





LAND MATERIEL ASSURANCE: AN ENABLER FOR THE ARMY

By Major Cyprian I. Matejek

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LAND MATERIEL ASSURANCE: AN ENABLER FOR THE ARMY INTRODUCTION

The Canadian Army (CA) is the primary user of land-based and common equipment in the Canadian Armed Forces (CAF) and relies on the Land Equipment Management System (LEMS) to fulfill its operational requirements. A 2015 Chief Review Services (CRS) audit found that LEMS continued to be relevant and met its clients' requirements.¹ However, CRS highlighted deficiencies in safety risk management, including unclear roles and responsibilities and reactive safety monitoring.² Concurrently, DND implemented or updated a series of DAODs related to materiel acquisition.³ Director-General Land Equipment Program Management (DGLEPM) also established the Land Materiel Assurance (LMA) Program with a mission to "enable evidence-based, risk-informed decision-making by leaders across the Defence Team in order to assure the land and common materiel contribution to mission success."⁴ The LMA Program includes the materiel assurance framework and the LMA Team as its staff members.

The establishment of successful change initiatives within the CAF requires analysis, consideration of strategic imperatives, effective implementation, and control and evaluation.⁵ Therefore, alignment with current transformative trends within the Army is an important consideration. Identifying options available based on the work of similar organizations is essential to forecasting potential approaches. While organizational

¹ Chief Review Services, Evaluation of the Land Equipment Program (Ottawa: DND, 2017), iv.

² Ibid., 19.

³ Department of National Defence, DAOD 3000-0 Materiel Acquisition and Support (Ottawa: DND, 2018).

⁴ Kevin Wright, "Presentation - Land Materiel Assurance Program", March 2021.

⁵ Canadian Forces Leadership Institute, *Leadership in the Canadian Forces: Conceptual Foundations* (Kingston: Canadian Defence Academy, 2005), 103.

change initiatives depend on long-term success, short-term success should also be considered to motivate stakeholders.⁶

This paper will argue that the LMA Program and Team can provide value to the Army in future operations if it closely aligns with modernization requirements, proactively maintains an overview of external materiel assurance initiatives, and assists in assessing unforecasted operational requirements (UOR).

This paper will first consider the latest statements from Army leadership regarding modernization to identify medium and long-term opportunities. Secondly, it will review similar initiatives in the US Army and the Royal Canadian Air Force (RCAF) to forecast potential requirements or solutions to common challenges. Lastly, it will describe a potential contribution to the assurance of short-term UORs in a pan-domain context.

LMA AND THE CANADIAN ARMY MODERNIZATION STRATEGY

In order to establish and maintain relevance, the LMA Program must ensure that it reviews and establishes a way ahead influenced by Army strategic directives. A detailed review of recently released strategic guidance will ensure that limited resources are directed towards precise areas of focus. DAOD 3035-0, Materiel Assurance, highlights the requirement to provide materiel assurance "instructions, directions and guidelines" for land equipment.⁷ This requirement to assist the Army can be fulfilled by closely analyzing its potential future requirements.

⁶ Ibid., 108.

⁷ Department of National Defence, DAOD 3035-0 Materiel Assurance (Ottawa: DND, Draft).

The release of Close Engagement in 2019 marked an evolution of the concept of Adaptive Dispersed Operations (ADO) first introduced in Land Operations 2021.⁸ It identified Adaptability as a key quality required over the next 10 to 15 years. It defines Adaptability as rapidly implementing technological change in the context of land equipment. For LEMS, it highlights a requirement to conduct investigations and forensics and design and testing at the unit level through the employment of a land equipment engineering capability.⁹

The release of the Army Modernization Strategy in 2021 was the next step in providing additional details on how the Army will prepare to fight in the future. The Army Commander indicated that the document should be an action plan instead of simply a strategic document.¹⁰ The structure of the strategy features precise assigned tasks to several key leaders, including COS A Ops and COS A Strat in the field of sustainment that will enable it to bring the Army of Today towards the Army of tomorrow in five to 15 years. It proposes that simplicity is at the forefront in implementing technology, and user input and requirements should be the driving factor to optimize equipment performance and sustainability.¹¹

The Army Commander also acknowledged that while Close Engagement provided a solid basis, there was a requirement to identify the way ahead to develop capability in the 2025 horizon. Risk is a recurring theme in the Modernization Strategy,

⁸ Canadian Army, *Close Engagement: Land Power in an Age of Uncertainty* (Kingston: Army Publishing Office, 2019), 17.

