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Historical Defence Capability Analysis

Applying the Defence Lines of Development Retrospectively

Richard Fisher

The Defence Lines of Development (DLOD) used by the Ministry of Defence encompass all elements of military capability. Historical study of military capabilities does not use a similar or equivalent model. Richard Fisher describes how the current DLOD model can be used to analyse historical capabilities. He provides an objective approach to any comparison by capturing the training, equipment, personnel, information, doctrine and concepts, organisation, infrastructure and logistics requirements of machine gunnery in the British Army from the First World War to the 1960s, as a case study to demonstrate the method.

Defence organisations use comparative historical analysis (CHA) extensively for learning and education. The most obvious is through the battlefield studies, described as a key mechanism for learning about a particular conflict through the prism of a specific location: the strategic, operational and tactical levels, and their limitations.[1] This allows for an element of macro-level CHA and is expanded on by incorporating 'tactical exercises without troops' using before-and-after comparisons of decision-making and actions for known events. Studies compare what happened and the processes and challenges that enabled it to happen: potential actions taken in the present against the actual decisions of the past.[2] When considering 'why study military history?' there is the problem of proving causal links, putting the general study of military history at odds with the intent of CHA; however, that should not deter the question from being asked but ensure that the answers are presented in context.[3]

This article cannot compare and contrast methods of CHA, but provides a potential model for those understanding current defence approaches and demonstrates the practicality of using a contemporary model for historical comparison. CHA is described as being focused on macro-level studies;[4] however, there may be a role for micro-focused studies of individuals and small groups. There are three distinct features of CHA: first, the use of it to explain causal factors in major outcomes; second, for describing historical sequences and development over time; and third, for 'systematic and contextualised comparison of similar and contrasting cases'.[5] The second feature is most akin to this research and uses the UK Ministry of

1. R G Haycock, 'I. The Relevance and Role of the Battlefield Tour and the Staff Ride for Armed Forces in the 21st Century Introduction', *Defence Studies* (Vol. 5, No. 1, 2005), pp. 5–14.
2. Michael Bechthold, 'III. "One of the Greatest Moments in My Life": Lessons Learned on the Canadian Battle of Normandy Foundation Battlefield Tours', *Defence Studies* (Vol. 5, No. 1, 2005), pp. 27–36.
3. Peter W Gray, 'XII. Why Study Military History?', *Defence Studies* (Vol. 5, No. 1, 2005), pp. 151–64.
4. James Mahoney and Dietrich Rueschemeyer, 'Comparative Historical Analysis: Achievements and Agendas', *Comparative Historical Analysis in the Social Sciences* (Cambridge: Cambridge, University Press, 2003), p. 5.
5. Frank Ohemeng, 'Comparative Historical Analysis: A Methodological Perspective', in Ali Farazmand (ed.), *Global Encyclopedia of Public Administration, Public Policy, and Governance* (SpringerLink, 2020).

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Soldiers testing a Vickers Machine Gun, September 1916. *Courtesy of Universal Images Group North America LLC / Alamy Stock Photo*

Defence's (MOD) capability management model. In doing so, it should be familiar to those in defence organisations.

Capability Management in Defence

Capability is the ability to carry out a task: 'military capability is not simply a piece of equipment such as a tank. Rather, it is a tank with a trained crew that: can communicate with others on the battlefield; can meet identified threats; and can be properly maintained and repaired during its lifetime'.[6] The MOD uses eight Defence Lines of Development (DLODs) to define capability: training; equipment; personnel; information; concepts and doctrine; organisation; infrastructure; and logistics (collectively called TEPIDOIL). The ninth 'silent' DLOD is interoperability capturing the relationships between DLODs.[7]

With minor exceptions,[8] DLODs are not defined in detail and this research uses the broad descriptors as a model for CHA.[9]

