway at the Zhongshan base, and then in 2016 it operated its first fixed-wing aircraft from there. In 2018, China announced plans to build a more permanent

1,500-metre airstrip of compacted snow on a glacier some 28 kilometres from Zhongshan.

Given its length, initially the only aircraft based there will be China's sole Basler BT-67, a turboprop-powered DC-3 specially modified in Canada for Antarctic research operations. Renamed as the Xue Ying 601 (Snow Eagle), the BT-67 is operated by Kenn Borek Air, a Canadian air charter company, and used for summer air operations supporting the two inland bases and various research expeditions within 1,300 kilometres of Zhongshan. The BT-67 deploys in summer to Zhongshan through South America and a multi-base hop across Antarctica.

The new airfield will take several years to become operational but will give China experience in a polar airfield's construction and maintenance, ground support, airspace management, and navigation aids. China's official *Science and Technology Daily* noted that the airbase "will provide a foundation for operating large aircraft, creating multiplane services, and building an Antarctic air traffic network in the future . . . and [allow] China [to] have a say in the international management of Antarctic air space" (Zhen 2018).

China's base expansion has created two specific concerns. First, China has developed the BeiDou multi-satellite navigation system, broadly similar in function to the US Global Positioning System, the European Galileo, and the Russian GLONASS. BeiDou ground-receiving and reference stations have been installed at Zhongshan and Kunlun, and, while very useful for Antarctic operations, will apparently also improve the overall global performance of the system, particularly in terms of locational accuracy. The dual-use nature of BeiDou has led to worries about the militarization of Antarctica. Similar concerns were raised when Norway built the Trollsat Satellite Station at its Antarctic station. Trollsat supports Galileo and is Norway's main contribution to this major European project.

Second, concerns have been raised about China's proposal for a new Antarctic Specially Managed Area (ASMA) at Kunlun. ASMAs assist co-operation in busy areas and are managed by a single country or group of countries. There are several ASMAs across Antarctica, including at the United States' South Pole Station. Some see geopolitics behind China's proposal, with the University of Canterbury's Anne-Marie Brady believing the ASMA is seen by China as a "soft presence . . . [a] subtle way for [the]

state to control territory" (2017, 10). Lacking an international endorsement for its ASMA proposal, China attempted to get multi-national agreement to a code of conduct for the area, but this also failed (Gothe-Snape 2019).

Russia in East Antarctica

While many bases closed after the Soviet Union's collapse, in recent years Russia has embarked on a reconstruction and reconstitution program. In East Antarctica, the country now operates two small summer-only bases (Druzhnaya 4 and Molodezhnaya), a small year-round base (Vostok), a medium-sized, year-round base (Progress 2), and a large year-round base (Mirny). Vostok is well inland, whereas the others are coastal facilities. Mirny is by a significant margin the largest base of any nation in East Antarctica; it can accommodate 60 staff during winter and 169 during summer. Of note is that Russia's old Novo airbase in Queen Maud Land, just outside of Australia's East Antarctic claim, has returned to life as a major airhead used by some eleven nations. In mid-2020 the Russian government approved an action plan to build new wintering facilities at Vostok and Mirny; construction commenced at Vostok in 2021 (Wenger 2022).

Two concerns have been frequently raised about Russia's bases. The first relates to Russia's seeming deep interest in resource exploitation. Russia's ten-year Antarctic Strategy, formally approved in 2020 but not publicly released, apparently aims to "strengthen the economic capacity of Russia . . . through complex investigations of the Antarctic mineral, hydrocarbon, and other natural resources" (Boyd 2019; see also Buchanan 2021). The second is again the issue of navigation satellite systems, with Russia installing GLONASS equipment at Progress and Mirny.

New problems have now arisen with Russia's invasion of the Ukraine. Russia is deeply involved in the Dronning Maud Land Air Network (DROMLAN). The network has been operating for some two decades and involves Belgium, Finland, Germany, India, Japan, Norway, Russia, South Africa, Sweden, the Netherlands, and the United Kingdom. DROMLAN uses services provided by the South African company Antarctic Logistics Center International for the intercontinental link flown by Russian Il-76 transport aircraft from Cape Town to the Novo ice runway airfield and

Kenn Borek Air ski-equipped aircraft for the intra-continental air services that fan out from Novo (Colombo 2019).

