Negative: Icebreakers / Finland

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Negative: Icebreakers / Finland

INHERENCY

1. Status Quo building 6 already

Coast Guard already has contracted for 3 heavy and 3 medium icebreakers and they're under construction now

Zamone Perez 2022 (editorial fellow at Defense News and Military Times) 14 July 2022 "US Coast Guard calls for larger icebreaker fleet to compete in the Arctic" DEFENSE NEWS (accessed 1 Jan 2023) https://www.defensenews.com/naval/2022/07/14/us-coast-guard-calls-for-larger-icebreaker-fleet-to-compete-in-the-arctic/

Production for the first polar security cutters began this year. Shipbuilder VT Halter Maritime is manufacturing the first PSC under a fixed-price contract, expected to conclude in 2025. The Coast Guard will eventually receive three heavy icebreakers, followed by three medium icebreakers. The Coast Guard requested $167.2 million in the fiscal 2023 budget to continue production of the PSCs, while also seeking $30.1 million to operate a commercially available icebreaker as it waits.

And 6 is more than we need, according to the Coast Guard

Andreas Kuersten 2016 (*law clerk for the U.S. Court of Appeals for the Armed Forces.  He previously worked for the National Oceanic and Atmospheric Administration on Arctic projects and is a former fellow with the Arctic Summer College*) 11 Oct 2016 "ICEBREAKERS AND U.S. POWER: SEPARATING FACT FROM FICTION" (accessed 1 Jan 2023) https://warontherocks.com/2016/10/icebreakers-and-u-s-power-separating-fact-from-fiction/

 Meanwhile, [studies](https://www.washingtonpost.com/news/checkpoint/wp/2015/09/01/obama-wants-more-polar-icebreakers-the-coast-guard-has-been-asking-for-years/) commissioned by the Coast Guard put forth that three of each class are required for the year-round fulfillment of northern responsibilities — although the Coast Guard vice commandant has [said](http://coastguard.dodlive.mil/2015/11/vice-adm-michel-testifies-at-arctic-hearing/) that the service only “needs at least two heavy icebreakers” given current demands.

2. Allies solve

US has allies in the Arctic that provide adequate icebreaking capability

Prof. Paul Avey 2019 (*assistant professor for political science at Virginia Tech; was a 2018–2019 Council on Foreign Relations International Affairs Fellow based at the US Dept of Defense*) 28 Nov 2019 "THE ICEBREAKER GAP DOESN’T MEAN AMERICA IS LOSING IN THE ARCTIC" (accessed 1 Jan 2023) https://warontherocks.com/2019/11/the-icebreaker-gap-doesnt-mean-america-is-losing-in-the-arctic/

A third problem with focusing solely on counts of U.S. capabilities is that it ignores the role of U.S. allies and partners. Seven of the eight Arctic nations are either NATO allies or NATO enhanced opportunities partners (six of which have [some icebreaking capacity](https://fas.org/sgp/crs/weapons/RL34391.pdf)). Non-Arctic allies, such as [the United Kingdom](https://www.gov.uk/government/news/defence-secretary-announces-new-defence-arctic-strategy), have interests and assets relevant to the region as well. These states’ capabilities and geographic locations shape the Arctic security environment. For example, [Canada currently operates](http://www.ccg-gcc.gc.ca/icebreaking/home) two heavy and four medium icebreakers and the [Norwegian Armed Forces’ Joint Headquarters](https://forsvaret.no/en/organisation/joint-headquarters) is located in the Arctic. Rebecca Pincus [explains how](https://warontherocks.com/2019/11/nato-north-building-a-role-for-nato-in-the-arctic/), “carefully calibrated,” the “NATO-Russia Council could be a useful forum for dialogue on security topics in the Arctic.” The contribution of specific allies and partners will no doubt be more relevant to some problems than others. Even if they are not able to directly contribute to a particular issue, allies and partners can free up U.S. time and resources to focus elsewhere. They can also help improve situational awareness and manage tensions more broadly to minimize dangers and create opportunities in and near the North American and European Arctic.

