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AN EXAMINATION OF THE RCAF'S SIMULATION STRATEGY 2025

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AIM

1. The aim of this paper is to highlight the benefits and gaps in the Royal Canadian Air Force (RCAF) Simulation Strategy 2025 (RSS) and provide recommendations for its successful implementation. The implementation of the RSS is an achievable goal, and must occur for the RCAF to meet the Force Generation (FG) needs of the future operating environment.

INTRODUCTION

2. Fiscal pressures continue to tighten on the RCAF; a trend which will likely continue over the next few decades. Despite those pressures, the RCAF will be required to maintain a high degree of operational readiness, and provide timely responses to the needs of the Government of Canada (GoC). Operational success is driven by high readiness, and in order to achieve a state of high readiness, the RCAF must continue to rely on excellence in training.¹ The RCAF's current training system relies heavily on the use of aircraft which is becoming cost-prohibitive, while advances in modelling and simulation (M&S) continue to develop.² In light of these concepts, the RCAF has published the RSS, which is planned to be fully implemented by 2025. By leveraging a networked common synthetic environment, the vision of the strategy is to "...optimize the means by which RCAF aviators achieve and maintain readiness, fully exploiting advances in both technology and training methodologies, to deliver world-class capabilities for the full spectrum of operations."³ The RSS vision has significant associated benefits, but there

¹ Canada, Department of National Defence, "Executive Summary: RCAF Simulation Strategy 2025," Royal Canadian Air Force, last modified 12 March 2015, <http://www.rcaf-arc.forces.gc.ca/en/news-template-standard.page?doc=executive-summary-rcaf-simulation-strategy-2025/i6mj0r6z>

² Canada, Department of National Defence, "New simulation strategy sets roadmap for RCAF future," Royal Canadian Air Force, last modified 13 March 2015. <http://www.rcaf-arc.forces.gc.ca/en/article-template-standard.page?doc=new-simulation-strategy-sets-roadmap-for-rcaf-future/i6mj1aa9>

³ Canada, Department of National Defence, "Executive Summary: RCAF Simulation Strategy 2025."

are also gaps which must be identified to ensure its successful implementation. Once this paper has highlighted the potential benefits and gaps of the RSS, it will provide recommendations for the successful implementation of the strategy.

DISCUSSION

Benefits

3. **The RSS is in line with the RCAF Commander's intent.** Lieutenant General (LGen) Hood has stated that his "...most important job is building the air force of 2030, because that has to be done now."⁴ He has recognized that projecting trends too far into the future will result in estimations fraught with inaccuracies,⁵ and has instead focused on the realistic timeframe associated with the RSS. According to LGen Hood, another priority of the RCAF is to integrate his concept of an Agile and Integrated air force with the Reach and Power (AIRPower) with the Canadian Army (CA) and Royal Canadian Navy (RCN).⁶ This is also supported by the RSS as it has identified more frequent joint training as one of its objectives.⁷

4. **Added training with joint and coalition partners.** The Canadian Forces Aerospace Warfare Centre (CFAWC) remains a key instrument of RCAF transformation and one of its mandates is to coordinate "...efforts to provide advanced synthetic environment (SE) as well as modelling and simulation services."⁸ To that end, it stood up the Air Synthetic Environment

⁴ Ryan Melanson, "AIRPower in Formation: RCAF commander brings his message to the East Coast," Royal Canadian Air Force, last modified 01 February 2016, <http://www.rcaf-arc.forces.gc.ca/en/news-template-standard.page?doc=airpower-in-formation-rcaf-commander-brings-his-message-to-east-coast/ijzbn7zw>

⁵ J.L.D. Lachance, "Projecting Power: Alternative Futures for Canada's Air Force in 2020" (Trenton: Canadian Forces Air Warfare Centre, 2010), 1.

http://airforceapp.forces.gc.ca/CFAWC/eLibrary/pubs/Projecting_Power_2020.pdf

⁶ Paul Pryce, "Canadian Air Power Doctrine: A New Flight Path?" NATO Association of Canada, last modified 24 July 2015, <http://natoassociation.ca/canadian-airpower-doctrine-a-new-flight-path/>

⁷ Canada, Department of National Defence, "Executive Summary: RCAF Simulation Strategy 2025."

