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Cold, dark, and dangerous: international cooperation in the arctic and space

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Abstract

This article compares Russian–Western cooperation in the Arctic and Space, with a focus on why cooperation continued after the 2014 annexation of Crimea. On the basis of this comparative approach, continued cooperation is linked to the following factors: (1) the Arctic and Space are remote and extreme environments; (2) they are militarised but not substantially weaponised; (3) they both suffer from 'tragedies of the commons'; (4) Arctic and Space-faring states engage in risk management through international law-making; (5) Arctic and Space relations rely on consensus decision-making; (6) Arctic and Space relations rely on soft law; (7) Arctic states and Space-faring states interact within a situation of 'complex interdependence'; (8) Russia and the United States are resisting greater Chinese involvement in these regions. The article concludes with the following contribution to international relations theory: The more that states need to cooperate in a particular region or issue-area, and the more they become accustomed to doing so, the more resilient that cooperation will become to tensions and breakdowns in other regions and issue-areas. This phenomenon can be termed 'complex and resilient interdependence', to signify that complex independence is more than a description. It can, sometimes, affect the course of state-to-state relations.

Introduction

The Arctic and Space are connected in many ways. The Inuit used the positions of the Sun, Moon and stars to guide their semi-nomadic lives; along with the Aurora Borealis, these celestial bodies feature prominently in their Indigenous knowledge and culture (MacDonald, 1998). The Arctic's climate is a consequence of Earth's orbital mechanics, most notably the tilt of the planet, which leads to the absence of sunlight in winter and 24-hour sunlight in summer. The Arctic is vulnerable to solar flares, which can disrupt electric power grids and radio communications, because the protection provided by the Earth's magnetic fields is weakest near the poles (Cassak et al., 2017). Indeed, during solar storms, airlines avoid transpolar routes or fly at lower altitudes to lessen the radiation exposure to their passengers and crews (Knipp, 2017).

Satellites are vital to Arctic communications, navigation, search and rescue, weather forecasting, sea-ice monitoring, environmental research, fishing, prospecting, forest firefighting, and the detection and tracking of oil spills. Most of the world's remote-sensing satellites, used for everything from intelligence gathering to agriculture to disaster relief, are placed in polar orbits which converge over the Arctic, and the largest commercial ground station is consequently located there (Kongsberg, n.d.).

These connections with Space offer exciting avenues for Arctic studies. For example, more research could be done on the effects of Space-based communications on the languages, cultures, social conditions, and politics of Arctic Indigenous peoples, whose small populations are spread over vast distances (Uden & Doria, 2007). More research could also be done on the effects of remote-sensing technologies on both Arctic science and Arctic security, including drawbacks as well as benefits (Haykin, Lewis, Raney, & Rossiter, 1994). Does remote sensing, while improving awareness, hinder deeper forms of understanding by taking researchers, security personnel, and policymakers away from the land, water, and local residents? A third possible avenue for research concerns the consequences of Space debris in the Arctic, with dozens of planned and unplanned re-entries of rocket stages and satellites taking place in the region each year, sometimes with highly toxic materials on board (Byers & Byers, 2017).

This article pursues a fourth avenue of research by comparing the Arctic and Space as regions of international cooperation, including between Russia and Western states, and exploring why most of this cooperation continued after the 2014 Russian annexation of Crimea. The annexation of Crimea is chosen as a dividing point for the analysis because it caused the most extensive breakdown in Russian–Western relations since the Cold War. Other events, such as the Russian intervention in Syria, have also strained the relationship, but the sections of this article dealing with post-2014 developments encompass their effects (or lack thereof) on Arctic cooperation.

This article begins by comparing Arctic cooperation before and after 18 March 2014—the date when Crimea was formally incorporated into the Russian Federation. It also compares Space cooperation during the same two periods. Based on the similarities that it finds between the two regions, this article then identifies the following eight reasons for continued Russian–Western cooperation: (1) the Arctic and Space are remote and extreme environments; (2) the Arctic and Space are militarised but not substantially weaponised; (3) the Arctic and Space both suffer from 'tragedies of the commons'; (4) Arctic and Space-faring states engage in risk management through international rule-making; (5) Arctic and Space relations rely on consensus decision-making; (6) Arctic and Space relations rely on soft law; (7) Arctic states and Space-faring states interact within a situation of 'complex interdependence'; and (8) Russia and the United States are resisting greater Chinese involvement in the Arctic and Space.

These reasons are not of equal importance; nor must they all be present for cooperation to occur. But as this article demonstrates, in a modest contribution to the larger international relations literature: The more that states need to cooperate in a particular region or issue-area, and the more they become accustomed to doing so, the more resilient that cooperation will become to tensions and breakdowns in other regions and issue-areas. This phenomenon can be termed 'complex and resilient interdependence', to signify that complex independence is more than a description. It can, sometimes, affect the course of state-to-state relations.

Two additional introductory points should be made: First, others have already drawn parallels between the Antarctic and Space, most notably the absence of recognised territorial claims in both regions (Jessup & Taubenfeld, 1959; Kerrest, 2011). But the phenomenon upon which this article focuses, namely extensive and continuing cooperation between Russia and Western states, is more prevalent in the Arctic and Space than it is in the Antarctic. Relatedly, the Arctic and Space are militarised but not weaponised, whereas the Antarctic is quite different, in that it is not militarised at all.

Second, the title of this article requires explanation. It is drawn from an informal practice within the Office of the Legal Adviser at the US State Department, where a single lawyer is charged with responsibility for all the issues arising with regards to both the Arctic and Space. He or she is referred to—with humour as well as insight—as the lawyer for 'cold, dark, and dangerous' places.

Arctic Cooperation

Arctic cooperation before the annexation of Crimea

The Arctic has long been a region of cooperation, including between the United States and the Soviet Union. In 1973, the two countries partnered with Norway, Denmark, and Canada in the Polar Bear Treaty, which prohibited the use of aircraft and large motorised vessels in the hunting of polar bears and thus arrested a deep decline in populations around the Arctic (Canada, Denmark, Norway, USSR & US, 1973). In 1982, the United States and the Soviet Union cooperated in the negotiation of the United Nations Convention on the Law of the Sea (UNCLOS, 1982). A global treaty, UNCLOS contains a number of provisions of direct relevance to the Arctic, including Article 234 on pollution prevention in ice-covered waters, and Article 76 on coastal state rights over continental shelves that extend more than 200 nautical miles from shore.

Cooperation increased as the Cold War drew to a close. In 1987, Soviet leader Mikhail Gorbachev prompted a process of institution building that led—after some additional Finnish and then Canadian leadership—to the Arctic Environmental Protection Strategy in 1991 and the Arctic Council in 1996 (Arctic Council, 1996; Canada et al., 1991; Koivurova & Vanderzwaag, 2007). Significantly, the two languages used at the Arctic Council are Russian and English. And while the Arctic Council does not deal with security matters, it has grown into the central governance mechanism for the region — including through: the initiation of treaty negotiations on search and rescue; oil spill preparedness and response; and scientific cooperation.

In 1998, Russia opened four transpolar air routes that provided significant time and fuel savings for foreign airlines and a revenue stream for Russia in the form of overflight fees (Blagov, 2001). Russia also sought to attract foreign shipping to the Northern Sea Route along its Arctic coastline. In 2011, it created the Northern Sea Route Information Office (now the CHNL Information Office) as a joint initiative of Rosatomflot, a Russian state-owned company, and the Centre for High North Logistics (CHNL), a Norwegian foundation (CHNL, n.d.).

On the security front, several arms control treaties were negotiated within the Organization for Security and Co-operation in Europe (OSCE). The 1990 Treaty on Conventional Armed Forces in Europe set limits on military equipment positioned between the Ural Mountains and the Atlantic Ocean, thereby including the Arctic regions of Western Russia, Finland, Sweden, and Norway (OSCE, 1990). The 1992 Treaty on Open Skies provided for reciprocal surveillance flights, including Russian flights over Canada and the United States, and flights by Canada, the United States, and other Western countries over Russia (OSCE, 1992).