Many of the DROMLAN participating nations actively oppose Russia's war and have introduced significant economic and business sanctions against the nation. It is unlikely that DROMLAN can continue in its present form, while Canadian company Kenn Borek Air may no longer be permitted to use the Novo airfield. A related matter is the renovation of the inland Vostok base in East Antarctica. The project is partially sponsored by the now war-sanctioned Russian oligarch Leonid Mikhelson, the major shareholder of gas producer Novatek. Reportedly, Mikhelson is providing about $60 million of the project's cost (Walters 2022).

Other National Facilities in East Antarctica

Larseman Hills Stations

Four nations have stations clustered closely together, within roughly a couple of kilometres of each other, in the ice-free Prydz Bay area. Along with Russia's Progress Station and China's Zhongshan (both already noted), India and Romania also have research stations. India's Bharati is a medium-size, year-round base and is the country's second active Antarctic research facility. Bharati was established in 2012 and can support twenty-four staff during winter and forty-seven in summer. Romania's Law-Racovita summer-only station opened in 2006. It was Australia's Law Station, originally constructed in 1986 and now rebuilt. The station can accommodate up to thirteen staff.

France/Italy

The Concordia Research Station opened in 2005 and is a medium-size, year-round facility established—like China's Kunlun and Russia's Vostok—well inland on the high Antarctic Plateau. Located at an elevation of some 3,200 metres, the station can support fifteen staff during winter and sixty staff in summer. Concordia has a 1,500-metre ice runway (Mekarnia and Frenot 2013, 178–80).

Belarus

The Vechernyaya summer-only station opened in 2016 some twenty-seven kilometres from Russia's also summer-only Molodezhnaya base. The coastal station can accommodate up to ten staff.

United States

Just outside East Antarctica, at the geographic South Pole, the United States maintains a very large, year-round facility that dates to 1957. The Amundsen-Scott South Pole Station has a surrounding ASMA and includes the Jack F. Paulus Skiway, a 3,500-metre-long snow runway.

Australia's Antarctica

The United Kingdom first claimed territory in Antarctica in 1841. In 1933, these claims were transferred to Australia under the Australian Antarctic Territory Acceptance Act. In 1954, Australia's first continental research facility, Mawson Station, was established; it is now the longest continuously operating station south of the Antarctic Circle.

Since then, Australia has built another two permanent scientific research stations in the Australian Antarctic Territory. All contribute to an internationally significant, ongoing scientific research program. The Department of Agriculture, Water and the Environment, through its Australian Antarctic Division (AAD), leads, coordinates, and delivers the Australian Antarctic program and administers the Australian Antarctic Territory.

In 2014, the Australian Government commissioned former AAD head Anthony Press to provide recommendations concerning future national Antarctic policies. The resulting report warned that "Australia's standing in Antarctic affairs is eroding because of historical under-investment at a time when new players are emerging in Antarctica" (Press 2014, 2). Acting on this, and after considering recommendations of a Senate inquiry, the Australian Government in 2016 released the *Australian Antarctic Strategy and 20 Action Year Plan* (Australian Government 2016). This document, in setting out the vision and the policy intentions for Australia's future Antarctic engagement, described Australia's national interests as follows:

- maintain Antarctica's freedom from strategic and/or political confrontation;
- preserve our sovereignty over the Australian Antarctic Territory, including our sovereign rights over adjacent offshore areas;
- support a strong and effective Antarctic Treaty System;
- conduct world-class scientific research consistent with national priorities;
- protect the Antarctic environment, having regard to its special qualities and effects on our region;
- be informed about and able to influence developments in a region geographically proximate to Australia; and
- foster economic opportunities arising from Antarctica and the Southern Ocean, consistent with our Antarctic Treaty System obligations, including the ban on mining and oil drilling. (Australian Government 2016, 17)

There are some seeming incompatibilities between the various interests, especially between preserving Australian sovereignty and supporting the ATS. The ATS sets aside Australia's claim, so it does not preserve Australia's sovereignty but instead disregards it. Indeed, under the ATS, Australia's claim seems somewhat anachronistic.