Research

DLOD analysis can be used to describe a particular capability in the whole, rather than one focused element. Machine gunnery developed during the First World War and became an arm of service as the Machine Gun Corps (MGC). Despite its disbandment in 1922,[10] the capability remained, but changed considerably over the following decades. This research describes the progression and changes of each DLOD from 1914 through to

6. National Audit Office, *Defence Capabilities – Delivering What Was Promised* (London: National Audit Office, 2020), p. 1.
7. Richard Fisher, 'Capability Management and the Defence Lines of Development', Overt Defense, 2020, <https://www.overtdefense.com/2020/06/12/capability-management-and-the-defence-lines-of-development/>, accessed 20 February 2023.
8. Ministry Of Defence, *JSP 912 Human Factors Integration for Defence Systems. Part 2: Guidance [Version 2.0]* (London: Ministry of Defence, 2021), p. 6.
9. Ministry Of Defence, 'Defence Lines of Development', Knowledge in Defence, 2020.
10. For which 2022 represents the centenary and machine gunnery is therefore an apt case study to use.

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the 1960s, when it stabilised with the introduction of the General Purpose Machine Gun (GPMG).[11] Previous studies of this subject are extensively equipment focused and often for popular rather than academic purposes; however, a study of the logistics requirements have demonstrated the strong relationship with organisation[12] and the doctrine and tactics employed.[13]

It is outside the scope of this article to establish all the links and lessons that could be explored using DLOD analysis, yet the following summaries demonstrate the value of this approach in explaining historical capability.

Training

Machine gunnery was a supplementary skill that equipped soldiers to be part of a specialist unit or sub-unit. They received preliminary training as an infantry or cavalry soldier before specialising. At the outbreak of the First World War, this was taught within the unit.[14] It included the mechanical knowledge required to service the gun and the tactical employment. As the First World War developed, Machine Gun (MG) Schools and MG Training Centres were established for mass MG training for both existing soldiers and new recruits. This included individual and collective training up to MG company level. Each branch of the Machine Gun Company (MGC) had a separate training centre, and schools were located in England and abroad that would swiftly learn from the lessons of the fronts and incorporate into their schemes and subsequent doctrine. Once the Schools and Training Centres were established, MG training received its own programmes, schedules and content separate to musketry training.

The end of the First World War saw the training centres close but the MG School remained a separate entity, at Netheravon, as a designated Small Arms School. During the Second World War, MG Training Centres were re-established for specialist training of large numbers of machine gunners.[15] After the Second World War, training again returned to the units overseen by the successors to the MG School.[16]

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Equipment

During the period of study, the medium MG, despite it not being called that until 1938,[17] was the Vickers MG. There were light machine guns (LMGs) – the Lewis and the Bren – used within the infantry companies; however, these are arguably part of the wider infantry combat capability. The land service Vickers MG did not change from the Mark I introduced in 1912 until obsolete in 1968.[18] There were manufacturing improvements and simplifications, but these were interchangeable and compatible across any Mark I gun.[19] It was a water-cooled, belt-fed MG mounted on a tripod. This suited accurate, long-distance sustained fire and provided the basics for machine-gunnery capability. It was mobile and could be moved in separate loads of approximately 50 lb (23 kg).[20]

Despite this relative consistency, the Vickers MG's accessories and ancillaries did change significantly, enabling and enhancing its capability. In the late 1930s, the dial sight and Mark VIIIz ammunition increased the effective range from 2,700 yards to

