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LEAD, FOLLOW OR FADE AWAY: INTERCHANGEABILITY AND CANADA

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Introduction

Canada's principal allies, the United States of America (USA) and the United Kingdom (UK) share a long and extensive history in their defence and security partnership. In 1958, the USA and UK signed the Mutual Defence Agreement (MDA) and since then, the two nations have shared and developed sensitive technologies and capabilities. Over time, their defence and security relationship has matured far beyond that of being interoperable. On October 21, 2020, the USA and the UK issued a Statement of Intent (SOI) titled 'Future Integrated Warfighting: From Interoperable to Interchangeable'. The SOI described how the USA and the UK would move towards interchangeability by addressing and aligning key areas from industry, capability development, acquisition through to the employment of systems and platforms. Less than one year later, the USA, UK and Australia announced the AUKUS trilateral defence agreement.

The decision to establish AUKUS was recognition of geopolitical realities and existential threats in Asia. Evolving from interoperability, this tripartite agreement advanced interchangeability between the nations. The AUKUS agreement consists of more than just Australia's procurement and eventual production of nuclear-powered submarines (SSN). Rather, it also focuses on extensive information and technology sharing, leveraging and synchronizing their respective industrial and technology bases through to developing and employing these capabilities to achieve interchangeability. This new defence and security architecture is envisaged to address critical strategic defence and security imperatives, today and well into the future.

The defence and security relationships of Canada's principal allies have evolved towards a framework defined by interchangeability. While the USA and UK are leading the evolution towards interchangeability, with Australia following, Canada seemingly remains within the fading construct of interoperability. At this time, there has been little or no mention of interchangeability or discussion whether Canadian defence and industry partners are capable of absorbing the requirements to achieve interchangeability**.**

Canada can achieve interchangeability in some areas of its defence and security framework but will need to further align and enable access to and sharing of technology, industry and defence capacities and capabilities to develop, employ and sustain platforms and systems with its principal allies.

This essay will review and analyze the differences between interoperability and interchangeability; provide a definition for interchangeability; and, assess the technological, industrial and military imperatives needed to progress towards interchangeability.

Interoperability vs Interchangeability: What's the difference?

The North Atlantic Treaty Organization (NATO) defines Interoperability as "The ability to act together coherently, effectively and efficiently to achieve Allied tactical, operational and strategic objectives." [1] Furthermore, according to NATO "Interoperability allows forces, units or

[1] NATO Standard Allied Joint Publication AJP-01. Edition E, Version 1, (NATO Publication Office, February 2017). LEX-5. https://www.coemed.org/files/stanags/01_AJP/AJP-01_EDE_V1_E_2437.pdf

systems to operate together. It requires them to share common doctrine and procedures, each other's infrastructure and bases, and to be able to communicate with each other." [2] Common equipment or equipment which can project the same level of combat power, protection or support required to achieve interoperability. Merely, the ability of systems, platforms, equipment and personnel to operate coherently is. In an alliance of 31 members, achieving interoperability is a significant combat multiplier given the number of industries, technologies and disparate systems and platforms. However, interoperability remains limited in focus, seeking to achieve operational breadth unlike interchangeability which seeks to achieve strategic depth.

At this time, interchangeability is not yet defined in the same doctrinal manner as interoperability. However, the understanding of interchangeability amongst the USA and UK was formally articulated in the SOI of 2020.

> …in order to keep pace with modern threats and fight as a truly cohesive force, we should endeavour to progress from interoperability to interchangeability. This positive step should enable critical force elements to become transposable; from ships of one navy operating in the other navy's taskforces, to manned and unmanned vehicles operating from the decks of each other's ships for refuelling, re-arming and re-tasking. This exchange of capability must be frictionless and immediate, allowing operational commanders to trust the assets they have at all times. We should endeavour to be agile and innovative in the development and delivery of equipment and personnel, coordinating requirements across shared business areas such as acquisition, training and capability development.[3]

Furthermore, when speaking about the USA, Australia's Minister of Defence, the Hon. Richard Marles stated AUKUS will "enable the industrial bases, the defence industrial bases, of our two countries to integrate together in a seamless way. So that that reflects the way in which our two Defence Forces are so interoperable – really, interchangeable – in the way in which we operate." [4] Interoperability does not require harmonizing or integrating defence industries; similar military platforms and equipment; the projection of the same level of combat power; and, a "mutually supportive logistics base." [5] In contrast, interchangeability requires leveraging and integrating technology and defence industries outputs; the same or similar military platforms and equipment; the ability to project the same or similar combat power and provide logistical support.

