National Defence Défense nationale

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JCSP 48

Service Paper

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CANADIAN FORCES COLLEGE – COLLÈGE DES FORCES CANADIENNES

JCSP 48 – PCEMI 48
2021 – 2022

Service Paper – Étude militaire

Understanding Tank Serviceability in the Canadian Army

Major Michael Timms

CAGED AND STARVED, BUT READY FOR A FIGHT: UNDERSTANDING TANK SERVICEABILITY IN THE CANADIAN ARMY

AIM

1. The aim of this paper is to change how the Canadian Army (CA) views tank serviceability, and present alternatives which enable the Royal Canadian Armoured Corps (RCAC) to better meet the strategic expectations of the tank capability.

INTRODUCTION

2. The poor serviceability rate of Leopard 2 Main Battle Tanks (MBT) is an endemic issue and a strategic level concern since implementation in the domestic CA.[1] Considerable problem-solving effort is invested in the Leopard 2 Family of Vehicles (FoV).[2] Much analysis, creativity, and strategic messaging resulted in the iterative implementation of partial solutions. The consistent and dedicated work of tankers in Edmonton and Gagetown, the Corps of Royal Canadian Electrical and Mechanical Engineering (RCEME), the Royal Canadian Logistics Branch, and Army senior leaders vested in the tank capability results in significant progress. The CA is nearing the point of maximum efficiency within the resource envelope available, achieving the best serviceability possible within current constraints. Yet, tank serviceability continues to miss CA ambitions for employment. As a result, a perception persists that the deployment of tanks is not possible, derived from an inability to meet training demands.[3] RCAC must frame the tank problem differently. The Corps has an opportunity to improve serviceability rates, to better communicate what is a reasonable expectation of the tank fleet, and to market what is an achievable tank deployment capability.

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[1] Parent, LCol J. N. M., *EXEC SUM for COS Army Ops - Leo 2 Family of Veh (FoV) Integration* (Ottawa: Canadian Army Headquarters,[2015]).; Parent, LCol J. N. M., *Executive Summary - Leo 2 A4/A4M/A6M Current Employment* (Ottawa: Canadian Army Headquarters,[2014]).; Carignan, BGen M. A. J., *COS Army Ops Planning Direction - Canadian Army Main Battle Tank Force Generation Analysis* (Ottawa: Canadian Army Headquarters, 2017).

[2] BGen S. M. Lacroix, *3 Cdn Div Tank FG Analysis* (Edmonton: 3rd Canadian Division Headquarters, 2019), 1-10.; BGen T. J. Cadieu, *Leopard 2 Family of Vehicles - 3rd Canadian Division Observations and Ongoing Fleet Sustainability Concerns* (Edmonton: 3rd Canadian Division Headquarters, 2017).; Col T. J. Cadieu, *Leopard Family of Vehicles (FoV) - Outstanding Integration Concerns* (Edmonton: Headquarters 1 Canadian Mechanized Brigade Group, 2014).; Col Robert Ritchie, *Leopard 2 Family of Vehicles (FoV) 1 Canadian Mechanized Brigade Group Outstanding Integration Concerns 2018-2019* (Edmonton: Headquarters 1 Canadian Mechanized Brigade Group, 2018).; BGen W. D. Eyre, *Leopard Family of Vehicles (FOV) - 3rd Canadian Division's Outstanding Integration Concerns* (Edmonton: 3rd Canadian Division Headquarters, 2015).

[3] "Evaluation of Land Readiness," last modified November, accessed Jan 19, 2022, https://www.canada.ca/en/department-national-defence/corporate/reports-publications/audit-evaluation/evaluation-land-readiness.html.; Lacroix, *3 Cdn Div Tank FG Analysis*, 4.

DISCUSSION

Understanding Serviceability

3. Tank serviceability is a persistent concern that requires attention. However, existing perceptions frequently exaggerate the extent of the situation. At headquarters, from the unit to Army level, the serviceability status is drawn from the Defence Resource Information Management System (DRIMS) on any given day.[4] This disregards the known pattern of serviceability, resulting from the burden of the inspection and repair work at the unit level with the entire fleet fielded. This is in contrast to a rotation through a separate repair and overhaul organization. Losing sight of this fact drives an overcompensated reduction in appetite for field use, and an atmosphere of defeat when evaluating tanks as a capability. As seen in the below figure, commitment of tanks for field use correlates with observed serviceability, with reduced serviceability coinciding with reduced commitment of tanks to field use.