As the Cold War faded into history, meetings and joint exercises between Arctic militaries became commonplace. The annual Arctic Security Forces Roundtable was established in 2011 as an informal venue for discussions among military generals from the eight Arctic states (Russia, the United States, Canada, Denmark, Iceland, Norway, Sweden, Finland) plus France, Germany, the Netherlands, and the United Kingdom (Foughty, 2014). Russia and the United States partnered in the Northern Eagle naval exercise in the Barents Sea on a biennial basis, beginning in 2004 and including Norway from 2008 (Daniels, 2004; Henry, 2011). Russian, American, and Canadian fighter jets took part in the Vigilant Eagle exercises from 2008, responding to mock hijackings of commercial aircraft in international airspace between the Russian Far East and Alaska (North American Aerospace Defense Command, 2013).

Even the strategic nuclear balance, which is based on intercontinental ballistic missiles (ICBMs) designed to fly through Space over the Arctic, has long involved a degree of Soviet/Russian–Western cooperation. This cooperation began in 1969 with the Strategic Arms Limitation Talks between the Soviet Union and the United States, which led to two treaties: the 1972 Anti-Ballistic Missile Treaty (ABM Treaty) and the 1972 Interim Agreement on Limitation of Strategic Offensive Arms (US & USSR, 1972b, 1972c). More progress was made after the Cold War with the conclusion of the 1991 Strategic Arms Reduction Treaty (START I) and the 1993 Strategic Arms Reduction Treaty (START II) (US & USSR, 1991, 1993). Although President George W. Bush renounced the ABM Treaty in 2002, he concluded the Strategic Offensive Reductions Treaty (SORT) with Russia that same year (US & USSR, 2002). SORT remained

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in force until 2010, when President Barack Obama negotiated a third Strategic Arms Reduction Treaty (NEW START) with Russia (US & USSR, 2010).

Arctic cooperation after the annexation of Crimea

Most military cooperation in the Arctic was suspended after Russia annexed Crimea in March 2014. The biennial US–Russia–Norway naval exercise Northern Eagle was cancelled (LaGrone & Majumdar, 2014) and cooperation between NATO and Russia was curtailed (NATO, 2017). Only essential channels of communication were kept open: For instance, naval commanders on opposite sides of the Russia–Norway boundary in the Barents Sea, which is proximate to large Russian naval facilities, continued talking on a weekly basis in order to avoid misunderstandings and accidents (Østhagen, 2016). Even the strategic nuclear balance came under strain, with US President Donald Trump announcing his country's withdrawal from the Intermediate-Range Nuclear Forces Treaty (INF Treaty) in October 2018 (Reuters, 2018). But while both Russia and the United States had repeatedly accused the other of violations of the INF Treaty, another factor in the breakdown seems to have been the failure of US efforts to bring China into this treaty, with the concern being that China's development of intermediate-range nuclear weapons could put US allies and forces in Southeast Asia at risk (Hellman, 2018).

In the summer of 2014, the United States, European Union, Canada, and Norway coordinated a series of economic sanctions and diplomatic measures that targeted key Russia sectors such as energy, banking, and defence. They also imposed travel bans on some Russian Government officials as well as arms embargoes and restrictions on access to Western capital and technologies (Myers & Baker, 2014; Reuters, 2014a, 2014b). The same countries prohibited Western companies from providing goods, services, or technologies for offshore oil projects in the Russian Arctic (Mohammed & Trott, 2014), forcing Exxon to cancel a joint venture with Rosneft (Holter, 2014). Russia responded with sanctions against food imports (BBC News, 2014). However, some trade continued, most notably in Russian natural gas—much of it produced in the Arctic.

Cooperation on search and rescue also continued. In December 2014, Russian officials requested assistance from the US Coast Guard after a South Korean fishing trawler sank inside the Russian search and rescue zone in the Bering Sea (Parfitt, 2014). The annual Norway–Russia 'Exercise Barents' still takes place each year (Nilsen, 2018; Staalesen, 2017), as does the Norway–Sweden–Finland–Russia 'Barents Rescue Exercise' (Joint Committee on Rescue Cooperation in the Barents Region, n.d.). Joint exercises under the Arctic Search and Rescue Agreement have also continued (Canadian Armed Forces, 2016). In 2015, the eight Arctic states created the Arctic Coast Guard Forum, which meets on an annual basis 'to focus on and advance operational issues of common interest in the Arctic, such as search and rescue, emergency response, and icebreaking' (Sevunts, 2015).

Fisheries cooperation continued, with Norway and Russia setting annual quotas together in the Barents Sea (Nilsen, 2017; Sætra, 2018). In 2015, the five Arctic Ocean coastal states adopted a declaration on the central Arctic Ocean in which they signalled their intent to prevent unregulated commercial fishing in that area of the high seas by ships flying their flags, and to seek similar commitments from non-Arctic states (Canada, Denmark, Norway, Russia, & US, 2015). In 2017, they were joined by China, Japan, South Korea, Iceland, and the European Union in a treaty that commits them to refrain from commercial fishing in the central Arctic Ocean until scientific evidence supports its opening (European Commission, 2017). Shipping cooperation also continued, with Western cruise companies chartering Russian Government-owned research vessels for Arctic voyages (Canadian Press, 2014; One Ocean Expeditions, n.d.), Western shipping companies sending vessels through the Northern Sea Route (Northern Sea Route Administration, n.d.), and the Polar Code, which sets new safety and pollution rules, being adopted by the International Maritime Organization in November 2014 (2014).

The Arctic Council was not significantly affected by the annexation of Crimea. The biannual meetings of the Senior Arctic Officials continued with Russian delegates always present. In 2015, the Arctic Council established a task force on Arctic marine cooperation (Arctic Council, 2015a), a decision that required Russia's support as the Arctic Council operates on the basis of consensus. A Scientific Cooperation Task Force, created in 2013, continued to meet regularly under the joint chairmanship of Russia and the United States (Arctic Council, 2016), with the resulting Agreement on Arctic Scientific Cooperation being adopted in 2017 (Arctic Council, 2017a). Most importantly, Russia joined in the declarations adopted at the 2015 and 2017 ministerial summits, thus allowing the United States and Finland to proceed with the programs for their two-year chairmanships (Arctic Council, 2015a, 2017b).

The UNCLOS process for determining the extent of coastal state rights over sea bed resources was likewise unaffected by the annexation of Crimea. In November 2014, Denmark filed a submission with the Commission on the Limits of the Continental Shelf that extended along the Lomonosov Ridge right up to Russia's 200 nautical mile exclusive economic zone (Denmark & Greenland, 2014). Instead of reacting negatively, the Russian Foreign Ministry stated:

> Russia was well aware of the Danish side's plans. Our countries have cooperated actively on this issue . . . and they will continue to cooperate on this issue. (Ministry of Foreign Affairs of the Russian Federation, 2014)

The Russian Foreign Ministry noted that both countries were following an established process, and confirmed that after the Commission finished its work:

> Possible adjoining sections of our countries' continental shelf in the high Arctic latitudes will be demarcated on a bilateral basis, through negotiations and in line with international law. (Ministry of Foreign Affairs of the Russian Federation, 2014)

Space Cooperation

Space cooperation before the annexation of Crimea

During the early Cold War, as the United States and the Soviet Union were building ICBMs designed to fly through Space, they were also negotiating four multilateral treaties setting out rights and duties for Space-faring states: the 1967 (Outer Space Treaty, 1967) Rescue Agreement, 1972 Liability Convention, and 1975 Registration Convention (Liability Convention, 1972; Outer Space Treaty, 1967; Registration Convention, 1975; Rescue Agreement, 1967). Key elements of these treaties included: a freedom of exploration and use of Space; a prohibition on the national appropriation of the Moon and other celestial bodies; a prohibition on the deployment of nuclear weapons in Space; and a commitment to rescue and return astronauts in distress.