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[2] NATO. Backgrounder. Interoperability for Joint Operations. (NATO Public Diplomacy Division, July 2006). 1. https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_publications/20120116_interoperability-en.pdf

[3] United States of America, United States Navy and the United Kingdom of Great Britain and Northern Ireland, Royal Navy, Statement of Intent (SOI) "Future Integrated Warfighting: From Interoperable to Interchangeable". (October 21, 2020). 1.

[4] Hon. Richard Marles, MP. Speech. Address to the Australian-American leadership dialogue. July 12, 2022. https://www.minister.defence.gov.au/speeches/2022-07-14/speech-address-australian-american-leadership-dialogue

[5] Stacie Pettyjohn. "Making AUKUS work for the US-Australia Alliance". Video. Carnegie Endowment for International Peace. March 16, 2023. 1:02:17. https://carnegieendowment.org/2023/03/16/making-aukus-work-for-u.s.-australia-alliance-event-8052

Therefore interchangeability can be defined as a defence and security architecture where technologies are shared and industrial capacities are integrated, coordinated and utilized in a manner to enable partner nations to develop, employ and sustain equivalent defence and military capabilities allowing for immediate and seamless operations without disruption or deficiencies.

Enabling the Interchange: Technology and Industry

Canada's 2017 defence policy, Strong, Secure and Engaged (SSE) identified the need for a more agile and responsive industry, which resulted in the creation of Innovation For Defence Excellence and Security (IDEaS). SSE recognized that "Canada's military needs a fundamentally new approach to innovation that allows it to better tap into the extraordinary talent and ingenuity resident across the country."[6] In 2017, the notion of IDEaS was forward thinking and remains so.

While IDEaS exists to "support DND/CAF's mission by stimulating innovation and bringing solutions to enhance defence capabilities"[7], our principal allies have also moved into this direction. In 2019, the current construct of NavalX Tech Bridge (Tech Bridge) was created in the USA and by 2022 the London (UK) Tech Bridge was established. The vision statement for London Tech Bridge identifies core concepts such as being solutions driven; cultivating "partnerships with organizations across academia, industry, and government, to produce solutions that can be scaled to benefit defence, industry, and the general public." [8] Ultimately, the goal is to "improve the interoperability and interchangeability of our [USA, UK] Naval and Defense Services."[9] Broadening the scope of IDEaS to include academia and collaboration spaces lends itself to the possibility of integrating IDEaS into Tech Bridge[10], one of the foundations for advancing interchangeability amongst our principal allies. According to the Global Innovation Index, Canada ranks 15 amongst 132 economies and ranked first in joint venture / strategic alliance.[11] Furthermore, SSE noted areas "for advanced research and development include surveillance, cyber tools for defence, space, alternative fuels, remotely piloted systems, data analytics, and counter-improvised explosive device solutions." [12] Along with similarities in the aims of Tech Bridge and IDEaS, some of the areas for development remain congruent with the SOI. The SOI noted critical areas to enable interchangeability consist of digital transformation; artificial Intelligence; autonomy and remotely piloted systems. According to the CSIS 2017 study of Canada's defence industry, "Canadian defence firms work at the cutting edge in many technology areas; engineers, scientists, technologists, and other innovation-relevant occupations comprise over 30 percent of [the] workforce."[13] An innovative workforce working on cutting-edge technology is a necessary step towards interchangeability. However, a workforce integrated into a technology hub such as Tech Bridge to allow for

[6] Department of National Defence. Strong Secured and Engaged, Canada's Defence Policy. (2017). 77

[7] Department of National Defence. 2020-2021 Annual Report. IDEaS Innovation for Defence Excellence and Security. (2021). 4.

[8] NavalX Tech Bridge. 2020 Annual Report. (2021). 48.

[9] *Ibid.,* 48.

[10] Peter Martinis. Email message to IDEaS. "IDEaS - NavalX Tech Bridge: question" 16 May 2023.