⁹ Ibid., 25.

¹⁰ Canadian Army, *Advancing with Purpose: The Canadian Army Modernization Strategy* (Ottawa: , 2021), 2. ¹¹ Ibid., 23.

and the LMA Program also has risk as one of its core elements. The clarification of the management of Safety Risk was an initial area of focus following the publication of the Safety Risk Coordination policy, and the development of innovative practices in collaboration with key stakeholders is one of its key objectives.¹² There is a vast area of technological elements described in the strategy based on pan-domain operations; however, the limited resources constrain the Army and it has identified a requirement to continue innovating to optimize resources.

The strategy also describes the potential for increased delegation of procurement power at the unit and formation level.¹³ Although this can increase procurement agility, it also introduces numerous risks that are not limited to financial risk and could impact materiel assurance. LMA guidance and its implementation at the lowest level is likely to be a requirement to mitigate risk.

The future of Army operations will include the introduction of disruptive technologies. Although it does not expect the rapid acquisition of these capabilities, the Army has established a requirement to provide a technological watch towards disruptive technologies. Directly relevant to a land force is the emergence of robotic and autonomous systems.¹⁴

Crucial army elements are the brigade and combat team as both Close Engagement, and the Modernization Strategy reiterate the importance of enabling the

¹² Land Material Assurance - Safety Risk Coordination (Ottawa: DND, 2018).

 ¹³ Canadian Army, Advancing with Purpose: The Canadian Army Modernization Strategy, 33.
¹⁴ Ibid., 52.

brigade in conducting pan-domain operations.¹⁵ Several brigade units demonstrated enthusiasm for acquiring and implementing new technology such as additive manufacturing and deploying it on operations.¹⁶ CAF leadership doctrine has determined that implementing institutional change required by the LMA Program is the most effective when performed incrementally by leveraging personnel at the lowest level.¹⁷

However, focusing on equipment, risk, and users at the brigade and combat team assets may limit the breadth and impact of the LMA Program as the program is designed to support all land and common equipment.¹⁸ In addition, several organizations such as Assistant Deputy Minister Defense Research and Development Canada (ADM (DRDC)) or Director Land Requirements (DLR) staff provide at least some form of a technological watch. Nevertheless, the LMA Program could include a framework to enable more precise monitoring and forecasting capability that is not influenced by the requirement to field attractive but unfit technology rapidly or by innovation with a limited practical value to the Army's principal source of land power.

Potential Areas of Focus for the LMA Program and Team

The examination of key elements of Army strategy can provide an action plan to the LMA Program in several priority areas. The LMA Team can start proactively scanning the technological horizon for the technologies identified in the Modernization Strategy. Although its goal should not be to conduct scientific research or to develop these capabilities as these should remain under the authority of ADM (DRDC), it should

¹⁵ Ibid., 17.

¹⁶ Joseph Tran, Chad Mooney and Jessica Ross, "Fabricating the Future: Additive Manufacturing on Operation REASSURANCE," *Land Equipment Management System Journal*, 14.

¹⁷ Canadian Forces Leadership Institute, *Leadership in the Canadian Forces: Conceptual Foundations*, 103.

¹⁸ Mr Kevin Wright LMA Program Lead, e-mail, 5 May 2021.

assist the Army in identifying and refining common technological challenges that will have an impact across several fleets or types of equipment in the 5-15 year horizon. DAOD 3035-0 also highlights a requirement to "regulate current and future manufacturing technology."¹⁹

Horizon scanning should ensure the implementation of the LMA Program towards issues affecting combat team and brigade assets. There is a wide variety and high volume of fleets concentrated at that level in limited physical locations. From a change management perspective, the value-added of LMA has the highest likelihood to persist across the Army in the future as today's junior officers and NCMs at both the operator and technical level will be the future leaders of the Army. Focusing LMA activities at the brigade and combat team level could increase the probability that it persists in the Army culture.

The success of institutional initiatives such as the LMA Program depends on a solid alignment with institutional priorities. A thorough and ongoing review of strategic direction will allow the LMA Program to focus on the elements that feature the highest level of risk to the Army while providing the most significant level of value to the program. The LMA Program can ensure its long-term success by focusing on core technologies and equipment affecting the brigade and combat team.

EXTERNAL TRENDS IN MATERIEL ASSURANCE

Having identified key areas in which the LMA Program and Team can align its priorities with the intent of Army leaders and personnel, potential areas of interest in the

¹⁹ Department of National Defence, DAOD 3035-0 Materiel Assurance.

