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WHY THE RCAF SHOULD FOCUS ON INTEROPERABILITY THROUGH DATALINK

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AIM

1. In modern battlefield, there is a tremendous amount of information, and how fast and secure the sharing and integration of these information for effective decision making can have a huge influence on the victory of wars. The importance of critical information integration can hardly be overlooked not only in tactical decisions that will determine who wins or lose in combat, but also in strategic decisions that will alter the overall flow of the war. In particular, the Air Force has to make these decisions faster, due to their unique characteristics, and it is necessary to integrate and share information faster and safer, in order to better respond to threats. Furthermore, the RCAF needs to consider its own interoperability with NATO or the U.S. military as it is exposed to a variety of coalition and alliance operational environments. This paper will examine how effective air operations can be achieved through a tactical data link and will recommend future developments in the interoperability of the RCAF.

Introduction

2. The Aerospace Capability Framework states that "The exploitation of information is a key element in the overall decision-making process"[1]. Interoperable data communication on fighter jets has long been required. Today, technological advances in the field of

[1] NDHQ Chief of the Air staff, The Aerospace Capability Framework: a Guide to Transform and Develop Canada's Air Force. Canada: Canadian Armed Forces,2003

interoperable data link have led to extensive data coverage by coalition partners across a secure and jam resistant communications network for most U.S. and NATO allies.[2] Tactical Data Links (TDL) creates crucial communications networks among force elements to sustain interoperability. TDL delivers tactical information securely to all force elements and commanders, effectively increasing Battlefield Management (BM) and Shared Situational Awareness (SSA). TDLs will play a very important role in the future. These have been demonstrated through various previous coalition and alliance operations and will become more important when considering the future development of the system.

3. The possibilities for the evolution of TDL are various and infinite, not only in increased situational awareness, but also in the areas of interoperability between components, more effective training, integrated air defense, and effective decision making of the commander. The RCAF is undergoing constant change, experiencing procurement of fleets and the modernization of equipment. Although, there is the need to modernize the ability of RCAF to flawlessly transfer information "from sensor to platform, from platform through processing and from processing to operational commanders."[3] This paper will examine why the RCAF should focus on interoperability through LINK-16 employment and how the RCAF can maximize interoperability by using LINK-16 capabilities. In addition, this paper will recommend how the RCAF can develop interoperability in various future operations.

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[2] Hura, Myron, Gary McLeod, Eric V. Larson, James Schneider, Dan Gonzales, Daniel M. Norton, Jody Jacobs, Kevin M. O'Connell, William Little, Richard Mesic, and Lewis Jamison. Interoperability: A Continuing Challenge in Coalition Air Operations. Santa Monica, CA: RAND Corporation, 2000. https://www.rand.org/pubs/monograph_reports/MR1235.html.

[3] The Royal Canadian Air Force C4ISR Concept, June 2017. p.5.

DISCUSSION

4. Why the RCAF should concentrate on interoperability through LINK-16? The RCAF will continue to make efforts to convert itself to an "agile, responsive and interoperable force" that can respond appropriately throughout all areas of operations, as stated in *Air Force Vector.*[4]. Integration of commands and controls, communications and computers, information and surveillance and reconnaissance (i.e., C4ISR) is currently the most important capability for combat. However, understanding of what the RCAF is trying to do is needed for a meaningful change. The CFDS states the necessities for the RCAF to operate "in a major international operation for an extended period utilizing multi-role and combat-capable military assets."[5] The requirement of TDL for information sharing and interoperability of coalition forces in these multinational operations environments is becoming important increasingly. The most common TDL for U.S., NATO and Coalition forces is the Multifunctional Information Distribution System (MIDS) Link-16, used in recent NATO and coalition operations. The United States has replaced its existing tactical data link with Link-16 or has been installing LINK-16 into a new fighter aircraft, helicopter, or unmanned aerial (UAVs) platform. Combined operations between the United States, Europe, and NATO members use Link-16 to ensure interoperability between weapons systems. As such, a growing number of countries are using Link 16, which incorporates functions of the old tactical data link. For the RCAF carrying out a variety of combined operations with the United States, the expanded employment of

[4] Director General Air Force Development (DG Air FD), *Air Force Vectors* (Ottawa: 2014), accessed Feb 1, 2018, http://rcaf.mil.ca/en/d-air-plans/rcaf-vectors.page

[5] Government of Canada, "Canada First Defense Strategy", accessed 01 Feb 2018 http://www.forces.gc.ca/en/about/canada-first-defence-strategy-summary.page.

Link-16 needs to be considered. LINK-16, including those on RCAF platforms, must be compatible with and part of the CAF, NATO and coalition.

