



F-35 Sustainment Challenges: Considerations for the RCAF

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F-35 SUSTAINMENT CHALLENGES – CONSIDERATIONS FOR THE RCAF

AIM

1. The aim of this service paper is to identify to the Royal Canadian Air Force (RCAF) the ongoing sustainment challenges affecting the F-35 program which may impact the platform's effective introduction to service with Canada. This will aid the RCAF in reviewing its sustainment and force posture assumptions.

INTRODUCTION

2. In 2017's *Strong, Secure and Engaged*, Canada confirmed it would acquire 88 advanced fighter aircraft in order to enforce its sovereignty and meet its North American Defence (NORAD) and North Atlantic Treaty Organisation (NATO) commitments.¹ In Jan 23, Canada announced the selection of the Lockheed Martin fifth generation F-35A variant as its future fighter, with initial deliveries expected to commence in 2026, and an Initial Operating Capability (IOC) to be declared by 2030. Early deliveries will be initially located at Luke Air Force Base in the United States (US) in order to support the RCAF's initial pilot and maintainer training requirements.²

3. In response to the increasing threats from Russia and China, the RCAF must be prepared to deploy its F-35s within its own territory for sovereign defence. Furthermore, as NATO develops its Agile Combat Employment frameworks in response to the increasing threat posed from Anti-Access/Area Denial systems,³ the RCAF should expect to operate its F-35s from overseas at dispersed locations. This requires an agile, responsive, and efficient sustainment posture. This paper presents the current sustainment challenges facing the F-35 program that the RCAF may wish to consider as part of its introduction to service and assessments to support its IOC declaration.

4. **Caveat.** The analysis and subsequent recommendations detailed within this paper are drawn from publicly available sources only. Through the RCAF's ongoing representation within the F-35 Joint Program Office (JPO), the current sustainment challenges may already be known; however, the aim is to consolidate and highlight the potential cumulative impact at the operational level, if these issues are not adequately addressed prior to operations in Canada.

¹ Government of Canada, "Strong, Secure, Engaged: Canada's Defence Policy" (Government of Canada, 2017), 13, <https://www.canada.ca/en/department-national-defence/corporate/reports-publications/canada-defence-policy.html>.

² Government of Canada, "Future Fighter Capability Project," December 13, 2018, <https://www.canada.ca/en/department-national-defence/services/procurement/fighter-jets/future-fighter-capability-project.html>.

³ Luca Chadwick, "The 'ACE' up Their Sleeves: Understanding NATO Agile Combat Employment | Feature from King's College London," accessed December 10, 2024, <https://www.kcl.ac.uk/the-ace-up-their-sleeves-understanding-nato-agile-combat-employment>.

DISCUSSION

5. **F-35 Program Status.** Following the completion of Block 3F Operational Test and Evaluation, and a review of System Development and Demonstration exit criteria, the F-35 program received approval to advance to full rate production status on 12 Mar 24. This signified that the program had achieved an acceptable level of performance in terms of reliability and the establishment of adequate sustainment and support systems.⁴ The RCAF's aircraft are to be delivered at Block 4 standard, which fields improved hardware and software capabilities and an expansion of the useable payload.⁵ Regardless of receiving an enhanced variant, the ongoing sustainment issues affecting the current global F-35 fleet warrants consideration for any impact to the RCAF's assessment and declaration of IOC. In support of this effort, this paper focuses specifically on three key areas of F-35 sustainment; spares management, maintenance, and deployability.

6. **Spares Management.** The F-35's sustainment strategy removes the need for individual services to own and maintain a scale of aircraft spares, ground support, and test equipment scaled to its operational needs. In order to enhance efficiency, each operator has access to a scale of platform spares and supporting equipment from a global spares pool, corresponding to their purchased fleet size. All assets within the global spares pool are owned by the US Government and managed by Lockheed Martin, with the primary aim to provide economies of scale, reducing each operators' logistical footprints, through life costs, and associated risks.⁶ This centralised sustainment management of spares and support assets for a large global fleet appears logical; however, current performance is impacting F-35 operational effectiveness.

7. In 2019 a US Government Accounting Office (GAO) report highlighted that in the preceding year a shortage of spares and backlog of items awaiting repair caused a 30% reduction in platform availability over a six-month period. Furthermore, the management processes and mechanisms to move items across the globe were immature.⁷ The scale of spares held at units, combined with their reliability and compatibility issues between varying platform hardware and software states, further impacted the overall availability of the platform.⁸ While this assessment was conducted during a period of fleet expansion and with multiple Block configuration within the global fleet, the management and agility of the global spares pool continues to impact platform availability rates.