[11] United Nations. World Intellectual Property Organization. Global Innovation Index. (2022).6. Last accessed 23 May 2023. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_2000_2022/ca.pdf

[12] Government of Canada. Strong Secured and Engaged, Canada's Defence Policy. 77

[13] Kristina Obecny and Gregory Sander. U.S.-Canadian Defense Industrial Cooperation. *Center for Strategic and International Studies*. CSIS Defense Industrial Group. (2017). 7

advanced research, design and development of defence systems and solutions is needed. Canada's technology industry is well-positioned to be an active contributor and potentially, a leader, needs to be enabled. IDEaS can be that organization.

Canada and the USA share a comprehensive defence cooperation framework and as a result, Canada's defence industry has developed and integrated itself into the broader US defence industry. In 1963, the Defense Development Production Sharing Agreement (DDPSA) was signed Canada and the USA. The DDPSA's intent was to ensure both the USA and Canada maintained a relatively equal trade balance within the defence industry. However, the trade balance eventually saw a number of US firms locate to Canada.

What followed the DDPSA was the evolution of Canada's defence industry to become less of a domestic producer of systems or platforms and instead a "producer of subsystems and components for the US market." [14] As a result the Canadian defence industry is characterized by specialized industrial capabilities.[15] Many of these specialized capabilities span all domains, from air sub-components; wide-area surveillance; digital fires control; sensor systems; acoustics processing, micro-UAVs, cyber components of underwater autonomous vehicles and integrated platform management systems.[16] All of these are integral to aligning industry to achieve interchangeability with Canada's principal allies.

However, the size of most Canadian companies involved in the defence industry means individually, they are not large enough to produce platforms and systems which can be easily shared. According to the CSIS, "90 percent of Canadian defense firms have fewer than 250 employees".[17] This invariably means it will be difficult for Canada to achieve the vital requirements for individual companies to produce certain platforms, without significant policy-industry alignment. Furthermore, achieving economies of scale will prove difficult particularly given the costs related to platforms, without participation from principal allies.

Subsequent agreements such as North American Defense Industrial Base Organization (NADIBO) have not altered this relationship. Canada's ability to provide additional surge capacity and sustain the US defence industry as recently as during the wars in Afghanistan and Iraq, required defence industrial cooperation.[18] This confirmed "Canadian industry's demonstrated engineering and sustainment expertise and familiarity with U.S. systems."[19]

However, Canada's ability to produce surface combatant platforms is well documented, owing to a robust development and production capability. Examples include the Restigouche, St. Laurent and, Annapolis classes, through to the Iroquois class destroyer and Halifax class frigate. Between the many classes, the Canadian shipbuilding industry has designed, developed and produced no less than 35 surface combatants over seven decades. This does not included the

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[14] Kristina Obecny and Gregory Sander. U.S.-Canadian Defense Industrial Cooperation. *Center for Strategic and International Studies*. CSIS Defense Industrial Group. (2017). 77

[15] *Ibid.,* 7.

[16] *Ibid.,* 8.

[17] *Ibid.,* VIII.

[18] Kristina Obecny and Gregory Sander. U.S.-Canadian Defense Industrial Cooperation. *Center for Strategic and International Studies*. CSIS Defense Industrial Group. (2017). 4.

[19] *Ibid.,* VIII.

new Canadian Single Class (CSC) combatant which will share the same hull design as its Australian and British counterparts. Although the surface combatants will certainly differ in some respects, it is conceivable that in this area Canada can achieve interchangeability with its principal allies. However, over-reliance on one partner can raise concerns about industrial capacity.

For example, concerns regarding industrial capacity were articulated at the outset of the AUKUS announcement. US Sen. Harry Reed and Sen. Inhofe stated "…we have grown more concerned about the state of the U.S. submarine industrial base as well as its ability to support the desired AUKUS SSN [nuclear sub] end state."[20] This is significant as both Senators expressed a concern about the capacity of the USA to sustain the capabilities of two nations, its own and Australia. The acquisition of the Virginia-class submarines is intended to bridge the capability gap Australia will have upon the decommissioning of the Collins-class submarines and onboarding of the SSN AUKUS-class submarines. Unlike Australia, Canada has not produced submarines nor has the industrial framework to do so. With Canada's surface shipbuilding industry being an exception, Canadian industry is largely a producer of components for modern platforms. A policy-industry alignment could further enable the production of platforms may be needed to successfully deliver interchangeability within defence and security partnerships with our principal allies. Doing so can mitigate over-reliance on one partner while allowing for mutually beneficial outputs.

