LEARNING TOGETHER, WINNING TOGETHER: AIR GROUND COOPERATION IN THE WESTERN DESERT

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Abstract: The contest for control of the Mediterranean Basin during the Second World War, with North Africa the central arena of air-ground operations, highlighted the importance of combined-arms warfare. Its advantages became increasingly clear from Italy's declaration of war in June 1940 until the Axis collapse in Tunisia in May 1943. In North Africa, the British proved more adept than their adversaries at combined-arms warfare. This occurred both in spite of and because of early German victories. Pushed back on their heels, the British had to learn or lose. Despite inevitable inter-Service rivalries, British soldiers and airmen in North Africa worked together exceptionally well. Ultimately, this increasingly close cooperation allowed them to outfight the Axis in the air-ground arena. The vital lessons they learned carried forward into Italy, France, and Germany.

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INTRODUCTION

The contest for control of the Mediterranean Basin during the Second World War, with North Africa the central arena of ground-air operations, highlighted the importance of combined-arms warfare across air, land, and sea domains, and the absolute necessity of coordinating the three. The advantage of effective combined-arms warfare became increasingly clear from Italy's declaration of war in June 1940 until the Axis collapse in Tunisia in May 1943. In North Africa, the British ultimately proved more adept than their Axis adversaries at combined-arms warfare. This occurred both in spite of and because of early German victories and Allied defeats. Pushed back on their heels, the British had to learn or lose. Conversely, the Germans believed, with some justification, that their way of war had proven itself in the conflict's first year. However, the Battle of Britain gave them their first taste of defeat. When the Germans faced the RAF in the Mediterranean, the Luftwaffe again proved unable to prevail. Axis defeat in the air played a direct role in the eventual British victory precisely because it had such profoundly negative impacts on the Axis conduct of both ground and sea operations.[1]

British air-ground cooperation in North Africa developed rapidly beginning with the lessons learned in the defeat of the Italians in Italian East Africa (IEA), continuing through the see-saw campaigns for control of North Africa, and culminating at El Alamein and in Tunisia. Historian Richard Overy and Air Chief Marshal Lord Arthur Tedder, who commanded RAF Middle East (RAFME) for most of the North African campaign, have asserted that British combined-arms efforts ultimately resulted in victory because they treated air power as a key part of a larger, coordinated strategy that involved the C-in-Cs from all three Services. This effort matured steadily, weathered significant challenges from Axis forces, particularly on the ground, and ultimately delivered a victory that had major implications for the conduct of the remainder of the war. While there was inter-Service rivalry, cooperation predominated.[2]

Any study of combined-arms operations in North Africa must be properly situated and discussed within larger contextual realities. The British achieved their policy and military-strategic objectives because they became better than their adversaries at waging combined-arms operations. An increasingly effective ground-air effort *within a given historical, geographical, and grand-strategic context* ultimately brought the Allies a series of victories, and the Axis a series of catastrophes from which, in conjunction with the disasters in Russia, they never recovered.

The North African campaign involved an extraordinary level of interdependence between the Services. Interestingly, while the historical record is full of references to 'supporting air forces,' there are few instances when senior officers referred to the army or navy as 'supporting forces,' even though victory or defeat in North Africa ultimately hinged as much on control of airfields and effective use of land-based air forces as it did on armies

or navies. As Air Marshal John Slessor said during the war, 'The fact is that 'Army Air Support' is really an obsolete term, as is the conception that the Air is a 'supporting arm' just like artillery.'[3] He continued:

> It's not only a question of the Air supporting the Army but of the Army supporting the Air. It is a question of seeing how the Air and the Army...can best collaborate and play into each other's hands—and the Air factor may have a preponderating influence on the whole plan. It may—in fact already has—determined where an attack can be made. And the primary essential principle underlying the whole thing must be the old principle of concentration of decisive force at the decisive time and place—i.e. flexibility...[4]

Similarly, Air Chief Marshal Lord Charles Portal, the RAF's Chief of Air Staff (CAS), felt compelled to state at the 260th Chiefs of Staff (CoS) meeting, the RAF's position regarding command of air forces in the Middle East. 'I am of course aware,' he said, 'that the C.I.G.S.' [Chief of the Imperial General Staff, Field Marshal Sir Alan Brooke's] conception of the correct state of affairs is that the air force should always be subordinate to the Army in any theatre of war in which the Army and Air Force are together engaged. This conception I regret I am quite unable to accept.'[5] Fortunately, most soldiers and airmen in North Africa shared Portal's views.

Any examination of ground-air efforts in North Africa must begin with an assessment of the larger theatre's grand-strategic importance. Because of its geography and climate, combat featured major air activity. Land-based airpower often set the tone and direction of the conflict, although always in conjunction with, and correspondingly dependent upon, land and naval forces. How each of the warring powers employed forces was tied to its grand-strategic views. Unfortunately, most studies mischaracterize the Mediterranean as a subsidiary or irrelevant theatre. This was putatively the result of a misconceived British approach that wasted lives and resources that would have been better spent elsewhere. These arguments fail to account for the fact that North Africa was the only place British ground and air forces could attack the Axis directly to hone their operational skills. Holding and winning in the Mediterranean was important for maintaining the Empire's global logistics network, and for giving the British a place where they could learn to fight and beat the Germans.[6]

The Mediterranean war was a vital part of a larger global conflict that determined the fate of the democratic powers. Douglas Porch says, 'while the Mediterranean was not the *decisive* theatre of the war, it was the *pivotal* theatre, a requirement for Allied success,' one in which the Allies were able 'to acquire fighting skills, audition leaders and staffs, and evolve the technical, operational, tactical, and intelligence systems required to invade Normandy successfully in June 1944.'[7]

Moreover, British defeat in North Africa would have been disastrous. The Axis would have seized enormous oil resources for their use or at least denied them to the Allies; gained passage for U-boats through the Suez Canal to the Indian Ocean; opened a back door into the Soviet Union; gained serious leverage in its efforts to bring Turkey and Spain into the war on the Axis side; and perhaps linked up with the Japanese to destroy the British position in India.[8]

British policymakers viewed the Mediterranean Basin and its surrounding areas as 'a single geo-strategic unit' within which the complex interplay between air, ground, and naval operations would determine success.[9] Churchill insisted that the British would fight to the 'last inch and ounce for Egypt.'[10] He understood that the Mediterranean campaign could not win the war but might well lose it and used this as leverage with Roosevelt for American support. Churchill believed that losing the Suez Canal would be a calamity 'second only to a successful invasion and final conquest' [of the UK].[11] The strategy was to conquer North Africa first, re-open the Mediterranean, and force Italy's surrender.[12] These were never intended to be substitutes for an invasion of the Continent, but rather indispensable preliminaries to shore up Britain's strategic position and weaken the Axis while awaiting American entry into the war.