3. Alternative technologies solve better

Alternative technologies like hovercraft work better for the same missions without needing icebreakers

Ashley Postler 2018. (master’s candidate in the Security Studies Program concentrating in international security at Georgetown Univ., and pursuing a graduate certificate in Diplomatic Studies.  Her research focuses on emerging security and diplomatic issues in the Arctic) 27 Nov 2018 "Beyond Icebreakers: Bridging the US Polar Icebreaking Gap," [Georgetown Security Studies Review](https://georgetownsecuritystudiesreview.org/) (accessed 1 Jan 2023) <https://georgetownsecuritystudiesreview.org/2018/11/27/beyond-icebreakers-bridging-the-us-polar-icebreaking-gap/> (brackets added)

Research and SAR [search & rescue] operations, both of which currently require a physical path through the ice, can also be accomplished either without breaking ice, or breaking it in more efficient and agile ways. For example, amphibious hovercraft can travel over water and ice far quicker than conventional marine vessels and can operate in difficult conditions such as heavy fog. While susceptible to “side slipping forces, hovercraft can operate on unbroken ice with far superior maneuverability than can traditional icebreakers moving through ice. There is thus potential for research missions to travel further and faster without even having to break ice. This is especially critical for SAR operations for which expediency is necessary, and when the vessel must get very close to the object, neither of which are best served by traditional icebreaking.

Icebreakers have minimal impact because better solutions exist, including submarines and drones

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However, icebreaking is no longer the sole answer to providing Arctic MDA [maritime domain awareness], which is partially achieved by USCG patrols conducted on the water. In the Arctic, this necessitates an ice-free path for USCG vessels to traverse. However, MDA can and is being achieved more purposefully under and over the water. The USN states that even the complete loss of icebreaker support would only minimally impact its ability to monitor and provide MDA in the Arctic. This is because, in addition to submarines, the USN already deploys unmanned underwater vehicles/unmanned surface vehicles (UUV/USV) that utilize swarm AI technology, such as the SwarmDiver, in support of reconnaissance and MDA.

Submarines are just as effective and faster than a heavy icebreaker

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Such research indicates that submarine pathbreaking through ice is possible. Submarines traveling at a depth of 30 meters below the surface can break ice up to one meter thick; at a depth of 20 meters, a submarine is capable of carving a path through two meters of ice, the same as the US heavy icebreaker Polar Star moving at three knots, but at ten times that speed. Outfitting submarines to not only break ice but also carve a path through it is a meaningful step toward replacing traditional icebreakers.

Voting Impact: With existing alternatives, buying new icebreakers is an unnecessary waste of money for outdated technology

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The strength of other nations’ traditional icebreaking fleets are often compared to that of the U.S., which is obviously aging and quickly diminishing. This comparison, which falls prey to “icebreaker envy” is used to argue for the addition of new—and expensive, time-consuming and cumbersome—icebreakers to the US polar fleet.  Such arguments obscure the reality that although the need for unrestricted access to US Arctic territorial waters regardless of ice conditions remains, despite global warming trends, traditional icebreaking is potentially becoming an outdated method of doing so.

HARMS / SIGNIFICANCE

1. A/T "Russia has more icebreakers than we do"

Don't panic: It's because they run supplies to Arctic coastal communities, which we don't have

C. Todd Lopez 2022 (writer for the US Dept. of Defense) 8 Feb 2022 "U.S. Needs More Icebreakers for Arctic" (accessed 1 Jan 2023) US DEPT. OF DEFENSE NEWS <https://www.defense.gov/News/News-Stories/Article/Article/2928402/us-needs-more-icebreakers-for-arctic/> (first brackets added; second brackets in original)

[senior advisor for arctic security affairs with the Ted Stevens Center for Arctic Security Studies, Randy] Kee also addressed concerns about the Russian Federation's own "vast number of icebreakers."  He said that while the Russians do use some of those icebreakers to maintain a sovereign presence in the Arctic, others are necessary for running logistics operations in the region, where Russian communities dot the coast of the Arctic Ocean. "They also use [them] for logistics support to their northern communities, because they don't have any other way to get the products to those communities," he said.

"Number of icebreakers compared to Russia" is irrelevant to national security. Turn: It leads to pursuing the wrong solutions

Prof. Paul Avey 2019 (*assistant professor for political science at Virginia Tech; was a 2018–2019 Council on Foreign Relations International Affairs Fellow based at the US Dept of Defense*) 28 Nov 2019 "THE ICEBREAKER GAP DOESN’T MEAN AMERICA IS LOSING IN THE ARCTIC" (accessed 1 Jan 2023) https://warontherocks.com/2019/11/the-icebreaker-gap-doesnt-mean-america-is-losing-in-the-arctic/

While Russia has at least 40 icebreakers in its fleet, China and the United States have two icebreakers apiece. However, using relative icebreaker fleet sizes as a key metric for the state of strategic competition in the Arctic is flawed. While they are an important platform, icebreakers do little to create or address the most commonly identified defense challenges in the region. Instead, analysts should focus on the nature of the military risks in the Arctic, the role of allies and partners, and economic interests in a broader geopolitical context rather than comparing specific capabilities. Doing so is important to avoid mischaracterizing the scope of the danger or emphasizing the wrong types of solutions.

