



DISTRIBUTED CONTROL: FLEXIBLE AND ADAPTIVE AIR POWER

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Service Paper

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AIM

1. This paper aims to demonstrate how and why the Royal Canadian Air Force (RCAF) needs to adjust its Command and Control (C2) doctrine by adopting distributed control to empower and provide additional flexibility and resiliency for its domestic Wings and deployed air detachments to operate in a contested and degraded environment.

2. Distributed control is currently being implemented into the US Air Force doctrine.¹ Due to the inability of the North Warning System (NWS) to detect and prevent new threats from hyper-glide weapons, coupled with increasing threats from hostile peers cyber and space capabilities, and the geographic dispersity of RCAF Wings, distributed control remains relevant to Canadian domestic and international operations. This paper will explore options to help implement distributed control doctrine to improve the RCAF's ability to operate in a contested Anti-Access and Anti-Denial (A2/AD) environment with degraded communication and networks to ensure the force remains capable of protecting Canada and projecting air power, home and abroad.

INTRODUCTION

3. The RCAF relies heavily on networks, communication, and data to coordinate C2 enabling it to plan and execute missions. The Combined Air Operations Centre (CAOC) remains a central component for providing the Air Component Commander (ACC) with the necessary situational awareness and ability to coordinate air operations with other Air Components.² This C2 network helps enable mission command through the air power tenets of centralized control and decentralized execution.³ This remains particularly important for coordinating air power as the RCAF is already heavily decentralized operating domestically and internationally across multiple bases.⁴ Notably, a major strength and tactical advantage of the RCAF is its ability to rely on space-enabled

¹ United States, Air Force, *Air Force Doctrine Publication 1-1, Mission Command*, 14 August 2023, p. 1, https://www.doctrine.af.mil/Portals/61/documents/AFDP_1-1/AFDP%201-1%20Mission%20Command.pdf.

² Canada. Department of National Defence. *B-GA-402-001 RCAF Command and Control*, 22 June 2017, p. 2-4, <https://www.canada.ca/content/dam/rcaf-arc/migration/docs/en/aerospace-warfare-centre/b-ga-402-001-fp-001-royal-canadian-air-force-doctrine-command-and-control.pdf>.

³ Canada. Department of National Defence. *B-GA-400 RCAF Capstone Doctrine*, November 2016, p. 16, https://publications.gc.ca/collections/collection_2017/mdn-dnd/D2-368-2016-eng.pdf.

⁴ During OP MOBILE, due to limited ramp space, the RCAF operated out of Sigonella, and Trapani in Italy, Richard Mayne, *Air Wing, RCAF Commander's Perspective During the 2011 Libyan Campaign*, Canadian Forces Aerospace Warfare Centre Production Section, 2018, p. 9, https://publications.gc.ca/collections/collection_2018/mdn-dnd/D2-401-2018-eng.pdf.

Furthermore, the RCAF maintains 14 Air Wings Across Canada.

systems, and information networks to maintain visibility of the battlespace.⁵ This was evident during the past air campaigns in Libya, Iraq, and Afghanistan where the RCAF and its allies maintained air supremacy with these capabilities providing a major advantage for which opponents had limited abilities to challenge.⁶ Although a strength, the data and communication networks remain an important critical capability providing information superiority, for which the RCAF remains very reliant to coordinate C2 and rapidly project air power.

4. However, Russia's current war against Ukraine, coupled with China's adoption of grey zone tactics and military modernization in the Indo-Pacific, has transitioned the globe toward the realities of great power competition. Both China and Russia have invested heavily in their cyber and space capabilities⁷ adapting their doctrine to attack and disable Western nations' C2 systems, through speed, deception, and surprise. This strategy would restrain, dissuade, and deny the RCAF's ability to operate and project force upon the immediate commencement of hostilities.⁸ Furthermore, both these peer nations are now employing precision hypersonic weapons and advanced cruise missiles, that the NWS can no longer track and identify.⁹ The distance provided by the three oceans surrounding Canada, previously a strength in Canada's defense posture, is therefore no longer a valid denial strategy as cyber, space, and precision weapons now have near-unlimited reach.¹⁰