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In 1972, the United States and the Soviet Union entered into a bilateral agreement on Space cooperation which led, three years later, to the first joint US–Soviet mission (1972a). The Apollo–Soyuz Test Project involved a docking between two spacecraft, followed by 20 hours of joint activities by the crews (NASA, 2010). Another marker of cooperation occurred in 1978 after Cosmos 954, a Soviet nuclear-powered reconnaissance satellite, malfunctioned and re-entered the atmosphere with more than 50 kilograms of Uranium-253 on board (Cohen, 1984). The debris was scattered across the Canadian Arctic and, after an expensive recovery effort, Canada requested $6 million in compensation. The Soviet Union denied legal responsibility but paid half of the requested amount to the NATO country (Canada & USSR, 1981).

Search and rescue beacons are ubiquitous in the Arctic today, but only exist because of an exercise in international cooperation that dates to 1979 when the United States, Soviet Union, Canada, and France initiated the International Cospas-Sarsat Programme (Levesque, 2016). The first rescue took place in 1982 in northern Canada, just weeks after the first satellite in the system, COSPAS-1, was launched by the Soviet Union (Levesque, 2016). In 1988, the four states formalised their cooperation in the International Cospas-Sarsat Programme Agreement (Canada, France, USA & USSR, 1988). Today, Cospas-Sarsat is an international organisation with a secretariat located in Montreal. It uses a network of satellites that provides coverage of the entire planet, including five satellites in low Earth polar orbit, eight satellites in geostationary orbit, and 37 satellites in medium Earth orbit (Inside GNSS, 2018). The satellites are owned and operated by Russia, the United States, Canada, France, the European Union and EUMETSAT, the European Organisation for the Exploitation of Meteorological Satellites. More than 200 countries and territories benefit from the service, which is provided at no cost, either to the owners of the beacons or to the governments receiving notice (including the precise location) of any beacon activated on their territory or off their coastline.

During the Cold War, the United States and the Soviet Union also began cooperating on the allocation of radio frequencies and 'slots' in geostationary orbit (Doyle, 1987). They did so because communications satellites can interfere with one other if broadcasting on the same frequency without sufficient physical distance between them. Moreover, the limited amount of space in geostationary orbit—which is due to the fact a satellite in this orbit must be locked into position above a particular point on the Earth's equator, by placing it at the exact altitude where it falls forward at precisely the same speed as the planet rotates beneath it—provided further incentive for this cooperation. Their mechanism for this cooperation was an organisation created during the 19th century, the International Telecommunication Union (ITU, n.d.).

Russia's involvement in the International Space Station (ISS) resulted from the United States' desire to engage that country in cooperation during the early post-Cold War period (Sheehan, 2007). Russia had much to offer in terms of technology and experience, particularly in long-duration Space flights. Just as important, its Space scientists were facing unemployment due to the country's steep economic decline. Had they not become engaged in new projects, their knowledge might have been acquired by governments hostile to the United States (Muir-Harmony, 2017; Sheehan, 2007). The United States paid most of the costs of the ISS, while treating Russia as a full partner (US General Accounting Office, 1994). When the Space Shuttle program was shut down in 2011, the United States and other Western countries began paying for Russia to transport their astronauts to-and-from the ISS on Soyuz spacecraft (Newton & Griffin, 2011). The same motivation—keeping Russian scientists employed at home—underlay the United States' decision to use Russian-made RD-180 engines for its Atlas rockets, which entered into service in 2002 (Daniels & Perez, 2007).

The Space-faring states began cooperating in the tracking of Space debris—defunct satellites, spent rocket stages, and fragments resulting from collisions—in the late 1980 s (Johnson, 2014). Today, tens of thousands of pieces of debris are detected, tracked and catalogued by the US military's Space Surveillance Network, which identifies potential collisions and shares this information freely (NASA Orbital Debris Program Office, 2018). Sometimes, advance warning of a collision can provide time for an endangered satellite to be moved to a safer orbit using on-board thrusters (Pelton, 2013). The International Space Station has engaged in evasive action on at least 20 separate occasions since 1998 (NASA Orbital Debris Program Office, 2016).

Last but not least, Russia has cooperated with Western companies in the commercial market for satellite launches. International Launch Services, which sells launches to geostationary orbit on Proton rockets, began in 1995 as a joint venture between Lockheed Martin and Khrunichev State Research and Production Space Centre (Daniels & Perez, 2007). Although the Russian state-owned company acquired Lockheed Martin's stake in 2008, International Launch Services remains incorporated and headquartered in the United States. Cooperation between Russia and Western companies in this domain also includes Eurockot Launch Services, which was founded as a German–Russian joint venture in 1995. It provides launches to low Earth orbit using 'Rockots', which are refurbished SS-19 intercontinental ballistic missiles. Today, 51 percent of the company is owned by the European multinational ArianeGroup; the other 49 percent is owned by the Khrunichev State Research and Production Space Centre (Eurockot Launch Services GmbH, n.d.). ArianeGroup also offers launches via its subsidiary, ArianeSpace, which uses Soyuz-ST rockets as one of its three types of launch vehicles. Forty-seven of these rockets—purchased from Roscosmos, the former Russian Space agency and now a Russian state-owned company—have been employed by ArianeSpace since 2011 (Arianespace, 2019).

Space cooperation after the annexation of Crimea

Russia and Western states continued to cooperate in Space after the annexation of Crimea. The ISS has been functioning normally, with Western astronauts travelling there in Soyuz spacecraft. Indeed, since the annexation in March 2014, NASA has booked an additional seven seats on Soyuz and taken out options on three more (Grush, 2016; O'Kane, 2017). The Cospas-Sarsat Programme is functioning normally and Russian-made RD-180 engines are still being used to launch US intelligence and military satellites. Although plans to replace the RD-180 with a US-made engine gained impetus from the annexation of Crimea (Ferster, 2014), the replacement engine is still years away. In 2016, the US Congress approved the purchase of an additional 18 RD-180 engines: enough to last until 2022 (King & Troyan, 2016).

All three of the commercial launch services based on Russian–Western cooperation continued to operate after the annexation of Crimea. Since March 2014, 12 commercial launches for Western customers have taken place on Protons, 3 on Rockots, and 18 on Soyuz STs (Space Launch Report, n.d.). Russia and the United States continue to share some information on Space debris, with the US military remaining at the centre of this international cooperation (Henry, 2018). The two countries also continue to observe the ban on the deployment of nuclear weapons in Space and, notwithstanding President Donald Trump's plans for creating a US Space Force, are refraining from testing anti-satellite weapons in ways that might create Space debris. As General John Hyten, the current head of US Strategic Command, stated in 2015:

> Kinetic [anti-satellite weaponry] is horrible for the world ... And to me, the one limiting factor is no debris. Whatever you do, don't create debris. (Billings, 2015)

In 2017, Trump redirected NASA's plans for human Space travel towards the Moon rather than Mars. NASA responded by proposing the Lunar Gateway, a Space station in cis-lunar orbit that would serve as a staging point for access to the Moon's surface as well for deep Space missions (NASA, 2017). Later that year, NASA and Roscosmos issued a joint statement on cooperation in pursuit of this objective (Weitering, 2017).

Russia and Western states are also cooperating with regards to natural hazards in-and-from Space, including through the International Asteroid Warning Network, created in 2013 to facilitate cooperation between observatories and Space institutions in discovering, monitoring, and characterising potentially hazardous near-Earth objects (NEOs) (International Asteroid Warning Network, n.d.). Russia is similarly working with Western states in the Space Mission Planning Advisory Group, an association of national Space agencies that was established in 2014 to 'prepare for an international response to a NEO threat through the exchange of information, development of options for collaborative research and mission opportunities, and to conduct NEO threat mitigation planning activities' (European Space Agency, n.d.). Last but not least, Space weather (that is solar storms) has become another subject of Russian–Western cooperation through the recent establishment of expert and working groups within the United Nations system as part of the Space 2030 Agenda and UNISPACE+50 exercise (St. Pierre, 2017).

In short, both the United States and Russia are still cooperating in Space, and appear intent on continued cooperation. In April 2018, Russian President Vladimir Putin said:

> Thank God, this field of activity is not being influenced by problems in politics. Therefore, I hope that everything will develop, since it is in the interests of everyone, in the interests of all humankind. ... This is a sphere of activity that unites people. (President of Russia, 2018)

Reasons for Continued Cooperation

There are a number of reasons for continued Russian–Western cooperation in the Arctic and Space; reasons that overlap with each other. These reasons are not of equal importance; nor must they all be present for cooperation to occur.

