



## RCAF MOBILE CONTROL AND REPORTING UNITS: LACKING MOBILITY

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### JCSP 50

#### Service Paper

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# **RCAF MOBILE CONTROL AND REPORTING UNITS: LACKING MOBILITY**

## **AIM**

1. In an era marked by significant transformations, the global landscape has become increasingly tumultuous and precarious, surpassing the level of instability seen since the conclusion of the Cold War. In the last few years our adversaries demonstrated that their doctrine has evolved, and they are now capable of small-scale attacks and target friendly detection equipment in a very rapid fashion.<sup>1</sup> The purpose of this service paper is to explain the factors contributing to the obsolescence of the TPS-77 radar system in its present configuration. Despite the initiation of its procurement process in 2007, the system is only now being delivered to the Royal Canadian Air Force (RCAF). Additionally, this paper will present and recommend interim solutions for customizing the radar system to ensure its continued relevance in a contested environment, primarily addressing concerns related to its inadequate mobility.

## **INTRODUCTION**

2. The RCAF has two Mobile Control Reporting Units (MCRU), 12 Radar Squadron (12 ER) located at 3 Wing Bagotville and 42 Radar Squadron (42 RS) located at 4 Wing Cold Lake. A MCRU, as depicted on figure 1, is a scalable unit and is comprised of 4 main elements. A radar detachment, capable of providing a radar picture, a tactical data link detachment, capable of providing primarily Link 16, a communications detachment, capable of providing ground to air radios communication and a control and reporting element, capable of providing air battle management. All these detachments can work together (collocated or geographically displaced) or independently, thus the scalable quality of the MCRU. The radar detachment, being the core of the unit, is the most important element. It is important to note that as per their Concept of Operations (CONOPS) MCRUs are on 72 hours' notice to move to deploy anywhere in the world and need to be able to provide an effect shortly after arriving on location.<sup>2</sup> Currently, MCRUs operate the TPS-70 (fig. 2) radar system. This system purchased after the Cold War, was a good choice at the time due to its mobility, rapidity of installation and commonality, it was a true mobile radar. In 2007, as the TPS-70 was approaching its end of life scheduled for 2015, the RCAF identified the need to replace the aging system that had been used by the MCRUs since 1990.<sup>3</sup> When its replacement project started, the team determined that a similar radar system was a good choice for the MCRUs and 15 years later, the TPS-77 (fig. 3) project was approved, and three radar systems were ordered from Lockheed Martin as a replacement for the TPS-70.<sup>4</sup> However, since 2007, the operating environment has changed and as stated in the RCAF Future Air Operating

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<sup>1</sup> Canada. Department of National Defence. "Pan-Domain Force Employment Concept," (2023), p. 5.

<sup>2</sup> RCAF Mobile Control and Reporting Units Concept of Operation, 2015.

<sup>3</sup> Kynaston, Brian, "The Case for Greater Investment In, and Employment of, RCAF Tactical Control Radar Squadrons" (Joint Command Staff Program Service Paper, Canadian Forces College, 2018), p. 3.

<sup>4</sup> Government of Canada, "Government of Canada Awards Contracts for New Tactical Control Radars," (<https://www.canada.ca/en/public-services-procurement/news/2021/06/government-of-canada-awards-contracts-for-new-tactical-control-radars.html>).

Concept “the threat has evolved considerably in the last few years and we now live in a world of rapidly evolving technology where air supremacy (and I would argue even air superiority) is not guaranteed anymore.”<sup>5</sup>



Figure 1

3. The radar system selected to replace the old TPS-70, the TPS-77, is a radar that has been purchased worldwide, extending its reach to several like-minded nations, such as the United States, Australia, the United Kingdom, and Denmark. However, these deliveries happened from 2004 to 2010. Presently, the operators of the TPS-77 are actively engaged in procuring the next-generation radar and are expecting deliveries within the next two years. The technology of these newer generation of radars not only boasts enhanced capabilities but, in certain instances, offers greater mobility as well. The TPS-77 that Canada is procuring is a powerful radar but lacks the technology and the rapidity of next generation radars. The TPS-77 is a transportable radar and not a mobile radar therefore, to maintain a technological advantage and remain agile and swift the MCRUs need to customize the radar system that has been purchased with the aim of increasing its mobility. Simultaneously, the RCAF should initiate the procurement process of a next generation radar system to stay at the forefront of technological advancements.