Russian icebreakers are not a threat

Andreas Kuersten 2016 (*law clerk for the U.S. Court of Appeals for the Armed Forces.  He previously worked for the National Oceanic and Atmospheric Administration on Arctic projects and is a former fellow with the Arctic Summer College*) 11 Oct 2016 "ICEBREAKERS AND U.S. POWER: SEPARATING FACT FROM FICTION" (accessed 1 Jan 2023) https://warontherocks.com/2016/10/icebreakers-and-u-s-power-separating-fact-from-fiction/

Russian icebreakers are not critical to the country’s navy because they facilitate Arctic naval surface warfare.  Rather, they are strategically essential because Russia’s principal shipyards, Northern Fleet, and only access route to the Atlantic Ocean without a major chokepoint are all located in or traverse the Arctic.  Icebreakers allow Russian surface warships to enter and exit the country’s most important naval bases and reach the Atlantic Ocean.  This is a necessity that has no comparison for the United States.

Russia's economy and geography are very different from ours in the Arctic, so it's no problem if they have more icebreakers

Prof. Paul Avey 2019 (*assistant professor for political science at Virginia Tech; was a 2018–2019 Council on Foreign Relations International Affairs Fellow based at the US Dept of Defense*) 28 Nov 2019 "THE ICEBREAKER GAP DOESN’T MEAN AMERICA IS LOSING IN THE ARCTIC" (accessed 1 Jan 2023) https://warontherocks.com/2019/11/the-icebreaker-gap-doesnt-mean-america-is-losing-in-the-arctic/

Second, the implications of relative numbers of icebreakers look different when considering the vastly different Arctic contexts, particularly for the United States and Russia. According to the Arctic Institute, [Russia has roughly](https://www.thearcticinstitute.org/countries/russia/) 24,140 kilometers of coastline and two million inhabitants in the Arctic. The [Economist highlighted](https://www.economist.com/special-report/2012/06/16/too-much-to-fight-over) that, all told, Russia has “at least half of the Arctic in terms of area, coastline, population and probably mineral wealth.” The Russian economy depends heavily on oil and natural gas, including from the Arctic, for its [federal budget](https://www.thearcticinstitute.org/countries/russia/) and [exports](https://www.washingtonpost.com/politics/2019/08/29/why-buying-greenland-wouldnt-really-help-us-economy-even-if-it-were-sale/).  As noted, a sizeable portion of Russia’s strategic nuclear deterrent is based in the Arctic. Russian interests dictate a large number of icebreakers. By comparison, the United States has roughly [4,057 kilometers (2,521 miles)](https://www.uscg.mil/Portals/0/Images/arctic/Arctic_Strategic_Outlook_APR_2019.pdf) of Arctic shoreline and [approximately 68,000](https://fas.org/sgp/crs/misc/R41153.pdf) people living in the Alaskan Arctic. Oil and gas extraction, even when including the non-Artic portion, makes up [a very small](https://apps.bea.gov/iTable/iTable.cfm?ReqID=51&step=1) [percentage of the U.S. economy](https://www.washingtonpost.com/politics/2019/08/29/why-buying-greenland-wouldnt-really-help-us-economy-even-if-it-were-sale/). The U.S. nuclear triad is not dependent [upon basing](https://www.tandfonline.com/doi/full/10.1080/25751654.2019.1631696) or [SSBN patrols in the Arctic](http://www.thesimonsfoundation.ca/highlights/nuclear-submarines-arctic-limiting-strategic-anti-submarine-warfare).