Enabling the Ability: Expeditionary Operations and Continental Defence

In May 2021, a squadron of US Marine Corps F-35B STVOL aircraft began a seven month deployment aboard the *HMS Queen Elizabeth II,* part of Carrier Strike Group 21. The UK and USA achieved interchangeability in naval operations during the seven month long deployment through integrating a squadron of F-35B and a US Navy destroyer, [21] projecting combined sea and air power, long-range strike capabilities and sustainment. It was also during this deployment Italian F-35B STOVL aircraft operating from the Italian aircraft carrier *Cavour*, integrated and conducted combined-joint training which also included ground-based sustainment. This was a first for the F-35B STOVL and for the aircraft carriers of these NATO nations. It is plausible this endeavour was made easier because Italy, a Tier 2 F-35 program participant, has the only F-35B STOVL final assembly plant outside of the USA. This likely enabled the timely onboarding of the platform and, subsequent combined-joint operations with the USA and UK, both Tier 1 F-35 participants. Thus, can the Canadian military absorb interchangeability and if so, under which defence and security imperative: expeditionary operations or continental defence?

Without question, expeditionary operations play a critical role in Canada's defence and security objectives but there are significant limitations. Although Canada deploys forces as part

[20] Justin Katz. Breaking Defense News. "EXCLUSIVE: Reid, Inhofe warn Biden AUKUS risks becoming 'zero sum game' for US Navy". January 2022. Last accessed March 1, 2023: https://breakingdefense.com/2023/01/exclusive-reed-inhofe-warn-biden-aukus-risks-becoming-zero-sum-game-for-us-navy/

[21] United Kingdom. House of Commons Defence Committee. The Integrated Review, Defence in a Competitive Age and the Defence and Security Industrial Strategy. Second Report of Session 2022–23. (28 July 2022). 34.

of NATO and non-NATO tasks groups, Canada lacks, for example, in having a long range strike capability sufficient to achieve its own security aims and arguably, those as part of a broader partnership or alliance. Without, for instance, a long range strike capability, whether by way of aerospace, surface and subsurface platforms or systems, Canada's ability to be interchangeable with and support principal allies will remain inherently limited. To frame this, Australia's Minister of Defence, Richard Marles, speaking about future acquisitions and security, defined impactful projection as "an ability to hold an adversary at risk, much further from our shores." [22] While SSE stresses interoperability with allies, Canada's role in an expeditionary context with its principal allies will require systems and platforms that can achieve some amount of impactful projection, ultimately interchangeability.

Looking to the future, the CSC is projected to have a command management system that the U.S. Navy uses, the CMS330 with AEGIS and is projected to incorporate a number of defensive fires and precision fires capabilities, specifically the Tomahawk missile. [23] If this capability is implemented, Canada will join the UK and USA as being the only nations with Tomahawk missiles on surface combatants. This is significant because the CSC will allow Canada to integrate into US-led naval task forces and do so without significant deficiencies in the capabilities of comparable surface combatant platforms. This will allow for a Canadian ship to fill "an operational role just as well as a U.S. ship can." [24] However, with construction scheduled to occur in 2023-24, and first delivery in the 2030's, Canada's ability to provide impactful projection remains years' away, limiting Canada's ability to become interchangeable, for now.

In contrast, the Canada-USA defence and security partnership is in some respects constrained to absorb interchangeability within continental defence. Although Canada may not be able to absorb interchangeability writ large, it will be well positioned to do so upon the employment of acquired systems, platforms and investment in infrastructure primarily through NORAD and the NORAD Modernization Project.

In the context of Canada and continental defence and what this may mean, consider the AUKUS case where Ashley Townsend describes interchangeability as follows: "It looks like a US or British submarine in Australia being replenished by Australian ground crews, it looks like US strategic bomber arriving in Australia being rearmed by Australians refuelled by Americans that are on the ground, doing so in ways that are nationality agnostic." [25] The concept of nationality agnostic is crucial to interchangeability, from industry through to development, employment and sustainment.