5. Currently, The RCAF suffers from lack of a common TDL to enable the exchange of tactical data among all assets in the operational environment (i.e., the ground-based and maritime-based of its joint and coalition partners). The RCAF has few airframes to allow TDL capability: the CF188 has Link-16, though the CH124 Sea King and CP140 has Link-11.[6] These TDL standards are compatible only with the use of a common interface to integrate information and build a common operating picture (COP). In order to overcome current obstacles for RCAF aircraft to exchange tactical data among all assets, an extension of the TDL capability is mandatory. Link 16 is a reasonable choice for the TDL for the RCAF, by regulating the data exchange with using the J series message formats, which is also used by other TDL systems. The United States and many countries in NATO are concentrating on expanding LINK-16 capabilities and following system-integrating for land, maritime and aerospace assets. This standardized LINK-16 will have a significant impact on interoperability in joint and coalition environment.

Capability Current RCAF platforms are outfitted, or will be outfitted with, the following:

Platform	Current DL	+Future Capability	Requirements
CF188	Link 16	-	-
CP140	Link 11	Link 16	Must be STANAG 5516

[6] The Royal Canadian Air Force C4ISR Concept June 2017

			compliant.
CC130J	-	Link 16	Must be STANAG 5516 compliant.
CC150	-	Link 16	Must be STANAG 5516 compliant.
CC177	-	Link 16	Must be STANAG 5516 compliant.
DMSCs	Link 11	Link 16	Must be STANAG 5516 compliant.
MH	Link 11	Link 16	Must be STANAG 5516 compliant.
TCRs	Link 11, Link 16, JREAP B, C.		Network Monitoring
CH146/147	-	Link 16	-
8 ACCS CGS	Link 16, JREAP B, C	Link 11	Link 11. Network Monitoring.
CADS	Link 11, JREAP B, C.	JREAP A, Link 16,	DAMA SatCom, Link 16 GEP, Network Management System.
CAOC		RTAP	-

[7]

[7] 1 Canadian Air Division/Canadian NORAD Region Data Links (DL) Concept of Employment (CONEMP)

6. Common TDLs for Joint and Multinational Operations states, "All CAF platforms will establish a TDL capability interoperable with the J-Series message format to enable joint and multinational command and control, including targeting and situational awareness."[8]. Link-16 standardizes the communication path that enables fighter jets to fly together more safely without fear of fratricide and to attack target correctly with maximum effectiveness and minimal collateral damage. Employing LINK-16 has become a precondition to participate in combined combat elements.

7. The NATO allies have a large air asset and C4ISR systems that are significantly ahead. For example, EF-2000 (Eurofighter), Rafale, and the Airborne Stand-Off Radar.[9] Even if NATO's systems were designed to be interoperable, such a system would need to integrate with U.S. capability to make the most profit. They also point out that interoperability must be addressed early in the design, research and development process to find the most affordable long-term solutions to integrate features into efficient and effective combined operations. Alternative efforts to integrate the deployed system could be just an ineffective solution rather than systematically integrating the elements into larger systems. It is especially difficult to overcome under the circumstances affected by procurement.

8. LINK-16 connects fighters to in-flight control agency, designated to ISR group and to land-stationed command, control core such as CAOCs. Link 16 delivers a number of battle data in real time to fighter aircraft and C2 centers. It can build the COP that enables

[8] CAF C4ISR Strategic Vision p.5.
[9] Interoperability: A Continuing Challenge in Coalition Air Operations. p.29.

the commander to make effective decisions. This would be the biggest benefit of integrating the information system. The COP provides the following information in real time; "an integrated air picture with both friendly and hostile aircraft locations, general situational awareness data, and amplifying data on air and ground targets, including air defense threats."[10] The Link-16 network delivers a sharing of SA data among the resources available for Link-16, and it is an essential for military commanders to make informed decisions within a battlefield. This will affect the combined control of the aircraft by ground or midair control agency. And this greatly increases the situational awareness and ability of the fighter pilot to accomplish mission goal or to avoid threats, resulting in increased efficiency. This would simplify the procedures of tasks that have been performed so far, such as Counter air, Interdiction, SEAD, and CAS missions and could accomplish more with the same amount of power.

9. If all ground and air assets' systems are integrated with LINK-16, in case of an air-to-air mission, LINK-16 will provide continuous, real-time intelligence of the enemy and our position and enables other friendly aircraft in the same battlefield to share the same information. In addition, when combined with Joint Helmet Mounted Cueing System (JHMCS) of CF-188, the pilot will have a higher situational awareness, with all of the information represented on the helmet. And the armament and fuel status of friendly aircraft can be checked without radio transmission, which is very helpful for the pilots in carrying out missions. Furthermore, friendly aircraft can be provided with a real-time, time-lapse location without the use of radar, and can also shoot the missile to the adversary with that information. As such, the integration of LINK-16 and the system

[10] Ibid.p.109.

increases the situational awareness and survivability resulting in the most effective mission performance.