⁸ Lachance, "Projecting Power: Alternative Futures for Canada's Air Force in 2020," i.

Centre (ASEC) in Ottawa on 01 April 2012.⁹ The ASEC has been tasked to examine the value of distributed mission training (DMT) and has furthered the analysis of several joint and coalition synthetic initiatives. It has accomplished this by participating in synthetic training events such as Virtual Flag,¹⁰ a five-day coalition synthetic exercise held four times annually from Kirtland Air Force Base, New Mexico.¹¹ The Coalition Virtual Flag is "...a multinational, large-force exercise that integrates live, virtual, and constructive elements in a major combat operations scenario."¹² It is modelled after the real world exercises such as Maple Flag (Cold Lake, Alberta) and Red Flag (Nellis Air Force Base, Nevada). Notwithstanding the challenging training environments provided by the Flag exercises, the relationship building amongst partners remains one of the most important aspects. While the face-to-face contact will no longer occur to the same extent as the real-world Flag exercises, ASEC has explored the use of video teleconference capabilities for the mission briefings, debriefings, and collection of lessons learned amongst participants.¹³ The RSS will provide an avenue for relationship building with joint and coalition partners in a more frequent and cost-effective manner. As the RSS implementation nears completion, the ASEC will also become the RCAF's distributed mission operations centre (DMOC) which will allow it to integrate all Canadian Armed Forces (CAF) synthetic assets in one virtual environment. Hence, all synthetic training events could potentially be conducted in one joint and coalition virtual world.

⁹ Kelvin Truss, "Canada's Air Synthetic Environment Centre: Enabling Force Transformation," *The Royal Canadian Air Force Journal* vol. 1, no. 3 (Summer 2012): 61. http://airforceapp.forces.gc.ca/CFAWC/eLibrary/Journal/2012-Vol1/Iss3-Summer/Sections/08-Canadas_Air_Synthetic_Environment_Centre-Enabling_Force_Transformation_e.pdf

¹⁰ *Ibid.*

¹¹ Grace Jean, "Air Force 'Virtual Flag' makes up for lost flying hours," *National Defense Magazine*, accessed 02 February 2016, <http://www.nationaldefensemagazine.org/archive/2007/May/Pages/AirForceVirtual2645.aspx>

¹² Truss, "Canada's Air Synthetic Environment Centre: Enabling Force Transformation," 62.

¹³ *Ibid.*, 61.

5. **Cost Benefits.** The current trend in spending on the sustainment of RCAF readiness based on the use of aircraft for training amounts to approximately \$1B per year.¹⁴ Without implementation of the RSS, and relying on the simulators available today, a study conducted by the 1 Canadian Air Division (1 CAD) in 2010 has revealed that 3,000 FG flying hours can be saved per year equating to savings of approximately \$20M per year.¹⁵ By comparison, the full implementation of the RSS is expected to generate savings in FG equating to \$2B over 20 years (or \$100M per year).¹⁶ The projected five-fold increase in savings will grant the RCAF flexibility in terms of increasing the Force Employment (FE) flying hours for operational taskings.¹⁷

6. Cost savings generated by the RSS will be compounded by forecasted increases in the price of oil. According to Natural Resources Canada, the global demand for crude oil is forecasted to increase by one per cent per year until 2030.¹⁸ When adjusted for inflation, this will translate into a 13.8 per cent increase in the price of oil per barrel over the next 15 years.¹⁹ Considering that the CC177 Globemaster's fuel burn rate during FG mission equates to approximately 20,000 lbs per hour, it is evident that FG missions are forecasted to become even more cost prohibitive in the future.

7. **More Efficient Training.** The output of training establishments (TE) will increase with the implementation of the RSS due to a reduced reliance on aircraft maintenance and conducive

¹⁴ Canada, Department of National Defence, "Executive Summary: RCAF Simulation Strategy 2025."

¹⁵ Lachance, "Projecting Power: Alternative Futures for Canada's Air Force in 2020," 18.