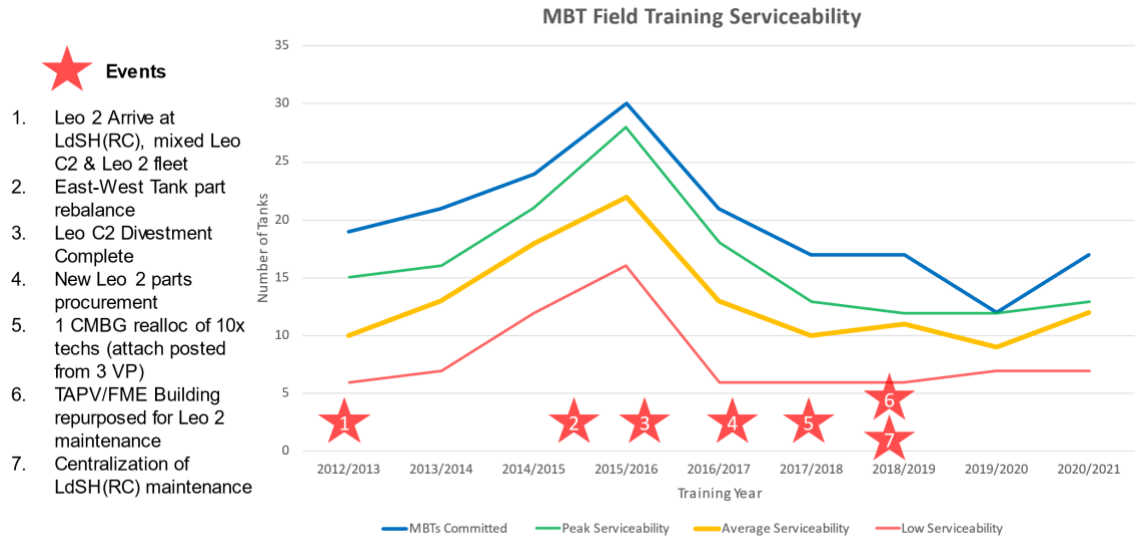

Figure – LdSH(RC) Tank Serviceability History
Maj Mike D. Timms, *HQ Sqn Change of Command Handover Briefing, Draft* (Edmonton: LdSH(RC), 2021). This graph is derived from a survey of serviceability reporting information during major exercises, due to the lack of relevant data in system of record.

[4] LCol M. J. Gallinger, *Briefing Note for the CCA, Current Leopard 2 Fleet Status* (Ottawa: Canadian Army Headquarters, 2017). At reference report and others, reported VOR uses DRIMS as our system of record, which lacks the inherent analysis to understand if an unserviceable tank is available or not. For the purpose of this paper the term serviceable is used to describe both serviceable and outstanding usable tanks, which have some fault awaiting parts or repair but are functional for training. A significant portion of the Leopard fleet being employed for training is in fact outstanding usable vice fully serviceable.

4. A cycle occurs each year, in which the required tanks are made serviceable for approximately one and half months each Fall and two months each Spring. Outside of these periods, serviceability plummets as inspections come due. It is also worth noting that disused tanks do not remain serviceable. As tanks become grounded awaiting inspection, they typically develop additional faults. Unless a larger fleet is acquired and technician workload is reassigned to an organization external to the units, such as a contracted facility, this cycle remains a reality. The CA can reasonably expect to have sufficient tanks serviceable for these field training periods, but cannot expect an arbitrary number of tanks to be serviceable on any given day.

