

Multi–Domain Operations; a Review of Contemporary Concepts and an Analysis of Select Capabilities and Actions of Fighter Command and No. 11 Group during the Battle of Britain

By Wing Commander Jamie Meighan

Biography: Wing Commander Jamie Meighan, is currently on exchange with the USAF as an instructor at the Air Command and Staff College, Maxwell AFB AL, USA. He teaches in the Multi-Domain Operational Strategist program. He has experience across the spectrum of RPA operations, targeting and Intelligence at all levels, as well as multiple deployments, including Bosnia, Iraq, Afghanistan and the Falkland Islands. Meighan holds a BA (hons) in History, MA in Leadership and MSc in Operational Art and Science.

Abstract: The recent reformation of 11 Gp as the RAF Multi–Domain Operations (MDO) Group has refocused efforts to understand, conceptualize and execute the integration of air, space and cyber capabilities. This article explores the path to deliver the renewed vision of 11 Gp, considering current doctrine, future doctrine, and concept development. In parallel, it seeks to understand how adversaries think about MDO. Finally, it applies one of the MDO models being explored by the USAF and applies it to the actions of 11 Gp during the Battle of Britain. There are many contemporary debates with respect to the way ahead for MDO and the future operating landscape, in considering these as well as the legacy of 11 Gp it is hoped that critical analysis and exploration of multiple concepts will assist the RAF in developing a coherent multi–domain operations strategy.

Disclaimer: The views expressed are those of the authors concerned, not necessarily the MOD.

Introduction

On 11 July 2018, the Chief of the Air Staff, Sir Stephen Hillier, announced the re-formation of 11 Gp as the RAF Multi-Domain Operations (MDO) Group responsible for the integration of air, space and cyber domains. The Air Chief Marshal described the original Group as 'an early demonstration of the power of multi-domain capability', capable of 'fusing aircraft, communications and decision makers across domains to deliver effects'.¹ 11 Gp under the umbrella of Fighter Command did play a pivotal role in the defence of London and the South East of England employing a combination of capabilities in order to bring clarity from complexity for decision makers. On 1 November 2018, a ceremony at RAF High Wycombe reformed No. 11 Gp, with Air Marshal Stuart Atha, Deputy Commander Operations commenting, 'We live in dangerous times and are being challenged in the air, space and cyber domains. This multi-domain threat demands a multi-domain response and that is at the heart of the 11 Group mission'.² During the Battle of Britain the actions of Fighter Command and specifically 11 Gp, with the Dowding System within it serve as a powerful reminder of the importance of historical reflection. In this instance, with hindsight the employment of capability and strategy led by Dowding and Park reflect some of the contemporary components of emerging MDO concepts. For we must not forget, 'if there is one attitude more dangerous than to assume that a future war will be just like the last one, it is to imagine that it will be so utterly different that we can afford to ignore all of the lessons of the last'.³

The path to deliver the renewed vision of 11 Gp should stretch further than current doctrine on 'cross-domain synergy' and 'Joint Action', extending into future doctrine, concept development and the enhancement of professional education and training. In addressing these issues, this paper seeks to provide a more thorough understanding of UK higher-level concepts as they relate to current MDO thinking as well as an appreciation of how our adversaries see the future operating landscape. This will likely assist the RAF and the contemporary 11 Gp in their development of current and future MDO doctrine and concepts. Furthermore, a thorough consideration of the UK interpretation of MDO, contrasted with the 6-domain construct taught by the Multi-Domain Operational Strategist (MDOS) Concentration at the USAF Air Command and Staff College (ACSC) will provide a contemporary model for analysis. Significantly, when analysed through the legacy of select Fighter Command and specifically 11 Gp activities, critical assessment and discussion may assist the RAF in developing a coherent multi-domain operations strategy. Finally, assessing and understanding 11 Gp actions, the utilisation of the Electromagnetic Spectrum, manoeuvre in the air domain as well as decision making conditions will provide useful insight. Even more useful when compared to Luftwaffe actions, reactions and decisions. In order to set the context, understanding a common set of definitions and a common lexicon will provide the foundation for more detailed and focused conceptual efforts.

First, in understanding the contemporary environment, the current debate in the US and UK is focused on how a nation's armed force can operate in a complex, contested, chaotic environment against peer adversaries, recognising that actions in one domain can and will

have multiple effects in others. The characterisation of the contemporary problems faced is not radically different from the environment in 1940. Complex contemporary questions range from 'What is a domain?'; 'What is multi-domain?'; 'What are domain dependencies?'; 'Can airmen recognise domain dependencies?'; 'How can vulnerabilities be exploited?'; 'How do forces manoeuvre in an MDO environment?'; 'How do you construct MDO plans and strategies?'; and 'How do you win in an MDO battle?'⁴ While contemporary discussion centres on Command and Control within the MDO environment, the conceptual foundations have yet to fully mature. MDOS teaches the concept of a Continuum of Domains, with a domain defined as 'Critical macro maneuver space whose access or control is vital to the freedom of action and superiority required by the mission'.⁵ This focuses on MDO as the interdependency of the Electromagnetic Spectrum (EMS), space, air, land, maritime and human domains; or 'continuum of integrated and interdependent domains',⁶ as defined by the MDOS Program Director, Dr Jeff Reilly.

This continuum relies upon the notion of 6 domains, with cyber being encompassed into an EMS domain, alongside space, which enables the more traditional domains, with the ultimate goal of impacting the human domain (the 6th domain). Figure 1 refers. This is a concept that has been at times and partially understood and executed periodically throughout history in some form or another and extends beyond the notion of Joint operations and Joint warfare. The case study presented in the later part of this paper; focused on the Battle of Britain, embodies many of the key elements of the continuum of domains. Whilst some of the technologies had not been created in 1940, such as space, historical reflection shows that, maybe unknowingly, Fighter Command approached the Battle as a multi-domain problem.

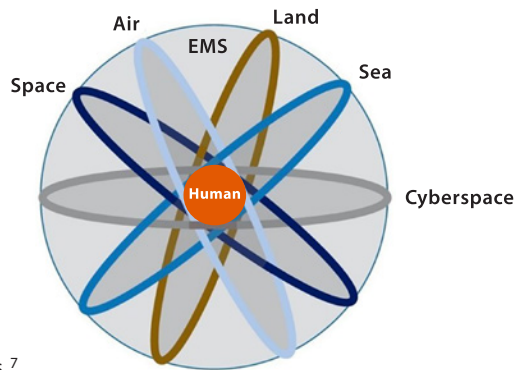


Figure 1: Continuum of Domains.⁷

The concept of a continuum requires critical thinking to deliver effects from, and in, domains, considering and predicting the 1st, 2nd and 3rd order effects of actions and interdependencies, ultimately forcing an adversary to make decisions he would not normally make. Most importantly, it presents opportunities to decision-makers, offering a flexible, adaptive, responsive approach to adversary actions or likely actions that have become more and more unpredictable and non-traditional in scope. Delivering the conceptual art of MDO requires the selection, development and education of specialised personnel capable of

using 'combinations of domains to achieve access, control, or destruction of the adversary's interdependence between domains in order to accomplish operational goals.'⁸

