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## ADAPTIVE DISPERSIBLE HEADQUARTERS: THE FUTURE SOLUTION TO COMMAND AND CONTROL RESILIENCE?

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## **ADAPTIVE DISPERSIBLE HEADQUARTERS: THE FUTURE SOLUTION TO COMMAND AND CONTROL RESILIENCE?**

*Service paper for Director Land Command and Information and Director Land Warfare Centre*

### **AIM**

1. The aim of this service paper is to introduce the concept of Adaptive Dispersible Headquarters (HQ) (ADHQ) as a potential solution to Canadian Army (CA) Command and Control (C2) resilience in non-permissive environments, and recommend the further research and development to explore this new frontier as part of the definition phase of the Land Command Support System (LCSS) Modernization (Mod) Project.

### **INTRODUCTION**

2. The Afghanistan counter-insurgency campaign caused tactical commanders to develop an unprecedented appetite for detailed, accurate information to be used in decision-making. Several factors came into play to cause this, including the complexity of fighting an insurgency where finding and fixing the enemy was challenging and increasingly enabled by technological means, the increased casualty aversion resulting in low operational risk tolerances, the growing availability of sensing and information dissemination and processing technologies, and the relative physical security of headquarters locations, to name but a few. Tactical HQs at many levels ballooned in size to accommodate this thirst for quality information. Existing staff structures were modified and new organizations were created, such as the All-Source Intelligence Centre (ASIC) and the Tactical Network Operations Centre (TNOC), to support this trend.

3. The net result of this increase in HQ size came at the cost of resilience: Simple, tactical HQs previously reliant only on tents, tables, chairs, paper maps, people, radios, defensive stores, and light trucks, which were easy to camouflage and quick to redeploy in ‘leapfrog’ or ‘caterpillar’ tactical movements, became unwieldy complexes of computers, smartboards, routers, cables, servers, big-screen TVs, Video Teleconference (VTC) facilities, ASICs, NOCs, and many more people – all without the integral lift capability required for expedient redeployment. Should the CA need to fight against a sophisticated enemy, its tactical C2 capability would be very easy to find, fix and strike, as evidenced by figure 1.



Figure 1: 5 Canadian Mechanized Brigade Group (CMBG) HQ, Exercise RAFALE BLANCHE, Jan 2014<sup>1</sup>

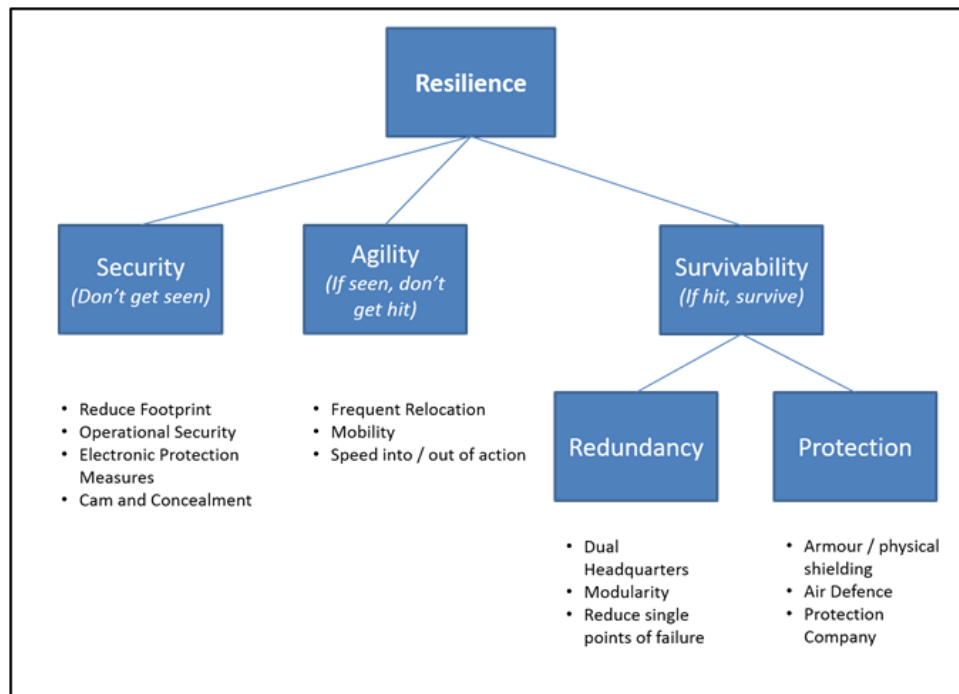
4. Luckily, since the closeout of the Afghanistan campaign, all three CMBGs have developed tactics, techniques and procedures to mitigate these risks, mostly by using available means to break down large HQ footprints into smaller, increasingly modular and hence, more