2. A/T "Threat from Russia"

You gotta be kidding. After the Ukraine war, it will be a long time before Russia will ever be a serious military power

Prof. Stefan Hedlund 2022. (professor of Russian Studies at Uppsala Univ.) 2 May 2022 " The collapse of the Russian military machine" (accessed 14 Nov 2022) https://www.gisreportsonline.com/r/russian-military-power/

Putin-era attempts at modernizing Russia’s armed forces have failed. The disastrous battlefield results in Ukraine signal geopolitical problems for the Russian state.
**END QUOTE. HE GOES ON LATER IN THE CONTEXT WRITING QUOTE:**
Looking forward, the prospects for Russia rebuilding its military capabilities are dismal. The software constraint could be overcome; it might also be possible to restore professional leadership and, over time, rebuild morale among troops that have been through hell. However, what may prove decisive, rebuilding military hardware promises to be a steep uphill battle.
**END QUOTE. HE GOES ON LATER IN THE CONTEXT WRITING QUOTE:**
As educated young Russians move out of the country and foreign firms fold their tents there, the quality of human capital needed for hi-tech military development could deteriorate dramatically. The fourth and most important consequence is that, as the war drags on and Russia weakens economically and militarily, and the Kremlin is forced to withdraw whatever troops can be “harvested” from other deployments, other actors are likely to be emboldened.

3. No economic impact

Icebreakers have no impact on US economic claims and wouldn't be effective at countering other nations' Arctic claims

Prof. Paul Avey 2019 (*assistant professor for political science at Virginia Tech; was a 2018–2019 Council on Foreign Relations International Affairs Fellow based at the US Dept of Defense*) 28 Nov 2019 "THE ICEBREAKER GAP DOESN’T MEAN AMERICA IS LOSING IN THE ARCTIC" (accessed 1 Jan 2023) https://warontherocks.com/2019/11/the-icebreaker-gap-doesnt-mean-america-is-losing-in-the-arctic/

To be sure, icebreakers are necessary to access polar areas even as ice cover diminishes. They are an important element of Arctic sovereignty as a result. However, the number that other countries possess does not affect the number that the United States requires to provide access to its exclusive economic zone.   It is also unlikely that a country would use icebreakers to stake a claim to the U.S. Arctic.  If it did, capabilities other than icebreakers would be better suited to dislodging them should diplomacy fail.

4. No military impact

Loss of icebreakers would have "minimal impact" because Navy ships don't try to operate in icy conditions

Military.com 2016. "Acquisition Chief: Loss of Icebreaker Would Have 'Minimal Impact' on Navy" 7 Sept 2016 (accessed 1 Jan 2023) <https://www.military.com/dodbuzz/2016/09/07/acquisition-chief-loss-of-icebreaker-would-have-minimal-impact-on-navy> (brackets added)

But such a loss would have minimal impact on the Navy, as naval Arctic missions primarily use undersea and air assets. "With the exception of two Combat Logistics Force ship classes, Navy's current surface combatants are not capable of operating in the extreme harsh environment of sea-ice conditions, even with the support of a Coast Guard icebreaker," [Assistant Secretary of the Navy for Research, Development and Acquisition Sean] Stackley wrote. Instead, he said, Navy Arctic surface operations take place during summer, when the most ice has melted. While the possibility of making Navy surface ships ice-resistant is being explored, this would require significant investment, and there are no plans currently on the table to make it happen, Stackley said.

5. More study needed

(As of Aug. 2022) We need to study Russia's military activities in the Arctic more to make good policy. We don't want to underestimate nor overestimate the threat and make bad policies

Dr Katarzyna Zysk 2022 (Professor of International Relations and Contemporary History, Norwegian Institute for Defence Studies) August 2022 " Myths and misconceptions around Russian military intent" (accessed 7 Nov 2022) https://www.chathamhouse.org/2022/07/myths-and-misconceptions-around-russian-military-intent/myth-8-russias-military-build

What would good policy look like? Nuances such as those discussed above matter. Neither exaggerating the extent of the Russian military build-up and overreacting as a result, nor underestimating its importance and responding inadequately, will serve Arctic security and stability. The state and composition of Russian military capabilities, their geographic distribution, the underlying threat perception and patterns of military operations are variables that can, and probably will, change over time. They will be further influenced by spill-over effects from international security, economic and other global dynamics, including Russia’s policies in other regions, not least the direct and indirect consequences of the 2022 full-scale invasion of Ukraine. To avoid succumbing to disinformation and creating artificial debates and disagreements, Western actors must correctly assess the Russian military build-up – its strengths, weaknesses and the intentions behind it – in the Arctic and elsewhere.