The Italian conquest of Abyssinia prompted the British to take actions that paid major dividends once the war began. It refocused their attention on the vital importance of the Suez Canal as the 'hinge' in the Empire's commerce. The growth of air routes to India, Singapore, and Australia also depended on a secure Middle East, and it had the added benefit of creating a far-flung network of airbases that proved its worth in the coming contest.[13]

The Commanders-in-Chief (C-in-Cs), Mediterranean and Middle East Theatre of Operations, began addressing key issues including basing requirements, logistics, operational planning, and inter-service cooperation.[14] Given the theatre's contextual realities, ground and air units had to be highly mobile and in close contact. This required a basing infrastructure, supply organizations, salvage and repair capabilities, a dense communications network, and huge numbers of vehicles. The C-in-Cs ultimately met these challenges by developing a field army and a parallel Metropolitan air force in Egypt, and by reaching out to Dominions and colonies within the Empire for supplies. The distance between London and Cairo was too great to allow for other solutions. The C-in-Cs' ensuing focus on logistics, intelligence, and C2 paid enormous dividends.[15]

Axis strategic and military approaches to the theatre were generally unrealistic and ineffective. They lacked a clear strategic vision. Although Hitler and Mussolini sought dominion over the Mediterranean Basin, Hitler's focus on conquering the Soviet Union eclipsed his thinking about the Middle Sea. This contributed to a series of inconsistent, contradictory, and ineffective decisions. The lack of Axis grand-strategic,

military strategic, operational, and combined-arms acumen played a major role in sealing their fate.[16]

The British understood Italian weakness and German predispositions relatively well by 1939. From March 1939, senior RAF officers reorganized RAFME and received Air Ministry approval to expand it in time of war to include all air assets in theatre. Centralized control—a now widely-employed but then still much-debated principle—was in place when Italy declared war. The ability to move air assets rapidly to localities where the Army needed them, and to work together effectively once there, proved vital. Reinforcements began arriving.[17]

To pre-empt Italian raids on targets in Egypt, the C-in-Cs planned to raid Italian airfields immediately to gain air superiority pending the start of a major British ground offensive. They prioritized objectives rather than allowing dissipation of air effort. Since the best way to blunt Italian air attacks was with continuing raids on airfields, RAFME made this its top priority, forming a mobile air stores park (ASP), supply and transport column, railhead-handling unit, and Repair and Salvage Unit (RSU), and building forward landing grounds to facilitate operations.[18]

To maximize effectiveness, Army and RAF headquarters were 'in close proximity.' A senior air staff officer served as liaison to the Army staff. 'It must be appreciated,' the guiding document said, 'that this connecting link between the G.O.C. [General Officer Commanding] Mobile Division and the Advanced Wing Commander is not an ideal organisation, and the Officer Commanding the Wing must take every opportunity of establishing personal contact with the G.O.C. Mobile Division.'[19] Collocation of headquarters thus became the norm well in advance of the start of Operation COMPASS in December 1940.

The Services also improved 'administration,' the process of providing forces with all items required for operations and sustainment. A high degree of ground mobility proved essential in what became a series of military operations designed, in large part, to capture airfields in the Western Desert and operate from them quickly to facilitate the Army's further advance. Airfields were also vital for attacking Axis shipping carrying supplies. The Army provided logistical services, but the RAF had its own maintenance organization including supply, repair, salvage, and transport. Land-based aircraft required a huge infrastructural investment and much lead-time to get into position for combat operations. The C-in-Cs thus built a second depot and established an advanced RSU in the Western Desert.[20]

When Air Chief Marshal Arthur Longmore took command of RAFME on 13 May 1940, he had less than a month of peace remaining to prepare his forces. There were 308 aircraft in theatre. The Regia Aeronautica had over 400 in Egypt and 170 in IEA, although their

organizational seams and logistical woes soon became apparent. Longmore received Hurricanes and Blenheim IV's to even the odds. He and the other C-in-Cs decided that major air operations would begin only when reconnaissance and intelligence made clear the Italians were preparing to do so. Then, RAFME would pre-empt to gain air superiority.[21]

The Italians declared war effective one minute after midnight on 11 June 1940. British commanders struck immediately. Bombing of airfields in IEA was particularly successful. Longmore knew he had to keep the Regia Aeronautica on the defensive. Italian raids were small and ineffective. British soldiers and airmen in Egypt used the desert to their advantage, operating far from the coastal road and building multiple landing grounds. The Italians stuck to roads and outposts, and used existing airfields, providing excellent targets.[22]

In a review of military strategy three months into the war with Italy, and despite their successes in the air to date, the C-in-Cs emphasized that

> [T]he Italian (possibly supplemented by German) air forces are likely to constitute the greatest threat not only to Egypt itself but also the Naval base at Alexandria and in certain circumstances to the military forces, and, therefore, *their neutralization is to be regarded in principle as of primary importance.* On the other hand, direct support for the land and naval forces may from time to time and for limited periods have prior claim on our air efforts.[23]

They stuck to this, with RAFME maintaining air superiority almost constantly. The Services worked closely to fulfil the C-in-Cs' guidance. Air superiority was the enabler; effective combined-arms operations were the ultimate focus. This effort began in IEA and reached maturity in the Western Desert.

