CDA INSTITUTE

NORAD MODERNIZATION FORUM

SEPTEMBER 9TH, 2020

THIRD REPORT

JADC2/JADO

Introduction

The CDA Institute, in partnership with NDIA and NORAD/USNORTHCOM, hosted a three-part virtual roundtable focused on NORAD modernization. The goal was to allow experts from industry, academia, and government to break down silos and engage in direct conversations about North American continental defence challenges and what form NORAD modernization might take to address them. The forum was created to imagine the art of the possible. More specifically, the goal of these three events were to identify security gaps and brainstorm actionable solutions to the issues identified during the discussions.

- **12 August 2020: Domain Awareness/Sensors**
- **26 August 2020: Defeat Capabilities**
- **9 September 2020: JADC2/JADO**

This report, focused on JADC2/JADO, summarizes the final of these three events. The report will outline the major points of consensus and contention reached by participants during the webinar, a backgrounder on Joint All Domain Command and Control Concepts, a section on obstacles to modernization, JADC2 requirements, design considerations for Canadian industry, and 'JADC2 on spec'. This report was commissioned by the CDA Institute and is intended to read as an overview of the key points made by our invited experts.

NORAD **Deputy Commander LGen Pelletier** gave introductory and closing remarks. A white paper overview was provided by **Dr. Thomas Walker** of Lockheed Martin. **Col Matt Eberhard**, Director of the Commander's Initiatives Group for NORAD/USNORTHCOM, provided the scene setter. **Ken Traylor** of Lockheed Martin moderated a panel discussion that included:

- **Speedy Martin**, Gen (USAF ret), GSMartin Consulting, Inc.
- **Dale Meyerose**, Maj Gen (USAF ret), MeyerRose Group, LLC.
- **Joe Wysocki**, Systems Planning and Analysis (SPA) Corporation.
- **Lee Obst**, Managing director Rockwell Collins (Collins Aerospace).

The report was produced by rapporteurs from the North American and Arctic Defence and Security Network (NAADSN), a Department of National Defence MINDS Collaborative Network.

Executive Summary

Joint All Domain Awareness Command and Control (JADC2) is a major element of NORAD modernization and continental defence, but more importantly represents a requirement for the entire American military and its global commitments. Developed by the United States Air Force (USAF), JADC2 draws data from a myriad of sensors to quickly detect threats, alert decision-makers, and guide defeat mechanisms to meeting these dangers. By utilizing artificial intelligence (AI), JADC2 aims to establish 'decision-making superiority' for authorities to effectively counter the actions of great power adversaries and deter them from mounting outright threats to the international system.

Canada boasts a wide range of technical capabilities to develop AI and other technologies supporting the JADC2 capability. However, lack of political will, policy, and slow procurement practices all stand in the way of Canadian industry actively participating in the JADC2 project. The infrastructure such a system will bring to remote Canada, including connecting it to the digital economy, should be emphasised to generate political support. Policy must also be developed to bring non-traditional defence players to JADC2 and to assist Canadian industry at large in obtaining American security clearances to participate. Developing speed and agility - words not normally associated with Canada's procurement processes - will be essential to keep pace with American industry as the JADC2 capability is created.

Canadian industry is well matched to contribute to JADC2, particularly in helping to build the communications infrastructure and networking that will securely move vast amounts of data around the world and processing it using AI. Canadian industry's ability to integrate data from across all domains and effectively present it to users will determine its success in this programme, making software development a crucial characteristic driving JADC2 capability.

Traditional procurement methods delivering 'mega systems' are not appropriate for JADC2. This capability should be developed through an incremental approach involving testing, building, and testing again. For this approach to unfold, major decisions must be made about what data is to be shared with whom. Sharing data with allies can enhance the scope of JADC2 and sharing data with civilian stakeholders can generate economic benefits. Both options bring challenges in protecting the integrity of the data being fed to JADC2. Whatever sharing practices are adopted, these decisions must be made before technical solutions that are essential to JADC2 can be designed and implemented.