11. Richard Fisher, 'The Logistics of Machine Gunnery: Examining the Support Requirements for a Small Element of the Overall Battle', in *Preparing for Battle* (Leeds: University of Leeds, 2019), proceedings of Preparing for Battle, University of Leeds, Leeds, UK, 2019.
12. *Ibid*.
13. Richard Fisher and Richard Willis, 'One Million Rounds Fired in 12 Hours? An Analysis of the Account of Six Guns of the 100th Brigade Machine Gun Company at High Wood in August 1916', *First World War Studies* (Vol. 9, No. 3, 2018), pp. 313–27.
14. War Office, *Musketry Regulations, Part I* (London: His Majesty's Stationery Office, 1909).
15. S R Barney and E J Frary, *An Informal Record of 26 Machine Gun Training Centre* (Chester: W H Evans, Sons & Co Ltd, 1946).
16. Richard Fisher, *The History of the Small Arms School Corps 1853-2017* (Solihull: Helion & Company, 2019).
17. Richard Fisher, 'What Weighs a Lot but Isn't Heavy?', The Vickers Machine Gun, 2 February 2018, <https://vickersmg.blog/2018/02/02/what-weighs-a-lot-but-isnt-heavy/>, accessed 23 Feburary 2023.
18. Dolf L Goldsmith et al., *Pride of the Emma Gees: The Vickers Machine Gun* (Henderson: Chipotle Publishing, 2021).
19. Alternative Marks were introduced but these were for air or armoured fighting vehicle use.
20. War Office, *Handbook for the .303-in. Vickers Machine Gun. Mounted on Tripod Mounting, Mark IV* (London: His Majesty's Stationery Office, 1918).

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4,500 yards for indirect fire.[21] It was not intended for use in other infantry weapons.

Personnel

Machine gunners were described prior to the First World War as needing 'good physique, calm temperament, fair education, and mechanical aptitude' and that 'young soldiers of about one year's service are the most suitable'.[22] MGC training lectures identify machine gunners as specialists because the infantry depend upon them, and the artillery, for success and safety. The machine gunner was selected based on 'intelligence or common-sense, education, physique, mechanical i.e. logical mind'.[23] By 1945 they 'must be tough and agile [...] some manual dexterity is necessary to use the dial sights. Map reading is essential'.[24]

The nickname of the MGC became 'the Suicide Club',[25] implying high casualty rates. Casualty rates have not been evaluated in depth; however, it appears that machine gunners of the Second World War were not exposed to the same level of danger as those previously. Minimal casualties in MG Battalions resulted in many mobilised reserves from 1939 surviving and ending the war with a higher average age, experience and potential morale than their equivalents in the infantry battalions of the same division.[26]

Information

Information for machine gunners is initially provided through training, becoming inherent knowledge of the equipment and doctrine with which to employ it. Once that is established, updates through revisions to the training and doctrine are continuous.

During use, different information is needed and analysed. Proactive information is used to employ the equipment: fire control orders; target indications; corrections; and general field orders for movement and deployment. Reactive status and records are needed to understand how the equipment was used and maintained, with the number of rounds fired eventually recorded per gun, rather than relying on visual inspection.[27]

Within the MG unit, most orders would be verbal unless pre-planned. Direct fire targets (visible from the gun position) were indicated using verbal fire control orders. Indirect fire targets (those not visible through obscurity at night, by fog or smoke, or due to the lay of the ground) may be indicated verbally from sub-unit commander to the MGs, but detailed fire plans were written down as part of a fire control plan.[28] Fire corrections, or simple fire control orders, could be signalled using semaphore (part of machine gunner training until the Second World War).[29] Wireless communications were not available in the early years of MGs and did not exist below the platoon commander until after the Second World War, when a simple radio was carried by the section commander. Communication from the section commander to the gun position was by wired field telephone.[30]

Indirect fire required specialist information. Range tables were available to MG officers and supplemented by daily meteorological information as for artillery. This information had to be updated when equipment changes happened (such as Mark VIIIz ammunition).[31] As not all units received the