The Arctic and Space are remote and extreme environments

The first reason for continued cooperation concerns the 'cold, dark, and dangerous' characters of the Arctic and Space. In every region of the world, natural factors such as geography, climate, and the presence or absence of resources play a role in national interests and policy preferences. In the Arctic and Space, a combination of remoteness and extreme conditions makes almost any activity very expensive.

These high expenses, in turn, create an incentive for cooperation and burden-sharing. As Vladimir Putin said in 2010:

> If you stand alone, you can't survive in the Arctic. Nature makes people and states to help each other. (Harding, 2010)

Examples of how states cooperate to overcome remoteness, extreme conditions, and high expenses abound in the Arctic and Space. For instance, the states which contribute their satellites and ground stations to the Cospas-Sarsat Programme all obtain much greater coverage and therefore faster notification of distress signals than they could ever obtain on their own, given the high costs of building, insuring, and launching satellites. This then saves them money by taking the 'search' out of search and rescue—a matter of no small importance for the Soviet Union/Russia, the United States, Canada, and France, which created the Cospas-Sarsat Programme and have some of the world's largest maritime zones. Similarly, all the states involved in the ISS benefit scientifically and commercially from having a laboratory in micro-gravity (Rai et al., 2016). Yet the cost of building and operating such a large, multi-functional, and long-lasting Space station would be prohibitive for any single state, including the United States (Zimmerman, 2003).

States also have a shared interest in cooperation as an antidote against conflict, especially in remote and extreme environments where military preparations and activities can be punishingly expensive. The OSCE's 1992 Treaty on Open Skies enabled the verification of arms control agreements. The Arctic Council was created, in large part, to foster communication, build confidence, reduce tensions, and thus help to prevent conflict in the post-Cold War period (English, 2013). The greatest accomplishment of the Arctic Search and Rescue Agreement may have been to regularise contact, and therefore confidence-building, among the militaries and coastguards of the eight Arctic states (Exner-Pirot, 2012). The creation of the Arctic Coast Guard Forum has carried this development further. In Space, one of the motivations for the Cospas-Sarsat Programme was to continue the cooperation and confidence-building that had developed—during the Cold War—as a result of the Apollo–Soyuz Project (Jamgotch, Knappet, & Carpio, 1988). In the 1990s, the same motivation led to Russia being invited to participate in the ISS as a full partner, despite the United States shouldering most of the cost. The recent inclusion of Russia as the United States' primary partner in the Lunar Gateway is a continuation of this policy—taking collaborative, confidence-building steps that reduce tensions and thus help to prevent conflict.

The Arctic and Space are militarised but not substantially weaponised

From a security perspective, the Arctic and Space have long been 'militarized' but not substantially 'weaponized'. Militarisation is the use of a region for the transportation of personnel and weapons as well as the placement of supporting equipment, whereas weaponisation involves the actual placement of weapons in the region (Sheehan, 2007). By avoiding the weaponisation of a remote and environmentally extreme region, states can avoid what might otherwise be punishingly high costs. Avoiding weaponisation will also facilitate international cooperation and therefore the advancement of mutual interests within a region. And one of the usual drivers for weaponisation—the so-called 'security dilemma'—will be easier to avoid in the Arctic and Space because of the relative ease with which the activities of other states can be monitored there.

The Arctic Ocean, located directly between the United States and the Soviet Union, was a key staging point for nuclear weapons during the Cold War. Long-range bombers circled over the ocean,

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waiting for the signal to fly deep into the other country to drop their nuclear bombs. Nuclear missile submarines conducted parallel operations under the sea-ice, and radar systems and acoustic sensors were built to surveil all this activity. But neither side was preparing to fight a war in the Arctic; the region was an avenue for transporting weapons to targets much further south, with the supporting infrastructure limited to runways and surveillance equipment.

The end of the Cold War saw a steep decline in Russia's military spending, with the country closing many of its Arctic airbases and allowing the Northern Fleet to atrophy. More recently, Russia sought to arrest the decline by resuming bomber flights, building new submarines, and re-opening airbases (BBC Monitoring Former Soviet Union, 2018). But most of the reinvestment in Arctic-specific equipment and infrastructure has focused on search and rescue and 'constabulary' capabilities associated with increased civilian activity such as shipping and oil drilling (Gurzu, 2016; Staalesen, 2016). Although Western commentators sometimes point to Russia's substantial naval presence on the Kola Peninsula as evidence that the Arctic has been weaponised, submarines and warships are not based on the Kola Peninsula because it is in the Arctic. Rather, they are based there because the Barents Sea is ice-free throughout the year, providing assured access to the Atlantic Ocean. This access is important for Russia because it has relatively little access to open ocean, despite being the world's largest country.

Except in Norway, which shares a land border with Russia, NATO countries have never prepared for a war in the Arctic. Most armed forces are stationed in more southern regions. Canada, for instance, has 68,000 full-time military personnel, but only 200 of them are based in the northern territories that make up 40 percent of its landmass (Canadian Army, 2018; Kalvapalle, 2018). US bases in Alaska are focused on the Russian Far East, North Korea, and China, not the Arctic Ocean. The United States does not have a single deep-water port along its Arctic coastline.

Space is heavily militarised, with thousands of military satellites having been launched since the 1950s for communications, surveillance, situational awareness, and targeting (Sheehan, 2007). Modern militaries are dependent on satellites, to the point where 'fifth generation' fighter jets and armed drones cannot operate to their full capabilities without space-based broadband (Thompson, Gagnon, & McLeod, 2018). GPS was developed for military purposes and is a key component of precision-guided missiles, bombs, and artillery. And while the militarisation of Space slowed at the end of the Cold War, it accelerated after President George W. Bush renounced the Anti-Ballistic Missile Treaty in 2002 and initiated US missile defence. Today, roughly half of the satellites in operation are military or dual-use satellites, that is to say, satellites, such as GPS, which serve both military and civilian purposes (Freeland, 2016).

To the degree that Space was ever weaponised, this occurred due to the testing of anti-satellite (ASAT) weapons during the Cold War. These weapons ranged from ground-based missiles, lasers, and jammers to Space-based 'killer satellites' designed to crash into other satellites, capture them, or nudge them off course (Moltz, 2014). But it is unclear whether any ASAT weapons are currently deployed in Space, and no such weapon has ever been used against a satellite from another country. As will be discussed below, in 2007, a Chinese ASAT test produced tens of thousands of pieces of Space debris, leading states to subsequently refrain from any testing of 'kinetic' ASAT weapons, that is to say, weapons which rely on violent impacts. They have done so because of widespread concern about the risk of 'runaway' Space debris, whereby collisions between two pieces of debris create thousands of smaller pieces, followed by more collisions, and so on (Billings, 2015).

There are a number of possible explanations for the militarised-but-not-weaponised character of the Arctic and Space. First, remoteness and extreme conditions make it difficult and expensive to design, construct, and deploy weapons for-and-in these regions. The same is true of the training, equipping, and deploying of troops. The large exercises that do take place are generally confined to the European and western Russian Arctic, which benefit from ice-free waters and relatively warm temperatures due to the effects of the Gulf Stream. Military exercises in the North American Arctic, with its persistent sea-ice and punishing climate, tend to be much smaller—because of the difficulty and expense as well as the related absence of threats. In 2009, Canada's then-Chief of the Defence Staff, General Walter Natynczyk, said: "If someone were to invade the Canadian Arctic, my first task would be to rescue them" (Deshayes, 2009). On another occasion, Natynczyk commented that it costs more to deploy a Canadian soldier to the Canadian Arctic than to Afghanistan (Canadian Press, 2011).

Troops have never been deployed in Space, nor is this likely to happen. Humans can only exist in Space within complex and expensive life support systems, leaving remotely operated (and now artificial intelligence) systems as much more attractive options.

Second, all of the Arctic states have undisputed rights over vast landmasses and extensive maritime zones. Indeed, the only disputed land in the Arctic is a 1.3 km^2 islet located halfway between Canada and Greenland, and the only two disputed maritime boundaries are between NATO countries, namely Canada and the United States, and Canada and Denmark (Byers, 2013). As a result, there is no reason for any of the Arctic states to desire more of the Arctic, or to have any interest in fighting over it.