5. Russian and Chinese A2/AD strategies provide them with the ability to prevent the RCAF from maneuvering or accessing strategic locations, intending to achieve effects before the battlefield can be contested.¹¹ They also pose a risk to communication and data networks that enable C2 and support the RCAF's Observe, Orient, Decide, and Act

⁵ Canada. Department of National Defence. *Strong Secured and Engaged, Canada's Defence Policy*, 2017, accessed 27 December 2023, p.55, <https://www.canada.ca/en/department-national-defence/corporate/policies-standards/canada-defence-policy.html>.

⁶ Gilmary Michael hostage III, and Larry R. Broadwell Jr, *Resilient Command and Control: The need for Distributed Control*, National Defense University Press, Joint Force Quarterly 74, 1 July 2014, <https://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-74/Article/577526/resilient-command-and-control-the-need-for-distributed-control/>.

⁷ Scott Pence, *Fighting as Intended – The Case for Austere Communications*, Joint Force Quarterly 102, 3rd Quarter, 1 July 2021, p. 5, <https://ndupress.ndu.edu/Media/News/News-Article/View/Article/2679508/fighting-as-intended-the-case-for-austere-communications/>.

⁸ Tom Lawrence, Major (RCAF), *Coming to a Theater near You Evolving Air Combat to Counter Anti-Access and Area-Denial*, Air & Space Power Journal, Summer 2021, p. 40, https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-35_Issue-2/F_Lawrence.pdf.

⁹ Andrea Charron, and James Ferguson, *Beyond NORAD and Modernization to North American Defence Evolution*, Canadian Global Affairs Institute, May 2017, p. 3, https://d3n8a8pro7vhmx.cloudfront.net/cdfai/pages/1629/attachments/original/1494458224/Beyond_NORAD_and_Modernization_to_North_American_Defence_Evolution.pdf?1494458224.

¹⁰ Jahara W. Matisek, *Multidomain Airpower Strategy: Integrating Air, Space, and Cyber Assets*, Chapter 7 in *Military Strategy, Joint Operations and Airpower*, edited by Ryan Burke, Michael Fowler, and Kevin McCaskey, Washington: Georgetown University Press, 2018, p. 92.

¹¹ NATO, *Delivering NATO Air & Space Power at the Speed of Relevance*, Joint Air and Space Power Conference 2021, p. 122, https://www.japcc.org/wp-content/uploads/Read_Ahead_2021_Screen.pdf.

(OODA) loop process.¹² A recent US wargame, simulating a Taiwan Campaign, demonstrated that networks and C2 remained vulnerable and would be the first systems to be attacked.¹³ As outlined in the Pan Domain Force Employment Concept (PFEC) “the Canadian Armed Forces (CAF) must expect to sustain damage be it to its equipment, communications infrastructure, sustainment networks, and must have the resilience to continue functioning.”¹⁴ Therefore, the RCAF must plan for future contested operations with limited to no air superiority and must seize the initiative by adapting and being ready to fight in a degraded environment with limited communications and networks. Updating the RCAF’s C2 doctrine through integrating distributed control will provide the RCAF with the means to provide better flexibility and survivability as further discussed below.

DISCUSSION

Distributed Control Doctrine

6. Retired General Hostage III, former US Commander, Air Combat Command, defines distributed control as “the conditional, adaptive delegation or assumption of control activities through orders or protocols to synchronize operations, maintain initiative, and achieve commanders’ intent.”¹⁵ Distributed control can be managed explicitly or implicitly. Implicitly, distributed control could occur when a set of pre-established conditions occur, such as the loss of communications with higher headquarters (HHQ) such as the CAOC. In this situation, despite the loss of connectivity, the Commander of the Wing or Air Detachment would be delegated and assume additional responsibilities to continue operating without disruption to operations until communications were reestablished.¹⁶ This doctrine provides additional agility and flexibility for commanders, detached from HHQ, to rapidly respond, and continue operating in a degraded environment, through a decentralized command structure, limiting the window of opportunity for the opponent.¹⁷

¹² Jahara W. Matissek, *Multidomain Airpower Strategy: Integrating Air, Space, and Cyber Assets*, Chapter 7 in *Military Strategy, Joint Operations and Airpower*, edited by Ryan Burke, Michael Fowler, and Kevin McCaskey, Washington: Georgetown University Press, 2018, p. 94.