10. From the point of view of the interdiction mission, all planned routes, target information, and air defense networks can be shared between ground and air commanders, and the package commander can monitor the progress of the mission in real time. If the SEAD mission pilots identify the active ground-to-air missile, its location will be shown to other friendly aircraft via LINK-16. It is possible to transmit the results and progresses of each task via image or video in near-real time. Furthermore, the status of all aircraft in the package and the results of the mission can be immediately identified through LINK-16, allowing for immediate reflection on future mission planning. If this integration of command and control systems and key assets is enabled, the commander will be able to make quick and effective decisions in most situations.

11. In the CAS mission with ground forces or maritime forces, the effectiveness is even higher. Target information was exchanged via radio transmission between JTAC and fighters. JTAC has controlled the CAS mission. This method took a long time and was not exactly satisfactory. However with the advanced technology about integration of systems, JTAC can also provide precise target information using LINK-16 and the CAS mission aircraft can pinpoint the target attack. JSTARS enables the fighter to target and track moving targets. The threat of fratricide also has been significantly reduced. As such, the benefits of information consolidation and visualization are numerous and necessary in the current and future battlefield. If the CP-140 Aurora has LINK-16 and an accurate

target pod, it would be a great SCAR-C asset. The CP-140 would be quite effective because it has a long flying times, the crew's work is split up, and is adapted to carry a considerable amount of munitions.[11]

12. . Links 16 are typically exchanged via Radio Frequency (RF), but could be transferred via secure wires, satellites and serial links. Data encryption and frequency variation technologies provide both anti-jamming and security for Link 16. Because it activates at the UHF band width, there is a limitation of LOS in communication. The link 16 can be "relayed" information via other platforms, but C2 still requires that infrastructures be placed in the appropriate geographic location to sustain a link system. These limitations have recently been supplemented by the use of an unaffected band range, satellite or aircraft capable of holding for extended periods.

13. The benefits of this consolidation are more maximized in a combined task situation. If it is able to communicate rapidly then concisely through an information network, it can resolve language barriers between multinational pilots, and thus effectively operate NATO air forces. Uncertainty and misunderstanding of verbal communication due to saturation of voice communication in complex battlefield can also be mitigated. The integration of weapons systems, sensors, and information via data link has motivated a shift in the concept of mission planning and execution. Because data link enabled to perform more tasks effectively with the same aircraft and the same pilots, in the same time frame. On the other hand, security of network and terminals must be taken seriously

[11] Alan Lockerby,2012, SCAR-C over Libya To War in an Aurora :Canadian Military Journal,http://www.journal.forces.gc.ca/vol12/no3/doc/PDFeng/LockerbyPage6367.pdf

because all the information on the battlefield is integrated and unified. And further efforts are needed to counter hacking and jamming.

Conclusion

14. As network-based technologies continue to evolve, they continue to affect the areas of military command and control. Link-16, which enables information to be consolidated, shared in real time, and closely interacted, continues to evolve and develop. Since the CAF and especially the RCAF are primarily responsible for multinational alliances with the United States or NATO countries, they are required to have sufficient LINK-16 capabilities to improve interoperability. In modern battlefield LINK-16 makes the mission process simpler, thus ensuring the effective use of power. Power of integrating the information enables all entities in the battlefield to share the same situational awareness, thus supporting effective mission employment, and enables the commander to make informed decisions. Not only air operations, but also the land-maritime operations itself can be agile and responsive. Even with multinational coalition forces, standardized data link could minimize uncertainties and maximize mission performance. There are many advantages, but to activate these capabilities, every single entity has to operate with LINK-16 terminals, but the military budget is too tight. Therefore it is necessary to plan for capability developments and make realistic preparations based on the budget that are relevant to the current situation and vision of the CAF.

Recommendation

15. As assumed in Canada's Air Force's doctrine, all the RCAF's aircraft should have the LINK-16 capability and accurate sensor to perform future mission agile and responsive. Link-16 is needed more urgently than stealth aircraft or sensors such as radar and targeting pod. However, the Canadian government's military budget cuts make it difficult to achieve these capabilities. Additionally, long-term purchase plans that fit the budget incur additional purchase costs due to rising costs and therefore take longer than planned. To solve these problems, the CAF should prioritize among components and carry out the force improvement projects to match its national future strategy.

16. Canada currently has a strong ally and no relative threat. Since there are always strong allies on coalition missions, the CAF's viability is not significantly threatened, leaving the government with little interest in boosting its military capability. However, force generation requires a lot of time, and military power is not always available when needed, unless it is well trained and prepared.

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