5. Leopard MBT serviceability hinges upon infrastructure, technicians, and spare parts.[5] Efforts to improve capacity are continuous and must not stop. However, incremental improvements only stem the decline of serviceability, and gains require either external resource investment or reduction in technician workload. Additionally, the current philosophy toward maintenance neglects the individual and collective readiness of technicians. The UK Army's Corps of REME used the axiom do we "support to train, or train to support," to describe the problem set faced when called upon to employ their Brigades' Combat Service Support (CSS) forces within training audience in British Army Training Unit Suffield (BATUS) exercises.[6]

6. Similar to what the CA is facing now, the UK's uniformed technicians were consumed by the task of attaining the needed serviceability of armoured fleets. As a result, this strained their capacity to achieve the individual and collective training necessary to carry out CSS roles in a tactical environment.[7] Reinforced by their experiences in Afghanistan and the acknowledged need for uniformed technicians to be soldiers first, this sparked a change in philosophy from support to train toward train to support. This included greater use of civilian contracts to carry out non-field maintenance, and a new whole fleet management strategy which allowed a greater portion of their fleet to be rotated out of use. The CA does not adopt one approach or the other, yet it is failing to achieve either. It expects technicians to achieve training requirements and succeed in collective training events but requires them to commit all of their time to production to meet tank serviceability goals.

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[5] Ritchie, *Leopard 2 Family of Vehicles (FoV) 1 Canadian Mechanized Brigade Group Outstanding Integration Concerns 2018-2019*, 3-4.

[6] Col Andrew J. Rogers, Email: Train to Support or Support to Train, January 29, 2021. Support to Train refers to an approach in which CSS forces primary focus is on ensuring the sustainment and serviceability of combat arms in a training environment, at the cost of their own training and in an administrative fashion outside of the training scenario. This is as a result of resource deficits including personnel, time, equipment, and infrastructure. Train to Support refers to an approach in which CSS forces meet their own training requirements and conduct field sustainment and maintenance tactically, within the training scenario. To achieve this, the burden of routine and non-field expedient repairs, inspections, and overhauls must be displaced to a different organization.

[7] Rogers, Email: Train to Support or Support to Train.

Capacity

7. In developing sustainment practices for the Leopard 2, those used for the Leopard 1C2 were adopted.[8] In practice, the sustainment needs of the Leopard 2 are greater than those for the Leopard 1C2, and this approach is inadequate. The volume of maintenance work, inspection and repair, far exceeds available capacity.[9] While doctrinally unit 1st line maintenance concerns itself with repairs taking four hours or less, current expectations are that 1st line conduct inspections which in some cases require greater than 90 hours labour. Lord Strathcona's Horse (Royal Canadians) possess less than half of the technicians (vehicle, electronic-optronic, and weapons) necessary for the recurring 1st line inspection and repair of the tank fleet.[10] This is also predicated upon achieving the published standards of time per inspection or repair activity, which are targets that neglect the realities of current infrastructure and tooling.

8. It is therefore unsurprising that the Strathcona's have averaged a serviceability rate of approximately 15 of 39 tanks over recent years. For the longevity of the fleet, it is important that the tanks employed be actively cycled. Otherwise, a minority of the fleet bears the most wear and tear, and faults with disused tanks worsen. Also, concurrent 1st line inspections and repairs are necessary to continue to sustain this average serviceability. However, it is worth acknowledging that serviceable output for training within any given year is at most half of the fleet. To achieve a higher rate, more than double the technicians, and commensurate increase in parts availability to reflect the increased labour, are required. Of note, even in ideal conditions full serviceability is not possible.

Technicians

9. Addressing the critical shortage of technicians is best accomplished through the use of contracted work for inspections and overhaul. However, in lieu of the resources and strategic priority to do so, it is possible to gain technician production capacity by studying and assuming risk. Currently, weapons technicians are the greatest shortage due to insufficient personnel establishment and Leopard qualification throughput. This is in part due to recent gains in vehicle technician manning influenced by previous study, and due to a recent increased requirement to conduct barrel scopes deriving from the Leopard 1C2 barrel failure in 2014. That said, beyond reducing the interval of the Leopard 2 barrel scope to align with other Leopard 2 nation or manufacture recommendations, little can be done to reduce weapons technician or electronic-optronic technician production demands. All turret related MBT inspection items are a matter of critical safety.

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[8] Ted Dossev, *Leo 2 FoV CAFDWG Presentation* (Ottawa: Force Development Working Group., 2018.

[9] Ritchie, *Leopard 2 Family of Vehicles (FoV) 1 Canadian Mechanized Brigade Group Outstanding Integration Concerns 2018-2019*, A-1/2.