As for Space, technology has not yet advanced to the point where states could benefit from claims to the Moon, asteroids, or other celestial bodies; they therefore have no interest in preparing for conflicts over them. And while Earth orbit is relatively easy to reach, satellites are fragile pieces of equipment that follow predictable trajectories; they are therefore much easier to attack than to defend. Moreover, it is widely accepted that runaway Space debris—of the kind that would result from the use of kinetic ASAT weapons—could cause severe damage to the global economy and therefore to every state. Together, these factors create a situation of mutually assured destruction with regard to communications and remote-sensing satellites, were an armed conflict ever to break out in Space.

Last but not least, it is relatively easy—especially with modern Space-based technologies—to gather information about military activities in the Arctic and Space, as compared to other regions, because of the relative absence of other human activities as well as trees, buildings, and other objects that might offer concealment. One example of this concerns how Arctic countries have invested in synthetic aperture radar satellites which can identify and track ships from Space, even at night and through clouds (Canadian Space Agency, 2018; European Space Agency, 2012a, 2012b). Another example concerns how amateur astronomers are able to identify the presence and orbits of new military satellites, notwithstanding the efforts of governments and launch providers to keep this information secret (Nash, 2012). This last factor enables Arctic and Space-faring states to avoid the classic 'security dilemma', whereby states feel compelled to build up their military capabilities in an escalating series of responses to suspected increases by others (Herz, 1950; Jervis, 1978; Booth & Wheeler, 2007).

The Arctic and Space both suffer from 'tragedies of the commons'

The Arctic and Space both suffer from 'tragedies of the commons': environmental crises that can only be resolved through the coordinated actions of everyone involved, with no free riders (Hardin, 1968). The presence of tragedies of the commons helps to explain the continuance of international cooperation in these two regions.

Persistent organic pollutants, mercury, chlorofluorocarbons, and carbon dioxide have all caused widespread harm to Arctic ecosystems and people, the latter two through their effects on the atmosphere. The first three of these problems are now being addressed by effective international instruments, namely the Stockholm Convention, the Minamata Convention, and the Montreal Protocol (UNEP, 1987, 2001, 2013). The Arctic dimension was particularly important during the negotiation of the Stockholm Convention, with the Inuit Circumpolar Council playing a decisive role (Watt-Cloutier, 2016). The Arctic dimension has also been important in international negotiations on the carbon dioxide emissions behind climate change, even though the results of those negotiations have been ineffective—so far. Nevertheless, the Arctic countries are making progress on collaborative efforts to reduce 'black carbon', which is produced by the burning of diesel and high-sulphur fuel oils and accelerates the melting of snow and ice by changing their albedo (Arctic Council, n.d.).

In Space, the tragedy of the commons involves the proliferation of debris in orbit. Space debris is the legacy of more than 5,000 orbital-rocket launches since 1957. According to the most recent scientific estimates, there are roughly 170 million pieces of debris in orbit, with 750,000 of them being larger than 1 cm (European Space Agency, 2013, 2018). Some pieces are dysfunctional satellites; others are discarded rocket stages; a few are tools lost by astronauts during space walks. Most are the result of collisions between such objects—at relative speeds of up to 56,000 km/h—which can turn two large objects into very many small ones.

In 2007, China tested its ability to destroy operational satellites by targeting a defunct satellite with a ground-based missile (Kaufman & Linzer, 2007). It was the worst debris-generating event on record, creating approximately 35,000 pieces larger than one centimetre (Keslo, 2007). This represented a 20 percent increase in objects in orbit, with a consequential 37 percent increase in predicted collisions (Keslo, 2007). A growing collision rate is characteristic of the 'Kessler Syndrome', named after a NASA scientist who in 1978 warned that once a certain amount of debris exists in orbit, debris–debris and debris–satellite collisions will lead to a continuously increasing collision rate (Kessler & Cour-Palais, 1978). This is because each fragmentation of a space object increases the surface area of the material, which increases the probability of another collision. Space debris thus threatens the global economy, which increasingly relies on satellites, as well as humanity's long-term access to Space and other celestial bodies (Garcia, 2013).

Space debris can be addressed through technological innovation and international cooperation, as was done with persistent organic pollutants, mercury, and chlorofluorocarbons. Preventing runaway Space debris will require that satellites be deorbited, boosted into graveyard orbits, or removed by specially designed spacecraft at the end of their operational lives. Russia, the United States, and other countries are already cooperating on this issue: more than 23,000 pieces of Space debris have been detected, tracked and catalogued using Earth-based and Space-based radar and telescopes. As mentioned, this information is widely shared, since advance warning of collisions can provide time for endangered satellites to be moved to safer orbits using on-board thrusters. In addition, NASA and the European, Japanese, and Chinese space agencies are researching ways to remove derelict satellites from orbit (NASA, n.d.; European Space Agency, 2016; Okada, 2017; Wen et al., 2018). Perhaps most important, states, after seeing the consequences of the 2007 Chinese test, have refrained from testing ASAT weapons in ways that could create long-lasting Space debris.

Again, tragedies of the commons can only be resolved through the coordinated actions of everyone involved. In the Arctic and Space, Russia and Western states have proved able to cooperate on these issues, at least where there are technological alternatives to the equipment or processes causing the problem, and where the costs associated with inaction are high. The challenges posed by persistent organic pollutants, mercury, chlorofluorocarbons, carbon dioxide, and Space debris cannot explain all of the cooperation taking place in these regions, but they are clearly contributing factors.

Arctic and Space-faring states engage in risk management through international law-making

Arctic and Space-faring states have a shared interest in avoiding the uncertainties and related challenges and expenses that would result from an absence of rules. As a consequence, every ship and spacecraft must be registered with a national government (UNCLOS, 1982, Art. 91; Registration Convention, 1975). Rules on liability for accidents are set out in treaties, backed up by globally accepted customary international law on state responsibility (Crawford, 2002; International Maritime Organization, 1969; Liability Convention, 1972). International rules also exist to protect and manage common spaces such as the high seas, deep sea bed, Earth orbits, and asteroids. The rules are more advanced and detailed with regard to the Arctic, as a result of the much earlier exploration and development of the oceans, which led to customary international law, the 1958 Geneva Conventions, and the 1982 UNCLOS—the so-called 'Constitution for the Oceans' (Rothwell & Stephens, 2016). But the negotiators of the 1967 Outer Space Treaty were addressing very similar issues when they prohibited national appropriation of the Moon and other celestial bodies.

The first attempt to add detail to that prohibition proved unsuccessful when the 1979 Moon Agreement received only 18 ratifications, none of them from states with space launch capabilities (Lefeber, 2016). But while the Agreement controversially specified that the Moon and its natural resources are the 'common heritage of mankind', it also declared that:

> States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible. (Moon Agreement, 1979, Art. 12(5))

It further provided that the UN Secretary General 'shall, at the request of one third of the States Parties to the Agreement and with the concurrence of the majority of the States Parties, convene a conference of the States Parties to review this Agreement' (Moon Agreement, 1979, Art.18). Today, this provision presents the opportunity to negotiate a Space mining regime—among

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the 18 States Parties, who would be free to invite other interested states—that protects common interests while being open to private companies (Koch, 2018). Part XI of UNCLOS provides an instructive precedent. Initially adopted as a common heritage regime that allowed only national governments to access the deep sea bed, Part XI was modified a decade later to open the regime to private companies—under the oversight of the same International Seabed Authority that had been created to regulate mining by governments (Bezpaiko, 2004).

In addition to providing an incentive for international cooperation, the management of risks through international rules can be self-reinforcing: first, through the obligatory character of the rules themselves; and second, through the benefits they deliver—such as predictability and transparency. The international cooperation involved in international law-making can also lead to additional international law-making, as diplomats and other experts exploit their now-developed connections to seek additional benefits through more cooperation. Risk management though international law-making is particularly important in the Arctic, Space, and other 'areas beyond national jurisdiction', where the legal and political arms of individual states cannot deliver the same stability and certainty as within their borders and boundaries.