Italy's unpreparedness to face a long war was especially evident in IEA. It was isolated, and the supply situation became disastrous after concerted RAF attacks. The destruction of aircraft and supplies began immediately on 11 June, rendering the Regia Aeronautica combat-ineffective within a month and depriving Italian ground units of air support. The RAF quickly gained air superiority, secured passage of merchant vessels through the Red Sea, and provided direct support to ground units. Ground and air commanders co-located their headquarters. The C-in-Cs had insisted on this. Victory in IEA ensured that the Empire's last remaining Sea Line of Communication (SLOC) for reaching Egypt—the Gulf of Aden and Red Sea—stayed open. The aggressive British bid for air superiority, and joint operations facilitated by joint headquarters, became the norm in the Western Desert.[24]

As the campaign in IEA unfolded, the C-in-Cs planned for coordinated operations further north. They expected hostilities across much of the Mediterranean Basin, requiring a

well-orchestrated effort centred on Egypt. The most fundamental problem was logistics. As the British developed the infrastructure required to support a *de facto* parallel RAF, field Army, and fleet, Wavell sought help from the Eastern Group Central Provision Office in New Delhi, which coordinated the shipment of war materiel from various colonies and Dominions to the Middle East. This brought a centralized logistics capability to maturity. Wavell emphasized RAFME's need for new aircraft models to hold air superiority, attack Italian logistics, and set conditions for the ground phase of Operation COMPASS. Air and ground reinforcements soon began arriving.[25]

The C-in-Cs' efforts ensured that RAFME and the Western Desert Force became highly capable and interoperable. The ability to keep them in being, despite heavy diversions and losses to come, relied on steady deliveries of vehicles and aircraft from overseas, and the support provided by supply, maintenance, and repair organizations in the Nile Delta. These processes improved rapidly once Air Marshal Arthur Tedder took command of RAFME in June 1941 with Air Vice-Marshal Graham Dawson as Chief Maintenance and Supply Officer, and when General Claude Auchinleck took command from Wavell in July 1941.[26]

Air Marshal Sir Arthur Tedder.

The keys to successful combined-arms operations were rapid movement and resupply. This required the speedy construction of landing grounds to which squadrons could 'leapfrog' forward or back as fortunes on the ground dictated. Rapid ground mobility allowed air units to stay in the fight alongside ground troops, helping them to exploit successes and shielding them from pursuit and encirclement after defeats. The RAF enablers here were RSUs, which supplied new aircraft, repaired damaged ones, and rebuilt salvaged ones. Aircraft Maintenance Units (AMUs) also increased in number and capabilities.[27]

When Mussolini ordered the Italian advance into Egypt on 9 September 1940, the C-in-Cs were ready. Italian airmen were to attack airfields, supply points, command posts, and then troop formations and vehicles. Heavy air action began on 13 September. The RAF pre-empted by attacking airfields and supply convoys while Italian bombers reciprocated but with little effect. The Italians made no concerted effort to gain air superiority, operating mostly as flying artillery for ground commanders. Conversely, the RAF gained air superiority and then devoted 60 sorties a day in round-the-clock attacks on Graziani's supply lines, going after trucks to create a logistical crisis. The dense network of RAF airfields constructed in 1939-1940 allowed aircraft to maximize sorties.[28]

The RAF soon turned from stopping the Italian advance to raiding airfields and logistics even more intensively in advance of Operation COMPASS, which was designed

to eject the Italians from Egypt and exploit further opportunities. The RAF deployed 1,200 airmen to provide rapid maintenance and repair, and a quick return of repaired aircraft to forward airfields. Longmore also received a new Deputy AOC-in-C, Tedder, just in time for Operation COMPASS. Tedder proved to be one of the outstanding senior officers of the war. Longmore gave Tedder command of air operations while he coordinated policy, military-strategic, and administrative issues with other C-in-Cs and the Air Ministry.[29]

The air phase of Operation COMPASS began with a deception scheme that habituated the Italians to a 'standard' pattern. Just before the ground attack, major raids on airfields rendered remaining Italian aircraft ineffective. A vital, if nascent, Army/Air Component stood up under General Officer Commanding WDF, General Sir Richard O'Connor. O'Connor and Air Commodore Raymond Collishaw (Air Vice-Marshal Arthur Coningham's predecessor as Commander of what became the Western Desert Air Force, or WDAF), and their staffs, were collocated at HQ Western Desert Force (HQ WDF). O'Connor also controlled an Army Cooperation Wing with two squadrons of fighters and a flight of reconnaissance aircraft. These innovations were the first step toward the Tactical Air Force (TAF) that became the norm in the RAF and USAAF.[30]

Having gained air superiority, the RAF inflicted severe losses on supply columns, halting the Italian advance. Italian soldiers arriving at Sidi Barrani were shaken and malnourished. Graziani tried to stockpile supplies, but RAF raids destroyed so many trucks that deliveries slowed to a trickle. Bombers raided Tobruk, closing the port and forcing the Italians to move troops, equipment, and supplies from Benghazi, which wore out their vehicles. During Operation COMPASS, advancing troops found 32 ships sunk at Tobruk and smaller ports. They also overran 1,100 aircraft and over 1,000 trucks destroyed or damaged by air attacks. The RAF set conditions for success in the ground phase of COMPASS by neutralizing the Regia Aeronautica and creating a supply crisis for the Italian Army.[31]

A final round of intensive airfield attacks began on 7 December, followed by more raids on ports, supply points, and troop concentrations. Night bombing proved particularly valuable since the Italians had no countermeasures and aircrews became skilled at bombing ports using their distinctive visual cues. Within a week, Italian air operations had largely ceased. As soon as troops advanced on 10 December, moving squadrons forward became challenging given the precipitous Italian retreat. 'Leapfrogging' techniques—also known as 'bounding'—were not yet mature, although RAF units were motorized, allowing for rapid movement. RAF logisticians and Army Royal Engineers mastered the rapid construction of forward landing fields. They also brought forward an ASP, RSU, and Air Explosives and Fuel Park (AEFP). Rapid airfield mobility emerged with the introduction of these units. RAFME was able to move with the Army.[32]