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<sup>1</sup> Note that the author was the commanding officer of this HQ and the Signal Squadron supporting it, from 2013-2015. This picture was taken during the exercise by 430 Tac Hel Sqn on request of the author.

mobile components. Meanwhile, the Directorate of Land Command and Information (DLCI) and the Directorate of Land Requirements (DLR) have been working to develop solutions to increase the overall resilience of tactical headquarters in the medium term.

5. DLCI/DLR Initiatives. While in mid-2014 the command support community was talking almost exclusively about increasing HQ mobility,<sup>2</sup> DLCI and DLR have since taken a more holistic approach, recognizing that mobility is but one potential solution to the real issue, which is HQ *resilience* in the face of the enemy, as depicting in figure 2.<sup>3</sup> They are currently investigating various solutions to address the most pressing elements of resilience, such as wireless connectivity to decrease set-up and tear-down time (agility), diversification of communications bearers, and a more modular architecture.



<sup>2</sup> LCol Fred Whichelo, Army Capability Development Board (ACDB), *HQ Mobility – Situation And Proposed Way Forward*, 15 Apr 14.

<sup>3</sup> 3000-1 (DLCI – DLR) *Mobile Headquarters Resilience – Concept of Operations*, Aug 15. The document describes a solid list of potential solutions to each sub-category of resilience, (more than listed in this paper) and if pursued successfully, it will likely solve many of the concerns of *current* commanders. But what of the commanders of 2030?

Figure 2 – Conceptual Breakdown of Sub-Categories of Resilience.

Source: 3000-1 (DLCI – DLR) *Mobile Headquarters Resilience – Concept of Operations*, Aug 15

6. While these initiatives are encouraging, they still do not deliver ‘assured resilience’ for tactical headquarters. An enemy with advanced Electronic Warfare (EW), and Electro-Optic and Infrared (EO/IR) detection capabilities will eventually find our HQ nodes. Even if HQs limit electromagnetic radiation and heat signatures to the absolute minimum, antenna parks will eventually be detected by EW. It would then be relatively easy to use advanced EO/IR capabilities to find the associated HQ, and then launch precision-guided long-range munitions against it. Further, Main HQs, still envisaged as static under these initiatives, will remain highly vulnerable to attack. A new approach is required, and the LCSS Mod project, delivery timeframe 2025-2030, offers the opportunity to completely rethink how the CA exercises tactical C2, to maximize its resilience against modern and emerging threats. ADHQs have the potential to achieve extreme levels of security, agility, redundancy and protection, while rendering HQs virtually unidentifiable<sup>4</sup> on a battlefield, thus dramatically increasing HQ resilience.

## DISCUSSION

7. This section will introduce the concept of the ADHQ,<sup>5</sup> and will suggest that culture and technology will soon converge, creating a paradigm shift within the delivery timeframe of the LCSS Mod project, which will make the co-location of HQ staff largely irrelevant for the commanders of tomorrow, and bring about a new way of exercising C2 in the field force.

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<sup>4</sup> As opposed to undetectable. The enemy will still be able to detect the vehicles or infrastructure used by the HQ, but will not be able to attribute the site to a HQ node.

<sup>5</sup> A more technically accurate name would be “Cloud HQs” but, being sensitive to the importance of branding, the author has picked a more accessible name for this paper’s Gen X audience who would not want to report to a ‘Cloud HQ’! That said, the negative connotation of the word ‘cloud’ is changing: While the baby-boomer and Gen X folks instinctively think ‘up in the clouds,’ ‘shoveling clouds’ or generally being distracted, disconnected, unpractical or irrelevant, Gen Y people love the cloud, seeing it not only as an enabler for increased productivity and networking, but also a *resilience* strategy for their valuable data.