Arctic and Space relations rely on consensus decision-making

International cooperation in the Arctic and Space has long relied on consensus decision-making. Article 7 of the 1996 Ottawa Declaration specifies that 'Decisions of the Arctic Council are to be by consensus of the Members' (Arctic Council, 1996). The UN Committee on the Peaceful Uses of Outer Space (COPUOS) also uses consensus decision-making, even though the use of consensus is not specified in either General Assembly Resolution 1348 (XIII) which created the Committee in 1958, or Resolution 1472 (XIV) which made it permanent in 1959.

Due in part to consensus decision-making, both the Arctic Council and COPUOS have accomplished a great deal, including during tense periods in the relationship between the Soviet Union/ Russia and Western states. The Arctic Council has produced dozens of influential reports, including the seminal 2004 Arctic Climate Impact Assessment, and initiated the negotiation of three multilateral treaties. COPUOS laid the groundwork for dozens of UN General Assembly resolutions, including the pivotal 'Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space' (UN General Assembly, 1963). The Declaration, adopted in 1963, provided most of the substance for the four core multilateral treaties on Space. More recently, COPUOS responded to the 2007 Chinese ASAT test by adopting seven Space Debris Mitigation Guidelines, the fourth of which reads:

> Recognizing that an increased risk of collision could pose a threat to space operations, the intentional destruction of any on-orbit spacecraft and launch vehicle orbital stages or other harmful activities that generate long-lived debris should be avoided. When intentional break-ups are necessary, they should be conducted at sufficiently low altitudes to limit the orbital lifetime of resulting fragments. (COPUOS, 2010)

Again, COPUOS operates on the basis of consensus. This means that China chose not to block the adoption of the guidelines, which were then endorsed by the UN General Assembly (2007) and have since been followed by all the Space-faring states.

There are several explanations for the reliance on consensus decision-making in the Arctic and Space. First, consensus decision-making works best when there is an alignment of interests, as is often the case in remote and environmentally hostile regions. When there is an alignment of interests, no state is motivated to disagree.

Second, consensus decision-making does not mean equality of power and influence. As Paul Reuter explained:

> Consensus may perhaps oblige the strongest to make certain sacrifices, but it sacrifices the viewpoint of another minority: the one which is not strong enough to make the consensus process fail; . . . in spite of the *apparent unanimity* which it represents, it constitutes an instrument of coalition against those who are isolated. (Reuter, 1967, my translation, emphasis added)

In other words, although each state in a consensus decision-making system could act as a spoiler, this fact provides an incentive for the other states to signal to any potential spoiler that the costs imposed for blocking consensus would be higher than any possible gains. Consensus decision-making can thus conceal and perhaps even facilitate the application of power. Decision-making by means of voting is different: although still open to applications of power, the process of calling a vote legitimises opposition by a single or small number of states.

The Arctic Council and COPUOS have always included two particularly powerful states. Consensus decision-making makes it easier for the United States and Russia to achieve their desired outcomes, at least on issues of significant concern to them, while preserving the appearance of unanimity.

Third, consensus decision-making protects the core interests of powerful states. This is because each powerful state, like the less powerful states, has the capacity to act as a spoiler. But unlike less powerful states, each powerful state is also capable of withstanding the pressure to support consensus. This feature—the capacity to act as a spoiler in both theory and practice—makes consensus-based systems particularly attractive to powerful states and ensures their continued support, even during otherwise tense periods in international relations. Indeed, for powerful states, the requirement of consensus serves the same function as the vetoes held by the permanent members of the UN Security Council: protecting the core interests of the state using the veto. Incidentally but importantly, consensus decision-making and vetoes also protect the institutions in which they are used, by acting as safety valves that suspend decision-making in circumstances where the institutions might otherwise implode from the pressure of irreconcilable interests (Weiss, 2003).

These three features of consensus decision-making help to explain why Russia and Western states have continued to cooperate in the Arctic and Space despite the tensions and breakdowns in other regions and issue-areas. Consensus decision-making works best in regions and issue-areas where states are likely to agree, and when they do not, it promotes and protects the interests of powerful states as well as the continued existence of the institutions in which it is used.

Arctic and Space relations rely on soft law

International cooperation in the Arctic and Space relies heavily on 'soft law', namely resolutions, declarations, guidelines, and other written agreements that are not meant to be legally binding (Abbott & Snidal, 2000; Chinkin, 1989; Shelton, 2003). In the Arctic, this reliance extends to 'soft treaties': legally-binding instruments composed of permissive, ambiguous, or redundant provisions (Abbott & Snidal, 2000; Byers & Nadarajah, n.d.; Olsson, 2013).

The founding document of the Arctic Council, the 1996 Ottawa Declaration, is not a treaty. All of the commitments and standards developed within the Arctic Council are likewise soft law, including the declarations adopted at the biennial ministerial summits as well as the many recommendations in the reports, assessments, and other documents produced by the Arctic Council's six permanent 'working groups' and its various ad hoc 'task forces' and 'expert groups'.

The Arctic Council initiated the negotiations of the 2011 Arctic Search and Rescue Agreement, the 2013 Agreement on Marine Oil Pollution Preparedness and Response in the Arctic, and the 2017 Agreement on Arctic Scientific Cooperation (Arctic Council, 2011, 2013, 2017a). But these are soft treaties which either repeat obligations set out in previously concluded, globally applicable treaties or, to the degree that they set out new expectations, do so only in the form of recommendations or aspirations rather than clear, substantive obligations.

For example, the eight states that negotiated the Arctic Search and Rescue Agreement were already parties to the 1944 Chicago Convention on Civil Aviation and the 1979 International Convention on Maritime Search and Rescue (Chicago Convention, 1944; International Convention on Maritime Search & Rescue, 1979). Indeed, the Arctic Search and Rescue Agreement states that these two conventions 'shall be used as the basis for conducting search and rescue operations under this Agreement,' and its provisions closely track the provisions in them. The Arctic Search and Rescue Agreement does not create any 'new operational or resource requirements' with respect to, for instance, the positioning of equipment or the response-times expected of personnel (Shih-Ming, Pearre, & Firestone, 2012). Where the Agreement does add something new is with respect to the other cooperative steps it encourages but does not require of states. These include the sharing of information services as well as procedures, techniques, equipment, and facilities; joint research and development initiatives; reciprocal visits by experts; and joint search and rescue exercises. Again, these are soft law provisions, added on top of hard law commitments—in the 1944 Chicago Convention on Civil Aviation and the 1979 International Convention on Maritime Search and Rescue—that were already binding on all the negotiating parties.

Similarly, the Agreement on Arctic Scientific Cooperation reiterates the existing scientific cooperation practices undertaken by several inter-governmental and non-governmental organisations, such as the World Meteorological Organization and the International Arctic Science Committee. It uses qualifying terms such as 'shall, where appropriate', 'best efforts', 'may continue', and 'shall facilitate', and states that its implementation 'shall be subject to the availability of relevant resources'. The Agreement's only substantively specific section sets out 'identified geographic areas', but these correspond with the territories and maritime zones of the eight Arctic states and are therefore redundant. This is not to say that the Agreement is unimportant; indeed, by promoting scientific cooperation within the region it will contribute to confidence-building and conflict prevention (Berkman, Kullerud, Pope, Vylegzhanin, & Young, 2017; Smieszek, 2017). However, it is a soft treaty rather than a hard treaty.

The 2014 International Code for Ships Operating in Polar Waters (Polar Code) is unusual among recent Arctic-related multilateral treaties, in that it does contain new, clear, and substantive obligations—for instance, a requirement that lifeboats be partially or totally enclosed (International Maritime Organization, 2014). However, the Polar Code came into force in 2017 as a result of the 'tacit acceptance procedure' used at the International Maritime Organization since 1974, whereby proposed amendments to the International Convention for the Safety of Life at Sea enter into force unless a set number of objections are received from parties before a specified date (Shi, 1999). The tacit acceptance procedure thus extends the effects of a period of relatively high cooperation, in this case in the mid-1970 s, forward in time, enabling the creation of new hard law provisions during a later, less cooperative period. The Polar Code is also unusual in that it applies in two regions, namely the Arctic and the Antarctic.