21. War Office, *Machine Gun Handbook (Technical), Volume I, Pamphlet No. 1 – Vickers .303-in. and .5-in. Machine Guns and Appurtenances* (London: His Majesty's Stationery Office, 1940).
22. J Bostock, *The Machine Gunner's Handbook*, 2nd edition (London: W H Smith & Son, 1913), pp. 87–88.
23. Grantham Machine Gun Training Centre, 'No. 1 Lecture: Training of Machine Gunners', 30 May 2016.
24. War Office, 'Job Analysis (Field): The Infantry', London, 1945, p. 60.
25. Graham Sacker, *The Suicide Club*, 3rd edition (Cheltenham: Promenade Publications, 2001). See also C E Crutchley (ed.), *Machine Gunner 1914-1918* (London: Purnell Book Services, Limited, 1973), p. 13.
26. Richard Fisher, *The Vickers Machine Gunner in North-West Europe 1944-45*, Emma Gees Study Series (Swindon: Vickers MG Collection & Research Association, awaiting publication).
27. War Office, *Infantry Training, Volume II, Infantry Heavy Weapons, Pamphlet No. 24 - The Medium Machine Gun, Part I - Mechanical Subjects* (London: His Majesty's Stationery Office, 1951), pp. 34–36.
28. War Office, *Small Arms Training, Volume I, Pamphlet No. 7, .303-Inch Machine Gun, Part III - Fire Control* (London: His Majesty's Stationery Office, 1939), pp. 82–86.
29. War Office, *Small Arms Training, Volume I, Pamphlet No. 7, .303-Inch Machine Gun, Part II - Training* (London: His Majesty's Stationery Office, 1944), pp. 25–27.
30. War Office, *Infantry Training, Volume II, Infantry Heavy Weapons, Pamphlet No. 24 - The Medium Machine Gun, Part II - Drills and Training* (London: His Majesty's Stationery Office, 1951), pp. 82–84.
31. The General Staff, *Machine Gun Range Table. For Mark VII Ammunition*, 1916; War Office, *Range Table of the .303-Inch Vickers Machine Gun* (London: His Majesty's Stationery Office, 1923; 1926; 1931; 1937; 1939; 1960).

latest equipment, they had to be provided with the older information.[32]

Concepts and Doctrine

Machine gunnery doctrine development was extensive over the period studied. Prior to the First World War, MGs were described as possessing 'the power of delivering a volume of concentrated rifle fire which can be rapidly directed against any desired object ... at effective infantry ranges'.[33] It was considered 'equal in volume to that of about 30 men firing rapidly' with a much smaller frontage.[34] However, it was not considered a weapon appropriate for sustained fire because of the rapid expenditure of ammunition.[35] MG roles varied with the wider doctrine of the period: direct attacks; defence; outposts; and fortress warfare.[36] They were very much considered 'weapons of opportunity'.[37]

By 1916 the MG was still considered a weapon of opportunity, but the introduction of the Lewis automatic rifle (later named an LMG) in infantry battalions saw them take on some of the role that was previously part of the MG section's duties.[38] MGs were still to move forward in the attack and the hoped-for open fighting. They had greater firepower than rifles and Lewis guns could provide, and held positions until reinforcements arrived.[39] Searching fire in the enemy's rear areas was part of the attack, to disrupt reinforcements. MGs were not suitable for holding ground in isolation and they had to be kept back from the front lines to ensure they were not lost in the first phases of any attack. Integration of MGs with artillery was also developed.[40] Preparations for indirect fire with aiming marks and calculations were prepared during daylight to overcome poor visibility caused by gas and smoke shells.[41]

MGs became a key part of the static trench defence system, this being their priority over indirect fire tasks.[42] Reserve guns were used for indirect fire and barrages had become part of the expected use of the MG, for attacks and defence. The concerns over ammunition restrictions were lifted and it was often 'necessary to spray a target considerably in order to make sure of hitting it'.[43]

By 1918 'the distinguishing feature of modern Machine Gunnery is its offensive power. The offensive intention has always been present, but lack of training and technical equipment hindered its realization ... Modern Machine Gunnery has reversed this passive tendency'.[44] Indirect fire was considered effective at 2,500 to 3,000 yards, much beyond the 1914 doctrine.[45]