ADHQs are headquarters characterized by *extreme modularity*, enabled by technology: the entire HQ can either be co-located or completely dispersed across the battlefield, without compromising its ability to work as a cohesive whole. To understand this, we need to look at history, society, and technological trends.

8. History has taught us that nothing influences military thought more so than the cultural shifts in the societies from which military forces are drawn: Out of the Scientific Revolution arose the idea of training and employing military forces rigidly like the efficient new machines of the day – a doctrine employed by Frederick the Great.<sup>6</sup> The French Enlightenment resulted in the notion of subordinate empowerment – because French soldiers “were too volatile...to be subjected to the iron discipline of the Prussians... [their] enthusiasm, initiative, aggressiveness, and quarrelsome nature allowed for freer and more flexible doctrines”<sup>7</sup> – a tactic used by Napoleon to great effect. Out of the Industrial Revolution came Carl van Clausewitz with a larger view of politics, strategy and warfare, where everything became viewed as interconnected and victory would be celebrated by the party who can break his enemy’s will by effectively targeting his centre of gravity. As for the Information Age, it has (thus far) brought John Boyd’s famous OODA loop, Net-Centric Warfare, and Network Enabled Operations, strategies based on achieving decision-making superiority over the enemy by leveraging an information advantage.<sup>8</sup>

9. The information age is far from over and is constantly changing how we think, live and work. Generation Y, also known as the ‘Millennials’ – those born after 1980 – grew up in this age and have a completely different outlook towards the place of technology in their lives.

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<sup>6</sup> Antoine Bousquet, *The Scientific Way for Warfare* (New York: Columbia University Press, 2009): 37-62.

<sup>7</sup> Azar Gat, *A History of Military Thought – From the Enlightenment to the Cold War* (Oxford: Oxford University Press, 2001): 40.

<sup>8</sup> This paragraph is essentially a 182-word synopsis of the JCSP War and Society course (DS543), taken by the author. Specific references available upon request.

Where Generation X (those born 1965-1980) see technology as a set of new tools, or something “you can hold in your hand,”<sup>9</sup> Millennials see it as ubiquitous and intangible – they have never lived without it. Because they are so comfortable with technology, they question the idea of the 9-5 workplace, as ‘online’ is a *place* for them.<sup>10</sup> Why would they go through the trouble of commuting to work, if they can perform their duties just as well from home or from a coffee shop, and use technology instead of colocation to collaborate with their peers, who are equally comfortable with this? This way of thinking has already spawned new workplace paradigms, such as distributed workforces and the Results-Only Work Environment (ROWE) companies:

- a. Distributed Workforces. “Today’s emerging technologies gives startups the opportunity to recruit the best and brightest talent no matter where they’re located,”<sup>11</sup> describes a recent Forbes article explaining this paradigm. A distributed workforce is a one that, as the name implies, has no regular place of work. Employees work from anywhere in the world towards a common business goal, and bridge collaboration challenges using technology. This trend is growing fast: According to the executive director of the Future of Work Institute, Dr James P. Ware, “there are two things we know without question about the future of work, it will require significantly more collaboration, and it *will be dramatically more distributed* [emphasis added].”<sup>12</sup>

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<sup>9</sup> West Midland Family Centre, *Generational Differences Chart*, <http://www.wmfc.org/uploads/GenerationalDifferencesChart.pdf>. retrieved 7 Feb 2016.

<sup>10</sup> April Joyner, “Why Flexible Workplaces Are Good For Business,” *INC.*, [www.inc.com/april-joyner/why-flexible-work-environments-are-good-for-business.html](http://www.inc.com/april-joyner/why-flexible-work-environments-are-good-for-business.html), retrieved 7 Feb 2016.

<sup>11</sup> Tolga Tanriseven, “Seven Considerations for A Successful, Distributed Workforce,” *Forbes*, 12 Sep 2014. <http://www.forbes.com/sites/theyec/2014/09/12/seven-considerations-for-a-successful-distributed-workforce/#6a8e9f89663812> retrieved 7 Feb 2016.