US Army and RCAF will be examined. The LMA Team should ensure that it is constantly aware of other approaches to develop the LMA Program elements. Leveraging the processes and innovation present in similar organizations while not discounting Army-specific realities will empower the LMA Program to achieve a high level of effectiveness rapidly.

US Army as an Innovator in Materiel Assurance Activities

The US Army has demonstrated a willingness to take calculated risks in implementing modern maintenance concepts such as conditions-based maintenance (CBM). A US Army Materiel Systems Analysis Activity (AMSAA) study assessed the US Army's maintenance policy and reviewed maintenance intervals.²⁰ Leveraging its robust Sample Data and Analysis Program, AMSAA analyzed the impact of drastically increasing the maintenance interval on an operational fleet of vehicles. The study extended intervals from a semi-annual or annual basis to 24 months, and a combination of risk mitigation through more frequent but less onerous visual inspections resulted in significant cost savings with no impact on safety or readiness.²¹ This relatively limited study is currently being reviewed before implementation and could directly influence US Army maintenance policy for low usage fleets.²²

The scale of US Army resources allows it to leverage civilian institutions to conduct advanced research in safety and maintenance and obtain independent advice on complex technical issues. The RAND Corporation assisted the US Army's Materiel

²⁰ Kevin Guite, "If it Ain't Broke...," *Army AL&T Magazine*, October-December, 2018, 43. Last accessed 21 April, 2020. https://asc.army.mil/web/news-alt-ond18-if-it-aint-broke/

²¹ Ibid., 46.

²² Ibid., 48.

Command (AMC) and the G4 staff in optimizing its visibility on issues affecting part quality for its UH-60 helicopter fleet. The study determined that reliance on existing written reporting and the advice of technical subject matter experts within project offices was not sufficient in providing adequate information to decision-makers. Researchers found that the US Army focused their efforts on a limited number of expensive critical items instead of considering a counter-intuitive but more effective approach focused on high volume but cheaper parts that had a much higher impact on the total maintenance cost.²³ The study also identified the requirement for a coordinated approach to communicating quality issues to senior management. Although several organizations within AMC have appropriate responsibilities, coordination of information was lacking and issues were disclosed only after the occurrence of critical problems.²⁴

To overcome some of the communication challenges at the organizational level, AMC has identified a requirement to clarify and centralize engineering and technical analysis capacity by integrating three formerly separate organizations into a single US Army Combat Capabilities Development Command Data Analysis Center (DEVCOM DAC).²⁵ The merging of AMSAA, Research Development and Engineering Command Survivability and Lethality Analysis Directorate (SLAD) and Army Research Laboratory Human Research and Engineering Directorate Human Systems Integration (HRED HIS)

²³ Elvira N. Loredo, Shawn McKay and Amber Jaycocks, *Methods for Identifying Part Quality*

Issues and Estimating their Cost with an Application using the UH-60 (Santa Monica: RAND Corporation, 2014), xi.

²⁴ Ibid., 38.

²⁵ US Army, "Army Merges Three Organizations to Create New in-House Analytical Capability," accessed 22 April, 2021.

 $https://www.army.mil/article/223093/army_merges_three_organizations_to_create_new_in_house_analytical_capability$

indicates that the US Army took action to improve on the delivery of materiel assurance analytics.²⁶

Although the US Army has embarked on a robust modernization plan that includes aggressive procurement of disruptive equipment at the lowest level, it also has challenges regarding implementation. A congressional study has determined that the stand-up of Army Futures Command (AFC) duplicated the roles and responsibilities already assigned to the Deputy Assistant Secretary of the Army for Research and Development. The Senate Appropriations Committee ordered the Assistant Secretary of the Army (Acquisition, Logistics and Technology) and AFC to provide a "clear description of the responsibilities of each organization throughout the phases of the planning, programming, budgeting, and execution of resources."²⁷ This illustrates that even with a highly integrated capability development and acquisition capacity within the US Army, duplication and governance issues can arise. Nevertheless, the LMA Program can still implement some of the initiatives developed by the US Army.

There are common lessons that the Army and LMA Program can adopt from the US Army. The LMA Program should establish a mechanism to monitor ongoing issues and solutions implemented by the US Army and DEVCOM DAC. RCEME officers are employed within AMC at several installations and have also identified innovation initiatives that can assist in the identification of technological opportunities.²⁸

²⁶ Ibid.