⁴ "F-35 Program Achieves Milestone C and Full Rate Production," U.S. Department of Defense, accessed January 18, 2025, <https://www.defense.gov/News/Releases/Release/Article/3704808/f-35-program-achieves-milestone-c-and-full-rate-production/https%3A%2F%2Fwww.defense.gov%2FNews%2FReleases%2FRelease%2FArticle%2F3704808%2Ff-35-program-achieves-milestone-c-and-full-rate-production%2F>.

⁵ Lockheed Martin, "Block 4 Capabilities Sharpen the F-35's Edge," August 1, 2024, <https://www.f35.com/f35/news-and-features/Block-4-Capabilities-Sharpen-the-F-35s-Edge.html>.

⁶ Peter Grinsted, "F-35 Logistics & Sustainment Strategy Overview" (F-35 Joint Program Office, 2012), https://www.sae.org/events/dod/presentations/2012/f35_logistics_and_sustainment_overview.pdf.

⁷ "F-35 Aircraft Sustainment: DOD Needs to Address Substantial Supply Chain Challenges," Report to Congressional Committees (US Government Accountability Office, April 2019), 13, <https://www.gao.gov/assets/gao-19-321.pdf>.

⁸ "F-35 GAO 2019 Report," 26.

8. In their 2024 report, the GAO highlighted that it had offered numerous recommendations to the Department of Defense (DoD) to address spares shortages and sustainment program management difficulties, yet many of these remain unactioned. It also asserted that a lack of spares and support equipment, which also impacted US and foreign service squadrons on operational deployments, continued to be a key challenge affecting the F-35's overall readiness rate.⁹ Moreover, the low resilience within the sustainment system was a contributing factor in neither of the three F-35 variants in the global fleet meeting any of their Mission Capable performance rates between 2019-2023. In particular, the F-35A variant achieved a Full Mission Capable rate of only 36% in 2023.^{10,11} In response to this finding, the DoD has stated that it plans to expand government oversight and is evaluating transitioning the management and control of sustainment from Lockheed Martin to the military. With platform Full Mission Capable rates stagnating below the minimum performance target of 80% between 2019-2023, and until the DoD's program of effort to resolve sustain management matures, low platform availability due to the inefficient management of spares is likely to continue. Through the RCAF's representation within the JPO, the maturity of the DoD's sustainment management projects should be continually reviewed.

9. **Maintenance.** Although the timely provision and reliability of spares has been a key driver affecting aircraft availability rates, the F-35 is a complex aircraft to maintain on unit. The GAO's 2023 report included a summary of responses from maintainers in the field where concerns were raised regarding their access to platform technical data. The F-35's Joint Technical Data, a technical manual database held within the Autonomic Logistic Information System, was reported as lacking detailed systems descriptions that would support more effective and expedient fault resolution. The GAO noted that the DoD's efforts to release more proprietary information to maintenance personnel were likely to be hindered by subcontractor concerns over losing competitiveness with Lockheed Martin via the release of their proprietary information. Additionally, initial technical training, which is delivered primarily through classroom-based presentations at Lockheed Martin's Integrated Training Centre, with an insufficient level of simulations or hands-on events, has led maintainers to rely heavily on contractor personnel support for fault resolution assistance and access to detailed technical information. In response, the DoD commented that training programmes were steadily improving; however, as Lockheed Martin owns the training material, the GAO assessed that the DoD is limited in the improvements it can enact.¹² In light of this, it is essential that the RCAF engages early with Luke Air Force Base to ensure its attached maintenance personnel receive the maximum exposure to a diverse range of maintenance events in order to develop a suitable scale of qualified and experienced personnel, prior to the platform's arrival in Canada.

10. Access to sufficient ground support equipment to enable maintenance was also cited as a contributory factor, with maintainers commenting on the higher demand for support equipment

⁹ "F-35 Sustainment: Costs Continue to Rise While Planned Use and Availability Have Decreased," Report to Congressional Committees (US Government Accountability Office, April 15, 2024), 11-12, <https://www.gao.gov/assets/gao-24-106703.pdf>.