¹⁶ Canada, Department of National Defence, "Executive Summary: RCAF Simulation Strategy 2025"

¹⁷ Sonia Connock, "Embracing the Future: RCAF finds solutions in innovative training technologies," Department of National Defence, Royal Canadian Air Force, last modified 25 March 2014. <http://www.rcaf-arc.forces.gc.ca/en/news-template-standard.page?doc=embracing-the-future-rcaf-finds-solutions-in-innovative-training-technologies/ht8s3wor>

¹⁸ Natural Resources Canada, "Long Term Outlook: Crude Oil Prices to 2030," Government of Canada, accessed 02 February 2016. <http://www.nrcan.gc.ca/energy/publications/markets/6511>

¹⁹ *Ibid.*

weather conditions. The RCAF CH149 fleet has estimated that the length of its first officer initial course can be reduced from 16 weeks to 10 weeks due to the advantages of reliance on simulation.²⁰ Similar reductions in course length will likely be reflected across all RCAF fleets. The maintenance assets and flying hours devoted to sustaining FG could instead be employed on operational taskings due to the RSS.

8. Due to the safety afforded by the synthetic environment, the RCAF has recognized that it is well-suited for efficient emergency procedures training. According to the RCAF's safe training practices published in the *Flight Operations Manual*, the CC150, CC130, CC130J, CC144, and CC177 fleets *only* allow the vast majority of their "abnormal procedures" training to be conducted in the simulators.²¹ The current drawback is that those fleets are only required to conduct emergency handling training either quarterly or semi-annually,²² which is likely due to simulator availability. The implementation of the RSS will increase simulator availability, therefore allowing more emergency procedure training to RCAF aircrew.

9. **Fostering public perception and support.** According to a Canadian Broadcasting Corporation's (CBC) voter engagement survey conducted between 29 August and 01 September 2015, the two issues Canadians are most concerned with are the economy and the environment.²³ Notwithstanding the increased flexibility that the RCAF will experience with increased FE flying hours and cost savings, the RSS will reduce the RCAF's carbon footprint associated with FG. Because of "...the general decline in privilege of public institutions, improvements in

²⁰ Canada, Department of National Defence, "Executive Summary: RCAF Simulation Strategy 2025."

²¹ Department of National Defence, *Flight Operations Manual* (Winnipeg: DND Canada, 2013), Appendix 3.1.1.12.A.1 to Appendix 3.1.1.12.A.8.

²² *Ibid.*, Table 5-503.A.2 – Flight Simulator Continuation Training.

²³ CBC News, "Vote Compass: Economy and environment rate as top issues," CBC News, last updated 11 September 2015. <http://www.cbc.ca/news/politics/vote-compass-canada-election-2015-issues-canadians-1.3222945>

communications, and greatly enhanced access to official information and documents,”²⁴ the Canadian public has become far more aware of the RCAF’s processes and operations. This transparency will likely continue for the foreseeable future, and if properly expressed, the RSS will foster the Canadian public’s perception of the CAF.

Gaps

10. **The required paradigm shift in the RCAF.** Training in the synthetic environment is not a new concept to the RCAF, and the RSS, in its current form, will not represent a panacea for the RCAF’s FG requirements. While CFAWC published a capstone document in 2010 identifying the RCAF’s commitment to the operational functions of command, sense, act, shield, sustain, and generate, doctrine regarding the generate function has yet to be published.²⁵ A shift in training culture will be crucial in order for the RSS to be successfully implemented. The RCAF has embraced simulation since the employment of the LINK trainers during the Second World War,²⁶ and the newest fleets (CC130J and CH147) are currently “...achieving in excess of 90 per cent of their training requirements through the use of simulation.”²⁷ While the M&S technologies have adapted and improved over the years, the methods of training in the synthetic environment have not. In today’s RCAF, “the dominant use of simulation in the pilot training system is for procedural training,”²⁸ and it is focused on the development of technical skills. Colonel (Col) Colin Keiver, Commander of 8 Wing Trenton, has researched human factors in the synthetic environment and suggested that the procurement of simulators will not necessarily translate into

²⁴ Canada, Department of National Defence, *Leadership in the Canadian Forces: Conceptual Foundations*. Canadian Defence Academy, 2005, xv.