DISADVANTAGES

1. Great Power competition mindset

Link: AFF promotes a Great Power competition mindset

As soon as they talk about how we have to compete with Russia in the Arctic, that's the mindset they're promoting. But that's bad because…

Impact: Negates other advantages to icebreakers. Great Power projection negates other benefits they could have had

Prof. Paul Avey 2019 (*assistant professor for political science at Virginia Tech; was a 2018–2019 Council on Foreign Relations International Affairs Fellow based at the US Dept of Defense*) 28 Nov 2019 "THE ICEBREAKER GAP DOESN’T MEAN AMERICA IS LOSING IN THE ARCTIC" (accessed 1 Jan 2023) https://warontherocks.com/2019/11/the-icebreaker-gap-doesnt-mean-america-is-losing-in-the-arctic/

But placing icebreakers in a central defense role comes [with opportunity costs](https://warontherocks.com/2016/10/icebreakers-and-u-s-power-separating-fact-from-fiction/). If the United States does field multiple new icebreakers, those ships may find defense missions taking up more and more of their time. As a result, they will be less able to support the myriad of homeland security and important scientific missions they will be increasingly called upon to perform. It is worth noting the Coast Guard [identified a need for six new icebreakers in 2013](https://www.gao.gov/assets/700/694249.pdf) (and gaps in support for polar missions in 2010), before the public discussion in Washington shifted to the [return of great-power competition](https://fas.org/sgp/crs/misc/R41153.pdf) broadly and in the Arctic specifically. Coast Guard polar security cutters will have plenty to do without additional tasks to offset a perceived military vulnerability arising from Russian and Chinese icebreakers.

Impact: Negative net benefits. Defense priority distracts icebreakers from their real beneficial uses

Andreas Kuersten 2016 (*law clerk for the U.S. Court of Appeals for the Armed Forces.  He previously worked for the National Oceanic and Atmospheric Administration on Arctic projects and is a former fellow with the Arctic Summer College*) 11 Oct 2016 "ICEBREAKERS AND U.S. POWER: SEPARATING FACT FROM FICTION" (accessed 1 Jan 2023) https://warontherocks.com/2016/10/icebreakers-and-u-s-power-separating-fact-from-fiction/

Second, constructing icebreakers with prominent defense expectations risks meaningfully diverting them from their core functions once built, which are: emergency response, law enforcement, research, and facilitating northern commerce.  If an icebreaker has to take several weeks to be party to a naval exercise or lead a warship on a simple Arctic “sail through,” that is time the vessel is unavailable for what it is actually needed for. Icebreakers contribute to U.S. Arctic security by providing human, economic, and environmental security, not by meaningfully enhancing northern defense capabilities.  Consequently, efforts to frame these vessels in military terms risk degrading American security both in the Arctic and elsewhere.

Impact: Net negative impact on US national security

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A defense impetus for the construction of U.S. icebreakers is, however, more than just spurious grounds for icebreaker procurement: poor issue framing can beget poor policy, and poor policy can exacerbate existing vulnerabilities or create new ones. First, if expensive icebreakers are purchased and built with the expectation that they contribute to U.S. defense, the Navy will be pressured to utilize them regularly for Arctic surface warfare exercises and the sailing of warships through the Arctic.  Given the low military tension in the region and the general impracticality of surface warships in icy waters, this would entail significant waste of naval assets and funds that could [more fruitfully contribute to national security elsewhere](http://warontherocks.com/2015/06/stability-in-the-arctic-dancing-with-polar-bears/), particularly if Duncan’s vision of a year-round Arctic defense presence is realized.

2. Military solutions to political problems

Link: Militarizing the Arctic with icebreakers is a poor substitute for diplomacy, and escalates tensions

Prof. Paul Avey 2019 (*assistant professor for political science at Virginia Tech; was a 2018–2019 Council on Foreign Relations International Affairs Fellow based at the US Dept of Defense*) 28 Nov 2019 "THE ICEBREAKER GAP DOESN’T MEAN AMERICA IS LOSING IN THE ARCTIC" (accessed 1 Jan 2023) https://warontherocks.com/2019/11/the-icebreaker-gap-doesnt-mean-america-is-losing-in-the-arctic/