In considering the MDOS approach, before considering the historical perspective, we must first consider current doctrinal definitions. In the US and UK, there are currently no agreed definitions of 'domain' and 'MDO'. The definition of a domain does not appear in US Joint Publications, while Multi-Domain in USAF conceptual language within the Air Force Future Operating Concept does not extend beyond air, space and cyberspace combined with command and control.⁹ The concept of the continuum of domains extends beyond this interpretation. It sees cyberspace as incorporated into the electromagnetic spectrum. US doctrine defines the electromagnetic spectrum as a 'physics-based manoeuvre space essential for control during all military operations.'¹⁰ The EMS is vital to the enablement of space operations (communications links, Positioning Navigation and Timing GPS-guided munitions, intelligence collection, indicators and warnings), which also directly support air, land and maritime operations. Space includes the earth's ionosphere, magnetosphere and, according to US Joint doctrine, 'electromagnetic radiation, charged particles, and electric and magnetic fields are the dominant physical influences.'¹¹ The land, maritime and air domains are relatively self-explanatory as the traditional physical dimensions of military operations, built upon with the traditional air, maritime and land services.

Importantly, specialized expertise about each domain should not be seen as equal ownership and control should not be assumed. This stems from the use of the term domain, which itself has links to the term dominance and in broad terms indicates sovereign ownership.¹² Historically, this has been linked to control of land territory, however control of the air, maritime and more recently space and cyber domains presents unique challenges such as environmental conditions, complexity linked to the idea of ownership and access and variations in the use of physical and virtual effects. If we consider the aims and objectives of the Luftwaffe and the RAF, both sought to achieve localized air superiority, in essence seeking to control the air domain. The RAF however, was dominant in the EMS domain. Finally, in this new MDO thinking, the expansion from 5 domains to 6 is a departure from current US doctrine yet should feel very familiar.

The human domain has featured in warfighting for centuries. US AP 3-0 states, 'Fundamentally, all war is about changing human behavior. It is both a contest of wills and a contest of intellect between two or more sides in a conflict, with each trying to alter the behavior of the other side.'¹³ Yet no clear definition of the human domain exists. The MDOS continuum of domains concept sees all of the 5 other domains directly impacting the human domain, specifically 'leadership, organizations, and populations in the environment, including their decision making, support, perceptions and behavior.'¹⁴ Through the employment of the strategies of 'deter', 'compel' and 'suasion', winning the contest of wills in the human domain is the only true measure of victory, creating multiple dilemmas for the adversary to attempt to cope with in an attempt to push the enemy into paralysis. This contest of wills was prevalent during the Battle

of Britain. Both German and British leadership, as is outlined later, sought to alter behaviors through the employment of capability such as the Dowding system, novel techniques, such as a move from the Big Wing concept and collaborative decision-making and situational awareness seen inside 11 Gp. What then does current UK doctrine offer with regard MDO?

In current UK doctrine, in the absence of the definition of a domain and a clear definition of MDO, it states that the 5 operating domains are air, land, maritime, cyber and space, underpinned by information. Within the information space, activity occurs in the physical, virtual and cognitive domains.¹⁵ A draft NATO definition for a domain is 'Discrete spheres of military activity within which operations are undertaken to achieve objectives in support of the mission.'¹⁶ Current and past UK doctrine uses language such as 'Cross-Domain Operations', 'Integrated Action', 'Full Spectrum Operations' and 'Joint Action'. All have varying definitions, some only applying to a single domain.¹⁷ There are undoubtedly elements of the MDO concept in each of these, but none considers or outlines a clear definition of MDO and its components. It is the recent Joint Concept Note 1/17 that provides the best insight into current and UK thinking on MDO-like concepts.¹⁸ From the outset, the narrative highlights the impetus for novel approaches in order to prepare and respond to adversary threats. The focus is on the interdependencies between domains; 'the future force will increasingly need to integrate information and physical activities across multiple domains' that are equally important.¹⁹ JCN 1/17 provides deeper analysis of each of the domains and within this are some encouraging aspects.

In considering the Cyber domain, JCN 1/17 recognises that Cyber and Electromagnetic activities (CEMA) are interdependent, and adversaries will seek to gain advantage using CEMA in all other domains. It also recognises that the freedom to use parts of cyberspace and the EMS will offer 'significant competitive advantage.'²⁰ This will rely on educated planners and operators capable of integrating CEMA effects and actions, while being able to operate in contested and degraded conditions. In moving towards a clearer UK understanding of MDO, the EMS domain must be at the centre of any future strategy. UK Joint Doctrine Note 1/18²¹ provides further insights into the UK's approach in this domain. The UK CEMA vision provides a positive indication of what will be; 'synchronisation and coordination of cyber and electromagnetic activities, delivering operational advantage'. However, a finalised CEMA policy does not currently exist.²² Any such policy should resist delineating between cyber and EMS, and instead take the opportunity to evolve the concept of a separate cyber domain into an EMS domain in which CEMA happen.

The US has discussed considering EMS to be a domain in its own right. Indeed, the U.S. Navy recently took the unprecedented step of doing just that. In its recognition of EMS, described as 'electronic systems, subsystems, devices, and equipment that depend on the use of spectrum to properly accomplish their function,'²³ it has begun to advance the conversation. There are now senior members of the military and Congress who argue, that, by focusing just on the cyber domain, the US has lost its way in the EMS sphere and must

find a way back. As Congressional Representative Don Bacon, (a member of the House Armed Services Committee) has repeatedly said, 'We need to be clear that electronic warfare, the electromagnetic spectrum, is indeed a physical domain. It is a separate physical domain. It's a scientific fact'²⁴ any future policy should consider the relationship between EMS and Space. As Dr Jeff Reilly points out, the EMS 'empowers space, allowing it to supply key enablers for the domains of air, land and sea, in turn facilitating the ability to influence the human domain.'²⁵

Similarly, in the space domain, the UK's JCN 1/7 and JDP 0-30 both recognise how other domains are dependent on space, making it a critical enabler for the three traditional domains of air, maritime and land. Operating within, from and assuring access are all critical components of the space domain in addition to factoring in system resilience and redundancy. JDP 0-30 characterises a 'day without space' as affecting strategic communications, command and control and ISR.²⁶ While the doctrinal focus on space is encouraging, it fails to present solutions or concepts to meet the challenge of synchronising 'space activity with that conducted in the cyber, maritime, land and cyber domains.'²⁷ It also outlines offensive and defensive space control measures that it can take to prevent the loss of space capability and maintain space situational awareness. However, it falls short in explicitly highlighting the connective tissue between EMS and space. Without unrestricted access to the EMS domain, the space domain could not function. Without both, the traditional air, maritime and land domains in a future conflict will struggle to operate.