Points of Consensus

- The goal of JADC2 is to provide global deterrence by giving ‘decision-making superiority’ to authorities.
- Developing AI will truly enable JADC2.
- JADC2 development prioritizes software solutions over hardware.
- Canadian industry has the capacity to contribute across the spectrum of JADC2 development.
- Canadian politics, policies, and procurement practices create obstacles for its industries to actively participate in JADC2 development.

Points of Contention

- JADC2 user customization facilitating decision-making versus added system complexity and hindrance to decision making.
- An appropriate balance between American security clearances and Canadian industry access to actively participate in NORAD modernization remains to be achieved.

Joint All Domain Command and Control Concepts

JADC2 "is spoken about in very ethereal terms," explained Col Matt Eberhard, Director of the Commander's Initiatives Group for NORAD/USNORTHCOM. These terms include redundancy, resilient architecture, and information 'at the speed of relevance'. While all of these terms are important, they are not useful for articulating how best to create the JADC2 capability. Ultimately, Eberhard argued that establishing JADC2 is about looking at the realm of the possible in building for now whilst keeping an eye on emerging technologies and their easy integration into the capability of tomorrow.

Eberhard provided background on JADC2, explaining that over the last two years USNORTHCOM has been refocusing on homeland defence. Command has tried to articulate the requirements it needs to fulfil this mission from a material solutions standpoint through the creation of the Strategic Homeland Integrated Ecosystem for Layered Defense (SHIELD) framework. SHIELD takes an adaptive approach that can keep up with the technological advancements of adversaries whilst integrating the civilian capabilities of allies, transitioning them to defence applications when the need arises through JADC2.

This JADC2 capability can take feeds from existing sensors but will also be able to handle future sensors with nascent technologies "from sub-surface to on orbit," fusing the data into a comprehensive picture that can identify threats at the extreme edge of awareness, not waiting for the threat to travel through layers of sensors and aggregated reporting to identify it as such. When a threat must be countered, SHIELD aims to develop advanced defeat mechanisms

that provide an active defence with a deep magazine. The goal is to 'flip the cost-curve' against the threats seen today so that a $3-10 million interceptor missile is not sent against a $300,000 threat.

JADC2 is the lynchpin connecting sensors and defeat mechanisms. Developing a JADC2 capability is a key area of emphasis for the American military as it is an essential requirement to succeed in a great power conflict. JADC2 is not a bespoken requirement for either NORAD/USNORTHCOM modernization. JADC2
is a requirement for the entire American military and its global commitments to "fight and win the fights of tomorrow." The intention is to make this capability available to allies and partners for future great power conflict, in what will be a globally integrated fight.

Drawing data from every sensor and sending it to the best shooter at all C2 nodes is accomplished by overcoming three challenges, Eberhart explained. The first is a data problem: sorting through processed data for authoritative data. This data is not just drawn from sensor data; it can be input by a distant soldier through a device that can feed directly into the system or even data coming in through social media reporting. The second challenge is cloud-based data architecture through which all the data must be ingested and infused. It must be open and accessible across all echelons of command. The goal is to provide user-defined information from the cloud. Lastly is the challenge of creating an all-domain common operating picture: essentially how all of this data is displayed. This entails the layers and fusion of all sorts of feeds, from threats to friendly readiness data, and presenting it in a user-defined awareness for the commander.

The goal is to be able to use this data around the world, enabling global integration with allies.

These three processes represent a significant step forward for C2 capabilities. However, overcoming these three challenges in themselves does not enable JADC2 capability. The sheer volume of data that is fed to C2, due to great power adversaries advancing as they are, overwhelms the human brain. Eberhard argues that for true JADC2, a fourth challenge must be overcome: machine-enabled insights.

Eberhard described machine-enabled insights as "at the heart of the JADC2." Computers are able to handle the volume of data the brain's physiology cannot. Machine-enabled insights are more than connecting sensors to shooters and winning conflicts. Eberhard was clear that the true capability of JADC2 comes into play before a shot is fired, increasing the decision space to act earlier on deployments and overall posture. Ultimately, JADC2 aims to provide authoritative information in real time to decision-makers so they can take actions "that deter competition and deescalate in crisis."