[10] Mitch J. Brown, *Production Capacity Assessment* (Edmonton: LdSH(RC), 2021).

10. An opportunity exists to improve vehicle technician production through the reduction of chassis inspection requirements. While turret inspections are typically completed within a week, provided parts are on hand for identified faults, hull inspections often take longer and account for the majority of unserviceable time for MBTs; F3 and F4 inspections can range from three to nine weeks depending on numerous circumstances. Ironically, these inspections are not always favourable to the serviceability of tanks. If accomplishing such inspections as part of an overhaul program, new or refurbished components are installed. However, the disassembly, repair as necessary, and reassembly conducted during inspections results in fatigue and strain to bolts, track components, brackets, hoses, and so forth. While this wear is relatively minor, the time penalty and technician hours for hull inspections is significant. Additionally, due to the nature of tank part failures, these inspections frequently fail to find faults which appear only once a tank is in use. Even for operations, there are certain hull items which are inspected at regular intervals as a matter of critical safety. Such items include service brakes, park brakes, fuel systems, power distribution systems, and fire suppression systems.

Infrastructure

11. Significant inefficiencies and measurable impacts exist as a result of the dispersed and ad-hoc infrastructure for the Leopard 2 MBT maintenance in Edmonton. Crews' primary place of duty in garrison is separated from their tanks, reducing stewardship culture and cooperation of crews and technicians. Tanks are moved between four different buildings for operator and 1st line maintenance, and significant time and complexity is added by the constant movement of tanks to accommodate the use of a limited number of available bays for maintenance. Additionally, existing facilities are not up to code in terms of operator safety.[11] In some cases, such as the Force Mobility Enhancement building, these deficiencies are less substantial. Nonetheless, multiple agencies, including Director Land Infrastructure, have identified notable risks. Gagetown based tanks face different but similar challenges, adapting old infrastructure to current needs.

12. To improve tank serviceability, the most valuable area for future investment is purpose built tank infrastructure. Ideally, this infrastructure is in the form of squadron tank barns, where each tank is assigned a specific bay for both storage and maintenance. These tank barns would double as the squadrons' primary workspace, and include provisions for both crew and technician work, such as classrooms, lockers, office space, and vaults. An adjacent maintenance facility is necessary for power pack run-up, welding, material technician work, specialty tool storage, and related work. This eliminates inefficiencies of moving tanks for most 1st line maintenance, with the majority of maintenance being completed in each tank's assigned bay. Particularly, while tanks are awaiting parts or labour in a state of disassembly. This also ensures the crews' primary place of duty is with their tanks and the technicians, fostering a culture of stewardship and cooperation. Actual technician efficiency will improve by eliminating the time spent

[11] Matthew D. C. Johns, *Tank Life Extension Survey* (Ottawa: Director Land Infrastructure, Canadian Army Headquarters, [2021]).

moving, assembling and disassembling to shuffle equipment in bays, and coordinating crew support.

Employment of Tanks

13. Cursory observation of the MBT sustainment challenge often leads to a perception that whole fleet management or motor pooling of tanks is the logical solution. Without a significant influx of resources, this is incorrect. Centralizing the Leopard 2 FoV both geographically and organizationally is beneficial, considering the lack of capacity to duplicate beyond 1st line sustainment functions. However, tanks need crews. It must be acknowledged that serviceable tanks require the contribution of both technicians and armoured soldiers. For many platforms, operator maintenance is an important but limited factor. For MBTs, it is hugely critical. Crews enable technician production, and without their work technician production needs are amplified. Many maintenance tasks are the responsibility of the crew, not technicians, notably track maintenance. Recent experience has shown that if a tank lacks a crew, or if a crew is responsible for multiple tanks, the serviceability of that tank suffers.

14. By acknowledging that attaining full serviceability is not realistic, it is possible to accept a hybrid solution. In garrison, the tanks can be distributed amongst the squadrons with each tank being assigned a crew. In this scenario, the crew commander is accountable for knowing and reporting the state of their tank, and responsible for supporting its maintenance. In the field, all squadrons contribute tanks to form a single squadron size fleet for each discrete field training period. Using loan cards and diligent handovers, rotating this fleet between squadrons for sequential collective training and primary combat function individual training is necessary. This enables achievement of a garrison culture of stewardship and the field training aims.