¹⁰ Full Mission Capable is the percentage of time an aircraft is able to perform all tasked missions as detailed in the Operational Requirements Document.

¹¹ "F-35 GAO 2024 Report," 8-10.

¹² "F-35 GAO 2023 Report," 21.

when compared to legacy aircraft. While the RCAF's dedicated F-35 infrastructure will likely encompass fixed power, cooling and hydraulic outlets, the current scale of mobile assets to support flight line maintenance activities with current operators was cited as inefficient.¹³ As ground support and test equipment forms part of the global spares pool, Lockheed Martin manages the provision of spares, shipping, and equipment maintenance at F-35 operating bases. Platform maintainers at multiple surveyed locations commented on their low ground support equipment availability rates and the time taken for repairs to be completed. In the subsequent 2024 GAO report, the inefficient scale of ground support equipment was cited again, with no plans for a resolution detailed. In addition, a heavy reliance on contracted personnel within the sustainment function and the associated limited government decision-making ability, combined with a restricted access to technical information, continued to drive maintenance delays.¹⁴

11. Noting the above factors, the 2024 analysis of Lockheed Martin's F-35A availability data showed that the variant failed to meet the minimum service target for mean flight hours between critical failure.¹⁵ Moreover, the F-35A was also unable to achieve the minimum threshold for the mean corrective maintenance time to resolve critical failures, this being the time taken to resolve faults that impact mission capability.¹⁶ In summary, the F-35A continues to encounter an increased rate of failure of its mission critical systems and corresponding maintenance activities are taking longer than the minimum service requirement.

12. While the RCAF will receive a Block 4 variant, given the slow pace in resolution to the current maintainability challenges with the F-35A, the RCAF should anticipate these to have persisted at the point their platform deliveries commence. Moreover, it should be noted that the development of Block 4 is already proving problematic due to development and supply chain challenges.¹⁷ The RCAF should review its planned maintenance resource allocations (Direct Maintainer Spaces per Aircraft) to ensure that it is postured correctly to cope with a potential increased maintenance overhead. As noted during Operation Test and Evolution assessments, the F-35A has an increased maintenance resource requirement over the other two variants.¹⁸ Additionally, it should be noted that the US services have begun to reduce their fleetwide annual flying hours, in part due to the planned life of the platform being increased and evolving projections about future use.¹⁹ While this has seen a reduction in annual sustainment cost for the US services, it should not be inferred as a result of increased maintenance efficiency or improved sustainment system performance. Given the delays in full Block 4 capability, some of which may not be delivered until at least 2030, coupled with ongoing challenges within the global fleet, the

¹³ "F-35 GAO 2023 Report," 30.

¹⁴ "F-35 GAO 2024 Report," 12.

¹⁵ Mean flight hours between critical failure measures the duration between faults that result in the loss of a capability to perform a mission-critical capability. Mission capabilities and associated metrics are detailed within the F-35 Operational Requirements Document.

¹⁶ "F-35 GAO 2024 Report," 11.

¹⁷ Jennifer DiMascio, "F-35 Lightning II: Background and Issues for Congress" (United States Government - Congressional Research Service, December 11, 2024), 1, <https://crsreports.congress.gov/product/details?prodcode=R48304>.

¹⁸ Director Operational Test and Evaluation, "DOT&E Assessment of Post-IOT&E F-35 Block 4 Operational Testing," xxii, February 2024, <https://www.documentcloud.org/documents/25260009-dote-assessment-of-post-iote-f-35-block-4-operational-testing/>.

¹⁹ "F-35 GAO 2024 Report," 6.

RCAF should review its operations and sustainment cost estimates to ensure adequate contingency funding.^{20,21} Moreover, it should engage with the JPO and directly with other F-35A variant services for access to lessons identified regarding introduction to service challenges.

13. **Deployability.** In support of defending Canada's sovereignty, support to NORAD and its commitments to NATO, the rapid movement and power projection of its F-35 will be essential. A key tenet of the F-35 sustainment strategy is a reduction in the logistics footprint and this is a Key Performance Indicator. A detachment of 24 F-35A aircraft is required to achieve a footprint of less than eight C-17 loads.²² However, a recent Operational Test and Evaluation report highlighted that the current footprint exceeds the number of loads by twofold, largely in part due to the size of the F-35's support equipment.²³ It should be noted that the majority of the F-35's support equipment is unique to type, with little opportunity to utilise support assets from other fleets in service with the RCAF. With such a high logistics footprint, deployments within Canada and overseas will necessitate in significant road transport capability, but more likely an increased demand for strategic air mobility. Noting the RCAF's limited scale of strategic lift assets, early deployment planning and consultation with allied partners on the access to strategic lift will be critical. Looking beyond IOC, as NATO forces further develop pooled maintenance practices to support Agile Combat Employment operations,^{24,25} the RCAF should engage early in order to support the development of measures that may reduce the burden on F-35 deployed logistics and maintenance resource requirements.