The counter-argument is that while the ATS continues, no nation can make a counterclaim to Australia's. From this perspective, the ATS keeps Australia's claim safe, and, crucially, achieves another key Australian objective: keeping Antarctica free from strategic conflict.

Supporting this position is the fact that the ATS is now sixty years old. It has succeeded not just in constraining geostrategic tensions in Antarctica, but also in encouraging rivals—such as the United States and the USSR during the Cold War—to collaborate in scientific research. The ATS has provided a durable framework for co-operative internationalism, allowing governments, including Australia's, to advance the idealistic

notion that their primary Antarctic objective is gaining scientific knowledge that is then made available to all.

Even so, the ATS may at some stage fade away under rising geostrategic tensions or intense resource exploitation demands. In such an eventuality, Australia's claim could become a useful diplomatic tool in negotiating a new Antarctic regime. The claim then becomes an important strategic asset. Daniel Bray has written that

> Preserving Australia's claim can . . . be seen as a hedge against the collapse of the ATS—a situation where historical claims would give Australia a strong diplomatic position in constructing a new regime and in any formal resolution of sovereignty claims. But perhaps most importantly, Australia's claim helps to deny sovereignty to other states by ensuring that its referent territory will always be a contested space should any other state seek sovereignty rights or exclusive access to Antarctic resources in the future. (2016, 268–69)

The obvious tensions between claiming sovereignty and strongly supporting the ATS, which disregards sovereignty, suggest a strong bifocal approach in Australian Antarctica strategic policy (Haward and Cooper 2014). Such an apparent incoherence provides a usefully flexible strategic stance in a somewhat uncertain Antarctica future. To achieve its various interlocking policy objectives, Australia has made considerable investments in Antarctic bases, supporting infrastructure and ongoing activities.

Australia's East Antarctic Operations

Australia has three medium-sized, year-round bases spread out along the East Antarctic coast, principally supported logistically and administratively from Hobart, Australia's most southerly state capital. In East Antarctic terms, Australia's three bases are a significant presence, particularly as they are year-round facilities. However, there is a sharp distinction between these coastal stations and the inland, high-altitude facilities built on the high East Antarctic Plateau with its average elevation of some

3,000 metres. Australia is re-acquiring an Antarctic overland traverse capability but has no inland bases, as China, Russia, France, and Italy do, even if some are summer-only facilities.

The Australian bases are logistically supported using air and sea transport, with shipping providing the logistical backbone. For some three decades, this involved the *Aurora Australis*, an 8,400-tonne, multi-purpose research and resupply icebreaker. The ship provided essential fuel and supplies to the three Australian stations, undertook personnel transfer, and was used for marine scientific research. Its Romanian-built replacement, the *Nuyina*, at 25,500 tonnes displacement, is significantly larger than the *Aurora Australis* and has much greater cargo and fuel-carrying capacity. After sea trials, the *Nuyina* arrived in Hobart in October 2021 and commenced Antarctic operations in the 2021–22 summer season, completing a thirty-nine-day voyage to resupply the Davis and Casey Stations.

Air operations are increasingly important, especially for personnel movement. Mawson has a summer ski runway constructed either on nearby sea ice (if present), or more often inland about 10 kilometres from Mawson at Rumdoodle. Davis station in the ice-free Vestfold Hills uses a ski runway on the Davis Plateau some 40 kilometres from the station and reconstructed each year on snow.

Casey's principal airfield is Wilkins, some 70 kilometres inland and sited 700 metres above sea level. The Wilkins runway has a foundation of natural glacial ice, which after annual surface grooming can accept wheeled, large transport aircraft. Wilkins is operational between October and March each year but closes for about six weeks in the middle of summer as warmer temperatures cause subsurface melting that undermines runway strength and creates blisters. This midsummer melt issue is likely to worsen as global warming intensifies.