Eberhard unpacked the machine-enabled insight challenge, the first priority being to

free humans from the big data, shifting them from pattern and anomaly detection and predictive analytics to focusing on higher order processes. This means applying deep learning – an aspect of AI – which is basically machine learning at a broader level to examine an adversary's battlespace and identify patterns of behaviour that are associated with certain activities, generating operational alerts for decision-makers when something is afoot.

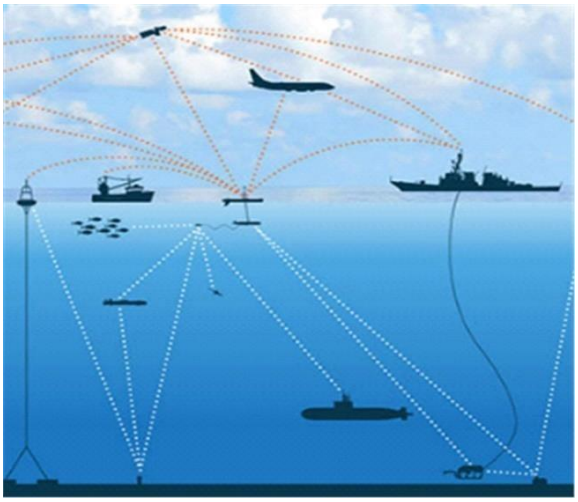
The second priority is to develop AI beyond pattern recognition and into hypothetical scenarios. This means layering historical and present data feeds to generate threat assessments, thus discerning an adversary's most likely and most dangerous courses of action for presentation to decision-makers. This assessment capability can also be used for allied contingency planning so that decision-makers can determine they can assume which posture best aligns with the data they are seeing in real time.

The final priority is to incorporate true AI into the process to look at all the sensor feeds and pair readiness data from observation of adversaries with generated hypotheticals. Eberhard was emphatic that the AI will not be making the decisions but will enable human beings to make decisions based on a position of information dominance. AI will allow the United States and its allies to make faster and better decisions on a foundation of clearer data than their adversaries, thus achieving 'decision-making superiority'. Eberhard concluded that this is the essence of the four-part concept that is being used to build the USAF's Advanced Battle Management System (ABMS) into a JADC2 capability with the support of software companies.

Obstacles to the Modernization of and the Defence of North America

Lee Obst, Managing Director of Rockwell Collins Canada, argued that Canada has strong technical capabilities to engage across the spectrum of JADC2 development. However, Canadian policy, political will, and procurement practices hinder industry from actively participating in JADC2. Obst posited that NORAD needs to appreciate that Canadian politics differ significantly from American, and that Canadian threat perceptions are lower than those south of the border. This means that politicians will be less willing to devote tax dollars to national defence spending. The pandemic and the major recession that it has caused are likely to push defence spending even further down the priority list for many Canadians. Obst recommended that JADC2 thus be presented to politicians not just as a defence capability, but as a major infrastructure project that will

connect Canadians to the digital economy across the vastness of the country. Remote communities in the North will particularly benefit from this infrastructure, especially from connectivity facilitated by new space-based assets feeding data to JADC2.



Obst also argued that Canada must enact policies to enable its industry's full participation in NORAD modernization, particularly by incentivizing high technology non-traditional defence players to join JADC2 development. This also means finding a solution to American security classification processes which act as a barrier to participation. How can Canadian companies receive appropriate classifications in a timely process that allows for their participation whilst preserving the protections that these classifications offer? Col (ret'd) Joe Wysocki, Vice President and Group Lead at SPA, warned that streamlining security classifications are an issue that has been discussed for decades with little policy progress. Regardless, Obst advocated (and Wysocki acknowledged) that government must engage as soon as possible with American authorities to allow for enhanced data and technology sharing between American and Canadian players in a less burdensome fashion.

Lastly, Obst noted that Canadian procurement system is robust but not particularly agile. Will it be able to meet the rapidly changing high tech environment that is generating JADC2? Canada's procurement system is slower than American practices, putting Canadian industry at an immediate disadvantage relative to their American counterparts.