Local defense challenges in the Arctic will remain, of course. Those should be addressed using political and economic diplomacy and refining military concepts and capabilities as necessary. Resisting the temptation to engage in numerical comparisons of icebreakers will help avoid alarmist views that may contribute to tensions and, at worst, the militarization of the region if the Pentagon deploys new resources in response to that perceived vulnerability. Other concerns, such as [China’s interest in building airports in Greenland](https://www.newsweek.com/china-wants-build-greenland-airport-might-threaten-us-military-base-experts-1114836), are best dealt with by diplomatic, information, and economic tools rather than military platforms (though trying to buy Greenland probably [isn’t the best](https://warontherocks.com/2019/08/lets-not-make-a-deal-geopolitics-and-greenland/) [approach](https://www.washingtonpost.com/politics/2019/08/29/why-buying-greenland-wouldnt-really-help-us-economy-even-if-it-were-sale/)). Even if a larger defense role in the Arctic is warranted, the United States should focus first on developing concepts for existing assets, determining what infrastructure requires modernization, and carefully examining how initiatives elsewhere can benefit regional security and minimize challenges emerging from the region.

Impact: Increased risk of conflict with Russia or China. Icebreakers divert resources away from solving conflicts elsewhere

Prof. Paul Avey 2019 (*assistant professor for political science at Virginia Tech; was a 2018–2019 Council on Foreign Relations International Affairs Fellow based at the US Dept of Defense*) 28 Nov 2019 "THE ICEBREAKER GAP DOESN’T MEAN AMERICA IS LOSING IN THE ARCTIC" (accessed 1 Jan 2023) https://warontherocks.com/2019/11/the-icebreaker-gap-doesnt-mean-america-is-losing-in-the-arctic/

The best way to deal with China and Russia in the Arctic is to address disputes in their own backyards. Most of the pathways to a great-power crisis that could end up affecting the Arctic stem from crises outside the region. Engaging Russia and China elsewhere rather than focusing on specific capabilities in the Arctic, including icebreakers, will thus have salutary effects. The nominal [Defense D](https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf)epartment [approach](https://www.armed-services.senate.gov/imo/media/doc/Colby_01-29-19.pdf) is to enhance a combat-credible forward presence in Eastern Europe and the Indo-Pacific. By deterring a conflict there, the logic goes, the Arctic is less likely to suffer negative [“strategic spillover.”](https://media.defense.gov/2019/Jun/06/2002141657/-1/-1/1/2019-DOD-ARCTIC-STRATEGY.PDF) A fixation with the number of icebreakers, or ice-hardened vessels more generally, as part of competing with Russia or China in the Arctic can lead to unnecessary investments and divert military assets better utilized elsewhere. Alternative approaches might focus on some form of [grand bargain](https://www.mitpressjournals.org/doi/abs/10.1162/ISEC_a_00199?journalCode=isec) or a more [restrained](https://www.cornellpress.cornell.edu/book/9781501700729/restraint/) [U.S. foreign](https://www.cato.org/sites/cato.org/files/pubs/pdf/our-foreign-policy-choices-white-paper.pdf) [policy](https://www.foreignaffairs.com/articles/russia-fsu/2014-08-18/why-ukraine-crisis-west-s-fault) to alleviate tensions. The hope of this approach is that it might broadly reduce competition. That would then also have benefits for the Arctic.

3. Environmental harm

Hovercraft break ice without disturbing marine life as icebreakers do

Ashley Postler 2018. (master’s candidate in the Security Studies Program concentrating in international security at Georgetown Univ., and pursuing a graduate certificate in Diplomatic Studies.  Her research focuses on emerging security and diplomatic issues in the Arctic) 27 Nov 2018 "Beyond Icebreakers: Bridging the US Polar Icebreaking Gap," [Georgetown Security Studies Review](https://georgetownsecuritystudiesreview.org/) (accessed 1 Jan 2023) <https://georgetownsecuritystudiesreview.org/2018/11/27/beyond-icebreakers-bridging-the-us-polar-icebreaking-gap/> (brackets added)

Furthermore, although hovercraft have less icebreaking capabilities compared to traditional icebreakers,  along icy surfaces, the former propel at speeds of up to 90 kilometers per hour.  The resulting vibrations create waves, known as flexural gravity waves, which form below the surface and oscillate across the bottom of the ice, causing it to snap.  Also, importantly, given that hovercraft leave no underwater pressure signature, marine life is undisturbed.  The Resonance method of ice destruction, whose origins for use in amphibious hovercraft date back to the 1980s, is currently employed by the Canadian Coast Guard to break ice along the St. Lawrence River.