<sup>5</sup> Royal Canadian Air Force, "Future Concepts Directive Part 2: Future Air Operating Concept," (15 August 2016), p. 11.



Figure 2



Figure 3

## DISCUSSION

### **Customizing the TPS-77 to increase its mobility.**

4. A TPS-77 radar system is comprised of 4 major components requiring two heavy vehicles for transportation. The most cumbersome component of the system is the radar antenna that weighs 19, 000 Lbs. With the current fleet of vehicles, the radar antenna can only be towed using mobilizers due to its weight but also its length. The other three components, the radar shelter, the equipment shelter and the operations shelter weigh less and can be transported on the bed of the trucks or towed. Figure 4 depicts the radar shelter on the bed of the truck and the radar antenna being towed using mobilizers. Another similar rig is required to move the two other components to have a full radar detachment however this does not include power generation, various support equipment and the three other elements of the MCRU. Therefore, a convoy of approximately 4 vehicles and trailers is required to obtain the full complement of the MCRU capabilities.



Figure 4

5. In its current configuration, the installation of the radar system and its associated equipment necessitates, at a minimum, a two-day effort carried out by a skilled crew comprising approximately 20 individuals. Moreover, preparing the terrain for hosting the radar system can extend to a month, as it mandates installation on an elevated hill, ensuring it stands at least 8 feet above any adjacent obstacles and equipment to fully leverage its capabilities. To attain this elevation, Lockheed Martin recommends building a mound that has a compaction level high enough to sustain at a minimum a pullout force of 1500 kg.<sup>6</sup>

6. Another obstacle to the mobility of the radar system is the method used to haul it from one location to another. As mentioned, the RCAF purchased a pair of mobilizers that are designed to attach to the radar antenna and be driven. These mobilizers have significant constraints: their clearance is approximately 16 inches from the ground, their speed rating is 55 mph on a level and paved road, and most importantly, they take hours to install. Given these constraints, accessing certain terrains may pose challenges, potentially expanding the installation site selection criteria and, in some cases, overlooking the most optimal sites for radar coverage.

7. The Royal Australian Air Force (RAAF) have been operating the same system since the mid-2000s and deployed it to Afghanistan shortly after receiving it.<sup>7</sup> After a few years of operation, they gathered and implemented multiple lessons learned on the system. First, to increase mobility and rapidity of deployed site installation the RAAF MCRUs have engineered an innovative system and were able to mount the TPS-77 radar antenna on a truck (Fig 5). This conversion was completed after the unit realized that the radar system was complicated to install and required substantial engineering to prepare the terrain thus reducing their mobility. This customization necessitated adjustments to their vehicles, without any modifications to the radar system itself, as it is inherently designed for truck mounting straight from the factory. However, given the heavy weight

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<sup>6</sup> Site Acceptance Test (SAT) / Temporary Operating Site Requirements (quick list), 2022.

<sup>7</sup> Press Release: Australian Defence Force, "RAAF Takes Control of Sth Afghanistan Skies," (Aug 6, 2007). <https://www.scoop.co.nz/stories/WO0708/S00155/raaf-takes-control-of-sth-afghanistan-skies.htm>.

of radar antenna, a vehicle with a greater Gross Vehicle Weight Rating (GVWR) was required.<sup>8</sup>



Figure 5



Figure 6

8. Second, the RAAF mounted all the essential equipment for a MCRU deployment on vehicles or trailers.<sup>9</sup> This allows them to install their equipment while remaining mounted on the back of the vehicles. Not only does this method expedite the installation process, but it also significantly streamlines the tear-down phase. This proves particularly advantageous in a contested environment where large radar antennas are deemed high payoff targets.

9. Third, the RAAF employs a specially crafted ground plate (fig 6) as part of its equipment. This plate is designed to anchor securely to various levels of ground compaction and is engineered to withstand the vertical pull necessary for stabilizing the radar antenna.<sup>10</sup> When utilizing this specialized equipment, the RAAF gains greater flexibility in choosing a soil compaction level, thereby enhancing overall adaptability. When integrated, these customizations significantly enhance the mobility and speed of operational impact of the RAAF MCRUs. It also provides them with more flexibility and adaptability when planning for site selection.