Operation COMPASS was an effective combined-arms operation. The Army moved into position as the RAF bombed troops and went after airfields. The navy bombarded enemy positions, causing enormous damage. Initial successes prompted commanders to advance into Libya. The attack on Bardia, from 3 to 4 January 1941, was an effective joint operation, with the RAF providing photo reconnaissance, bombing enemy strong points, and maintaining a bomb 'curtain' in front of advancing troops. The Italians lost 45,000 men captured along with tanks, artillery, and vehicles. They had lost over 20,000 men previously and fled toward Tobruk.[33]

The assault on Tobruk involved a coordinated air, naval, and artillery bombardment of airfields and key defensive positions. When troops encountered strong points, bombers attacked. Tobruk fell on 22 January, the harbour began receiving shipping on 24 January, and the Army had a secure supply base from which to continue advancing. Another 20,000 Italians became prisoners. The C-in-Cs followed up each successive victory. Fuel and munitions came by truck over the Via Balbia, allowing effective ground-air operations to continue.[34]

Despite logistical challenges, the C-in-Cs decided to capture Benghazi. This would alleviate growing logistical challenges and facilitate bombing raids on Tripoli, Sicily, and southern Italy. Air operations from Benghazi would also combine with those from Malta to put enemy shipping in a vice. Benghazi fell on 7 February after O'Connor's victory at Beda Fomm, which bagged the rest of the Italian Army in Cyrenaica. Yet just as British victory in the desert appeared possible, events in Greece pulled ever more assets away. By 25 February Collishaw's command had 64 aircraft, and a most unwelcome new arrival appeared: The Luftwaffe. German air operations grew rapidly in scope. Luftwaffe raids closed Benghazi, exacerbating their logistical problems.[35]

Even as Luftwaffe units arrived, the RAF remained a 'learning organization.' To maximize air-ground cooperation, Air Liaison Sections became active at Army corps and division levels. These units represented the first dedicated effort to coordinate all aspects of ground-air operations. The Lysander, a slow reconnaissance aircraft associated with these efforts, was vulnerable, but with Hurricane escorts it provided superb reconnaissance and artillery spotting.[36]

'Informal reconnaissance,' which yielded information on enemy forces provided by aircrews after missions, proved important as the joint staffs learned to incorporate intelligence into plans and operations. Intelligence officers debriefed aircrews while communications specialists relayed intelligence to headquarters. However, despite the rapidly growing need for photo reconnaissance and photo interpretation, there was only one Hurricane equipped with cameras and a small section to develop, annotate, and distribute prints. Desert terrain required multiple passes to find troop concentrations and give photo interpreters enough prints to produce charts to help soldiers find and

engage these forces. In January 1941, photo reconnaissance aircraft brought back 980 negatives, from which photo interpreters made 15,500 prints—a diminutive effort by later standards but an important first step.[37]

Despite major improvements, air-ground cooperation remained imperfect. Collishaw ordered several attacks on troop concentrations without coordination at Army HQ, resulting in an ineffective employment of air assets during mobile phases of the ground battle—a problem the Services did not fix until summer 1942. Equally troubling was the difficulty telling friend from foe. Army and RAF liaison officers were just beginning to receive communications gear for vectoring aircraft to target, and to develop ground markers to point aircraft to their targets. The beginnings of a permanent solution awaited the advent of Air Support Controls, or ASCs, during Operation CRUSADER nearly a year later.[38]

Regardless of these problems, air reconnaissance gave O'Connor the insights he needed to win at Beda Fomm. The entire campaign lasted 10 weeks. The Regia Aeronautica made no appreciable impact. By 15 February 1941, Italian Army losses totalled 130,000 POWs, 380 tanks, and 845 guns. After that, the Italians requested German military assistance. On 27 November, Hitler ordered *Fliegerkorps X* forward but wanted them back by February—one month away. Evidently, he expected quite a bit from this unit in such a short period. It had orders to close the Mediterranean to British shipping, neutralize Malta, protect the transport of the *Afrika Korps* along with reinforcement and resupply convoys to Tripoli, and raid shipping in the Suez Canal. German airmen fought a determined campaign for over two years, but their leadership's failure to employ air assets effectively as part of a combined-arms effort hamstrung efforts to gain air superiority and thus help Erwin Rommel win.[39]

Hitler's Directive No. 22 of 11 January 1941 said German assistance was vital 'for strategic, political, and psychological reasons.'[40] A blocking detachment deployed to hold Tripolitania while Luftwaffe units attacked the British fleet, disrupted SLOCs, and interdicted British troop movements. Rommel arrived in Tripoli on the 12th. The *Afrika Korps* was at the front within days. Of 220,000 tons of cargo sent to Libya in February and March 1941, 90 percent arrived as German aircraft attacked Malta and closed the SLOCs. Despite heavy losses over England, the Luftwaffe was still a formidable instrument, as its raids quickly proved. Nonetheless, it became involved in a new theatre of war at a moment when it was at its weakest point since September 1939 and with Operation BARBAROSSA on the horizon. German airmen laboured under the exigencies imposed by this three-front air war, the often incapable senior leadership directing it, and a marginally effective ground-air coordination effort in North Africa.[41]

Fliegerführer Afrika became active on 20 February with *General der Flieger* Stephan Fröhlich arriving on 1 March. Göring ordered Fröhlich to 'direct and commit the elements

of the German Air Force employed in the African theatre of war—such as flying and antiaircraft units—*in a manner that will guarantee maximum support of the Army units employed in that area*.'[42] The initial objective was for the Luftwaffe to go after the RAF and Benghazi while covering Rommel's forces. However, subsequent directives changed the focus to control of the SLOCs and destruction of British warships. These conflicting priorities pulled *Fliegerkorps X* and *Fliegerführer Afrika* in multiple directions. The two units failed to give one another, or the ground and maritime efforts, the full range of support required to prevail in the theatre.[43]