¹³ Tara Copp, *It Failed Miserably: After Wargaming Loss, joint Chiefs are Overhauling the US military will Fight*, *Defence One*, 26 July 2021, <https://www.defenseone.com/policy/2021/07/it-failed-miserably-after-wargaming-loss-joint-chiefs-are-overhauling-how-us-military-will-fight/184050/>.

¹⁴ Canada. Department of National Defence. *Pan Domain Force Employment Concept, Prevailing in a Dangerous World*, 2023, p. 32.

¹⁵ Gilmary Michael Hostage III, General US Air Force, and Larry R. Broadwell Jr, Major General US Air Force *Resilient Command and Control: The need for Distributed Control*, National Defense University Press, *Joint Force Quarterly* 74, 1 July 2014, <https://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-74/Article/577526/resilient-command-and-control-the-need-for-distributed-control/>.

¹⁶ *Ibid.*

¹⁷ NATO, *Delivering NATO Air & Space Power at the Speed of Relevance*, Joint Air and Space Power Conference 2021, p. 126, https://www.ulib.sk/files/english/nato-library/collections/monographs/japcc-conference-proceedings/japcc_conference_proceedings_2021.pdf.

7. Distributed control can also provide the ACC with additional flexibility by explicitly delegating authority so the CAOC can focus attention elsewhere, such as higher priority tasks, or devise and redistribute an existing Air Detachment or Wing, providing the ability to quickly adapt to threats on the battlefield.¹⁸ In a contested environment with capable peer opponents, weapons such as GPS-guided ballistic missiles, coupled with Increased Intelligence Surveillance and Reconnaissance (ISR) capabilities, such as drones and space satellite surveillance, have increased the speed, precision, reach, and flexibility of weapons. Although funding pressures would encourage centralization,¹⁹ the need to disperse forces during operations to improve survivability has increased. With the limited number of existing RCAF platforms, coupled with China and Russia's capable and sizable air forces of 4th and 5th-generation fighters,²⁰ diminishing risk by dispersing forces will be key to decreasing losses due to attrition and precision strikes.²¹ Distributed control would therefore enhance the current RCAF doctrine providing the ability to explicitly split and rapidly reassign forces as required.

Implementation of Distributed Control in the RCAF

8. To enable distributed control, it is fundamental that the commander's intent and direction include clear detailed priorities and objectives, and be distributed to tactical aviators, planners, and commanders. This detailed direction will allow tactical units the ability to quickly continue planning and executing missions, should communications be lost with the CAOC or if these tactical Air Detachments or Wings are explicitly provided operational control (OPCON) by the CAOC to execute missions.²² It will be key that condition-based authorities are documented in writing. This can be achieved through the provision of pre-planned Air Tasking Orders (ATO), Special Instructions (Spins), and Air Operations Directives (AOD). Furthermore, Transfer of Command Authorities (TOCA) needs to be made available to provide authority to command the equipment, and personnel allocated to them.²³ These documents will assist commanders with continuing

¹⁸ Gilmary Michael Hostage III, General US Air Force, and Larry R. Broadwell Jr, Major General US Air Force *Resilient Command and Control: The need for Distributed Control*, National Defense University Scott Press, Joint Force Quarterly 74, 1 July 2014, <https://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-74/Article/577526/resilient-command-and-control-the-need-for-distributed-control/>.

¹⁹ Frederick Coleman, Colonel (USAF), *Distributed Control; Getting it Right*, The Mitchell Institute for Aerospace Studies, The Mitchell Forum, No. 50, January 2023, p. 1, https://mitchellaerospacepower.org/wp-content/uploads/2023/01/MI_Forum_50-C2-Distributed-Control-FINAL.pdf.