CONCLUSION

14. The F-35A program presents both substantial promise but with notable challenges for the RCAF as it moves toward the aircraft's introduction to service and subsequent declaration of IOC. The sustainment challenges with spares management, maintenance complexities and overall logistics footprint may induce risks to the platform's operational effectiveness, if not suitably resolved by the JPO or mitigated by the RCAF. Despite improvements in aircraft capabilities within the Block 4 standard, ongoing sustainment challenges continue to impact platform availability and mission readiness across the global fleet, with the F-35A in particular facing lower-than-expected mission capable rates and maintenance delays.

²⁰ DiMascio, "CRS Report 2024," 10.

²¹ Christopher Penney and Albert Kho, "The Life Cycle Cost of Canada's F-35 Program – A Fiscal Analysis" (Government of Canada - Parliamentary Budget Officer, November 2, 2023), 11, <https://www.pbo-dpb.ca/en/publications/RP-2324-018-S--life-cycle-cost-canada-f-35-program-fiscal-analysis--cout-cycle-vie-programme-f-35-canada-une-analyse-financiere>.

²² John Hoehn, "F-35 Joint Strike Fighter (JSF) Program" (Congressional Research Service, May 2, 2022), 41, <https://crsreports.congress.gov/product/pdf/RL/RL30563>.

²³ Director Operational Test and Evaluation, "DOT&E Assessment of Post-IOT&E F-35 Block 4 Operational Testing," 4-1.

²⁴ Royal Air Force, "RAF and U.S. Air Force Sign Combined Vision Statement on Agile Combat Employment," Royal Air Force, September 2023, <https://www.raf.mod.uk/news/articles/raf-and-u-s-air-force-sign-combined-vision-statement-on-agile-combat-employment//>.

²⁵ Facci Eugenio, "F-35 Cross-Servicing Milestone to Greater NATO," Key.Aero, April 23, 2024, <https://www.key.aero/article/f-35-cross-servicing-milestone-greater-nato-interoperability>.

15. The RCAF's ability to deploy its F-35s effectively on deployed operations at home in support of NORAD or overseas with NATO, will be further challenged by the current limitations in the sustainment system. The complexity of maintaining the platform, specifically persistent issues with technical training, data access, and ground support equipment availability, may complicate the path to achieving an effective IOC declaration by 2030. It is critical that the RCAF proactively reviews these potential sustainment and maintenance limitations as part of its force posture planning and ensure sufficient contingency resources are in place to mitigate all emerging risks. Above all, the RCAF must maintain close engagement with JPO and other F-35 operators to remain informed of lessons learned and to influence ongoing sustainment improvements and the development of deployed maintenance and sustainment concepts. Only through a collaborative and anticipatory approach to these challenges can the RCAF ensure the F-35A's integration into service does not hinder its operational capabilities or its commitments to NATO's collective defense strategy.

RECOMMENDATIONS

16. It is recommended that RCAF HQ and its Future Fighter Project Team consider the following actions:

- a. In consultation with the JPO, review and assess the maturity of the DoD's sustainment management projects, particularly platform spares availability and the management of the global spares pool.
- b. Engage early with Luke Air Force Base to ensure RCAF maintenance personnel receive the maximum exposure to a diverse range of maintenance events.
- c. Review planned maintenance resource allocations (Direct Maintainer Spaces per Aircraft) to ensure it is correctly postured. Engage with other F-35A operators to understand lessons learned and adjust resource planning accordingly.
- d. Review planned sustainment cost estimates and ensure contingency budgets are sufficient.
- e. Assess road and strategic lift capabilities and measure impact on ability to deploy and sustain F-35 operations within Canada and overseas.
- f. Looking beyond IOC, engage with allied partners to develop options for reducing the F-35's logistic footprint. Support the development of common maintenance practices to enable contributions to NATO's Agile Combat Employment operations.

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