However, things went well initially as veteran soldiers and aircrews went after a tired and ill-supplied adversary at his culminating point. Luftwaffe reconnaissance aircraft let Rommel know how dispersed British formations were. Air attacks began on 14 February. Once British forces retreated, Luftwaffe units could not keep up with *Afrika Korps* because they had insufficient vehicles to 'leapfrog.' Heavy RAF attacks slowed *Afrika Korps*' advance. Incomprehensibly, raids on RAF airfields, which at that point were highly vulnerable, remained minor. Conversely, RAFME planes constantly raided Luftwaffe airfields. This took its toll on aircraft and personnel. The gradual wearing-away of men and machines was a crucial factor in determining the course of events.[44]

Rommel's efforts to seize Tobruk from 9 to 30 April drained Luftwaffe assets. Me. 109s flying close escort lost their advantages. During Rommel's initial efforts to take the port the Luftwaffe was bringing forward its aircraft and could not provide support. This was due to vehicle shortages created by German Armed Forces High Command (Oberkommando der Wehrmacht (OKW)) requisitions for Barbarossa, and to Rommel's purloining of others. The Tobruk air effort marked another requirement in a war where *Fliegerkorps X* had already been moved to Greece and its remaining assets in the central Mediterranean, along with those of *Fliegerführer Afrika*, were at the limits of their endurance. It was the culmination of the Luftwaffe's first and initially successful intervention, underscoring problems with C2 and the movement of air units over long distances. Failure to gain air superiority when the RAF was at its weakest was a colossal error. Luftwaffe dispersion of effort, logistical problems, and command deficiencies, and Rommel's actions, were already hampering the ability to capitalize on *Afrika Korps* victories.[45]

It became increasingly clear that Rommel could not exploit tactical and operational successes to achieve strategic ones. Conversely, the British Army could not defeat Rommel or survive his counterattacks without RAF air superiority. The seesaw battles that ensued were emblematic of these basic realities. The side that learned more quickly and was better able to address logistical requirements would have an advantage. Tedder resolved to keep his aircraft concentrated and focused on air superiority. He observed that effective German combined-arms operations in Greece, a product of air supremacy, had facilitated a rapid victory.[46]

Tedder thus ordered his units to raid airfields often. His great worry was that Luftwaffe fighters would launch a 'real blitz' against RAF units. Tedder thus made them highly mobile, dispersing them widely and procuring additional mobile radar sets. Only fighters ready to scramble stayed at airfields. The rest went to dispersal sites. His advanced HQ brought together intelligence, logistics, plans, and operations specialists along with Army liaison officers. It remained collocated with HQ WDF (renamed Eighth Army on 24 September 1941).[47]

Tedder's innovations after Operation COMPASS included the creation of an Advanced Wing comprised of one fighter and four bomber squadrons that gave direct support to troops and cooperated closely with HQ WDF. He also established Air Headquarters (AHQ) Western Desert in June 1941 under Air Vice-Marshal Arthur Coningham (replacing Collishaw's No. 204 Group). Implementation of Tactical (AHQ Western Desert—the WDAF), Strategic (No. 205 Group), and Coastal (No. 201 Naval Cooperation Group) components of RAFME in October 1941 made RAFME more effective. Self-contained mobile wings allowed fighter squadrons to keep pace with ground formations. Rapid salvage and repair, and mobile field units evolved. No. 253 Army Co-operation Wing also stood up to maximize air-ground coordination. The Air Support Control (ASC) Organization that emerged greatly improved joint operations.[48]

Two key elements in this increasing combined-arms effort were intelligence and communications. The British had a holistic view of intelligence as a vital asset at all levels of war, and held an ace with Ultra. It was a force-multiplier, particularly in North Africa where long-haul communications went by wireless transmission. Ultra was the most important source of strategic intelligence, helping commanders to understand the pivotal importance of logistics. However, it lacked the detail required to plan operations. Dissemination of intelligence also improved, although messages marked 'Most Immediate' took up to 12 hours to get to commanders until late 1941. Poor signals discipline contributed to this problem, as messages flooded in with no prioritization and too few trained operators to process them. An early innovation designed to correct this placed small Army units, known as Air Intelligence Liaisons (AIL), with reconnaissance and fighter squadrons. They worked with aircrews to maximize intelligence collection and dissemination. A relatively sophisticated communications network connected each squadron directly to the division or corps headquarters with which it worked. Despite growing pains, the combination of effective intelligence and a rapidly improving C2 network became key building blocks of the air-ground team.[49]

In the communications arena, RAFME Chief Signal Officer (CSO), Group Captain William Mann, found capabilities in theatre barely adequate despite the fact that it had highest priority for delivery of communications personnel and equipment. The War Office agreed to send him 4,000 communications specialists. A three-man Operations Research Section analysed the signals system in detail, leading to more effective communications

networks. Mann also worked tirelessly to bring VHF communications into theatre for improving ground-air cooperation. Fighter units received 75 VHF sets for tactical communications and reconnaissance. Over 400 mobile VHF vehicles arrived at Army formations to facilitate communication with VHF-equipped aircraft. All sector headquarters and flying squadrons had these capabilities by summer 1942. Finally, wireless observer units with special vehicles began reporting on enemy aircraft activity using the latest height-finding/direction-finding, air-intercept, and ground-controlled-intercept radar.[50]

As British air-ground cooperation improved, Rommel's forces tried to advance further despite heavy air attacks. Blenheims began the process. Pairs of fighter-bombers then attacked from the rear, at very low altitude, out of the sun. Once additional fighter-bombers became available in summer 1941, two entire squadrons made these attacks. With Eighth Army badly attrited, the RAF had to halt Rommel's advance. His supply convoys could not endure the constant raids and dispersed.[51]