²⁰ Brad Gladman and Andrew Billyard, *Canada, Royal Canadian Air Force Future Air Operating Concept (FAOC) Functional Concepts*, Defence Research and Development Canada, Government of Canada, 2017, p. 9 and 12, https://cradpdf.drdc-rddc.gc.ca/PDFS/unc322/p807784_A1b.pdf.

²¹ Frederick Coleman, Colonel (USAF), *Distributed Control; Getting it Right*, The Mitchell Institute for Aerospace Studies, The Mitchell Forum, No. 50, January 2023, p. 4, https://mitchellaerospacepower.org/wp-content/uploads/2023/01/MI_Forum_50-C2-Distributed-Control-FINAL.pdf.

²² Tom Lawrence, Major (RCAF), *Coming to a Theater near You Evolving Air Combat to Counter Anti-Access and Area -Denial*, Air & Space Power Journal, Summer 2021, p. 43, https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-35_Issue-2/F_Lawrence.pdf.

²³ Pux Barnes, Lieutenant-Colonel RCAF (Deceased), *Mission Command and the RCAF: Considerations for the Employment of Air Power in Joint Operations, Command and Control and The Royal Canadian Air*

to plan and execute missions should communications be degraded for a prolonged period.²⁴

9. Additionally, to ensure sufficient mission command, conditions-based delegation of authorities needs to remain flexible to empower tactical commanders and aviators. Mission Command is essential as it involves “centralized intent and decentralized execution which allows the force to take calculated and managed risks, as well as learn, anticipate, and adapt quicker than unsupportive and hostile actors to exploit opportunities.”²⁵ Also, well-understood and adaptable Rules of Engagement (ROE) are essential to provide tactical aviators with the ability to conduct dynamic targeting should communication be degraded.²⁶ Finally, to enable distributed control, the RCAF must establish and distribute Standard Operating Procedures (SOPs) to identify actions to take should communications be degraded or cut at both the tactical flying and planning levels. This will increase responsiveness, freedom of action, and speed when cut off from the CAOC, providing improved readiness and projection of force diminishing the window of opportunity for opponents.

Culture of Empowerment

10. Past technological innovations from robust ISR and communications and networks have enabled greater “tactical generalship” providing the CAOC the ability to coordinate tactical operations. This has created a culture where aviators have lost personal autonomy and flexibility to operate independently during air operations, needing to rely on direction and guidance from HHQ.²⁷ In an A2/AD contested environment, reliance on secure C2 remains a vulnerability as there is a significant risk operators may have limited communications with the CAOC or Main Operating Base (MOB). Through distributed control, additional authorities and decision-making are provided to the tactical level to quickly make independent decisions in isolation of HHQ. It will therefore be key that the RCAF begins to empower its tactical operators and commanders with additional mission command through trust.²⁸ With mutual trust, subordinates will be more inclined

Force , Minister of National Defence. Government of Canada, 2014, p. 4,

<https://www.canada.ca/content/dam/rcaf-arc/migration/docs/en/aerospace-warfare-centre/c2-article-4-mission-command-and-the-rcaf.pdf>.

²⁴ Gilmary Michael Hostage III, General US Air Force, and Larry R. Broadwell Jr, Major General US Air Force *Resilient Command and Control: The need for Distributed Control* , National Defense University Press, Joint Force Quarterly 74, 1 July 2014, <https://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-74/Article/577526/resilient-command-and-control-the-need-for-distributed-control/>.

²⁵ NATO, *NATO Standard AJP-01 Allied Joint Doctrine*, Edition F, Version 1, December 2022, p. 77, <https://www.cimic-coe.org/resources/external-publications/ajp-01-edf-v1-f.pdf>.

²⁶ Tom Lawrence, Major (RCAF), *Coming to a Theater near You Evolving Air Combat to Counter Anti-Access and Area -Denial* , Air & Space Power Journal, Summer 2021, p. 43, https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-35_Issue-2/F_Lawrence.pdf.