<sup>12</sup> James P. Ware, “The Future of Business Collaboration,” *The Future of Work* (2011), [http://thefutureofwork.net/assets/FOW\\_FutureofBusinessCollaboration.pdf](http://thefutureofwork.net/assets/FOW_FutureofBusinessCollaboration.pdf), retrieved 7 Feb 2016.



- b. ROWE Companies. Similar to distributed workforces is the advent of ROWE companies, who basically espouse the notion that employees can work “whenever they want, wherever they want, as long as the work gets done.”<sup>13</sup> These companies attempt to effectively engage and manage millennials by adopting entirely new work philosophies, moving from ‘time at the office’ as the primary currency to impress management, to ‘results-only.’<sup>14</sup> This gives employees freedom over their time and mobility, while being held increasingly accountable for results. Should this seemingly growing trend continue, this will have a significant effect on society as a whole.<sup>15</sup>

10. Characterizing the Challenge. Sceptics of the ability of technology to bridge distance often take the position that “nothing replaces face-to-face communications.”<sup>16</sup> Psychologists Gary and Judith Olson of the University of Michigan have investigated the various components of achieving what they call “common ground” – a term closely related to the doctrinal concept of

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<sup>13</sup> Huffington Post Article, “Is ROWE The Future of Work? Or An Unworkable Fantasy?” *Huffington Post*, [http://www.huffingtonpost.com/2013/04/15/rowe-future-work\\_n\\_3084426.html](http://www.huffingtonpost.com/2013/04/15/rowe-future-work_n_3084426.html), retrieved 7 Feb 2016.

<sup>14</sup> Go ROWE Website [consulting firm for ROWE companies] <http://gorowe.com/pages/about-rowe.html>, retrieved 7 Feb 2016.

<sup>15</sup> The most mediatized setback is Best Buy’s recent reversal of their ROWE managerial practice, which has been the subject of much debate, whether or not this was a good decision for Best Buy, which is well outside the scope of this paper. The important point here is that the corporate world is increasingly trending towards dispersion, bridged by technology, and this societal phenomenon will not only affect how military leaders of tomorrow think, but the kinds of technologies that are developed due to the increased market for remote collaboration tools.

<sup>16</sup> A recent example in the CA context, is when the author, then CO 5 CMBG HQ & Sig Sqn arranged for the purchasing and implementation of a Video-Teleconferencing (VTC) capability, connecting the Brigade (Bde) Main and Forward (Fwd) HQs to the manoeuvre Unit HQs, during to Ex MAPLE RESOLVE 2015 (MR 15). The bde commander was open to try this, and during MR 15, received several information and decision briefs while at the Fwd HQ, from his Plans staff, left at the static Main HQ location. He also received back-briefs from unit commanders over VTC, thus lowering the risk of displacement in a non-linear/ non-contiguous battlefield. While this was only a trial, it showed that common intent could be preserved without colocation. It is interesting to note that before trialing this strategy, Comd 2 CMBG had advised Comd 5 CMBG not to proceed with splitting his HQ, using the arguments that “you can’t replace face-to-face communications.” Both Bde commanders were likely correct, within the context of their own bdes. 5 CMBG is widely known to have a bit of ‘tech culture’ or willingness to trial and exploit new technologies. The 5 CMBG culture was ripe for this trial, whereas it may not have been in 2 CMBG. The key point here is that culture matters in determining the acceptance of technology.

common intent – through the use of technology as seen at figure 3.<sup>17</sup> “Copresence” is the missing link that is still not achievable at a distance with today’s technology, and is defined as “access to the same artifacts to support the conversation, allowing deictic reference and shared context.”<sup>18</sup> Yet, just as video conferencing added the concept of visibility, Augmented and Virtual Reality (AR/VR) are about to bridge this final ‘copresence’ gap. This has the potential to dramatically fuel the distributed workforce and ROWE movements in society, spark further development of these technologies, and ultimately, combine with Gen Y culture to bring about the possibility of ADHQs.