Inter-war doctrine saw MGs kept in reserve to make more infantry available for the attack, with the concept of Forward and Rear (now called Supporting) guns continuing, as well as 'brigading' MGs together from different units.[46] MGs working with anti-tank weapons enhanced the defence

32. Australian Military Forces, *Range Table for .303-Inch Vickers Machine Gun (Using Mk VII Ammunition)* (Melbourne: Victoria Railway's Printing Works, 1943).
33. War Office, *Field Service Regulations, Part I, Operations (1909, Reprinted with Amendments)* (London: His Majesty's Stationery Office, 1914), p. 20.
34. War Office, *Infantry Training* (London: His Majesty's Stationery Office, 1914), p. 198.
35. War Office, *Field Service Regulations, Part I, Operations (1909, Reprinted with Amendments)*, p. 20; War Office, *Infantry Training*, p. 201.
36. *Ibid.*, p. 272.
37. War Office, *Infantry Training*, p. 201.
38. The General Staff, *S.S.122. Some Notes on Lewis Guns and Machine Guns* (London: His Majesty's Stationery Office, 1916).
39. The General Staff, *S.S.106. Notes on the Tactical Employment of Machine Guns and Lewis Guns* (London: His Majesty's Stationery Office, 1916), p. 6.
40. *Ibid*., p. 11.
41. *Ibid.*, p. 20.
42. The General Staff, *S.S.106. Notes on the Tactical Employment of Machine Guns and Lewis Guns. Amendments.* (London: His Majesty's Stationery Office, 1917), p. 1.
43. *Ibid.*, p. 2.
44. The General Staff, *S.S.192. The Employment of Machine Guns. Part I - Tactical* (France: Army Printing and Stationery Services, 1918), p. 6.
45. *Ibid.*, pp. 8–9.
46. War Office, *Field Service Regulations, Volume II, Operations* (London: His Majesty's Stationery Office, 1929), p. 111, pp. 119–20.

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greatly:[47] 'as long as machine gunners are still holding out, no position can be regarded as lost'.[48]

As the Second World War approached, mechanisation influenced the doctrine. With MGs, the principal role in the attack was 'to support the advance by covering fire, to protect the flanks and to assist in consolidation',[49] yet they were considered the 'real backbone of the defence' and were to be considered first when designing positions. The maximum effective range was considered to be 2,000 yards;[50] changes in ammunition and sighting then increased the effective range to 4,500 yards. The Vickers was now considered a medium MG (MMG) as opposed to the Bren LMG in service with the infantry battalions. The main role of the MMG was 'to give depth to the defence'.[51] Its role in the attack was still limited due to wheeled transport;[52] later, tracked carriers overcame this.[53] In the withdrawal, MGs were used to 'stiffen the defence of rearguard positions'. The independence of the MG battalion meant that it could be used for specific standalone tasks.[54]

After the Second World War, MMG roles were limited, and they were accompanied by flamethrower carriers. This challenged the doctrine for the platoon as a whole because of the different ranges employed: flamethrowers had an extremely short range whereas MMGs were still accurate over 2,000 yards. It resulted in a dominance of direct fire use, albeit extremely mobile.[55] This remained constant until the re-organisation of the infantry battalion in 1961[56] and the introduction of the GPMG in 1962.[57]

Organisation

Before 1915, MGs were in a section of two guns as part of the infantry battalion or cavalry regiment headquarters; however, this soon increased for infantry to four guns.[58] Brigading guns together for specific tasks, commanded by the Brigade MG Officer, was recognised as a method of temporarily increasing numbers[59] until the MGC's formation in October 1915 when brigade MG companies and squadrons were formally established.[60] Infantry brigade MG companies had 16 guns and cavalry brigade MG squadrons had six. Another MG company was added to an infantry division in 1917 as a reserve. Companies amalgamated into an MG battalion of 64 guns in early 1918.[61] There were also batteries of motor MGs used as reserves and exploitation troops at Corps or Army level.[62]

The MGC's disbandment meant MGs were returned to the infantry battalions and cavalry regiments in 1922.[63] Infantry battalions initially had an MG platoon of eight guns[64] but increased to a company of 16 guns by 1930.[65] This was the highest number of MGs per infantry battalion at any point during the period of study.