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[22] Dr. Marcus Hellyer and Andrew Nichols. Impactful Projection: Long Range Strike Options for Australia. Australian Strategic Policy Institute. (12 Dec 2022). 7.

[23] Canada. Department of National Defence. Royal Canadian Navy. CSC Factsheet English, October 2021. http://www.navy-marine.forces.gc.ca/assets/NAVY_Internet/docs/en/fleet/csc-fact-sheet-eng.pdf

[24] Admiral Mike Gilday, "CNO Seeks Not Just Interoperability But Interchangeability With Foreign Militaries". Defense One. July 2022. Last accessed May 1, 2023: https://www.defenseone.com/threats/2022/07/exclusive-cno-seeks-not-just-interoperability-interchangeability-foreign-militaries/374905/

[25] Ashely Townsend "Making AUKUS work for the US-Australia Alliance". Video. Carnegie Endowment for International Peace. March 16, 2023. 1:03:25. https://carnegieendowment.org/2023/03/16/making-aukus-work-for-u.s.-australia-alliance-event-8052

Therefore, how might this look in the case of Canada's continental defence responsibilities? As part of the NORAD Modernization Project, Canada will upgrade "infrastructure to support the arrival of our new fleet of F-35 fighter jets and United States NORAD capabilities" [26] and thus "will meet NORAD and broader Canadian Armed Forces military requirements." [27] The requisite logistics, maintenance and infrastructure needed to support the relationship will be shared with our principal ally when or as required as part of NORAD operations. Therefore, there will be a framework in which the United States Air Force (USAF) and Royal Canadian Air Force (RCAF) could conduct integrated land-based air and achieve a similar level of interchangeability the USA and UK achieved in naval air operations in 2021. This will be due to Canada and the USA employing the same air platform, operating out of shared locations and sustained by mutually supportive logistics. The ability to absorb interchangeability is achievable within NORAD and continental defence, but likely incremental.

Conclusion

While interoperability and interchangeability can coexist, the imperative for Canada is to progress towards interchangeability with its principal allies. Interchangeability requires a forward thinking approach, sharing, aligning and integrating technology and industry through to developing and employing capabilities from systems to platforms.

Some challenges which Canada will face will be in its industrial capacity to absorb interchangeability. Relying on one defence partner may be a short-term need, but it is not a long-term solution. Canada's defence industry is fragmented and will likely require a policy-industry alignment to support interchangeability. Within its current defence industry partnership, the development of components or systems with the USA will continue to enable the sharing of technology throughout the lifecycle of platforms and systems but, more is required.

There are niche aspects to Canada's defence technology industry which can be leveraged for mutual benefit. With Canada's standing in technology and its integration in the broader US defence industry, integrating IDEaS into the Tech Bridge partnership will allow for access to advanced technologies and concepts. This may result in Canada being a valuable net contributor to advanced technology and concepts, while also benefitting.

The Canadian military's capacity to absorb interchangeability will be a long-term endeavor and achievable in an incremental approach. Interchangeability can be achievable initially through NORAD and continental defence. NORAD modernization will harness Canadian industry to advance the needed capabilities, sustainment and logistics to fully integrate the military resources of both nations. Beyond continental defence, the platforms required are years away but once delivered, may allow for Canada to integrate with its principal allies.

The benefit of achieving interchangeability will allow Canada to face emerging defence and security challenges within a compatible and mutually supportive framework with our principal allies. Incompatibility will inhibit the development and integration of capabilities required for Canada to fulfill its defence obligations. The implications for future policy will be

[26] Canada. Department of National Defence. "NORAD Modernization Project Timelines." Last accessed 15 May 2023. https://www.canada.ca/en/department-national-defence/services/operations/allies-partners/norad/norad-modernization-project-timelines.html

[27] *Ibid.*

prioritizing the industry, domain and the platforms of initial focus. This will likely be followed by assessing the impact on the employment and sustainment of forces, domestically and within an alliance construct. The risk in not pursuing interchangeability is a defence and security architecture incompatible with that of our principal allies. If Canada does not lead or follow, Canada may merely fade away.

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