In briefly analysing the traditional domains of air, maritime and land, elements of current doctrine recognise the interconnected nature of actions in and through domains. JCN 1/17 states, 'In their contribution to joint action, maritime forces will support land and air forces with cross-domain logistic support, ISR and power projection as part of a full spectrum approach. The maritime domain is similarly subject to actions from all other domains.'²⁸ In considering the future operating environment, JCN 1/17 provides an encouraging list of roles and capabilities for maritime projection as well as future systems such as directed energy weapons, hypersonic weapons and autonomous systems.²⁹ These will all be relevant capabilities in any future MDO peer-on-peer fight. Similarly, JCN 1/17 states that the land domain is a supported and supporting force for the other domains, enabling effective integration and action.³⁰ Finally, when considering air, JCN 1/7 provides a comprehensive vision of the contested, congested air environment that will be the norm. First, with threat actors gaining access to more disruptive technologies, the prospect of losing control of the air becomes highly likely. Instead, effects and domain awareness inside the air domain will rely upon capabilities from other domains in order to combat complex air defences, passive sensing, hypersonic capabilities and swarming tactics.³¹ The delivery of effects will rely on access to, and the ability to mitigate denial within the EMS, as well as sufficient bandwidth to operate.³² JCN 1/17 designates 'air focus' areas. These are similar to the other domains: operate and command in degraded and denied environments, focus on technologies, seek synergies between platforms and the need for cross-domain integration.³³

While UK Doctrine does not identify a human domain, it does recognise the importance of influence activities through its approach to Joint Action. Joint Action is a deliberate military approach to 'affect an actor's will, understanding and capability, and the cohesion between them to achieve influence.'³⁴ A combination of manoeuvre, fires, and outreach and information activities combined can act to deter, coerce, persuade and change adversary behaviour.³⁵ Recognising this is a key component to a successful MDO, integrated operations or domain superiority will not be sufficient to achieve this. In considering the totality of current doctrine, what becomes apparent is achieving MDO and the integration required on paper is extremely easy to (over) state but in reality is a monumental challenge to execute. Historically the UK has undertaken focused efforts to achieve service integration; Air-Land Integration (ALI) in Iraq and Afghanistan, Air-Maritime Integration (AMI) in Libya, Air Space and Air-Cyber integration as part of the fight against ISIL. Lessons identified from these efforts include a better understanding of co-ordination of forces, command and control, flexibility and tempo, common understanding, effective training and the impact of operating in a contested environment.³⁶ Sharing Joint doctrine and collaboration with partners and allies to come to common understandings of MDO and an MDO approach is vital, especially now as the UK and its allies must react to an ever-evolving and threatening range of peer and non-peer adversaries.

This transition from a cross-domain strategy to MDO is a reaction to a changing strategic environment. Countries such as China continue to prepare for and deliver elements of their unrestricted warfare doctrine, seeking to use 'all means, including armed force or non-armed force, military and non-military, and lethal and non-lethal means to compel the enemy to accept one's interests.'³⁷ At the forefront of Chinese thinking is the EMS and the need to dominate it. In 2014, Alan Shaffer, the Pentagon's Research and Engineering Chief, publicly stated that the US had lost its dominance in the EMS.³⁸ While China in 2015, through its establishment of the Strategic Support Force, formalised its efforts to synchronise activities within the EMS, bringing together Cyber, EW and Space.³⁹ For the UK, with fewer strategic interests in the Pacific region, China does not represent a competitor state in the same way that the US views it. However, Russia too has invested time and money in EMS, and the UK, with its geographical proximity and its NATO commitments in Eastern Europe, finds itself more relevant to that threat. A report published in September 2017 by the International Centre for Defence and Security in Estonia outlines the challenges members of NATO face as Russia builds on its capabilities in the EMS; a "total package" including capabilities to ensure Russia dominance in the EMS.⁴⁰

Just like China, Russia has embarked on a strategy of maximising the EMS, recognising it as a distinct domain and building structures around it.⁴¹ The UK, like the US, is behind in operating within and maintaining control of the EMS. A recent House of Commons Defence Committee Report has called for additional funding for EMS concluding, 'the UK needs to be in a position to deter and challenge peer adversaries equipped with a full range of modern military technologies who seek to use them in ways that confuse our traditional conceptions of warfare.'⁴² In developing a better understanding of the changing strategic environment,

EMS as a domain (a combination of Cyber and EW) is surely an urgent necessity. As the then Chief of Defence Staff Sir Stuart Peach articulated, 'to understand, manage and control the electromagnetic environment is a vital role in warfare at all levels of intensity. The outcome of future operations will be decided by the protagonist who does this to decisive advantage.'⁴³

With a solid understanding of the contemporary doctrinal and conceptual debates that are ongoing, we reconsider Fighter Command and specifically 11 Gp's employment of MDO concepts consistent with the notion of the continuum of domains. On 1 May 1936, 11 (Fighter) Group re-formed, transferring to RAF Fighter Command on 14 July 1936. In 1940, 11 Gp significantly, was responsible for the Air Defence of London and the South East during the Battle of Britain, using approximately 40% of Fighter Command's assets. This was by far the most operationally active Group during the Battle and therefore provides one of the most complete perspectives when considering MDO. The stated objective of Fighter Command, of which 11 Gp was a key component, was 'to remain in being and offer undiminished and constant opposition, thus denying the Luftwaffe air superiority.'⁴⁴ The German objectives were twofold: destroy the RAF as a fighting force and degrade the UK economy by attacking ports and industry.⁴⁵ A critical element to meet the objective of Fighter Command and counter the Luftwaffe was the Dowding System, a revolutionary integrated air defence system and ultimately the key element during the Battle of Britain for Fighter Command and 11 Gp from an Electromagnetic dimension.

The Dowding System was the world's first air defensive network, its creation entrusted to Air Chief Marshal Sir Hugh Dowding, Chief of RAF Fighter Command. This system was an interconnected mesh of radars, ground-based observers, barrage balloons, searchlights and anti-aircraft divisions used to provide early warning of incoming air threats flying towards the English coast. In total, nine Chain Home Radar Direction Finding (approximately 30 miles apart), twenty-two Chain Home low-looking radio direction-finding stations, and twenty-four mobile stations were utilised during the Battle of Britain. British scientists had developed these radar systems since 1935. In addition to this, anti-jamming equipment was deployed to prevent German attempts to jam the Dowding system.⁴⁶ Integrated into this were sector control rooms, filter rooms, plotter rooms and communication links all directly contributing to 'Fighter Command's situational awareness, survivability, and lethality.'⁴⁷ In modern terms, when considering the continuum of domains, Fighter Command and 11 Gp utilised this system as its critical element within the EMS domain to facilitate on-demand access to enable parity of air control. The result was a German leadership that faced frequent decision-making challenges. As German ace General Adolf Galland, who at the time of the Battle was a fighter group commander, stated after the war 'From the first the British had an extraordinary advantage, never to be balanced out at any time during the whole war, which was their radar and fighter control network and organization.'⁴⁸