15. While the value of tanks is intuitively obvious to those who understand the contemporary land battlefield, justifying the existence of a capability in the CA is challenging if it cannot show what value that capability is beyond its own training. As a result of the current perception of Leopard 2 FoV serviceability, deployment of tanks on operations is not considered viable.[12] Although, tank deployment was proven achievable in 2006, when the state of the Leopard 1C2 fleet was worse. As is done to meet the biannual training periods, a squadron of 19 tanks could be made serviceable for deployment in a reasonable period of time with the necessary impetus. Given the state of the fleet, deployment of tanks impacts the ability to meet Managed Readiness Plan (MRP) demands. However, the initial deployment of any CA capability initiates a re-evaluation of the MRP. The most recent revision of the MRP addressed the new normal of sustained CA deployments on Operations REASSURANCE, UNIFIER, and IMPACT.

[12] Lacroix, *3 Cdn Div Tank FG Analysis*, 6.; Ritchie, *Leopard 2 Family of Vehicles (FoV) 1 Canadian Mechanized Brigade Group Outstanding Integration Concerns 2018-2019*, 6.; Matthew D. C. Johns, "Leopards without Claws: The Future of Tanks in the Canadian Army" Canadian Forces College, 2018, 3.

CONCLUSION

16. Revision of maintenance practices and external resource investment creates improvements in the mean serviceability of MBTs. In the near term, accepting risk and reducing the scope of hull inspections is the most notable opportunity. The RCAC must also develop and communicate a coherent framework for its future needs, including a clear definition of ideal tank infrastructure requirements. While the needed infrastructure is not currently a priority, without defining our need clearly it is likely to remain this way. Regardless of improvement to the current serviceability norm, it is important that we recognize and communicate the tank serviceability challenges with consideration of the annual pattern of serviceability, vice serviceable rates on any given day. Moreover, we must define and quantify a deployable tank option for the CA.

RECOMMENDATIONS

Tank Deployment Options

17. The CA and CJOC can benefit from the RCAC developing and communicating a deployable Leopard 2 capability construct. This requires a range from high resource requirement to meet a short time frame deployment, to a more moderate resource requirement to meet a planned longer horizon deployment, a year or more in the future. It also includes a caveat that refocusing on sustaining a deployed tank contribution will impact tank contribution to CA *Build Phase* MRP training.[13]

Relief of 1st and 2nd Line Maintenance Burden

18. The Leopard 2 FoV Lifecycle Material Management (LCMM) be tasked to complete a study of our approach to inspections. Through analysis and rationalizing all of the F3 and F4 hull inspection requirements, a proposal can be made to accept risk by not inspecting non-safety critical items, repairing only on failure. This is further aided if a *predictive maintenance* approach is adopted.[14] The aim is to design a hull inspection which minimizes disassembly and reduces the grounding time due to inspection. Additionally, this significantly reduces the burden on uniformed chassis technicians and results in greater availability of serviceable tanks.

19. Efforts must continue to address the lack of strategic investment in tank sustainment. The purpose of uniformed technicians is to be a soldier first, and deployable to sustain equipment in a hostile environment; this requires the demanded training, which is critical to tanks as a capability. The CA must aim to reduce the expected production of technicians to enable this training. Combined with the need to avoid obsolescence, this necessitates contracted support for repair, overhaul, and lengthy inspections.

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[13] The *Build Phase* is one of three with the CA MRP. During this phase, there is an expectation that the limited tank fleet will enable combat team level combined arms training with all infantry companies participating in the *Build Phase*.

[14] Maj Ronald R. Balkaran, "Enabling Foresight: The Transition to a Predictive Maintenance System" Canadian Forces College, 2021, 3.

Reassessment of Approach to Infrastructure Development.

20. The CA must consistently message a need for a new approach to infrastructure investment. While infrastructure needs are considered for the implementation of new capabilities, the stove-piped nature of each capability procurement results in dispersion of units amongst many buildings shared by multiple units. This is completely incompatible with our force structure, and the Leopard 2 sustainment challenges in Edmonton serve as a clear example of how such an approach erodes effectiveness.

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