10. Closer to us, the Canadian Army (CA) recently acquired a medium-range radar system capable of relocation in 20 minutes nevertheless, there is minimal collaboration and integration (if any) between the radar units of the two services.<sup>11</sup>

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<sup>8</sup> Personal notes from staff visit to 3 Control & Reporting Unit, RAAF Williamtown, 1-4 May 2023.

<sup>9</sup> Personal notes from staff visit to 3 Control & Reporting Unit, RAAF Williamtown, 1-4 May 2023.

<sup>10</sup> Personal notes from staff visit to 3 Control & Reporting Unit, RAAF Williamtown, 1-4 May 2023.

<sup>11</sup> "Canadian Army Acquires Medium Range Radar from Rheinmetall." (Apr 24, 2018). <https://www.army-technology.com/news/canadian-army-acquires-medium-range-radar-rheinmetall/?cf-view>.

## **Initiating the procurement process of the RCAF next-generation radar system.**

11. As previously noted, should the plan unfold without any delays in the delivery of the TPS-77 radar systems, the procurement process for the radar will have taken a total of 18 years. This timeline is unacceptable, especially considering the swift technological advancements by our adversaries and falls short even when compared to the pace at which our allies are updating their technology. For the RCAF to effectively fulfill the priorities of Strong, Secure, and Engaged (SSE), the planning for the next generation of radar must commence without delay.<sup>12</sup>

12. Modern radars boast increased detection ranges, can detect flying and non-flying targets, and can also detect targets with the cross section of a small drone. Additionally, some are designed for truck mounting and can function seamlessly while in motion, similar to a shipborne radar system. Regrettably, the RCAF's MCRUs lack these crucial attributes necessary to confront the contemporary threats encountered on today's battlefield.

13. Recently, the RAAF has awarded a contract to CEA Technologies for the purchase of the HPAR-64SG which “will provide the RAAF with enhanced mobility, situational awareness and fire control capabilities”.<sup>13</sup> The United States Air Force (USAF) has also awarded contracts to Lockheed Martin to procure this next generation of radars, the TPY-4. This modern radar system will be “able to identify and track smaller targets at longer ranges”.<sup>14</sup> When these two projects deliver, our closest allies will be 15 years ahead of us in mobile radar technology. To continue to be interoperable and make a tangible contribution to the NATO alliance, the RCAF must initiate planning for the next-generation radar with the goal of achieving a shorter timeline than the current one.

## **CONCLUSION**

14. As stated in the Pan-domain Force Employment Concept (PFEC), “Adversary activities may require the Canadian Armed Forces (CAF) to quickly reallocate force elements between standing campaigns or to redirect the efforts of national/reach-back capabilities”.<sup>15</sup> This is particularly true with detection equipment that allows forces to sense the airspace. The MCRU is a solid concept that has been adopted by most of our NATO allies and can greatly contribute to the fight but needs to move quickly.

15. Furthermore, lessons drawn from Ukraine, where readily available drones have become increasingly prevalent and capable of deploying explosive munitions increase the risks for a TPS-77 radar system. The system is easily detectable, and once located, it

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<sup>12</sup> Canada. Department of National Defence. "Strong Secure Engaged, Canada's Defence Policy," (2017), p. 14.

<sup>13</sup> "Air6500 Phase 1 Tranche 1." (Oct, 2023). "AIR6500 Phase 1 Tranche 1", <https://www.cea.com.au/domains/air-6500-phase-1-tranche-1/>.

<sup>14</sup> "The Air Force is Moving Forward with a Replacement for its Decades-Old Long-Range Radar," last modified JAN 26, <https://taskandpurpose.com/news/air-force-tpy-4-lockheed-radar/>.

<sup>15</sup> Canada. Department of National Defence. "Pan-Domain Force Employment Concept," (2023), p. 43.



becomes a vulnerable target. It has been shown that once the electronic signature of a radar has been detected the system has only between 10 and 15 minutes to move before being targeted and destroyed.<sup>16</sup> The imperative for swift packing up and relocation within a short timeframe is crucial in today's dynamic operational environment. Strengthening coordination and cooperation between the CA and the RACF MCRUs could potentially optimize the utilization of the CAF radar systems.

16. According to the Oxford dictionary, the term "mobile" pertains to the capability of someone or something to move or be moved freely or with ease. I contend that the existing equipment of the Mobile Control and Reporting Units does not embody true mobility but rather transportability. This deficiency in mobility can be rectified through the installation of the TPS-77 radar system on the bed of heavy vehicles.