The assimilation of the data provided to the filter rooms showed the true success of the radar system, heavily utilised by 11 Gp who faced a constant flow of German aircraft from across

the channel. In modern terms, filter rooms acted as fusion hubs, combining numerous radar pictures and providing inputs to leverage response options for fighter aircraft. It also had the challenge of determining friendly tracks from enemy ones. Chain radars' maximum range was limited to approximately 120-200 miles, with an average of 80 miles and could provide limited data (range, bearing) for aircraft above 1,000 feet with an approximate 20-minute warning. Chain Home Low radars were limited to 30 miles range and could provide accurate azimuth but not height.⁴⁹ Success was much higher during the day than at night. Signals Intelligence and observers acted to pre-empt or confirm the movement of enemy aircraft, augmenting the radar network. Signals Intelligence through the interception of High Frequency radio could provide a 2-hour warning and give insight into aircraft numbers, types and routes.⁵⁰ Significantly, the use of Radio Telephony Direction Finding automation from selected friendly aircraft providing ground radar friendly position data contributed to accurate vectoring against the incoming enemy.⁵¹ The employment of the Dowding system, combined with intelligence and fusion in the EMS domain resulted in the ability of Fighter Command and 11 Gp to react and manoeuvre rapidly in the air domain to meet German air raids, employing small formations of assets to affect the enemy, while limiting losses in the air and on the ground. This was a defensive strategy executed by Air Vice-Marshal Keith Park in command of 11 Gp. Park was later described by Air Vice-Marshal 'Johnnie' Johnson, the RAF's leading Second World War ace, as 'the only man who could have lost the war in a day or even an afternoon.'⁵² Park executed the defensive strategy laid out by Dowding, partly because of the intimate knowledge of defensive systems and strategy he had gained between 1926 and 1932, while under his command.⁵³

In executing this defensive air strategy, focused application by 11 Gp at the squadron level was central to success. The simplicity of the strategy introduced indecision and confusion into the German leadership, sowing seeds of doubt into the German air strategy. The Luftwaffe's tactics from the outset sought to draw the RAF into a decisive battle. Large formations were sent over England with the sole purpose of luring in RAF fighter aircraft, predominantly from 11 Gp. The use of smaller formations of 8-12 bombers with 9-30 escorts sought to achieve this objective.⁵⁴ The German leadership had expected a more decisive response from 11 Gp aircraft, but instead faced small but constant piecemeal skirmishes. This approach, with a mere 250 aircraft, had three main objectives set by Park. First, the objectives of his squadrons were to interdict the bomber aircraft destined for airfields and cities. Park recognised that in order to survive, a purely fighter vs fighter campaign would end in disaster. Second, Park recognised that, with limited numbers, his bases in the South were vulnerable and so early and effective interdiction of German bombers was critical. Third, because of a shortage of experienced pilots and recovery means, engagements over land were preferred.⁵⁵ Park's strategy was counter to those in command around him (12 Gp for example) who preferred the 'big wing' tactic where numerous squadrons would mass to seek a knockout blow. This, however, was time-consuming and counter to the objective to ensure localised air control, providing just enough to facilitate manoeuvre space.⁵⁶ 11 Gp was able to sustain constant pressure on the Luftwaffe through the continuous use of well-directed small-scale packages of fighter aircraft against

bomber forces and fighter escorts. In addition to this, 11 Gp had a distinct advantage against the Luftwaffe because the proximity of its airfields to the German threat which had massed in France. Being closer increased RAF reaction time as well as limited the ability of the Luftwaffe to mass large formations before being intercepted or engaged. Through the effective use of the EMS domain (in essence the Dowding System), be that through identification, command and control or jamming, 11 Gp aircraft were able to rapidly concentrate small formations of fighter aircraft, to disrupt German bombers in the air domain, degrade German fighter escorts as opportunity presented, but more importantly strategically delay Operation SEALION, the invasion of the United Kingdom.

In considering the Human Domain, analysis of the distinct leadership approaches and decision-making taken by Dowding and Park in contrast to the Germans' provides useful insight. Dowding and Park shared in their belief about a common strategy and tactical employment of assets based on the assessment that the Luftwaffe would focus its objective on the targeting of Fighter Command. This vision was supported by a fully decentralised command and control ecosystem to support dispersed forces. This was however was not a vision supported by all or communicated well. Additionally, in creating sectors, Dowding thrust Park into a central role with 10 Gp in the Southwest and 12 Gp in the North in supporting roles. The frictions created by this arrangement and lack of clarity in communication by Dowding had the potential to undermine the overall vision. In particular, Air Vice-Marshal Leigh-Mallory commanding 12 Gp (who had wanted to be 11 Gp Commander) believed he had more time to react and thus could use different tactics to attempt to shoot down as many aircraft as possible. He also believed that his tactics be employed by all Gp's. This was never to be the case.⁵⁷

Because of the tempo and geography of the battle that Park and 11 Gp faced, over the course of the Battle, he issued 35 instructions to his Group a significant number in comparison to his peers and his way of ensuring a common understanding of the operational picture as well as his intent. Significantly, instructions were not orders, as per British military regulation, and therefore were open to interpretation as the operational environment required.⁵⁸ This afforded latitude in Mission Command and significantly increased the speed of information sharing throughout the defensive network. Park, supported by this ecosystem, executed a strategy designed to make the Germans 'give up if he becomes convinced that he is getting nowhere.'⁵⁹

In contrast was the German organisation and demeanour. In 1940, the Luftwaffe's Head of Intelligence, Major Josef Schmidt, surrounded himself by staff that he hand-selected but were sub-standard in capability. His team issued a series of reports to the General Staff indicating that the Battle of Britain could not only be won, but would be a total pushover. Reports provided on 2 July 1940 painted a picture of inferior aircraft, limited operational airfields, a small-scale aircraft industry and an inflexible command structure. It also suggested that Britain's air defences were weak, which was a significant miscalculation.⁶⁰ Most significantly, on assessing radar, ten separate agencies all contributed to an assessment but failed to share

their findings; this was a highly effective system that if not dismantled was likely to create significant challenges to the Luftwaffe.⁶¹ Yet in 1940, the German Luftwaffe lacked a clear air strategy against the UK. Göring and subsequently Hitler provided broad guidance to include targeting aircraft, ground supply, factories, and people in order to gain air superiority. The Luftwaffe was also to be prepared to support Operation SEALION.⁶² Even when Göring launched Operation ADLERANGRIFF (Eagle Attack) and issued his initial attack directive, the objectives were broad in nature, undermined by continuous over-estimation of German capability in relation to the RAF. Significantly, this meant an underestimation of the significance of radar and the vital role it would play in preventing German success. As one German officer stated, this lack of clarity about the complexities of a strategic bombing campaign as well as gaining air superiority was just 'romantic warfare'.⁶³

It is unsurprising that the German reaction to encountering the Dowding system was disbelief, surprise and upright arrogance. They had anticipated an inflexible system, prone to mass attack. Yet, during the Battle of Britain, the actions of Fighter Command and specifically 11 Gp supported by the Dowding system not only acted as an accelerant to German attrition: they also created havoc in the leadership of the Luftwaffe. Poorly organised for an offensive counter air-fight or a meaningful strategic bombing campaign, and presented with poor intelligence, the German leadership were unable to confirm if its bombing efforts were rendering Fighter Command inoperable or weakening defences in Southern England. It therefore continued to fight.⁶⁴ Over-inflated estimates of aircraft destruction aligned with optimism in the early stages that 'the RAF would be neutralised in some two to four weeks', added to the confusion that followed.⁶⁵ In contrast to the broad unity of command displayed by Dowding and Park, the German leadership lacked co-operation and co-ordination, and was blighted by rivalry.⁶⁶ Officers frequently embellished reporting provided to Göring. Overall, the German leadership in the Luftwaffe did not know what was going on. Significantly, the Luftwaffe did not fully grasp how the UK radar network operated. The inability of the Luftwaffe to destroy radar masts, poor intelligence assessments about sub surface operations rooms and a lack of accurate Battle Damage limited damage to the RAF radar network.