²⁷ Andrew Feickert and Brendan W. McGarry, *The Army's Modernization Strategy: Congressional Oversight Considerations* (Washington: US Congressional Research Service, 2020), 9.

²⁸ Jason Das, "Innovation in Defence: Insight Gained through Liaison with our American Colleagues," *Land Equipment Management System Journal*, no. 4 (February, 2020), 15.

The RCAF as a Source of Program Risk Areas

As the LMA Program and Team continues its progress towards maturity, it should proactively identify the key areas of improvement noted in the latest RCAF Airworthiness Program (AWP) Audit. Although the nature and employment of aerospace equipment have differences, there are organizational issues that are likely to affect the LMA Program. A key finding was that the AWP still "lacks objective, independent oversight."²⁹ The audit also recommended more intensive training to be provided to operators and technical personnel with online training as a potential option.³⁰ It identified the requirement for additional training and clarification of roles and responsibilities within Director-General Air Equipment Program Management (DGAEPM) and regulators.³¹ It is also challenging to assess the effectiveness of the AWP given a lack of appropriate and sufficiently detailed metrics to measure improvement in the processing of Records of Airworthiness Risk Management (RARMs).³²

The LMA Team must consider the detailed analysis and comparison of allied airworthiness programs and best practices, including independence, qualified personnel, and performance measurement. Although landworthiness initiatives are also a good source of information, the maturity of AWPs is likely a better source of lessons learned. Establishing a performance measurement framework for the processing of LMA Records of Risk Management (RORMs) in support of safety risk coordination should be the first area of development.

³¹ Ibid., 11.

²⁹ Chief Review Services, Evaluation of the DND/CAF Airworthiness Programme (Ottawa: DND, 2016), A-4.

³⁰ Ibid., 10.

³² Ibid., A-10.

Allied organizations and the RCAF provide a rich and detailed amount of information regarding the implantation of materiel assurance or airworthiness programs. The LMA Program can leverage the more extensive resources and expertise of the US Army or RCAF to maintain best practices and identify common focus areas. This analysis will ensure to optimization of the employment of limited program resources.

UORs AS AN IMMEDIATE AREA OF CONCERN FOR LMA

This paper has established current practices in relevant organizations and identified critical areas of knowledge. The following section will demonstrate how the LMA program can concretely leverage this expertise and its analytical and forwardlooking capabilities to benefit future requirements.

The procurement of UORs was a regular feature of the Afghanistan conflict, and a conflict in a pan-domain context will likely generate its wave of UORs. Army personnel are already exposed to innovative technology among our allies, and there will likely be a renewed appetite to rush to procurement. The principal objective of effective acquisition should be to ensure that Army units have the equipment required to operate in a pan-domain environment. However, another important objective is that the adept execution of the next surge of UORs could assist the LMA Program in establishing credibility by providing added value to the Army's procurement process and ensuring approval from external compliance organizations.

A 2009 Office of the Auditor-General Report (OAG) on the acquisition of key equipment during the Afghanistan conflict highlighted success in providing equipment to troops rapidly but identified significant issues. The audit analyzed the procurement of four significant projects valued at more than a billion dollars and delivered between 5 to 32 months from approval. The OAG acknowledged that all projects required rapid execution to maintain operational effectiveness and the safety of CAF personnel.

However, major issues were still noted, including a lack of references and process for UORs, an absence of most required project documents or a substandard level of execution that provided little value.³³ The most deficient aspect was in the Project |Profile and Risk Assessment area. However, other areas of interest from a materiel assurance perspective included limited documentation of the Initial Operational Capability and Full Operational Capability certificates.³⁴ Close Engagement indicates that the Canadian Army will expect a more efficient procurement process in the future and acknowledges the requirement to lead by example within its area of procurement responsibility to accelerate acquisition.³⁵ A 2012 CRS audit of the UOR process reinforced the requirement for an effective process with a clearer understanding for acceptance of a higher level of risk to the benefit of rapid execution.³⁶ Control over rushed procurement activities will continue to be an area of concern in the future, given our allies' or adversaries' ongoing introduction of disruptive technologies.

For example, loitering munitions have made a notable appearance in the Nagorno Karabah and Syrian conflict and Azerbaijani, and Turkish units employed them effectively.³⁷ UAV-based loitering munitions or suicide drones provide several

May 2, 2021. https://rusi.org/commentary/democratisation-precision-strike-nagorno-karabakh-conflict

³³ Office of the Auditor General of Canada, 2009 Fall Report of the Auditor General of Canada (Ottawa: Government of Canada, 2009).