17. Alternatively, major capital projects typically take an average of 10 to 15 years to complete from start to finish.<sup>17</sup> Factually, 70 percent of all CAF procurement projects fail to meet their deadlines.<sup>18</sup> The technology is evolving very quickly, and our adversaries do not have the same procurement constraints. Also, our allies have already completed the procurement process of the next-generation radars and will be fielding this capability in the coming years. To remain interoperable and relevant the RCAF needs to start looking at the next generation of radars.

18. The PFEC states that: "We must adopt a long view while being able to act rapidly and with operational agility."<sup>19</sup> Achieving this objective necessitates the immediate initiation of the procurement process of the future radar. This will enable the RCAF to pull the trigger on a replacement radar long before the TPS-77 has reached the end of its operational lifespan therefore maintaining continuity of operation.

## RECOMMENDATIONS

19. It is recommended that the RCAF:

- a. Divest from the mobilizers as the primary means of transporting the TPS-77 radar antenna and obtain and customize a transport vehicle that can accommodate the radar antenna on its bed.
- b. Procure the specially crafted ground plates that will anchor the radar antenna to a various level of soil compaction thus decreasing the constraints for site selection.

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<sup>16</sup> Jensen, Rebecca, Presentation on Ukraine, 3 Feb 2024.

<sup>17</sup> William & al Richardson, " Toward Agile Procurement for National Defence: Matching the Pace of Technological Change," (June 2020).

[https://www.cgai.ca/toward\\_agile\\_procurement\\_for\\_national\\_defence\\_matching\\_the\\_pace\\_of\\_technological\\_change](https://www.cgai.ca/toward_agile_procurement_for_national_defence_matching_the_pace_of_technological_change).

<sup>18</sup> Canada. Department of National Defence. "Strong Secure Engaged, Canada's Defence Policy," (2017), p. 74.

<sup>19</sup> Canada. Department of National Defence. "Pan-Domain Force Employment Concept," (2023), p. 24.

- c. Foster stronger collaboration with the Canadian Army medium-range radar units through the establishment of joint exercises, facilitating opportunities for both services to collaborate and enhance mutual learning.
- d. In coordination with the CA medium-range radar units, begin the procurement process for the RCAF next generation of radars immediately.

## BIBLIOGRAPHY

- "Air6500 Phase 1 Tranche 1." (Oct, 2023). "AIR6500 Phase 1 Tranche 1", <https://www.cea.com.au/domains/air-6500-phase-1-tranche-1/>.
- "Canadian Army Acquires Medium Range Radar from Rheinmetall." (Apr 24, 2018). <https://www.army-technology.com/news/canadian-army-acquires-medium-range-radar-rheinmetall/?cf-view>.
- Canada. Department of National Defence. "Pan-Domain Force Employment Concept." (2023).
- CEA Technologies Pty Limited. "AIR6500 Phase 1 Tranche 1." <https://www.cea.com.au/domains/air-6500-phase-1-tranche-1/>.
- Department of National Defence. "Strong Secure Engaged, Canada's Defence Policy." (2017).
- Government of Canada. "Government of Canada Awards Contracts for New Tactical Control Radars." <https://www.canada.ca/en/public-services-procurement/news/2021/06/government-of-canada-awards-contracts-for-new-tactical-control-radars.html>.
- Lockheed Martin. "TPS-77 Site Acceptance Test (SAT) / Temporary Operating Site Requirements (Quick List).".
- Australian Defence Force. "RAAF Takes Control of Sth Afghanistan Skies." (Aug 6, 2007). <https://www.scoop.co.nz/stories/WO0708/S00155/raaf-takes-control-of-sth-afghanistan-skies.htm>.
- Richardson, William, *et al.* "Toward Agile Procurement for National Defence: Matching the Pace of Technological Change." (Jun 2020). [https://www.cgai.ca/toward\\_agile\\_procurement\\_for\\_national\\_defence\\_matching\\_the\\_pace\\_of\\_technological\\_change](https://www.cgai.ca/toward_agile_procurement_for_national_defence_matching_the_pace_of_technological_change).
- Royal Canadian Air Force. "Future Concepts Directive Part 2: Future Air Operating Concept." (15 August 2016).
- Roza, David. "The Air Force is Moving Forward with a Replacement for its Decades-Old Long-Range Radar." <https://taskandpurpose.com/news/air-force-tpy-4-lockheed-radar/>.