²⁷ Richard Goette, *Preparing the RCAF for the Future: Defining Potential Niches for the Future* , Ottawa National Defence, 2020, p. 69, https://publications.gc.ca/collections/collection_2021/mdn-dnd/D2-420-2020-eng.pdf.

²⁸ Gilmary Michael Hostage III, General US Air Force, and Larry R. Broadwell Jr, Major General US Air Force *Resilient Command and Control: The need for Distributed Control* , National Defense University

to take risks and initiative during disrupted operations knowing their commander is ready to back up and support their decisions.²⁹

11. Aviators need to develop more judgment, initiative, autonomy, and creativity to enable them to quickly react and adapt to changing circumstances in future degraded environments.³⁰ Operating in this complex environment will require additional intellectual agility to overcome challenges by creating an environment that fosters trust through interpersonal and team relationships between subordinates, superiors, and allies.³¹ Promoting and enhancing these skills will require additional professionalization and individual and collective training through exercises and professional development. Also, additional decentralized and degraded training will help diminish risk regarding errors by reinforcing the respect of ROEs and improving reaction time regarding decision-making.

Distributed Control Training Requirements

12. Although distributed control provides tactical aviators and commanders with a higher degree of flexibility and speed, it poses a higher degree of risk due to less oversight and control from HHQ. This remains especially relevant when members lack experience operating and planning in a degraded environment, due to previous heavy reliance on robust C2 and communication systems.³² The RCAF needs to optimize its exercises and training by incorporating distributed control and integrating degraded environment scenarios such as lost communications and networks to challenge C2 and tactical operations. The RCAF has begun participating in some exercises that practice degraded and A2/AD environments, such as the Multi-National Exercise Mobility Guardian 2023, in Guam, supporting RCAF Air Mobility assets,³³ or NORAD fighter exercises such as Amalgam Dart.³⁴ It will be imperative to continue to fund and maximize exercise participation to ensure aviators are getting sufficient exposure and

Scott Press, Joint Force Quarterly 74, 1 July 2014, <https://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-74/Article/577526/resilient-command-and-control-the-need-for-distributed-control/>.

²⁹ Pux Barnes, Lieutenant-Colonel RCAF (Deceased), *Mission Command and the RCAF: Considerations for the Employment of Air Power in Joint Operations, Command and Control and The Royal Canadian Air Force*, Minister of National Defence, Government of Canada, 2014, p. 5,

<https://www.canada.ca/content/dam/rcaf-arc/migration/docs/en/aerospace-warfare-centre/c2-article-4-mission-command-and-the-rcaf.pdf>.

³⁰ Richard Goette, *Preparing the RCAF for the Future: Defining Potential Niches for the Future*, Ottawa National Defence, 2020, p. 68, https://publications.gc.ca/collections/collection_2021/mdn-dnd/D2-420-2020-eng.pdf.

³¹ *Ibid.*

³² Frederick Coleman, Colonel (USAF), *Distributed Control; Getting it Right*, The Mitchell Institute for Aerospace Studies, The Mitchell Forum, No. 50, January 2023, p. 4,

https://mitchellaerospacepower.org/wp-content/uploads/2023/01/MI_Forum_50-C2-Distributed-Control-FINAL.pdf

³³ Chris Thatcher, *Royal Canadian Air Force: Contested Airlift*, Skies Daily. 19 January 2024, <https://skiesmag.com/email/newsletters/2024-01-19.html>.

³⁴ Canada. Department of National Defence. *Ready Forces*, 9 March 2023, <https://www.canada.ca/en/department-national-defence/corporate/reports-publications/departmental-plans/departmental-plan-2023-24/planned-results/ready-forces.html>.

experience operating in a contested environment and can practice distributed control which requires further tactical decentralized execution. Establishing exercise goals and standards regarding degraded operations helps maximize the training value while providing the opportunity to assess performance which can identify vulnerabilities and opportunities to enhance readiness and doctrine while continually providing lessons learned (LL) to share internally among the RCAF and externally with allies.³⁵ This will provide operators the ability to test capabilities and tactics in a degraded environment and provide tactical planners and commanders the ability to exercise planning and coordination and exercise C2.³⁶