³⁴ Ibid.

³⁵ Canadian Army, *Close Engagement: Land Power in an Age of Uncertainty*, 37.

³⁶ Chief Review Services, Audit of Unforecasted Operational Requirement (UOR) Process (Ottawa: , 2012), 29.

³⁷ "The Air and Missile War in Nagorno-Karabakh: Lessons for the Future of Strike and Defense," accessed

advantages; however, their effectiveness is also based on a willingness to rapidly procure, field and expend several units to gain an advantage over the adversary. A key requirement for such equipment is attritability.³⁸ However, attitudes towards the loss of dozens of copies of newly procured military equipment could be a challenge to justify, even if they are mass-produced and relatively inexpensive. Therefore, there will be a requirement to provide a convincing argument that their effectiveness balances the negative optics of expendable advanced equipment on operations.

LMA Team's Contribution to the Provision of Advice

The LMA Team should proactively advise the Army on conducting risk assessments based on the most likely capability to be requested as a future UORs. Advice should be focused on capabilities in the initial stage of definition by the Army or recent technology. However, its function should not be to serve as another layer of compliance or approval. The Canadian government has already established an Independent Review Panel for Defence Acquisition (IRPDA) for projects valued at \$100 million or with a high level of Project Complexity and Risk Assessment (PCRA).³⁹ Instead, the LMA Team could be leveraged as an objective source to assist the Army's capability development staff to deliver on the justification for UORs. This approach will allow projects to overcome the level of scrutiny expected by Treasury Board, the IRPDA or other relevant authorities.

³⁸ Nick Reynolds and Jack Watling, "Your Tanks Cannot Hide," *RUSI Defence Systems* 22, no. 1 (March 5, 2020). accessed May 2, 2021, https://rusi.org/publication/rusi-defence-systems/your-tanks-cannot-hide

³⁹ Canada. "Project Complexity and Risk Assessment Tool," accessed April 28, 2021. https://www.canada.ca/en/treasury-board-secretariat/services/information-technology-project-management/project-management/project-complexity-risk-assessment-tool.html

A coordination function between DLR, Equipment Management Teams, the Land Engineering Support Center, and Quality Engineering and Testing Establishment (QETE) could accomplish an accurate, current and relevant identification of requirements. These organizations are already closely involved in conducting failure and accident investigations and forensic investigations on operations.⁴⁰ QETE's integration into the primary Army training event, Ex MAPLE RESOLVE, illustrates the benefit of closely integrating specialized materiel assurance assets while maintaining independence.⁴¹ Internal to the RCEME Corps, junior NCMs to officers have demonstrated a high level of motivation and expertise towards identifying and commenting on technological trends such as telerobotics, artificial intelligence and data analytics in the Land Equipment Management System Journal.⁴²

The requirement for the rapid introduction of land equipment is likely to occur in future Army operations. Lessons from the Afghanistan conflict have highlighted the potential of significant shortcomings in identifying risk and introducing equipment procured through a UOR. The LMA Team has an opportunity to assist the Army in its risk management mechanism for the inevitable surge of UORs in the near future.

CONCLUSION

The LMA Program and Team should closely analyze the detailed strategic guidance provided by Army leadership. A focus on identifying the impact of

⁴⁰ Glen Butcher and Vince Horne, "Lessons from the Past Contribute to CAF's Future Operational Success," *Land Equipment Management System Journal* (November, 2018), 11.

⁴¹ Gary Lacoursiere, Scott Beeston and Kosta Grygoryev, "QETE's Failure and Accident Investigation Capability Supports Exercise MAPLE RESOLVE 19," *Land Equipment Management System Journal* (September, 2019), 15.

technological advances and risks focused on brigade and combat team assets will optimize limited program resources and leverage the multiplying effect of change of junior leaders. The LMA Team should also consider extensive external resources to further its development of the LMA Program and focus on the shortcomings of established material assurance programs. It should closely monitor their accountability results to maximize performance improvement. Lastly, as a change initiative, it has the opportunity to demonstrate value to its main client by assisting in the risk management process for UORs by leveraging formal and informal land engineering expertise networks.

This paper demonstrated that the LMA Program and Team could provide value to the Army in future operations by focusing its initial efforts on strategic alignment, analyzing similar programs, and advising on UOR risk. Further research in the maximization of existing maintenance data held in enterprise systems could enable the LMA Program to contribute to more advanced analytical and predictive modelling of materiel assurance issues.

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