This was not to say that the Germans did not attempt to use the EMS and develop their own radar system. The success that this could have yielded was deeply limited by a doctrinal focus on offensive destruction of the enemy and its aircraft on the ground, vice the employment of a defensive network.⁶⁷ Between 1936 and 1938, Germany had tested radar out to a range of 120km. Between 1937 and 1939 they created a coastal chain radar system that could have been highly successful if they had sought active integration into the wider military command and control network.⁶⁸ The Germans also attempted to employ radar in France in the initial stages of the Battle, but failed to maximise radar to monitor RAF reactions.⁶⁹ In addition to this, the utilisation of radio beam technology called 'Knickebein' sought to improve targeting at night, which initially was extremely effective, although ultimately the development by RAF Intelligence of a means to detect this resulted in the capability being routinely jammed.⁷⁰

Adlertag 'Eagle Day', which began on 12 August 1940, was Göring's effort to refocus on gaining air superiority as well as targeting the Royal Navy in order to set the conditions for Operation SEALION.⁷¹ 12 August 1940 and the days immediately after it, serve as a good example of a specific part of the Battle of Britain in which both sides sought to maximise manoeuvre within the EMS domain, providing cueing for air assets, while seeking to compel the other side to over-commit and be drawn into further air attrition. The Luftwaffe expected this to be 'the beginning of the end of Fighter Command.'⁷² A Luftwaffe operational trials wing, Erprobungsgruppe 210, was formed using BF109 fighter-bombers to conduct focused attacks against UK targets, specifically radar sites. Attacks began against the Ventnor radar site on the Isle of Wight, as well as five other airfields including Manston, Hawkinge and Lympne. What followed was a package of almost 500 bombers and fighters (in loose escort) heading for Portsmouth.⁷³ Yet, radar, whilst degraded, was able to identify and help vector fighters to respond and, more importantly, could be regenerated quickly when damaged. This showed the Luftwaffe pilots that they were detectable from the moment they launched, observed by what some called 'the evil eye of these invisible signals.'⁷⁴ While Luftwaffe fighters circled craving a decisive engagement, Park launched attack after attack against bombers with devastating results.

On 15 August, known as 'Black Thursday' by the Luftwaffe, 75 aircraft were lost against RAF losses of 34.⁷⁵ The Luftwaffe leadership refused to accept the reality of the situation and, playing into Park's hands, felt compelled to provide a surge of fighter sweep and fighter escort sorties. German leadership called by Göring, fought to explain how Eagle Day had been such a disaster. Attacks by Unit 210 against radar sites failed in planning and execution. It was highly unlikely an attack would destroy a radar site, but persistent daily attack could assist in disrupting it. Attrition rates of the Stuka bomber force further compounded the task. Göring responded by calling for even greater numbers of fighters to protect the Stuka bombers (ratio of one Stuka wing to three Fighter wings) in essence stretching their remaining force even further. He eventually stopped using the Stukas entirely. He provided further instructions that included limiting attacks on radar stations airfields that were attacked on the previous day, as he did not believe the attacks were having a significant effect.⁷⁶ On 20 August 1940, orders to the Luftwaffe were to launch continuous attacks against the RAF on the ground, as well as industry and ports in an attempt to provoke the RAF into prolonged battle. The Germans were never able to assess the impact of this strategy, but the losses continued to mount for the Luftwaffe.⁷⁷ The Luftwaffe had 25% more aircraft shot down than the RAF as well as seven times the rate of aircrew killed. Inaccurate intelligence assessments further complicated decision-making. Intelligence assessed that by the end of August 1940 the RAF only had 100 fighter aircraft left, when in fact the number was close to 700.⁷⁸

Göring's lack of strategy as well as his overconfidence and egotism had directly contributed to the survival of Fighter Command and 11 Gp.⁷⁹ He had also created a divide within his own organisation; tensions between fighter and bomber units, compounded by his own self-interest and preservation, prevailed. In comparison, Dowding and Park had developed

a strategy that used EMS to detect aircraft, combined with focused, selective fighter engagement within the air domain mainly against bombers to force a change in behaviour by the German leadership. In England, morale of the population was high, as news of the limited RAF losses of aircraft and pilots spread as well as the mounting German losses. The Germans lost more aircraft in the week of 12 Aug 1940 than in the entire previous month.⁸⁰ Validation of the Dowding system was supported by the decision making of Park and actions of 11 Gp. By September 1940, as sortie rates for Luftwaffe fighter pilots rocketed, morale quickly slumped. Unlike the rotations to the north of England that Dowding and Park were able to make for aircrew, there was limited respite for the Luftwaffe crews who began to lose a sense of purpose.⁸¹ In being compelled to surge aircraft, the Luftwaffe failed to stop Fighter Command, failed to gain the air superiority needed for Operation SEALION, and changed targeting strategies.⁸² 15 September 1940 now remembered in Britain as 'Battle of Britain Day' reminded the Germans that Fighter command and 11 Gp were alive and well. Park scrambled 170 Hurricanes and Spitfires to meet a raid destined for London.

The actions of Fighter Command and specifically 11 Gp undoubtedly contributed to the ultimate outcome of a German defeat during the Battle of Britain, especially with the majority of air activity taking place in and around London. Figure 2 provides a graphical representation of how the interdependence of domains as part of the continuum model resulted in an effect on German decision-making, the Luftwaffe leadership and operators, as well as the perceptions of the German population. Much has been made of German equipment shortfalls, especially the lack of a strategic long-range bomber.⁸³ Even with a strategic bomber, bombing accuracy would have remained an issue and more significantly, the tactics and techniques employed by 11 Gp would have remained unchanged. The Luftwaffe failed to concentrate on the relevant Centre of Gravity, which was Fighter Command and specifically the Dowding system, Command and Control, aircraft and pilots.⁸⁴ Intense, sustained attacks against radar sites and Sector Operations Rooms may have resulted in a different outcome. However, as evidenced by