Reorganisation and mechanisation in the 1930s saw the removal of the MG squadrons from cavalry

47. *Ibid*., p. 159.
48. *Ibid*., p. 167.
49. War Office, *Field Service Regulations, Volume II, Operations - General* (London: His Majesty's Stationery Office, 1935), p. 126.
50. *Ibid*., p. 191.
51. War Office, *No. 31. Notes on the Organization and Tactical Handling of Medium Machine Guns*, Military Training Pamphlet (London: His Majesty's Stationery Office, 1940), p. 4.
52. *Ibid*., p. 7; War Office, *No 23 Part I. General Principles, Fighting Troops and Their Characteristics*, Military Training Pamphlet (London: His Majesty's Stationery Office, 1942), pp. 16–17.
53. War Office, *Small Arms Training, Volume I, Pamphlet No. 7, .303-Inch Machine Gun, Part II - Training* (1944), pp. 19–24.
54. War Office, *No. 31. Notes on the Organization and Tactical Handling of Medium Machine Guns*, pp. 7–9.
55. War Office, *Volume IV. Tactics. The Infantry Battalion in Battle*, Infantry Training (London: His Majesty's Stationery Office, 1952), pp. 32–35.
56. War Office, *Volume IV. Supplementary Pamphlet for the Tactical Handling of The New Infantry Battalion (Provisional)*, Infantry Training (London: Her Majesty's Stationery Office, 1961).
57. War Office, *Volume I. Infantry Platoon Weapons. Provisional Pamphlet for the General Purpose Machine Gun*, Infantry Training (London: Her Majesty's Stationery Office, 1962).
58. Fisher, 'The Logistics of Machine Gunnery: Examining the Support Requirements for a Small Element of the Overall Battle'.
59. War Office, *Field Service Regulations, Part I, Operations (1909, Reprinted with Amendments)*, p. 20.
60. The National Archives, 'Machine-Gun Corps', *WO 123/57 - Army Orders (War Office)* (1915), para. 413.
61. A F Becke, *Order of Battle of Divisions* (London: His Majesty's Stationery Office, 1934).
62. The General Staff, *S.S.192. The Employment of Machine Guns. Part I - Tactical*, p. 7.
63. The National Archives, *WO 293/13 Army Council Instructions (War Office)*, 1922, para. 353.
64. War Office, *Machine Gun Training* (London: His Majesty's Stationery Office, 1925), pp. 10–11.
65. War Office, *Machine Gun Training, 1925 (Supplement)* (London: His Majesty's Stationery Office, 1930), p. 5.

and the formation of specialist MG battalions in the infantry. Initially, they had four companies of three platoons with four guns each: 48 guns in total.[66] In the Middle East, the MG battalion also equipped with anti-tank guns.[67] Divisional (support) battalions were then introduced – three brigade support groups each fielding MMGs, 4.2-inch mortars and light anti-aircraft weapons[68] – for a short period before the MG battalion of three MMG companies and one heavy mortar company became standard from February 1944.[69] Infantry battalions did not have MMGs unless they were in a specialist role, such as parachute, airlanding, motor or special force battalions.