13. Additionally, to “train as we fight”,³⁷ exercises must not be limited to deployed Air Detachments, and Squadrons, but also include Wing Commanders and staff. With multiple Wings dispersed across the country, they too now remain vulnerable to space and cyber attacks. Garrison units should therefore be exposed to a variety of degraded A2/AD environment training and exercise opportunities that hone and evaluate their capability to conduct distributed control. This also helps support domestic training opportunities, to enhance knowledge and skills should these members be deployed in a future contested environment. As well, tactical Air Detachment Commanders and Wing Commanders could be challenged with explicit distributed control direction, to disperse their forces from the MOB. This would provide opportunities to exercise planning and decision-making skills. Exercising distributed control, therefore provides aviators and commanders at the domestic Wings with the ability to gain exposure and planning experience while also incorporating SOPs into routine operations.

14. Furthermore, it is also recommended that Wings and Air Dets be evaluated yearly through a National Operational Assessment (NAT OPASSESS), conducted by a Standards Evaluation Team (StanEval), to assess and objectively measure readiness standards and deficiencies regarding executing distributed control procedures in a degraded environment.³⁸ As it will take time to experiment with different force capabilities, document LL, identify gaps, and adapt tactics and doctrine,³⁹ it will be paramount that the RCAF continue leveraging training opportunities domestically at Wings, and with allies, to improve readiness for future air campaigns.

³⁵ NATO, *Delivering NATO Air & Space Power at the Speed of Relevance*, Joint Air and Space Power Conference 2021, p. 127, https://www.ulib.sk/files/english/nato-library/collections/monographs/japcc-conference-proceedings/japcc_conference_proceedings_2021.pdf.

³⁶ Tom Lawrence, Major (RCAF), *Coming to a Theater near You Evolving Air Combat to Counter Anti-Access and Area -Denial*, Air & Space Power Journal, Summer 2021, p. 45, https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-35_Issue-2/F_Lawrence.pdf.

³⁷ Canada. Department of National Defence. *B-GA-402-003/FP-001 RCAF Doctrine Force Sustainment*, July 2017, p.17, https://publications.gc.ca/collections/collection_2017/mdn-dnd/D2-384-2017-eng.pdf.

³⁸ Canada. Department of National Defence. «*I Canadian Air Division Orders, Volume 7 – Op Eval & Assessment*», published 21 December 2023, p. 12, rcaf.mil.ca/assets/RCAF_Intranet/docs/en/1-cad/CADO/volume-7.pdf.

³⁹ NATO, *Delivering NATO Air & Space Power at the Speed of Relevance*, Joint Air and Space Power Conference 2021, p. 124, https://www.ulib.sk/files/english/nato-library/collections/monographs/japcc-conference-proceedings/japcc_conference_proceedings_2021.pdf.

Improving Reliability of Communication and Planning Networks

15. Despite distributed control providing a better C2 construct to operate in a degraded environment, the RCAF should continue investing in technology and establishing a layered system to provide additional redundancy of communication and information networks.⁴⁰ This redundancy can be realized by leveraging antiquated technology which is immune to cyber and space attacks. As well, the RCAF should also ensure its planning cells and Wings have printed copies of maps, SOPs, the Commander's Intent, and other critical information required for planning and coordination of air operations should access to networks become disrupted. Furthermore, the RCAF should monitor new technological innovations such as the Multi Domain Combat Cloud (MDCC) concept being developed by the US.⁴¹ This opportunity could provide the RCAF, the CAF, and NATO with a tested solution to improve the distribution and sharing of information among decentralized units and decrease central network vulnerabilities. The CAF could leverage cost savings through cooperation with allies and industry while improving interoperability with joint and coalition partners.⁴² The MDCC could greatly improve the speed, accessibility, and efficiency of distributed control, but the technology still needs time to be refined and developed before implementation.