Air operations can be usefully divided into inter- and intra-continental. Since 2007, the AAD has operated an intercontinental air link using wheeled A319CJ passenger jet aircraft flying between Hobart and Wilkins airfield carrying personnel and high-priority, lighter-weight cargo. Since 2016, Royal Australian Air Force C-17A heavy-lift aircraft also fly into Wilkins to deliver high-priority outsize cargo.

Since 2010, the AAD has contracted to Kenn Borek Air for intra-continental services using Basler BT-67 and DHC-6 Twin Otter aircraft, and

to a Tasmanian company, Helicopter Resources, for Squirrel helicopter support. The fixed-wing aircraft provide services from the Wilkins entry point to the other Australian stations, Mawson, and Davis, as well as supporting distant inland expeditions. The Squirrels are sea- and land-based. When operating at sea, the helicopters undertake ship-to-shore carriage of expeditioners and cargo. Two or three Squirrels are also typically land-based at Davis during summer supporting numerous scientific programs and deploying, supporting, and retrieving field parties.

The 2016 Strategy and Action Plan announced an intention to develop a paved year-round runway in a rare ice-free area near Davis station to be capable of supporting intercontinental flights. There are no paved runways in East Antarctica, although on the other side of the continent, at the northernmost tip of the Antarctica Peninsula, there is a small airbase operated year-round by Argentina. However, the climatic conditions, variable weather, the ability to work only in summer, and the great distance from Australia all combine to make building a runway in East Antarctica a very difficult task. The planned airfield was unlikely to be in service until the late 2030s. In November 2021, the project was cancelled on cost and environmental grounds.

The Antarctic Region in Twenty Years' Time

Intuitively we know the future is always uncertain; our predictions may or may not eventuate. A way around this dilemma is through using an alternative futures approach. This approach tries to make use of the certainty of uncertainty, initially by being more specific about what uncertainty is. The type of uncertainty encountered in a problem may be conceptually classified as follows:

- **Level 1.** The residual uncertainty is irrelevant to making strategic decisions as robust analysis shows only a single possible future with change linear and evolutionary.
- **Level 2.** The future will be one of two or three discrete scenarios.
- **Level 3.** Although there are only a few uncertain dimensions, analysis is unable to reduce the future to a

limited number of discrete scenarios. A range of futures along a continuum for each identified dimension can be identified. Uncertainty is bounded.

- **Level 4.** The numerous dimensions of uncertainty interact, making it impossible to determine a range of potential outcomes or scenarios, or to identify the relevant variables that will define the future. The uncertainty is unbounded. (Courtney 2001, 15–38)

In applying these uncertainty levels to the future of East Antarctica it is apparent that level 1 is too simplistic as there are many possible futures, not just one. Level 2 is similarly afflicted in that the future, being non-linear and subject to "butterfly" effects, cannot be reduced to only two or three tightly scripted alternatives. However, the chaotic vision of level 4 also seems inappropriate as there are certain dimensions or parameters from the present that carry on into the future. The future will build on the past; it is not totally unbounded.

Level 3 seems the relevant type of uncertainty when considering how East Antarctica may change. This level of uncertainty means little can be accurately predicted based on past events, but it is possible to examine the present and discern important existing trends and emerging drivers. A bounded range of possible futures can be determined, although which specific scenario will eventuate is unable to be ascertained.

Antarctic Alternative Futures

In broad terms, there seems to be some fundamental uncertainties when thinking about Antarctica's future. Twenty-nine states unquestionably want a say in how the ATS evolves. They are already conducting substantial and expensive research activity within Antarctica as part of ensuring they possess ATS decision-making powers. These states all have different agendas and objectives they wish to advance but these will not all be easy to reconcile, and some will probably be in conflict. The ATS governance mechanism will evolve in the future, but how that eventuates is not certain.