After 1945, MGs were decentralised and returned to the infantry battalions, where they formed an MG platoon with six guns[70] and remained as such until the end of the period of study when GPMGs were integrated into the rifle companies.[71]

Infrastructure

Each DLOD has infrastructure requirements to support it. Many of those have been described in their separate sections and it would be repetitive to cover them here; those not described elsewhere are for the manufacture and support of the equipment that exists outside the army. These are civilian organisations considered in modern parlance to be part of the 'defence ecosystem'.[72]

The British Army's Vickers MGs were built at two UK factories in Kent: Erith and Crayford.[73] While these facilities built guns and spare parts, accessories and further spares were manufactured around the UK and abroad. The extent of this is not describable in this research; however, for example, the MG tripods between August 1914 and June 1915 were supplied from 12 different factories and belt-filling machines from five. Ammunition belt boxes of the types used between 1915 and 1917 were provided by 12 companies from the West Midlands area where tin plate was produced in large quantities.[74]

The Second World War saw the same expansive list of suppliers. Contract ledgers for the Ministry of Supply identify 908 suppliers with contracts for small arms.[75] While not all supplied components for the Vickers MGs or their accessories, those identified as having done so are extensive.[76]

In peacetime, the amount of equipment manufactured for machine gunnery was limited as the war stocks provided sufficient reserve; however, there were small contract runs.

Ammunition production was an exception to this as the lifespan of small arms ammunition was limited. By 1944, UK .303-inch ammunition production capacity was 208.8 million rounds per month. Of this, 24 million rounds was Mark VIIIz, only used by the Vickers MG, coming from five of the 23 factories used for small arms ammunition production.[77]

Logistics

The basic requirements of machine gunnery were always personnel and equipment. Delivering these to where they were needed was simplified by

66. The National Archives, *WO 24/936. War Establishments (War Office)* (1939), Vol. III/1931/32 E/1 – An Infantry Machine Gun Battalion.
67. The National Archives, *WO 24/943. War Establishments January to June (War Office)* (1942), Vol. VI/579/1 – Machine Gun Battalion, Middle East.
68. The National Archives, *WO 24/947. War Establishments April to June (War Office)* (1943), Vol. II/236/2 – Brigade Support Group.
69. The National Archives, *WO 24/950. War Establishments January to March (War Office)* (1944), Vol. II/240/1 – Machine Gun Battalion.
70. War Office, *Volume II, Infantry Heavy Weapons, Pamphlet No. 24 - The Medium Machine Gun, Part I - Mechanical Subjects*, p. 2.
71. War Office, *Volume IV. Supplementary Pamphlet for the Tactical Handling of The New Infantry Battalion (Provisional).*
72. Richard Fisher, *The UK Defence Ecosystem* (Farnborough: UK Defence Solutions Centre, 2018).
73. Goldsmith et al., *Pride of the Emma Gees: The Vickers Machine Gun*, pp. 58–63. Other countries around the world producing the Vickers under licence included Australia, Japan, Portugal and the US. Vickers Limited (later Vickers-Armstrongs) also sold considerable numbers commercially but that is outside the scope of this research.
74. *Ibid*., pp. 74–77.
75. Ian Skennerton, *British Small Arms of World War 2* (Brisbane: I D Skennerton, 1988).
76. Richard Fisher and Thomas Riley, 'Manufacturers' Markings', The Vickers Machine Gun, 2022, <https://vickersmg.blog/the-guns/markings/manufacturers-markings/>, accessed 24 February 2023.
77. The National Archives, *CAB 102/359. Small Arms Ammunition 1939-45. Miss J M Embery (Cabinet Papers)* (1946), planned capacity of components-filling and loading-in UK in millions per month.

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mechanisation; however, mechanical transport – either trucks or carriers – required more specialist support than the horses and fodder of the limbered wagons.[78] The carriers' mobility largely negated using pack-saddlery as guns could be delivered closer to off-road positions, although pack- saddlery training was still provided in 1944.[79]

As indirect and barrage fire developed, additional sighting and gunlaying equipment was needed. This is demonstrated in the number of commodity lines per MG. Improved designs reduced the multiple pieces of equipment, for example the dial sight replaced the clinometer and bar foresight in the Second World War.[80]