The Luftwaffe then concentrated its fighters over Tobruk in a defensive role to keep the RAF from attacking Rommel's vehicle convoys, or in fighter sweeps that were predictable and easy to avoid. There were not enough fighters to fly sweeps and standing patrols everywhere, or enough ground radar sets, so commanders adopted an air observation system that scrambled fighters only when they received sighting reports, making the process reactive. This defensive posture wasted resources and squandered opportunities to defeat the RAF.[52]

The RAF also denied Axis forces the use of Benghazi, as the Luftwaffe had done to British forces. Blenheims and Wellingtons attacked virtually every day and night. Most supplies thus came from Tripoli—a 1,000-mile journey. This was difficult due to vehicle shortages after Italian defeats; the amount of fuel these convoys used; wear-and-tear on trucks; and RAF attacks. Captured Axis airmen said their aircraft were constantly short of fuel as a result of targeted raids on the vehicles, transport aircraft, and ships carrying it.[53]

On 18 April, *General der Flieger* Hoffman von Waldau, Luftwaffe High Command Chief of Staff, visited Luftwaffe units to assess the state of affairs. He did not like what he found. His biggest concern was the RAF's air superiority. Waldau called for additional Me. 109s but none arrived. Further, he emphasized the exhaustion brought on by excessive mission types and operations tempo. Supply and maintenance problems were serious as was the shortage of airfield-construction units. Rommel had taken most of the Luftwaffe's trucks and Flak, making it even less capable of 'leapfrogging,' and leaving its airfields extremely vulnerable.[54]

With Rommel's first offensive over, the C-in-Cs sought to regain the initiative. The operations intended to do so - Operations BREVITY and BATTLEAXE - failed but

reinforced critical lessons. For instance, Tedder detected serious weaknesses in Luftwaffe's employment of the Stuka without air superiority, and in its effectiveness as an attack platform in desert soil types. He concluded that RAF fighter-bombers and light bombers, and not any sort of dive bomber, should continue to have the ground-attack role. Soldiers reported that Stuka attacks did negligible damage. Conversely, low-flying Me. 109s were a menace, killing and wounding troops and destroying vehicles. 'We hated them,' one soldier said. Yet the Germans rarely used fighter-bombers.[55]

Operations BREVITY and BATTLEAXE also marked the Army leadership's last bid to exercise control of air units. This had become increasingly rare as most soldiers and airmen realized that working together and allowing each service to control its own assets maximized aggregate effectiveness. Nonetheless, General Allen Brooke, Chief of the Imperial General Staff, tried once more. Wavell supported this—one of several reasons Churchill fired him. Portal's staff calculated that meeting stated Army requirements for a specialized ground-support force would require 98 squadrons. Tedder had 44.5 in theatre. Churchill came to the RAF's rescue in a roundabout way, asking Wavell why he had not mentioned the RAF in his plans and wondering whether his staff was working with Tedder's, and telling him to concentrate on joint operations. This ended the last significant Army effort to control air assets. Wavell's successor, Auchinleck, championed co-equal ground-air efforts.[56]

During Operation BREVITY (15-16 May 1941) and Operation BATTLEAXE (15-17 June) the RAF raided airfields and vehicle convoys. However, soldiers and airmen were not yet entirely in step. Army commanders requested that fighters establish defensive patrols over advancing troops, with medium bombers on call. Tedder agreed against his better judgment, quickly reconfirming that employing air assets in this way constrained their flexibility, split them into small packets, and kept bombers grounded too often. Operation BATTLEAXE failed in the face of excellent German anti-tank tactics. Wavell blamed the RAF, prompting Portal to ask Tedder whether there was any truth to Wavell's claim that 'we never had air superiority,' and that the RAF did not provide direct support. Tedder said there was not and sent Portal a series of signals proving Wavell's claims groundless. However, he emphasized that both Services had problems, saying it was 'Increasingly clear that crux of whole problem is communications.'[57] Portal sent 16 Air Control Officers to fly special communications-liaison aircraft that facilitated direct-support missions.

Churchill's decision to replace Wavell with Auchinleck did much to fix combined-arms shortcomings. The lull in operations during summer 1941 proved a crucial time for air-ground cooperation. Auchinleck and Tedder directed a series of major joint exercises to improve communications and coordination, calls for air support, and aircraft and munitions usage in different situations. They also formed an inter-Service committee to improve combined-arms operations by developing Army Training Instruction No. 6,

which set forth training and skills requirements for tactical communications. New Army Air Support Controls (AASCs) would select battlefield targets and call for attacks on them along with assistance from collocated RAF Air Support Controls (ASCs).[58]

The new air-ground cooperation system that followed was a major improvement but nowhere near mature. Teething problems included a lag time of three hours from a request for air support to arrival of aircraft over target, delays in routing messages through ASCs, and difficulties finding targets. The RAF and Army solved these problems by summer 1942, but providing effective air support during mobile phases of the battle remained problematic.[59]

The Services had to cooperate closely to win given Rommel's tactical and operational acumen. Without air superiority and air support, the Army would have trouble advancing. Without an Army advance, the RAF could not occupy airfields in the Cyrenaican Hump—a requirement for giving RAF units the range to support a further Army advance, reach Axis ports, and engage in joint anti-shipping missions with the Royal Navy. The first instance of a ground-air liaison team was an Air Liaison Section (ALS), comprised of a group captain and a squadron leader, at HQ WDF.[60]