16. However, despite advancements in new technology, networks will always maintain vulnerabilities when operating in a contested A2/AD environment due to peer opponents continually improving their cyber and targeting capabilities. Investing in new technological innovations remains costly requiring further analysis and testing before committing large sums of taxpayer money which is competing with other government priorities.⁴³ Therefore, incorporating distributed control now within the RCAF's C2 doctrine provides an affordable solution to improving resiliency and survivability to continue operating in a contested environment. This minimizes the window of opportunity for opponents to capitalize on degraded communication and information networks. Furthermore, this doctrine can be integrated and enhanced as future technologies such as the MDCC if adopted by the RCAF.

⁴⁰ Frederick, Coleman, Colonel (USAF), *Distributed Control; Getting it Right*, The Mitchell Institute for Aerospace Studies, The Mitchell Forum, No. 50, January 2023, p. 5, https://mitchellaerospacepower.org/wp-content/uploads/2023/01/MI_Forum_50-C2-Distributed-Control-FINAL.pdf

⁴¹ Jacob Hess, Major USAF, Major Aaron Kiser, USAF; Major El Mostafa Bouhafa, Royal Moroccan Air Force; and Shawn Williams, Defense Intelligence Agency *The Combat Cloud: Enabling Multidomain Command and Control across the Range of Military Operations*, Air Command And Staff College, Wright Flyer Paper No. 65, February 2019, p. 1, https://www.airuniversity.af.edu/Portals/10/AUPress/Papers/wf_0065_hess_combat_cloud.pdf.

⁴² Jean-Michel Verney, Brigadier General (Retired) French Air Force and Thomas Vinçotte, Colonel (Retired) French Air Force, *The Multi-Domain Combat Cloud in Light of Future Air Operations An Enabler for Multi-Domain Operations*, Joint Air and Space Power Conference, Joint Air and Power Competence Center, June 2022, p. 98-99, <https://www.japcc.org/essays/the-multi-domain-combat-cloud-in-light-of-future-air-operations/>.

⁴³ Tom Lawrence, Major (RCAF), *Coming to a Theater near You Evolving Air Combat to Counter Anti-Access and Area -Denial*, Air & Space Power Journal, Summer 2021, p. 38, https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-35_Issue-2/F_Lawrence.pdf.

CONCLUSION

17. With China, Russia, and other peer opponents continuing to invest in cyber, space, and precision-guided missile technologies, the odds of operating in an A2/AD contested environment remain strong with air superiority no longer guaranteed. Additionally, the US and NATO forces are in the process of updating doctrine and preparing for dispersed and degraded operations. The RCAF therefore needs to incorporate distributed control into its C2 doctrine to quickly adapt to the threat of lost or degraded networks and communications limiting the window of opportunity for the opponent. This enables greater mission command, interoperability, and resiliency to operate under degraded communications and network environments and could assist with explicitly coordinating and enabling dispersed Air Detachments.

RECOMMENDATION

18. It is recommended that the RCAF integrate distributed control into its doctrine and adopt the following practices as discussed:

- a. Update C2 Doctrine to include RCAF's air power tenet to centralized command, distributed control, and decentralized execution;
- b. Communicate clear commander's intent. Documented written and widely distributed condition-based authorities including, ATO, SPINS, AOD, and TOCA;
- c. Empower commanders and aviators with additional initiative, and creativity through a culture of mutual trust;
- d. Update exercises, with clear objectives, to "train as we fight" tactical planners and operators, in degraded environments, including dispersed operations;
- e. StanEval complete annual NAT OPASSESS assessing Wing's operational readiness;
- f. Adopt SOPs, LL, and share best practices with allies;
- g. Invest in layered C2 communication and information networks; and
- h. Monitor opportunities to leverage technological innovations such as MDCC with allies and private industry.

19. Due to the increasing risk and time that it will take to incorporate distributed control as recommended, it will be key that the RCAF adopt this doctrine as soon as possible. Ultimately, the RCAF must continue to empower its commanders and aviators

with additional authority and trust to enable a culture that can remain flexible, responsive, and adaptive, to face the future challenges of the 21st century.

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