Design Considerations for Canadian Industry

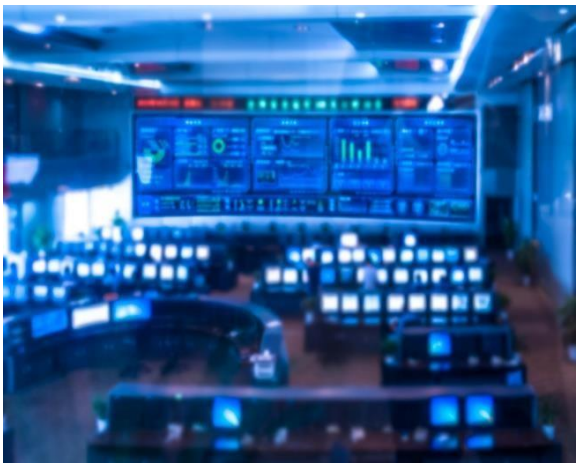
According to Gen (ret'd) Gregory Martin, President and CEO of GS Martin Consulting Inc., the USAF's drive to acquire JADC2 began in 2015 with its focus shifting to potential great power conflict and its subsequent creation of the ABMS. The USAF began testing the ABMS through the 'Doolittle' series, which has since given way to 'on ramp' exercises, and ABMS produced the operational concept of JADC2. Martin noted that USAF planning efforts made clear to him that for the United States and its allies to prevail in a future great power conflict, they would have to present their adversaries with "more deceptive, disruptive, and destructive dilemmas than they could overcome." The decisive factor is the ability to lash these things together across the all-domain environment to overwhelm adversaries. Martin hopes that future 'on ramps' will give Canadian industry insights into how domains can be fused together and into the technologies needed to fashion dilemma delivering systems.

Maj Gen (ret'd) Dale Meyerrose, President of the MeyerRose Group, noted that while most attention is focused on the technology enabling battle management, the people using this technology is the most important variable. He made two major observations about how JADC2 technology can best enable the people who will use it. The more

things are added to JADC2, the more complex it becomes, thus making it harder to reach a decision. Complexity adds to technical risk, human error risk, and cyber security risk. Second, Meyerrose observed that it is often more effective to try and do a little less than it is to try and do everything. If technology does not contribute to NORAD's core goals, then it should be pushed aside. Meyerrose insisted that it is essential for NORAD to cover the basics and to do them well.

Obst observed that Canada's large and robust defence industry is well suited to contribute substantively across the spectrum of JADC2 requirements. This also presents an excellent opportunity to bring Canada's diverse advanced technology industry – a non-traditional defence player – into the process. While larger Canadian technologies companies specialize in network communications and telecommunications, many smaller- and medium-size advanced technology firms work in quantum computing, data analytics, and AI—the very technologies that will enable JADC2. Obst

highlighted that these companies could benefit from public-private partnerships to overcome political resistance, building communications infrastructure as a positive externality of their work for NORAD which will benefit Canadians across the country. Industry will need to collaborate with the Canadian and American governments to



qualify non-traditional defence companies with the appropriate security classifications necessary to participate. Access to NORAD data will give these companies a competitive advantage in future commercial endeavours, generating issues of intellectual property rights that will need to be addressed. This means industry will have to deeply engage in the software development which will be "the heart and soul" of the future JADC2 system. Ultimately, Obst emphasized that Canadian industry wants to participate in the creation of these technologies rather than be buyers and users of them.

Wysocki argued that Canadian industry has an opportunity in the transportation of data across a renewed NORAD in real or near real time. Wysocki suggests that microservice architecture can help overcome this challenge. Processing data remains a challenge for JADC2 that Canadian industry can also address. Advancements in sensors represent a growing data exponentially, with much of the data that they provide being left on the proverbial floor owing to bottlenecks in transporting it and challenges in processing it. AI can help to process larger volumes of data and present it as actionable information. Regardless of what

opportunities industry chooses to pursue, Wysocki noted how companies should approach these challenges. He warned that leaders must be aware of tribalism within their centres and should suppress the urge to compete against each other. Leaders need to "grow a selfish culture" around *mission* success, not around who gets credit for providing individual solutions.