The greatest emerging tension seems to be between states that wish to keep Antarctica a pristine wilderness for scientific research and those that

wish to exploit its marine, genetic, and mineral resources. The eventual future balance that will be achieved between these competing interests is uncertain.

Antarctica does not exist in a political void. The twenty-nine states deeply involved in the ATS bring their national ambitions and international relationships with them. Geostrategic stresses affect the Antarctic even as the ATS tries to limit their more harmful aspects. Antarctica's particular uncertainties in relation to governance and resource exploitation are themselves set within the context of the wider international system and its own uncertainties.

Future uncertainties are important, but they are not the whole picture. In thinking about Antarctica's future, distinct continuities, strong trends, and certain assumptions appear evident. In terms of continuities, in the future Antarctica will remain a tough place to get to, work in, and survive in, especially during the winter. Decisions relating to human engagement in Antarctica will take time to be implemented. In general, most activities can only happen during summer months, slowing progress down. Furthermore, such activities are costly, making decision making to fund them usually protracted.

The ATS involves many states, so achieving agreement on new initiatives takes time and patience. In some cases, this is deliberate and institutionalized. The Madrid Protocol, for example, puts off even debating changing Antarctica's resource-exploitation regime until 2048. Of course, states can just ignore the protocol, or flaunt it, but such steps in themselves would impose friction, constraints, and delays. In general, changes in how humans relate to Antarctica or the ATS will remain slow and, for people used to the twenty-first century's frenetic pace, surprisingly seasonal.

Considering trends, the dominant one in the current era is climate change. In this there is no uncertainty: Antarctica will be affected by climate change in all alternative futures. Access for large vessels that are not ice-strengthened is likely to become easier, but sea ice movements may be less predictable and more frequently trap vessels. The easier access combined with a longer summer season will allow more time to undertake scientific research or tourism, but Antarctica's unique flora and fauna will decline as other warmer-weather species move in. In this, the effects of climate change are happening much faster in West Antarctica, where they are

being measured in years. So far, the visible pace of change is slower in East Antarctica, with its much thicker ice sheet, being measured in decades.

More broadly, across the globe there will be a progressive increase in weather variability. Food production will become more difficult through longer droughts and changed temperature patterns. There may be associated population movements, wars, and epidemics. Accordingly, some states may shift their interest and research funding away from costly Antarctic science, with its slow rate of return, toward more pressing, greater-payoff initiatives. The Antarctic may become a less important investment to states as climate change deepens.

The various uncertainties, continuities, trends, and assumptions can be usefully combined using the scenario matrix planning methodology. This uses two selected key uncertainties axes to derive four quadrants, each an alternative future qualitatively different from the others in a logical, non-random way.

Such an endeavour has recently been undertaken in a seminal New Zealand study about Antarctica's futures (Liggett et al. 2017). The axes devised were appropriate for the specific study but have some shortcomings in being particular to Antarctica and so less able to be extended into comparative examinations of Arctic alternative futures. Moreover, they only tangentially situate the future of Antarctica within the wider international system.

Given this chapter's geostrategic thrust, it is useful to place the alternative futures the wide-ranging New Zealand study created within a broadly strategic studies-related framework. To achieve this, a futures framework originally developed to provide strategic insights for the Netherlands and since adopted by the Australian and UK defence forces is useful (Netherlands Ministry of Defence 2010; Department of Defence 2016; UK Ministry of Defence 2018) In this futures framework, the two axes were, first, states having more or less power in the international system and, second, states being co-operative or competitive toward each other. The two axes in crossing create four quadrants: co-operative/less state power, co-operative/more state power, competitive/less state power, and competitive/more state power.