²⁵ Pryce, “Canadian Air Power Doctrine: A New Flight Path?”

²⁶ Canada, Department of National Defence, “Executive Summary: RCAF Simulation Strategy 2025.”

²⁷ Connock, “Embracing the Future: RCAF finds solutions in innovative training technologies.”

²⁸ Ryan Kastrukoff, “Shifting Paradigms: Aerospace Simulation in the RCAF,” *The Royal Canadian Air Force Journal* vol. 4, no. 1 (Winter 2015): 40. http://www.rcaf-arc.forces.gc.ca/assets/AIRFORCE_Internet/docs/en/cf-aerospace-warfare-centre/elibrary/journal/2015-vol4-iss1-winter.pdf#shifting_paradigms

an effective learning environment without the required focus on behavioural performance.²⁹ Researchers such as Salas, Bowers, and Rhodenizer have also echoed that sentiment by stating that the gap must be bridged between current simulation practice and advances in training research where there is a “...shift in focus from the designing of simulation realism (and hope that learning occurs) to the design of human-centered training systems that support the acquisition of complex skills.”³⁰ By focusing on the technical skills and procedural knowledge, it is evident that the RCAF’s current training system in the synthetic environment is based on the misconception that technical failures are the main cause of aviation incidents. In fact, research conducted by Alan Hobbs, G.E. Anderson, the International Civil Aviation Organization and the United States Air Force all indicate that between 70 and 80 per cent of aviation incidents actually occur due to failures of human performance or errors in judgement.³¹ Further research conducted by NASA beginning in 1999 determined “...that current training practices prepared pilots for only a very small number of the types of situations that actually occurred...they often found themselves ill equipped and ill trained for what they had to face.”³² Col Keiver has neatly summarized the adaptation that the RCAF will have to perform by writing, “it is no longer enough to focus on systems knowledge and published procedures. Training must be shifted from teaching the operators all the details of the system they are operating to teaching them to be more

²⁹ Colin Keiver, “Line Operational Simulation: Towards Optimizing Human Performance in the Canadian Air Force,” *The Curtis Papers: Canadian Aerospace and Joint Studies* vol. 1, book 1 (2013): 4. http://airforceapp.forces.gc.ca/CFAWC/eLibrary/pubs/The_Curtis_Papers-Vol1-Book1_e.pdf

³⁰ Eduardo Salas, Clint A. Bowers, and Lori Rhodenizer, “It Is Not How Much You Have but How You Use It: Toward a Rational Use of Simulation to Support Aviation Training,” *International Journal of Aviation Psychology* 8, no. 3 (1998): 199. [http://nas.psych.uidaho.edu/~ad.uidaho.edu%5Cbdyre/psyc562/readings/VE_Simulation_Motion_Sickness/Salas_et_al\(1998\).pdf](http://nas.psych.uidaho.edu/~ad.uidaho.edu%5Cbdyre/psyc562/readings/VE_Simulation_Motion_Sickness/Salas_et_al(1998).pdf)

³¹ Keiver, “Line Operational Simulation...,” 7-9.

³² Barbara K. Burian, Immanuel Barshi, and Key Dismukes, *The Challenge of Aviation Emergency and Abnormal Situations*, report prepared for the National Aeronautics and Space Administration (Ames Research Center, Moffat Field, California: NASA, 2005), 1. http://human-factors.arc.nasa.gov/publications/20051028111241_Review_of_ASRS_Reports.pdf

aware of what they do and do not know.”³³ The RSS holds the potential to be the vehicle of this training transformation, and must incorporate these concepts in order to ensure its successful implementation.