JADC2 on Spec

Martin referenced traditional military procurement methods, arguing that "if past is prologue, there is no way we will get" an effective JADC2 capability. He asserted that past procurement methods, if applied to JADC2, would deliver a proprietary and inflexible 'mega system' within ten to fifteen years that would offer little capacity for upgrading over time. Instead, Martin articulated the need for a new and incremental procurement path to JADC2, achieved through testing a bit, then building a bit, testing again, and so on. Obst agreed, arguing that evolving capability requirements should be driving this approach. There is a need for NORAD and industry to be able to experiment faster to better meet requirements: what Obst termed a "buy and try" approach. Open architecture will allow for "plug and play" of various components across the entire system, which can rapidly grow JADC2. Obst offered the analogy of what cellular phones were fifteen years ago and what they have become. Martin gave the example of the F/A-18 Super Hornet, an aircraft that is still not what was originally promised but one that has been operational for the past twenty years and is continuously being upgraded. Like the Super Hornet, the first article of JADC2 is not the final plan. The capability will keep growing via an incremental process to meet evolving demands.

Meyerrose emphasized that data demands will shape how JADC2 develops. Obst suggested that the 'Five Eyes' intelligence community and NATO all have capabilities that can contribute to JADC2's global all-domain picture. Wysocki pointed out that the sharing of data between allies brings with it the challenge of contributing to the maintenance and updating of architecture across JADC2. He suggested that a good model for this future burden sharing can be found in the American nuclear command and communications (N3) world, as the different Services invest appropriately across N3 to maintaining and renewing the nuclear deterrent.

Obst noted that the massive amount of data that sensors are collecting is not just for military purposes, but also has civilian applications. For example, weather data informs the insurance industry by offering predictive data on storm damage. The technology and data that enables JADC2 can be mobilized for civilian purposes with the appropriate business model. Wysocki offered two examples of how the challenge of sharing data with the civilian world could be managed, drawing on his background in the space community. Operation Olympic Defender brings together allies to provide joint C2 for space. Data is pooled from and shared across multiple communities. The space community also has the Unified Data Library (UDL) which captures data on space objects. The UDL classifies and partitions this data, allowing for entities with the requisite security clearances to draw from it as needed. Wysocki asserted that decisions about how, and with whom, JADC2 data is shared must be made before technical solutions to enable this sharing are designed and implemented.

Meyerrose also raised the issue of data integrity, stating that sharing it increases the

risk of compromising JADC2. He suggested that industry should look at how banks and credit card companies securely handle tremendous volumes of financial transactions. To prevent financial data from being exploited, these companies did two things. First, they segmented their data so that had to be correctly combined for a complete picture. Second, these companies rely on Robotic Process Automation (RPA) to process vast amounts of data, freeing up people to do other things. NORAD must pursue segmented data and RPA to transport and process data for JADC2 - a point that Obst seconded.

Wysocki also raised that, while JADC2 can be applied across the globe, users should be able to customize their interface at the tactical level to give them the data they need, tailoring needs to match geographic demands. Meyerrose concurred, arguing that industry must make the architecture modular so that users can tailor JADC2 for specific missions. He also warned that excessive customization adds to the complexity of the system, running the risk of inhibiting decision-making. Where the balance lies between customization and complexity remains to be determined.

Conclusion

LGen Pelletier, Deputy Commander of NORAD, closed the webinar by noting that this series helped to clarify the challenges that exist in renewing the binational command. Of the challenges covered during the webinars, JADC2 is the most exciting problem. The capability is about enabling decision cycles that are needed for NORAD to defend North America and narrowing the gaps in the defences of the command. JADC2 promises to draw information from myriad sources and process huge volumes of data to deliver predictive intelligence, taking humans “out of the loop” of crunching numbers and placing them “on the loop” of the decision-making cycle.

Current projects like Pathfinder are helping NORAD to become more agile, making

faster and better decisions. Pelletier emphasized, however, that NORAD still has a long way to go. Industry is well ahead of the military on big data issues, and Pelletier hopes that industry will work with NORAD to tackle these challenges and deliver modular solutions, plugged into a layered architecture, that will better enable the binational command to detect, deter and defeat threats against North America.

Special thanks to our NAADSN rapporteurs:

Ryan Dean and Dr. Nancy Teeple