Soft law also finds widespread use in Space. The last two multilateral Space treaties to come into force were the 1975 Registration Convention and the 1998 International Space Station Intergovernmental Agreement, the latter of which applies only between the 15 states involved in the ISS (Canada, European Space Agency, Japan, Russia, & US, 1998; Registration Convention, 1975). Most Space cooperation now occurs through non-binding guidelines and codes of conduct. These include the 1982 Broadcasting Principles, the 1986 Remote Sensing Principles, the 1992 Nuclear Power Sources Principles, and the 1996 Space Benefits Declaration, all of which were adopted by the UN General Assembly (UN General Assembly, 1982, 1992a, 1992b, 1996). The trend towards soft law continued after the turn of the century, with annual reports from COPUOS providing content for UN General Assembly resolutions on 'Prevention of an arms race in outer space', 'Transparency and confidence-building measures in outer space activities', and 'International cooperation in the peaceful uses of outer space' (UN General Assembly, 1993, 2007, 2017). Finally, there are soft law instruments produced by other bodies, such as the 2011 Space Debris Mitigation Requirements adopted by the International Organization for Standardization (2011).

The widespread use of soft law in the Arctic and Space can be explained, in part, on the basis that Russian–Western cooperation in these regions takes place against the backdrop of rivalry and suspicion between the same states elsewhere. By using soft law, states are able to pursue collective goals within a discrete region or issue-area without making clear and firm commitments to states that they distrust. Although Russia and NATO states are hardly allies, they are clearly able to cooperate in discrete contexts when their interests align, and especially when new, clear, and mandatory commitments can be avoided.

Soft law is the most likely result of consensus decision-making, since using soft law reduces the stakes and therefore the need for tough negotiating. In particular, powerful states are less likely to block consensus with regard to soft law. The stakes involved in hard law are higher because it involves clear, mandatory, and sometimes enforceable commitments. Soft law can develop into hard law, for instance, customary international law, but this only happens over time, and only if states demonstrate through consistent practice that they are following the norms and consider them legally binding (Akehurst, 1976; Byers, 1999; D'Amato, 1971).

Epistemic communities are networks of 'professionals with recognised expertise and competence in a particular domain and an authoritative claim to policy relevant knowledge within that domain or issue-area' (Haas, 1992). Such networks are present throughout the international relations of the Arctic and Space, which involve numerous scientific and technical issues. For instance, the Commission on the Limits of the Continental Shelf is made up of oceanographers and geologists, while COPUOS' legal subcommittee is made up of international lawyers. The prevalence of epistemic communities in the Arctic and Space contributes to the widespread use of soft law, since soft law instruments, unlike treaties, rarely require the approval of the highest levels of governments. Soft law instruments can be kept within the ambit of the experts, while guiding the behaviour of states in specific areas of activity.

Soft law has also facilitated the involvement of non-state actors in the governance of the Arctic and Space. As Koivurova & Heinämäki (2006) explained, soft law has 'revolutionary' potential because its non-legally binding character enables the inclusion of non-state actors in its creation, while the resulting norms are still considered authoritative. The inclusion of Indigenous peoples as 'permanent participants' at the Arctic Council is the prime example of this, since they sit at the negotiating table alongside the member states and take part in all discussions (Arctic Council, 2015c). And while three of the permanent participants took part in the negotiation of the Agreement on Arctic Scientific Cooperation, that instrument, as explained above, is a soft treaty containing no new, clear, substantive obligations.

Finally, the reliance on soft law in Space might be related to the United States and Russia's efforts to slow China's rise as a Space power. As will be explained below, the United States has excluded China from the ISS, while Russia has refused to sell China the technology behind its RD-180 rocket engines. Nor have the United States or Russia shown much interest, or made much effort, to pursue any new multilateral treaties on Space. Negotiating such a treaty would require recognising and involving China as a major Space power and therefore an equal stakeholder. Moreover, most of the soft law developed on Space takes as its starting point the four core multilateral treaties that were negotiated in the 1960s and 1970s under US and Soviet leadership. In other words, the United States and the Soviet Union, through those early treaties, set the general direction for the soft law that followed. A new multilateral treaty would set a new agenda; one less dominated by American and Russian power.

Despite continued efforts to restrict China's involvement (and, to some degree, because of them), all of these different aspects of soft law contribute to ongoing international cooperation in the Arctic and Space. They do so by enabling Russia and Western states to work together—without the formalities, constraints, and consequences of hard law.

Arctic states and Space-faring states interact within a situation of 'complex interdependence'

Elsewhere, I have employed the Arctic as a case study for exploring how a pre-existing situation of 'complex interdependence' can help to preserve cooperation during an international crisis (Byers, 2017). The concept of complex interdependence was developed by Keohane & Nye (2012) during the Cold War to explain aspects of international relations for which traditional 'realist' approaches could not account. Among other things, they argued that a multiplicity of issues, actors, transnational channels of contact, and associated interdependencies can—as a consequence of complexity—separate some dimensions of an interstate relationship from others. I carried this insight further, arguing that this separation can prevent a disruption in one dimension of an interstate relationship from spreading to other dimensions. And this, my research revealed, was precisely what occurred in the Arctic after the annexation of Crimea, when the suspension of military cooperation and the imposition of sanctions did not disrupt Russian–Western cooperation in search and rescue, fisheries management, scientific cooperation, and a number of other discrete issue-areas.

My analysis is strengthened by finding that Russian–Western cooperation also continued in Space. Space involves a multiplicity of issue-areas, from Space-based search and rescue, to scientific cooperation on the ISS, to the sharing of information about Space debris. It involves a multiplicity of governmental and non-governmental actors, transnational channels of contact, and interdependencies—including the United States' dependence on Soyuz rockets and RD-180 engines, and Russia's dependence on selling launches, equipment, and expertise to Western governments and companies. As in the Arctic, this complex interdependency has enabled Russia and Western states to treat their cooperative relations in Space separately from their relations in other regions and issue-areas, and for cooperation to continue despite the tensions and breakdowns elsewhere.

Resisting greater Chinese involvement

A final similarity between the Arctic and Space is that Russia and the United States are resisting greater Chinese involvement in both regions. China applied for observer status at the Arctic Council in 2006 and was made to wait seven years before its status was granted—although, starting in 2007, Chinese officials were admitted to Arctic Council meetings on an ad hoc basis (Koivurova, Hasanat, Graczyk, & Kuusama, 2017). During that time, the Arctic Council member states introduced rules that require applicants for observer status to recognise 'Arctic States' sovereignty, sovereign rights and jurisdiction in the Arctic', that 'an extensive legal framework applies to the Arctic Ocean including, notably, the Law of the Sea,' and that 'this framework provides a solid foundation for responsible management of this ocean' (Arctic Council, 2015b).

The Law of the Sea is important to Russia and the United States in this context because it excludes non-Arctic states from the continental shelf resources of the Arctic Ocean by assigning all of the shelf to one or another of the coastal states. This will leave just one or two relatively small pockets of 'deep seabed' in the middle of the Arctic Ocean that will be subject to a 'common heritage of mankind' regime. And while the United States has not yet acceded to UNCLOS, it has long accepted its provisions as reflective of customary international law binding all countries. It has also, repeatedly, expressed its support for the UNCLOS process of delimiting extended continental shelves, including by partnering with Canada in the collection of scientific data in the Beaufort Sea (Boswell, 2008; Griffiths, 2010). Non-Arctic states are not in a position to contest these rules, as many of them benefit from the same provisions off their own coastlines, including China in the East China Sea (Peterson, 2009). Moreover, all parties to UNCLOS have accepted its rules as a 'package deal' and rely on other parts of the Convention (Freestone, 2007). China, for instance, was the first country to make use of an UNCLOS mechanism to receive an exploration permit for mining sulphides around hydrothermal vents on the deep sea bed, in that case in the Indian Ocean (International Seabed Authority, 2010); China is therefore unlikely to undermine UNCLOS in the Arctic. All this provides the five Arctic Ocean states with two incentives to insulate UNCLOS from the crises in Ukraine and Syria: UNCLOS privileges them as coastal states, to the detriment of non-Arctic countries such as China; and it is accepted and relied upon by that country.