Medium	Copresence	Visibility	Audibility	Cotemporality	Simultaneity	Sequentiality	Reviewability	Revisability
Face to face	•	•	•	•	•	•		
Telephone			•	•	•	•		
Video conference		•	•	•	•	•		
Two-way chat				•	•	•	•	•
Answering machine			•				•	
E-mail							•	•
Letter							•	•

Figure 3 – Characteristics that contribute to achieving common ground that are inherent in various communications media.

Source: Gary Olson and Judith Olson, “Distance Matters” (Note 12)

11. Developments in AR/VR. The October 2015 cover of *Vanity Fair* featured a picture of Mark Zuckerberg, founder of Facebook, along with this statement: “He changed the world once. He says he’ll do it again with Oculus Rift.”<sup>19</sup> They were referring to Facebook’s recent

<sup>17</sup> Gary Olson and Judith Olson, “Distance Matters,” *Human-Computer Interaction* (2000, vol 15): 139-178.

<sup>18</sup> *Ibid.*

<sup>19</sup> *Vanity Fair*, October 2015 Cover.

acquisition, for an impressive two billion dollars, of a startup company called Oculus VR, whose headsets can “make you feel like you’re actually present in another place with other people,”<sup>20</sup> according to Mr Zuckerberg. Many other companies are following suit developing similar headsets, such as the HTC Vive, the Sony PlayStation VR, and Samsung Gear VR. These devices are way too cumbersome for military use, but as these will be the very first consumer-level VR systems, they should be compared, relatively, to the first consumer cellular phones – not today’s mature smartphone technology. Microsoft is developing an AR device called Hololens, specifically geared for the workplace.<sup>21</sup> Liam Callahan, director and analyst for market research company, NDP Group, was recently quoted in Fortune Magazine stating: “We’ve been promised VR culturally, whether it’s the holodeck in Star Trek or the Danger Room in X-Men, for a long time. And the fact is: We’re on the doorstep of it.”<sup>22</sup>

12. Internet of Things (IoT). The IoT is another area of impressive development and promises to network and enable the exchange of data between everyday tools, machines, utilities, devices, and basically any ‘thing’ that could contribute to, or benefit from, data sharing. It promises to change everyday lives by delivering everything including refrigerators that can order groceries, home thermostats that know where owners are (in and outside the home) and adjust the temperature accordingly, and smart cities that can tell a passenger’s autonomous car where the closest vacant parking spot is. But it is what is “under the hood” that is most interesting: Common protocols. These common protocols form a universal language between all ‘things’ and will enable further integration of military sensors, decision support tools, and weapon systems.

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<sup>20</sup> Mark Zuckerberg, *Facebook post*, 25 March 2014, <https://www.facebook.com/zuck/posts/10101319050523971>, retrieved 8 Feb 2016.

<sup>21</sup> Microsoft Website, <https://www.microsoft.com/microsoft-hololens/en-us>, retrieved 7 Feb 2015.

<sup>22</sup> Chris Morris, “Is 2016 The Year of Virtual Reality?” *Fortune* (4 Dec 2015), [www.fortune.com/2015/12/04/2016-the-year-of-virtual-reality/](http://www.fortune.com/2015/12/04/2016-the-year-of-virtual-reality/), retrieved 8 Feb 2016.

Currently, information from battlefield sensors are digitally fed up to servers located at Bde HQ and these servers must be queried by a connected user to access the information. This may work for deliberate planning, but not for the front line warfighter. According to DLR, it would more beneficial to enable sensors to exchange information between each other and with strike assets, for example, “to enable rapid cross-cueing and strike of fleeting targets.”<sup>23</sup> These technologies will place a lesser burden on formation level HQs, which currently have to act as a large information processing and disseminating facility, and facilitate a new era of mission command, where front line commanders down to the section and platoon level will be able to leverage the information directly from higher sensors.