Ammunition supply was the main logistical challenge. Each MG required first-line ammunition with it in the limbered wagon, truck or carrier. This was initially between 2,500 and 3,500 rounds per gun,[81] increasing to 4,750 rounds with the introduction of the Universal Carrier.[82] Mark VIIIz ammunition was in factory-packed liners and reduced the front-line burden for belt-filling; however, it did limit the ability for MMGs to use the Mark VII rifle and LMG ammunition to emergencies only.[83] In the airborne and special force divisions, their MGs used Mark VII ammunition to simplify supply.[84]

Analysis

DLODs in machine gunnery were not developed in isolation and the influences upon one another were vast. The development of the concepts and doctrine for machine gunnery were initially constrained by the training, equipment and logistics that allowed for sustained overhead fire to be effective and worthwhile. The introduction of alternative equipment – the LMG – outside the principal capability affected how the main equipment was used: it was possible for machine gunnery to become a distinct organisation-centric specialism rather than just providing additional weight of automatic firepower to supplement others. It is worth noting that, having completed this temporal narrative, machine gunnery was only truly considered a separate capability when it had the organisation to support it and the separate and specialist training that was provided.

This approach cannot capture the wider political and organisational decision-making that could influence many aspects of a capability; however, it provides a basis on which those influences can be assessed, and the decisions evaluated on a comparable basis against alternatives.

This article clearly demonstrates the interconnectivity of DLODs even in a historical context where their interoperability was not explicitly considered

Discussion

This article clearly demonstrates the interconnectivity of DLODs even in a historical context where their interoperability was not explicitly considered. Each DLOD cannot be read in isolation, and this is evident from the narrative that relies on discussion across the DLODs to understand how the capability is employed.

The value of this approach for historical analysis is two-fold: first, it provides a recognisable model for students of defence methods to analyse historical capabilities; and second, it minimises the risk of overlooking or omitting elements of the whole capability.

Furthermore, by using the model to analyse historical information as a capability, it is possible to gather the data to enable capabilities of different periods or countries to be compared with each other

78. Fisher, 'The Logistics of Machine Gunnery: Examining the Support Requirements for a Small Element of the Overall Battle'.
79. War Office, *Small Arms Training, Volume I, Pamphlet No. 7, .303-Inch Machine Gun, Part II - Training* (1944), pp. 85–97.
80. War Office, *Small Arms Training, Volume I, Pamphlet No. 7, .303-Inch Machine Gun, Part II - Training* (London: His Majesty's Stationery Office, 1941).
81. P H R Jephson (ed.), 'Machine Gun Limber Drill', *Instructional Binder, Instructional Staff* (Grantham: Machine Gun Training Centre, 1917). See also War Office, *Volume I, Pamphlet No. 7, .303-Inch Machine Gun, Part II - Training*, Small Arms Training (London: His Majesty's Stationery Office, 1939), pp. 40–41.
82. War Office, *Small Arms Training, Volume I, Pamphlet No. 7, .303-Inch Machine Gun, Part II - Training* (1944), p. 37.
83. War Office, *Machine Gun Handbook (Technical), Volume I, Pamphlet No. 1 – Vickers .303-in. and .5-in. Machine Guns and Appurtenances*.
84. Richard Fisher, 'An Airlanding Battalion', The Vickers Machine Gun, 2022, <https://vickersmg.blog/in-use/british-service/the-british-army/an-airlanding-battalion-of-1944-45/>, accessed 24 February 2023.

on a like-for-like basis. To extend this study, it would be possible to compare the British MG capability with those of its adversaries or allies to identify any additional lessons.

Specialist capabilities, such as machine gunnery, are at risk when not 'owned' by a particular organisation dedicated to that capability. The doctrine element appears to become subsumed as part of others (in this case, infantry) and could be lost as an identifiable and distinct element; thus, the use of MGs does not feature in the pamphlets of the latter part of the Second World War and is merely hinted at in the infantry sections of those pamphlets, whereas the specific machine gunnery pamphlet[85] had become obsolete by organisation, logistics and equipment developments. ■

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85. War Office, *No. 31. Notes on the Organization and Tactical Handling of Medium Machine Guns*.

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