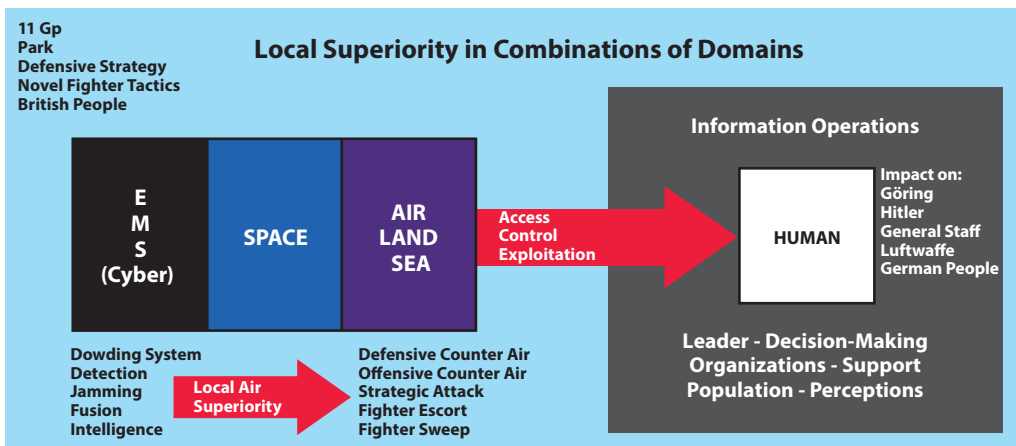


Figure 2: Continuum of Domains and their inter-dependence during the Battle of Britain.⁸⁵

the erratic actions of Göring, a lack of informed strategic decision-making is likely to have been one of Germany's greatest shortfalls. In considering the role of radar within the EMS, employed to facilitate Fighter Command's strategy, the RAF and German leadership made decisions in two very different ways.

The Cynefin Model or framework (Figure 3 refers)⁸⁶ helps leaders to determine context to characterize a problem or situation in order to make appropriate choices or decisions.⁸⁷ The model makes it possible to try to explain some of the effects that the exploitation of domains had on British and German leaders and organisations within the Human Domain during parts of the Battle of Britain. The Cynefin model, presents five components: simple, complicated, complex, chaotic and disorder. These represent ordered on one side (simple and complicated), unordered (complexity and chaos) the other and disorder in the middle.

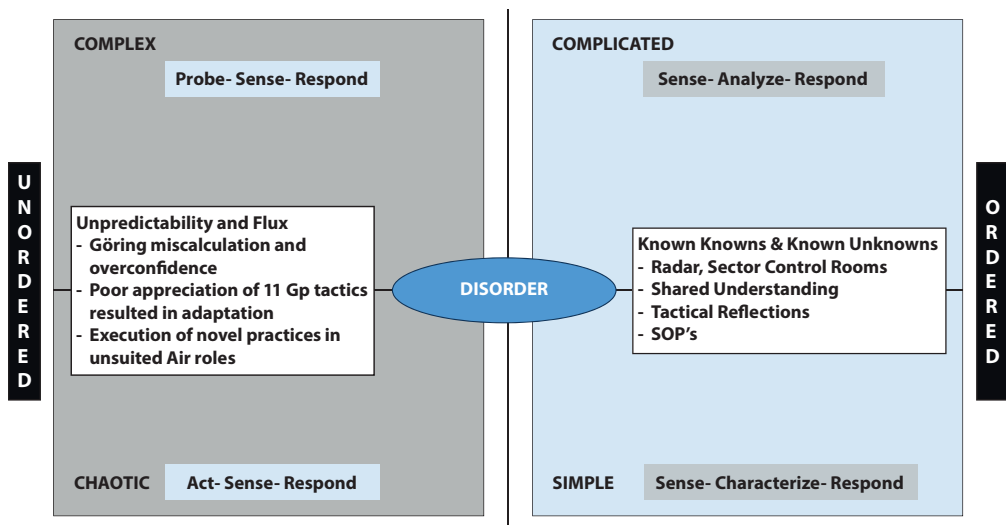


Figure 3: Cynefin Model and decision making during the Battle of Britain.

In considering the actions of 11 Gp and the Battle of Britain, Park, within the human domain was able to retain a high degree of decision making order. If we consider the decisions made within 11 Gp, much of the activity of the network of radar stations, sector control rooms and observers falls somewhere between the realm of simple and complicated, i.e. 'known knowns' and 'known unknowns'. These components are characterized by leaders who 'sense, categorize, and respond' on the one hand, and 'sense, analyze, and respond' on the other.⁸⁸ Park and his command of 11 Gp centered upon shared understanding and the ability to respond using established operating procedures and developed practices. In the shadow of particularly demanding days, Park was able to spend time analyzing how the system responded to the German threats and improve best practice if needed. On 13 September, with a period of bad weather, he spent time reading combat reports, synthesizing tactics and communicating his observations to his Sector Station Commanders.⁸⁹ The Public Record Office is full of other

examples, such as memorandums, communications and tactical reflections shared routinely with units and stations.⁹⁰ Park, over a period of five months, was able to anticipate his adversary's moves and react quickly and decisively, earning him the title 'Defender of London.'

In contrast, the Germans lacked insight and knowledge of the RAF and the tactics and techniques that Park would employ. Göring miscalculated the importance of the EMS, specifically radar, in enabling Fighter Command operations. Göring's overconfidence meant a shift away from a tactical support to land role that the Luftwaffe had performed so well previously, to a move toward strategic bombing in which the Luftwaffe had limited training, techniques and procedures. Further compounding these miscalculations was an arrogant, divisive and controlling leadership style in which tactical commanders who were Subject matter experts, were prevented from contributing to the decision making process. Göring viewed the attack on England as his battle, and in preparing for this failed to appropriately analyze and direct what to target, how to target and failed to gain local air superiority to allow the invasion of England to begin. This lack of understanding meant that Göring spent most of the Battle of Britain in complexity, creating 'unpredictability and flux' as well as routinely 'seeking to impose a course of action' on his subordinate commanders.⁹¹ The inability to adapt to the situation as it unfolded, in part because of the actions taken by 11 Gp led by Keith Park, resulted in poor decision making.

From a poor starting point, the Luftwaffe's limited understanding of Britain's defensive network, aerial tactics, nature of targets, knowledge of the aircraft industry, and RAF fighter tactics served to push Göring into crisis mode. As Eagle Day showed, Göring was unable to 'act to establish order' and respond to the situation he and the Luftwaffe faced.⁹² He could not identify a way to counteract Park's fighter intercept policy; his bomber force was experiencing high levels of attrition and he was making mistakes. On 30 August 1940, partly in response to the continued bombing of Berlin (itself a response to an accidental German raid on London), Hitler lifted the ban on attacking London with the first attacks on 7 September. Göring had the chance to disagree, but did not. By 15 September, with raids continuing day and night, the Luftwaffe reached a tipping point. By 30 September, because of aircraft attrition, German attacks all but stopped. The shift of focus away from Britain's Centre of Gravity – i.e. Fighter Command, was a strategic blunder, relieving pressure on Dowding's forces.⁹³ Hitler had not followed the assessment provided by the Luftwaffe Operations Group before the war in which they declared, 'because of the increasing strength of the air defences, no decision could be hoped for by terror attacks on London. On the contrary, such attacks [are] more likely to produce the opposite effect and undesirably strengthen the national will to resist.'⁹⁴ Ultimately, the decision to shift focus was in part, because 11 Gp and Fighter Command were able to dominate the EMS, preventing the Luftwaffe from gaining air superiority over the UK and sending the Luftwaffe into disorder. The Luftwaffe showed that once in disorder, sensemaking and decision making becomes extremely difficult to achieve as indicators of disorder are less obvious and if decision makers do not adjust it is easy to remain stuck in ambiguity and uncertainty.