11. **Flying hours – logbook equivalency.** In 2009, the Chief of the Air Staff (CAS) tasked CFAWC with examining both the future of simulation and potential FG issues.³⁴ In the follow-up document, *Projecting Power: Alternative Futures for Canada’s Air Force in 2020*, CFAWC identified that FG in terms of recruitment will continue to be a serious challenge where “...demographic trends indicate that novel strategies and methods for recruiting, training and retaining may have to be employed.”³⁵ In relation to aircrew recruitment and retention, the fact remains that many RCAF aircrew members rely on experience (i.e. flying hours) gained in the military to bolster their portfolios for future employment in the civil aviation industry. This has been, and will continue to be a significant incentive for the RCAF’s aircrew. While the vision of the RSS makes reference to delivering “...world-class capabilities...”³⁶ there is no mention of the level of certification sought by the strategy. According to Transport Canada (TC) standards, which are equivalent to those of the Federal Aviation Administration (FAA), there are four levels of certification for the synthetic environment comprised of A through D.³⁷ Level D simulators are the most sophisticated, and pursuant to the Canadian Aviation Regulations (CARs), level D simulators permit “...type endorsement of pilots not current on a similar type aeroplane without any aeroplane training...”³⁸ TC has recognized that level D simulators possess the fidelity required to accurately model the real aircraft, and as a result, RCAF aircrew will be able to log

³³ Keiver, “Line Operational Simulation...,” 10.

³⁴ Lachance, “Projecting Power: Alternative Futures for Canada’s Air Force in 2020,” v.

³⁵ *Ibid.*

³⁶ Canada, Department of National Defence, “Executive Summary: RCAF Simulation Strategy 2025.”

³⁷ Transport Canada, *TP 9685E: Aeroplane and Rotorcraft Simulation Manual*, Revision 2 (Revised January 2005), 2.1.1. <https://www.tc.gc.ca/Publications/en/tp9685/pdf/hr/tp9685e.pdf>

³⁸ *Ibid.*, Appendix 8-A.

hours equivalent to those of the real world while training in a level D synthetic environment. Given that the RSS is conducive to increased FG hours as the simulators will experience higher serviceability rates than the actual aircraft, implementation of the strategy will grant RCAF aircrew more frequent training opportunities than the status quo. Hence, if the RSS is implemented with level D certifications from TC, the RCAF's aircrew will accumulate more hours for their logbooks and further bolster their portfolios and experience in a manner which will be recognized by the civil aviation industry. This in turn will support the "novel strategies and methods for recruiting" proposed by CFAWC. The RSS must make level D certification a priority.

CONCLUSION

12. The RCAF will be forced to operate in an increasingly constrained fiscal environment, and the RSS represents the future of its FG efforts. The strategy has many associated benefits, including the fact that it supports the current RCAF Commander's intent, it will provide more frequent and efficient training with joint and coalition partners and it can be leveraged to foster the Canadian public's perception of the CAF. The associated gaps identified are that the RSS has not addressed the shift in training practices that the RCAF must undertake, and it does not address flying hour equivalency with the civil aviation industry. To ensure its successful implementation the following recommendations should be observed.

RECOMMENDATIONS

13. CFAWC must publish the RCAF's *Generate* doctrine as soon as possible, to include the importance of training to *both* technical skills and human performance in aviation. The heavier reliance on training in the synthetic environment that the RSS will bring necessitates the shift in RCAF training practices.

14. The RSS implementation project office must seek level D certification from TC once the new simulators are procured. The more frequent training opportunities afforded by the RSS, once fully implemented, will greatly benefit the RCAF's aircrew experience levels in terms of flying hours, but only if those hours spent training in the synthetic environment are recognized by the civil aviation industry.

15. ASEC should continue to evaluate the benefits of joint and coalition exercises in the synthetic environment, and be prepared to take on the role as DMOC for the CAF once the RSS is fully implemented. On the fleets that have already obtained high-fidelity simulator assets such as the CC130J and CH147, the Virtual Flag participation must be transferred from ASEC to those fleets' squadrons as soon as possible so that the RCAF's operators can continue their relationship building with joint and coalition partners, and begin their lessons learned processes in the synthetic environment.

16. The Director of Air Force Public Affairs should be engaged as soon as possible, if it has not already happened to begin an extensive Public Relations (PR) campaign with the Canadian public pertaining to the RSS. The RSS will generate more assets and personnel for operational taskings, spend taxpayers' contributions in an effective manner for FG, and reduce the RCAF's FG carbon footprint. All of these factors should be expressed to the Canadian public as soon as possible.

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