In 2015, the five Arctic Ocean states accepted China as a partner in negotiations on central Arctic Ocean fisheries. Before doing so, however, they concluded a preliminary agreement among themselves that set a template for the negotiations (Canada et al., 2015). Once again, they kept China at arm's-length while making key decisions about the region.

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China, by playing along, thus accepted a secondary status within the Arctic Council and with regards to the initial phase of negotiations on Arctic Ocean fisheries. But now, it is seeking other entry points into Arctic cooperation through scientific research, shipping, trade, and foreign investment, including with the Polar Silk Road initiative it announced in 2018 (Reuters, 2018). These activities play to China's strengths, and the country's influence in the Arctic is growing accordingly.

China is not involved in the ISS because the US Congress banned NASA from working with the Chinese National Space Agency in 2011 due to concerns about technology theft (US Congress, 2011). For the same reason, China is not yet part of NASA's proposed Lunar Gateway, while Russia is considered an essential partner. However, unlike in the Arctic, where geography and international law privilege the coastal states, China's access to Space is unlimited. Its territory is well situated for launches into geostationary as well as polar orbits, and it has the same freedom of exploration and use of Space as other countries, as codified in the Outer Space Treaty. China is also a member of COPUOS, with participation rights equal to those of Russia and the United States.

On Space issues, Russia cooperates more with China than the United States does. In 2008, and again in a 2014 revision, Russia and China (2008, 2014) jointly submitted a draft 'Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects' to the Conference on Disarmament, an UN-affiliated body. However, the Conference on Disarmament operates on the basis of consensus, which has enabled the United States to block any consideration of the draft, and Russia and China have not found the collective will to take their initiative to an alternative negotiating venue, as Canada did with anti-personnel landmines and Norway did with cluster munitions. China has also been negotiating the purchase of Russian-made RD-180 rocket engines, like those used to launch US intelligence and military satellites (Clover, 2018). However, Russia is only willing to sell the engines, and not the technology that would enable the Chinese to build RD-180 s themselves (Clover, 2018). Nor has Russia used its influence to involve China in the ISS or the Lunar Gateway. In both the Arctic and Space, the United States and Russia are protecting their dominant positions by resisting greater Chinese involvement. This shared goal has, in turn, contributed to the ongoing cooperation between them.

Conclusion

I have argued elsewhere that Russian–Western cooperation in the Arctic continued after the 2014 annexation of Crimea because of the existence of 'complex interdependence' within the region (Byers, 2017). A multiplicity of issues, actors, transnational channels of contact, and associated interdependencies made it possible for Russia and Western countries to treat their relations in the Arctic separately from the tensions and breakdowns elsewhere. This article builds on that work by also examining Space, where Russian–Western cooperation similarly continued after 2014—most obviously on the International Space Station but also with respect to space debris, satellite-based search and rescue, and the sale of Russian rocket engines and launch services to Western governments and companies.

This article finds that, while complex interdependence is an important factor in continued cooperation in both the Arctic and Space, at least seven other factors also contribute to the continuance of pre-2014 relations. These include: the Arctic and Space are both remote and extreme environments; the Arctic and Space are militarised but not substantially weaponised; and the Arctic and Space both suffer from 'tragedies of the commons'. Together, these first three factors give rise to a response which is, itself, a factor in continued cooperation: Arctic and Space-faring states engage in risk management through international law-making. And this law-making is facilitated by two further factors which likewise contribute to cooperation: Arctic and Space relations rely on consensus decision-making; and Arctic and Space relations rely on soft law. A final contributing factor, at least to Russian–American cooperation, is that both Russia and the United States are resisting greater Chinese involvement in the Arctic and Space.

This multiplicity of factors is entirely consistent with the existence of complex interdependence, which Keohane and Nye have always insisted is a 'concept' rather than a 'theory'. Indeed, understanding a highly complex situation often requires the use of multiple theoretical lenses—in order to identify and assess multiple factors. As Peter Katzenstein and Nobuo Okawara explained:

> Strict formulations of realism, liberalism, and constructivism sacrifice explanatory power in the interest of analytical purity. Yet in understanding political problems, we typically need to weigh the causal importance of different types of factors, for example, material and ideal, international and domestic. Eclectic theorizing, not the insistence on received paradigms, helps us understand inherently complex social and political processes. (Katzenstein and Okawara, 2002)

This article has taken a theoretically open approach to identifying the factors behind Arctic and Space cooperation; how states regularised that cooperation; and how certain forms of decision-making and certain types of legal instruments facilitate that process. It has been deliberately open to finding different motivations for—and influences upon—state behaviour, ranging from rational calculations of self-interest to the development of shared identities and interests within epistemic communities. It is not an article about international relations theory, but it does open up a rich new domain for theorising.

That said, the continued role of the various factors involved in Arctic and Space cooperation will be contingent on future technological, economic, and political developments. For example, the tragedies of the commons that are unfolding in the Arctic and Space, namely climate change and space debris, do not originate in these regions and have potentially catastrophic spillover effects elsewhere. As David Welch and others have pointed out, melting Arctic permafrost is a ticking methane bomb that could push the entire planet's climate to new and increasingly unstable extremes (Welch, 2019). Similarly, runaway space debris could render key Earth orbits unusable for a wide range of services that are increasingly essential to human life on the surface. Either of these developments could cause such deep ruptures in international politics that neither Arctic nor Space cooperation would survive.

Less dramatically, the reliance on consensus decision-making in the Arctic and Space could be challenged by the involvement of new actors. Until now, the number of states involved in Arctic and Space decision-making has been limited by either geography or technology. But rapid climate change in the Arctic and equally rapid technological change in Space are inducing and enabling the entry of more state and non-state actors. It is unclear whether consensus decision-making can survive in the Arctic Council once China becomes fully involved in the region. For instance, one could imagine one of the less powerful Arctic Council member states withstanding the pressure to join in consensus on a particular issue, if it had economic and political backing from a very powerful non-member state. Similarly, the influence exercised by Russia and the

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United States on decision-making with COPUOS could be challenged by the ongoing rise of China as a Space power.

It is even possible that a less powerful state might be able to withstand the pressure to join in consensus because of support from one or more large companies. If this sounds improbable, consider the influence of Liberia and Panama—the world's two largest shipping registries—on decision-making within the International Maritime Organization (Lee, Humphreys, & Pugh, 1997). The power of these tiny 'flag of convenience' states has been greatly magnified by the support they receive from global shipping companies.

Contingency, however, is an inevitable consequence of complexity, and with the exception of complex interdependence, none of the factors identified in this article are prerequisites for the development of regional or issue-specific forms of cooperation that are resilient to tensions and breakdowns elsewhere. And even if one or more pro-cooperation factors were to disappear, they might be replaced by new pro-cooperation factors.

One final observation: Notwithstanding this article's emphasis on complexity, the utility of the Arctic and Space for deriving insights into international cooperation is due, at least in part, to their being 'areas beyond national jurisdiction'. Such areas, almost by definition, involve less depth and density of historical, political, and economic activity than the territorially based regions and issue-areas more often studied by scholars of international relations. Studying the reasons for international cooperation in the Middle East or Southeast Asia, to give just two examples, is a more daunting and difficult exercise. Yet by examining international cooperation in the Arctic and Outer Space, we can identify factors that might contribute to be international cooperation in other, more difficult to study areas.

Ultimately, all of these insights gleaned from this examination of the Arctic and Space contribute to a broadened concept of complex interdependence—one that includes the factors leading to and regularising international cooperation, as well as the factors that reinforce this cooperation and thus make it even more resilient to tensions and breakdowns in other regions and issue-areas. This article can thus conclude with the following, modest contribution to the larger literature on international relations: The more that states need to cooperate in a particular region or issue-area, and the more they become accustomed to doing so, the more resilient that cooperation will become to tensions and breakdowns elsewhere. This phenomenon can be termed 'complex and resilient interdependence', to signify that complex independence is more than a description. It can, sometimes, affect the course of state-to-state relations.

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