MDO is greater than just the physical elements of fusing information, command and control or providing data to decision makers. Focusing on the physical linkages enabled by technology is the easy part of the MDO journey. Re-evaluating current definitions and doctrine provides an opportunity to understand how to leverage the relationships between domains as a whole, as well as the ultimate goal: to shape the human domain. Renewing the historical vision of 11 Gp during the Battle of Britain through the lens of MDO current thinking shows how air power thinkers have already been considering and exploiting these relationships. Understanding the relationships between domains, how to access, exploit and control dependencies between domains and how to directly affect decision makers, is an art and not a science. There are numerous historical examples of MDO in action. The actions of Keith Park and 11 Gp during the Battle of Britain allow for basic analysis that provides a glimpse of the simplicity and complexity of MDO. Developing a UK, Service-specific, Joint and allied MDO conceptual framework, organisational framework and strategy is not easy. Our adversaries, however, are unlikely to repeat Göring's mistakes. We must therefore accept the challenge just as the leaders of 11 Gp and Fighter Command did in 1940.

Notes

¹ <https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/speeches-apc18-cas-keynote>. Accessed on 10 August 2018.

² <https://www.raf.mod.uk/news/articles/historic-11-group-reforms-for-multi-domain-challenges>. Accessed on 10 December 2018.

³ J C Slessor, *Air Power and Armies*, (Oxford: Oxford University Press, 1936), x.

⁴ The recent Air Forces Association Conference in Sep 18 in Washington DC, focused on Multi Domain complexity. The RAF is currently beginning to explore MDO concepts as part of the establishment of No. 11 Gp.

⁵ <https://othjournal.com/2018/09/17/defining-the-domain-in-multi-domain>. Accessed 13 Jan 2019.

⁶ Jeffrey M. Reilly, "Multidomain Operations," *Air & Space Power Journal (ASPJ)* 30, no. 1 (Spring 2016), 61–73, http://www.airuniversity.af.mil/Portals/10/ASPJ/journals/Volume-30_Issue-1/V-Reilly.pdf.

⁷ The online journal *Over the Horizon* based at Air Command and Staff College has provided permission to print this diagram.

⁸ <https://othjournal.com/2018/06/27/nato-planning-and-multi-domain-operations-a-german-perspective/>. Accessed on 20 November 2018.

⁹ U.S. Air Force, *Air Force Future Operating Concept: A View of the Air Force in 2035*, Washington, D.C., September 2015, 14.

¹⁰ Joint Publication (JP) 6-01, *Joint Electromagnetic Spectrum Management Operations* (Washington, DC: Office of the Secretary of Defense, 2012), I-1.

¹¹ Joint Publication (JP) 3-59, *Meteorological and Oceanographic Operations* (Washington, DC: Government Printing Office, 2016). Accessed October 7, 2018. http://www.dtic.mil/doctrine/new_pubs/jp3_59.pdf. GL-5.

¹² Webster dictionary defines a domain as 'complete and absolute ownership of land'

¹³ <https://www.otc.army.mil/ADP3-0.pdf>, 2. Accessed 20 October 2018.

¹⁴ OTH online Primer <https://www.youtube.com/watch?v=NE6BVmxAYMs&feature=youtu.be>. Accessed 20 September 2018.

¹⁵ Joint Capability Note 1/17, Future Force Concept. Accessed 10 September 2018.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643061/concepts_uk_future_force_concept_jcn_1_17.pdf.

¹⁶ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732503/20180803-doctrine_uk_terminology_JDP_0_01_1_2018.pdf.

¹⁷ There is not an exhaustive list of former and current definitions, although each of these is focused toward integration of effects. Joint Action in JDP 3-00, 3rd Edition, Change 1 is defined as “The deliberate use and orchestration of military capabilities and activities to realise effects on an actors’ will, understanding and capability, and the cohesion between them to achieve influence”.

¹⁸ Joint Capability Note 1/17, Future Force Concept. Accessed 10 September 2018.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643061/concepts_uk_future_force_concept_jcn_1_17.pdf.

¹⁹ *Ibid.*

²⁰ *Ibid.*, 3.

²¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/682859/doctrine_uk_cyber_and_electromagnetic_activities_jdn_1_18.pdf.

²² *Ibid.*

²³ <https://defensesystems.com/articles/2018/10/24/navy-electronic-warfare-williams.aspx?m=1>. Accessed 19 Jan 2019.

²⁴ <https://breakingdefense.com/2017/11/spectrum-ew-should-be-a-warfighting-domain-rep-bacon/>. Accessed 19 Jan 2019.

²⁵ Jeffrey M. Reilly, “Multidomain Operations,” *Air & Space Power Journal* (ASPJ) 30, no. 1 (Spring 2016), 61–73, http://www.airuniversity.af.mil/Portals/10/ASPJ/journals/Volume-30_Issue-1/V-Reilly.pdf.

²⁶ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/668710/doctrine_uk_air_space_power_jdp_0_30.pdf. 73.

²⁷ JCN 1/17, 27.

²⁸ *Ibid.*, 30.

²⁹ *Ibid.*

³⁰ *Ibid.*, 36.

³¹ *Ibid.*, 43.

³² *Ibid.*, 44.

³³ *Ibid.*, 47.

³⁴ *Ibid.*, 5.

³⁵ *Ibid.*, 6.

³⁶ Examples of this can be found in a variety of publications including:

<https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/delivering-effective-air-land-integration-ali-in-the-next-war-what-enduring-lessons-can-uk-defence-draw-from-historical-and-contemporary-operations-to-generate-and-maintain-an-efficient-joint-/>.

<https://www.rand.org/content/dam/rand/pubs/reports/2008/R4045.pdf>.

<https://medium.com/raf-caps/integrating-cyber-with-air-power-in-the-second-century-of-the-royal-air-force-bca74b8d42ed>.

https://www.airuniversity.af.edu/Portals/10/AUPress/Books/B_0105_BROWN_SPACE_POWER_INTEGRATION.pdf.

³⁷ Qiao Liang and Wang Xiangsui. (1999). *Unrestricted Warfare*. PLA Literature and Arts Publishing House, Beijing. Downloaded from <http://www.terrorism.com/documents/unrestricted.pdf>. Accessed 7 September 2018.

³⁸ <https://breakingdefense.com/2014/09/us-has-lost-dominance-in-electromagnetic-spectrum-shaffer/>. Accessed 7 September 2018.

³⁹ <https://www.c4isrnet.com/home/2017/06/08/dods-annual-china-assessment-shows-growing-cyber-ew-capabilities/>. Accessed 7 September 2018.