The four alternative futures derived from the New Zealand study have been somewhat modified and then mapped using a geostrategic futures

Table 6.1. Antarctic Alternative Futures

Alternative future	Quadrant	Description
Networked	Co-operative/less state power	ATS becomes regime for the collaborative management of resource exploitation. Focus on technology development and testing to support responsible exploitation. Commercial operators regulated. NGOs become partners in regulation development. Marine resource exploitation expanding, diversification into marine bioprospecting and aquaculture. Tourism declining.
Multilateral	Co-operative/more state power	Maintain ATS governance arrangements. Ongoing national investment in Antarctic science. Highest priorities environmental management and scientific research. Sustainable marine resource exploitation. Fisheries maintained within CCAMLR targets. Marine protected areas established across Southern Ocean. Sustainable tourism but not expanding.
Fragmented	Competitive/less state power	ATS collapsing. Declining national interest in Antarctica with falling investment. States acting independently driven by commercial imperatives. Private investment favoured. Privately owned facilities researching alternative uses for Antarctic resources. Illegal, unreported, and unregulated fishing significantly increases. Land-based niche tourism.
Multipolar	Competitive/more state power	ATS increasingly ignored. States driven by their competing national interests. Focus on technology development to improve exploitation. States make bilateral agreements to assist exploitation. States support commercial ventures and privately owned facilities. Environmental standards only of secondary interest. Tourism expanding with rapid diversification, including developing land-based facilities.

framework onto the four quadrants. This creates four alternative futures, labelled for ease as Networked, Multilateral, Fragmented, and Multipolar. Each alternative future is described in table 6.1 above and in more detail in the text following. Each world is different, although it is possible to imagine how particular current trends when extrapolated might possibly lead to each world in twenty years' time.

None of these four futures is necessarily expected to emerge. Instead, the hope is that the future is broadly captured somewhere within the wide span of possibilities all four worlds cover. Ideally, these four alternative futures bracket the range of future strategic environments that may eventuate. Importantly, no one world is considered more likely than the others. The futures are so developed to both allow the differences between them to be explored and to form the basis for later development of strategies that might try to shape the future in a desired direction.

Multilateral Future

In this alternative future, globalization is ongoing. States are the most important actors in the international system and are focused on making absolute gains through co-operation. States are deeply engaged in strong regional and global multilateral institutions, with the UN playing a particularly important role in global governance. There is a growing sense of global community with foreign aid, foreign direct investment, and subsidies seen as preferred ways to help less-developed countries. The emphasis on co-operation, though, means that to address problems there is a need to build consensus, which can be both difficult and time consuming.

In terms of Antarctica, this future world is essentially a better today. In it, states uphold and strengthen the ATS with scientific research remaining the highest priority. The ATS deepens through better funding of the Antarctic Treaty Secretariat and the development of a wide-ranging co-operative work program among the Antarctic Treaty parties. Sustainable marine resource exploitation continues with krill and finfish catches maintained within CCAMLR targets; a series of marine protected areas is established across the Southern Ocean. The global importance of Antarctic science is increasingly publicly recognized, leading governments to invest more in national and international research initiatives. A mature relationship develops with the tourism industry, thereby enhancing

research opportunities and including citizen science activities. Tourism focuses on sustainability, peaks around 2030, and then plateaus.

Networked Future

In the networked alternative future, globalization is deepening, with non-state actors and states working together to make absolute gains. There are strong regional and global multilateral institutions, including a powerful UN. However, the participants are diverse and dissimilar, ranging across states, large commercial organizations, civil society groups, and non-governmental organizations (NGOs). There is a broadly based global governance regime, a strong sense of global community, and a desire to solve problems through consensus.

This future world envisages states, commercial entities, and non-state actors continuing to support the ATS but with all shifting to a more utilitarian perspective. The ATS is perceived as a regime for the collaborative management of resource exploitation. It is strengthened through increased membership and the negotiation of additional resource-management agreements, including the return of the Antarctic mineral resource convention and negotiation of a convention to regulate bioprospecting. Marine exploitation is expanding on broadly sustainable terms, with diversification into marine bioprospecting and aquaculture. NGOs join the ATS to contribute through a partnership approach to the new sustainable exploitation regulations.

Research activities are increasingly moving to focus on developing the technology appropriate to sustainable resource exploitation. An international association, the Council of Managers of National Antarctic Program, adjusts its focus from coordinating scientific research toward providing education to new commercially oriented operators, together with coordinating safety management and search and rescue activities. Tourism is in decline as the wilderness aspects of Antarctica decline, but some niche and extreme tourism remains.