Each corps and armoured division received a highly mobile ASC comprised of a joint-service staff with an advanced wireless communications capability known as a tentacle, which linked the ASC to each brigade. An RAF support team known as the Forward Air Support Link (FASL) also worked at each brigade headquarters and had two-way radios for talking with aircraft engaged in support missions. Rear Air Support Links (RASLs) completed the picture, connecting advanced airfields and landing grounds with ASC headquarters. The RASLs and air staff at advanced headquarters had radios to monitor reconnaissance aircraft communications with the FASLs. Air support gradually became more rapid and lethal, with armed tactical reconnaissance aircraft and brigade commanders using tentacles to guide airstrikes. Whenever an ASC commander validated a request, his staff told the RASL at a given landing field to launch aircraft. Aircraft received directions to the target with pre-planned coordinates, from a reconnaissance aircraft, or by FASL guidance. Key ground features defined bomb-lines, while flares and Verey lights helped pilots distinguish friend from foe. The first two ASCs became operational on 8 October—six weeks before Operation CRUSADER. Despite missteps and modifications, this system ultimately resulted in an effective combined-arms capability.[61]

One crucial result of this effort was 'Middle East Training Pamphlet No. 3—Close Air Support,' released in September 1941, which set clear guidelines for air-ground cooperation. The most important change was the increase in tentacles within each AASC from 7 to 9—one for every division and brigade headquarters. AASCs processed requests for air support from reconnaissance aircraft and forward Army units through

the tentacles. At least one formation of six aircraft in each squadron was at 'instant' readiness, with others at two-hour readiness.[62]

Meanwhile, Air Commodore Sir Basil Embry, who Portal had sent at Tedder's request to teach aircrews the latest fighter tactics, determined that an elite team of German fighter pilots was hammering RAFME. Tedder was impressed with Embry's tactics and requested the loan of seasoned commanders and pilots from the UK to implement them. Portal sent 105 pilots.[63] Once Operation CRUSADER began, Tedder said, 'Our chaps have for the time being knocked the enemy right out of the air. I had a few seconds to talk...with Basil Embry this evening. Said things were very satisfactory, but the Hun won't fly—they can't take it.'[64] Eighth Army Commander, General Neil Ritchie, said the air situation was 'like France, only the other way round.'[65]

As British ground-air cooperation improved, Axis efforts lagged. Their C2 capabilities were deficient. This was clearly the case with Rommel and Fröhlich. On 4 July 1941, Rommel complained that while *Afrika Korps* headquarters was at Bardia, *Fliegerführer Afrika's* headquarters and airfields were in Derna—150 miles away. Consequently, Rommel said, 'Owing to this wide separation and the long approach flights which consequently must be made, there is no longer any guarantee of close co-operation, quick support for the Africa Corps' ground operations and secure and close communication between the two headquarters. In addition to the wireless there is a telephone connection to Derna, but the line is impossible...Repeated requests to move up his formations were rejected by the Fliegerführer.'[66] Fröhlich based these refusals on logistical and supply difficulties, limited mobility, and inadequate Flak—problems Rommel had helped to create. The Luftwaffe remained incapable of 'leapfrogging' with the Army.

These problems paled in comparison to the tangled Italo-German C2 structure. An agreement between Axis air forces called for close cooperation but did not compel it. The *ad hoc* division of labour hampered unity of action. Reconnaissance aircraft were not under unified command. Photo intelligence was to be passed immediately to all interested headquarters, but there was no means for ascertaining which ones were interested because air-reconnaissance request and tasking processes were fractured. Germans flew the most dangerous missions, suffering the highest losses. There was no combined staff—just a collection of liaisons who rarely de-conflicted operations. Axis air forces fought parallel air campaigns, further hampering ground-air coordination.[67]

As both sides struggled to rebuild and pre-empt with a major offensive, Auchinleck and Tedder visited London in July 1941. All participants in their high-level meetings agreed the WDAF needed more aircraft, and more modern types, to maintain air superiority and support ground forces. All the Middle East C-in-Cs supported this increase in air assets. Churchill supported Portal and Tedder, and Tedder found a kindred spirit in his new operational commander, Air Vice-Marshal Arthur Coningham.[68]

Coningham began his tenure as Commander of WDAF by improving tactics. Tedder helped by restructuring flying wings, and giving them organic maintenance and logistics organizations. These improvements were in place by the start of CRUSADER in November. Greater flexibility and mobility followed. Coningham also oversaw the air aspects of the major joint exercises both Services agreed were necessary. He served on the inter-service committee Auchinleck and Tedder stood up to study air support for the Army, and was a key drafter of 'Middle East Training Pamphlet (Army and Royal Air Force) No. 3 – Direct Air Support.'[69]

Coningham's efforts paid off as Tedder saw his pilots moving from a 'village cricket' to a 'test-match' level of ground-air cooperation. Coningham followed Tedder's guidance to 'get together' with Army commanders. Doing so was of 'fundamental importance and had a direct bearing on the combined fighting of the two Services until the end of the war.'[70] During joint exercises with the Army, wing headquarters 'leapfrogged' each other to ensure effective C2 of forward assets. Each squadron developed three specialized parties for rapid mobility, including advanced refuelling and maintenance teams that moved with maximum speed to advanced landing fields, and a party that remained at the primary airfield with the squadron's workshops and logistical assets. Army Royal Engineers built advanced landing grounds. Tedder worked with Dawson to ensure units had organic repair, salvage, logistics, and supply capabilities.[71]

The air component of CRUSADER began nearly five weeks before ground forces attacked on 18 November 1941. Reconnaissance; concerted raids on airfields, SLOCs, and vehicle supply routes; and attacks on German reconnaissance flights began in force. The new Strategic Reconnaissance Unit conducted long-range, high-altitude collection flights with Spitfire and Mosquito photo reconnaissance aircraft arriving from the UK; the Photographic Reconnaissance Unit focused on specific points closer to the battle area; and the Survey Flight worked with the Army to provide photos for mapping. A sophisticated photo interpretation and analysis capability made full use of the much-increased number of aerial photographs.[72]

Despite the arrival of the Me. 109F, Tedder was confident the RAF would control the air. As the air effort began, RAF aircrews concentrated on Axis airfields. RAF operations from 14 October to 17 November consisted of 3,000 sorties and did significant damage to Axis logistics. On 17 November, the day before ground operations began, Tedder wired Portal that 'Squadrons are at full strength, aircraft and crews, with reserve aircraft, and the whole force is on its toes.' He wished his forces 'Good hunting.'[73]