⁴⁰ Roger McDermott, "Russia's Electronic Warfare Capabilities to 2025," International Centre for Defence and Diplomacy (Estonia), September 2017, icds.ee/russias-electronic-warfare-capabilities-to-2025-challenging-nato-in-theelectromagnetic-spectrum/. Accessed 10 December 2018.

⁴¹ *Ibid*, 10.

⁴² <https://publications.parliament.uk/pa/cm201719/cmselect/cmdfence/818/81807.htm>. Accessed 19 January 2019.

⁴³ JDN 1-18, 2.

⁴⁴ Stephen Bungay, *The Most Dangerous Enemy* (London: Aurum Press, 2000), 192.

⁴⁵ <https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/air-power-review-vol-18-no-2-battle-of-britain-75th-anniversary-special-edition/>. 143. Accessed 26 July 2018.

⁴⁶ Bungay, *The Most Dangerous Enemy*, 65.

⁴⁷ Paul M. Kennedy, *Engineers of Victory: The Problem Solvers Who Turned the Tide in the Second World War*, 1st ed (New York: Random House, 2013), 93.

⁴⁸ <https://www.rafmuseum.org.uk/documents/Research/RAF-Historical-Society-Journals/Bracknell-No-1-Battle-of-Britain.pdf>. 10. Accessed 10 September 2018.

⁴⁹ <https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/air-power-review-vol-18-no-2-battle-of-britain-75th-anniversary-special-edition>, 89. Accessed 26 July 2018.

⁵⁰ Tony Devereux, *Messenger Gods of Battle* (London: Brassey's Ltd., 1991) 124-5.

⁵¹ <https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/air-power-review-vol-18-no-2-battle-of-britain-75th-anniversary-special-edition>, 92. Accessed 26 July 2018.

⁵² "Introduction by Terry Smith, chairman of the Sir Keith Park Memorial Campaign", Sirkeithpark.com. Accessed 12 September 2018.

- ⁵³ <https://www.rafmuseum.org.uk/documents/Research/RAF-Historical-Society-Journals/Bracknell-No-1-Battle-of-Britain.pdf>, 36. Accessed 10 September 2018.
- ⁵⁴ <https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/air-power-review-vol-18-no-2-battle-of-britain-75th-anniversary-special-edition> 145. Accessed 27 July 2018.
- ⁵⁵ John Terraine, *The Right of the Line*, (Hodder and Staughton, 1985), 185.
- ⁵⁶ Sir Julian Corbett, *Some Principles of Maritime Strategy*, 87.
- ⁵⁷ LCdr Kenneth P. Neubauer USN (1994) *Operational Leadership in Air Warfare: A Study of the Battle of Britain and Operation Desert Storm*, Naval War College, 10-12.
- ⁵⁸ Terraine, *ibid*.
- ⁵⁹ Bungay, *The Most Dangerous Enemy*, 134.
- ⁶⁰ *Ibid*, 188.
- ⁶¹ Wing Commander M. P. Barley RAF (2004) *Contributing to its Own Defeat: The Luftwaffe and the Battle of Britain*, *Defence Studies*, 4:3, 387-411, DOI: 10.1080/1470243042000344812, 406.
- ⁶² <https://www.rafmuseum.org.uk/documents/Research/RAF-Historical-Society-Journals/Bracknell-No-1-Battle-of-Britain.pdf>. 19. Accessed 12 September 2018.
- ⁶³ <https://www.rafmuseum.org.uk/documents/Research/RAF-Historical-Society-Journals/Bracknell-No-1-Battle-of-Britain.pdf>. 24. Accessed 12 September 2018.
- ⁶⁴ Bungay, *The Most Dangerous Enemy*, 135.
- ⁶⁵ *Ibid*, 152.
- ⁶⁶ *Ibid*, 187.
- ⁶⁷ Wing Commander S. P. Kilvington RAF (2013), *Delivering effective Air-Land Integration (ALI) in the next war: what enduring lessons can UK Defence draw from historical and contemporary operations to generate and maintain an efficient, joint ALI capability that is fit for future conflict*, *Defence Research Paper*.
- ⁶⁸ Barley, *Contributing to its Own Defeat*, 398.
- ⁶⁹ Bungay, *The Most Dangerous Enemy*, 116.
- ⁷⁰ Williamson Murray, *German and British Adaptations and the Context of German Strategic Decision Making in 1940-41*. 110. <http://www.nids.mod.go.jp/publication/senshi/pdf/200803/07.pdf>
- ⁷¹ <https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/air-power-review-vol-18-no-2-battle-of-britain-75th-anniversary-special-edition>, 203. Accessed 27 July 2018.
- ⁷² Bungay, *The Most Dangerous Enemy*, 210.
- ⁷³ *Ibid*, 204-206.
- ⁷⁴ *Ibid*, 206.
- ⁷⁵ *Ibid*, 218.
- ⁷⁶ *Ibid*, 219.
- ⁷⁷ <https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/air-power-review-vol-18-no-2-battle-of-britain-75th-anniversary-special-edition> 147. Accessed 27 July 2018.

⁷⁸ <https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/air-power-review-vol-18-no-2-battle-of-britain-75th-anniversary-special-edition> 204. Accessed 27 July 2018.

⁷⁹ Ibid. 206.

⁸⁰ Bungay, *The Most Dangerous Enemy*, 232.

⁸¹ Ibid, 303.

⁸² Ibid, 236.

⁸³ Ibid, 376.

⁸⁴ Ibid, 377.

⁸⁵ Permission to use and print has been kindly provided by Dr Jeff Reilly, Director Future Security Studies, Air Command and Staff College, Maxwell AFB, AL, USA.

⁸⁶ Adapted from the model created by David Snowden and Mary Boone with original concepts added. In "A leaders Framework for Decision Making", *Harvard Business Review* (November 2007).

⁸⁷ David J. Snowden and Mary E. Boone, "A Leader's Framework for Decision Making," *Harvard Business Review* (November 2007), <http://sistemas.uniandes.edu.co/~isis4617/dokuwiki/lib/exe/fetch.php?media=principal:hbr-article.pdf>. This model also appears in JCN 2/17.

⁸⁸ Ibid.

⁸⁹ Bungay, *The Most Dangerous Enemy*, 316.

⁹⁰ Ibid, 382.

⁹¹ Snowden, *A Leaders Framework*.

⁹² Ibid.

⁹³ Bungay, *The Most Dangerous Enemy*, 305.

⁹⁴ Barley, *Contributing to its Own Defeat*, 402.

This article has been republished online with Open Access.

Ministry of Defence © Crown Copyright 2023. The full printed text of this article is licensed under the Open Government Licence v3.0. To view this licence, visit <https://www.nationalarchives.gov.uk/doc/open-government-licence/>. Where we have identified any third-party copyright information or otherwise reserved rights, you will need to obtain permission from the copyright holders concerned. For all other imagery and graphics in this article, or for any other enquires regarding this publication, please contact: Director of Defence Studies (RAF), Cormorant Building (Room 119), Shrivenham, Swindon, Wiltshire SN6 8LA.

 **ROYAL
AIR FORCE**
**Centre for Air and
Space Power Studies**

OGL