Fragmented Future

In the fragmented alternative future, globalization is declining. Conflict is persistent and widespread, with non-state actors and states actively competing against other non-state actors and states. All see advantage in

working with other states and non-state actors to advance their aims. The catch cry is "the enemy of my enemy is my friend," with short-term, continually shifting alliances of convenience common.

This future world envisages Antarctica and Antarctic science becoming increasingly irrelevant to governments globally. With the consequent decreasing political and financial investment, the ATS is steadily collapsing. Environmental NGOs continue to advocate for conservation but gain little traction. There is a reduced public awareness of Antarctic issues as the media lose interest in the Antarctic and political commitment to the region becomes largely symbolic.

Reduced funding means international collaboration becomes hard to achieve. Science projects are now small-scale, short-term, and disparate, with many states encouraging national Antarctic programs to seek private investment to support their research. State-owned Antarctic research bases struggle to justify their continuance, become more commercially focused, and are complemented or replaced by private facilities investigating resource-exploitation options. Harvesting of Southern Ocean resources continues, but diminishing international co-operation means the level of illegal, unreported, and unregulated fishing is significantly increasing. As regulation evaporates, tourism moves into land-based facilities offering niche opportunities.

Multipolar Future

In the multipolar world, globalization is splintering, shaped by intense great power competition. Seeking security, small states and middle powers now cluster around these great powers in various types of blocs and alliance structures. The great powers are focused on improving their bloc's relative power, strength, and influence. The great powers may then at times offer military, economic, and diplomatic inducements to attract lesser states to leave existing blocs and join theirs.

In this alternative future, the ATS becomes progressively irrelevant and ignored. States shift from being part of the multilateral governance of scientific research toward making bilateral agreements with others about exploiting mutually beneficial commercial opportunities. States are now focusing on their own individual national or bloc interests and are supporting private ventures and privately owned facilities in the competition

for resources. Environmental standards are of only secondary interest to the companies and states active in Antarctica.

The main research thrust is now on technology for better resource exploitation. The public interest in Antarctica has also become focused on the commercial benefits possible and a range of new entrepreneurial ventures has emerged. Tourism reflects this with a less regulated, more competitive industry that has diversified into land-based hotels and visitor facilities.

Conclusion

The four worlds are all different in particular ways, whether in ATS governance or the emphasis on resource exploitation or scientific research. Only one alternative future is like today.

An important aspect of using alternative futures for thinking is that no single world is more likely than another. Even so, it is interesting to speculate that the world could be moving from our contemporary multilateral, rules-based structure toward one where globalization seemingly splinters and a multipolar world then emerges. Some, sensing the rise of China and the relative decline of the United States, might be tempted to seize on this perspective. On the other hand, as climate change becomes more pronounced and more challenging, it is quite plausible that interest in expensive, long-payoff Antarctic science could markedly decline. Antarctica's future might then be the fragmented world of retrenchment and decline, although for different reasons than postulated in that world's earlier description.

In some respects, such changes have happened before. In the Cold War era, geostrategic imperatives saw "boom times" in Antarctica with relatively liberal funding by many parties involved. This period ended with the drawdown of the Cold War, shifting the justification for Antarctic involvement principally to scientific research payoffs. Today's emerging emphasis on great power competition may lead again to boom times that might be once again truncated, this time by climate change.

There are four possible alternative Antarctic futures, but they will not happen by accident. States and non-state actors can consciously choose their desired future and actively try to make it happen. If they decide not to be activist in this way, then either fate or, most likely, other states and

non-state actors will choose their future for them. In this, the four alternative futures discussed provide a backdrop against which strategies can be devised that allow states and non-state actors to achieve their Antarctic ambitions.

NOTES

1 This chapter draws on Layton, Hallen, and Bishop (2019).

2 Antarctica covers some 14.2 million square kilometres, Australia some 7.6 million square kilometres. Australia's Antarctic claim is 6.0 million square kilometres.

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