13. Virtual Work Environments. Another trend that is gaining momentum and will undoubtedly be further fueled by the popularization of consumer AR/VR devices and the IoT, is virtual workspaces. Companies have already written software to power rudimentary online collaborative environments. Should this trend continue, and be applied to the military environment, several step of the Operational Planning Process (OPP) could occur within a virtual workspace. With the addition of 3D maps and terrain, real-time, and context-sensitive common operational picture driven by the IoT, the virtual environment could dramatically increase battlefield visualization. A Plans cell could be physically separated, yet white-boarding courses of action (COA) in a virtual environment. Intelligence staff, also dispersed, can join them for the COA wargame, and the commander and key ops staff members can join in for the Plan wargame. The commander can then give his orders to his unit commander within this environment, and receive back-briefs once unit plans are complete. Finally, should time permit, a final Rehearsal of Concept (ROC) drill could take place before H-Hour, without the requirement for subordinate

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<sup>23</sup> Informal Email exchange between DLR and author, 21 Jan 2016.

commanders to relocate to the Bde HQ, which currently puts formation-level C2 at risk, as depicted in figure 4.



Figure 4: 5 CMBG HQ ROC Drill during NATO Exercise TRIDENT JUNCTURE with detailed map model. These ROC drills are a significant point of vulnerability in the battle, as subordinate commanders are usually present to brief their part of the overall bde plan. Should the enemy target the HQ at this very moment, the entire brigade C2 would fall apart and bde warfighting would be reduced to individual company level efforts for some time.



Figure 5: Current commercially available virtual online collaboration workspace

Source: [www.3dicc.com](http://www.3dicc.com)

14. Commander's Location. Doctrine states that commanders should choose their location on the battlefield by considering “access to information on which to make timely decisions, including the ability to judge the condition and morale of his own forces, communications to points of command, planning and decision-making capability, and security, including physical protection.”<sup>24</sup> ADHQ will have significant impacts on how commanders think about their location on the battlefield. It will likely result in a strange dichotomy: On one hand the commander will be less tied down to a specific location and so will be able to move anywhere he wishes to influence the battle, security permitting. On the other, his place of choosing will be less significant as a factor. It will nonetheless remain important for the commander to be seen as sharing the risks of his subordinates in order to maximize trust and influence.<sup>25</sup>

15. Tomorrow's Commanders. Assuming LCSS Mod delivers at the late stage of the current timeline (2030 for example), the bde commanders receiving the tools delivered by the project are going to be millennials (born in vicinity of 1980). If Mark Zuckerberg has his way, they will have been using AR and VR to connect with people, buy cars, build homes, and take online courses, well before taking command. Some of their staff will have received their first VR headset as a Christmas gift, possibly when they still believed in Santa Claus. While the views expressed in this paper may sound extreme to the generation making decisions on projects like LCSS Mod, it is worth considering the possibility that millennials commanders *may* wonder

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<sup>24</sup> Department of National Defence, B-GL-300-003/FP-001, *Command in Land Operations* (Ottawa: DND Canada, 2007), 3-8.

<sup>25</sup> This is an area that deserves to be investigated further, and will be in the author's Directed Research Paper (DRP).

what went wrong, should these views not come to fruition by the time they take command of brigades.

## **CONCLUSION**

16. This service paper has argued that emerging societal changes, brought about by the ongoing evolution of the information age, will have a significant impact on how tomorrow's commanders envisage C2. Virtual and augmented reality technologies will have likely matured enough by 2030 for teams to work collaboratively, irrespective of the location of individual team members. This will allow headquarters the flexibility to either adopt a single large footprint (for example, for peace support operations), or be massively dispersed across the battlefield, virtually unidentifiable from other friendly elements. This will enable a new form of OPP to emerge, something beyond the scope of this paper, but that deserves further investigation.<sup>26</sup> Commanders on the other hand will no longer be tied to their large HQs, and will possess unprecedented levels of battlefield visualization capabilities.

## **RECOMMENDATION**

17. It is recommended for the S&T community and the Canadian Forces Warfare Centre to actively research ongoing societal trends in distributed and ROWE workforce management, developments on the IoT, and civilian and military AR and VR collaborative applications, in order to inform the LCSS Mod Project. Should these technologies not show enough promise by the 2022 timeframe, a decision point is recommended for the project, as to whether or not it should wait to achieve a generational bound in C2 ability and resilience, or accept an incremental improvement to the existing C2 paradigm.

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<sup>26</sup> This will also be an area of further investigation in the author's DRP.

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