Meanwhile, Hitler again changed his mind and decided to make a bid for primacy in the theatre. Führer Directive No. 38 of 2 December 1941 ordered *Luftflotte 2* to deploy from Russia under the command of *Generalfeldmarschall* Albert Kesselring as C-in-C South. His tasks were to establish naval and air superiority by neutralizing Malta, and to help

ground forces in North Africa secure a decisive victory. In theory, Kesselring commanded all Axis air assets and could give orders to naval forces. In reality, the Italians resisted combined operations, and Rommel undermined Kesselring with direct appeals to Hitler. Stunningly, Fröhlich was subordinate to *Fliegerkorps X* in Greece. This and other seams in the Luftwaffe command structure left nearly half the aircraft in theatre sitting partially idle under *Fliegerkorps X* control while those in *Fliegerführer Afrika* fought tooth and nail.[74]

Eighth Army went forward on 18 November 1941, with twenty fighter and thirteen bomber squadrons in direct support. Attacks on airfields and supply convoys intensified after 18 November. The Axis response was initially ineffectual. Kesselring was visiting Rommel's headquarters and succeeded in obtaining air-transport units to fly in fuel. *Fliegerkorps X* sent reinforcements on 21 November, bringing Frölich's strength to about 300 aircraft. Kesselring assigned an officer to revitalize the supply system, but logistical problems transcended the Luftwaffe. Heavy shipping losses reduced supply deliveries, as did RAFME raids. Heavy fighting consumed the rest, compelling Rommel to abandon the siege of Tobruk, the Sollum Line, and then all of Cyrenaica.[75]

RAF airfield parties and Army Royal Engineers kept up with Eighth Army's pursuit, repairing the Gazala airfields in two days under artillery fire and bringing in 10,000 gallons of aviation fuel *in advance* of Eighth Army's forward units. They repeated this during the move to Mechili, moving 15,000 gallons of fuel and receiving another 60,000 gallons from Army motor-transport companies. Then they moved to Msus with another 10,000 gallons of fuel. Here, landing parties built two 1,500 foot runways with dispersal points, and 11 squadrons flew in. Agility, improvisation, and risk-taking underpinned these successes.[76]

On 7 December 1941, the day the war in the Pacific began, Tedder noted that Rommel was putting up fierce resistance. The RAF held the upper hand in the air, but it was a constant struggle. Tedder felt that despite Rommel's tactical advantages, heavy attacks on vehicle convoys, especially those carrying fuel and ammunition, would cause the enemy to break. Air superiority facilitated Eighth Army's situational awareness and responsiveness to Rommel's counterattacks. From 10 to 13 December, Rommel's forces were nearly encircled at Gazala, yet the Army did not close the trap, and RAF bombers sat idle due to problems telling friend from foe. Rommel withdrew to El Agheila on 24 December under constant air attack as the British occupied Benghazi and Sollum. With both sides exhausted, the front stabilized.[77]

British inter-Service liaison continued to improve during Operation CRUSADER. At GHQ, an Inter-Service Intelligence Staff Conference and an Inter-Service Operational Staff Conference met daily to exchange information and funnel it to the C-in-Cs and field headquarters. ALOs and their Army counterparts received special training to maximize

coordination. Both Services placed a premium on clear and timely joint communications. Wings notified HQ WDAF of aircraft available for commitment to direct-support sorties, allowing Coningham to assign aircraft rapidly as requests arrived.[78]

However, signals from headquarters to flying units still took up to 20 minutes to arrive. Army formations requesting strike missions often did not receive confirmation that they were en route, and if the aircraft found their targets and the units they were supporting, the latter lacked an identification system visible from the air. Pilots were often unable to complete their missions. To solve this problem, AASC tentacle units used 15-foot white cloth arrows to point toward the target, with bars on the arrow indicating distance to target. Army units painted white Saint George's crosses on a black background on the top portions of all their vehicles. They soon replaced these with RAF roundels. An RAF/Army instruction on recognition methods directed that aircraft inbound on direct-support missions fire white illuminating flare cartridges. Troops responded with a smoke bomb or canister, a large 'T' ground strip, and a 'V' sign pointed at enemy troops. However, the friction involved in such operations made good solutions elusive. Fratricide remained a problem, and the communications bottleneck continued restricting the flow of orders and air-support requests.[79]

In addition to making direct support difficult, unrealistic bomb-lines created C2 problems. Army commanders often knew less about the position of their own forces than did the RAF with its advantage of altitude. This resulted in the conservative placement of bomb-lines. RAF senior officers and pilots fumed about this but did not understand fully how chaotic the ground situation was, and how difficult it was for troops in combat to provide exact positions, much less take time to deploy ground markers. Finally, sound joint planning depended on clear processes, and there were few until summer 1942 for coordinating bomb-lines. The bomb-line was 50 miles from friendly troops, giving Axis convoys within it relative immunity.[80]

Despite these challenges, the RAF's handiwork quickly became clear. At Derna, Berka, and Benina airfields, the Allies found 172 Axis aircraft abandoned. Aircraft losses due to airfield raids and a shortage of spare parts proved disastrous for the Luftwaffe and Regia Aeronautica. Tedder visited Derna and Benina on 21-22 January. 'Derna,' he said was,

> an extraordinary sight, littered with aircraft, mostly Hun, in all stages of repair and disrepair! Some, obviously deliberately 'demolished,' others equally obviously knocked out by our bombing and low shoot-ups...Benina even more of a sight than Derna. Hun aircraft everywhere.[81]

During Operation CRUSADER, the Army captured 450 aircraft in various states of repair, 250 of which were German. Axis aircraft losses totalled nearly 800.[82]

Aside from detailing the damage RAF assets did to Axis logistics during Operation CRUSADER, German POWs, diaries, and other sources made clear the pain and demoralization they caused troops. Captured intelligence summaries emphasized WDAF air superiority, making air reconnaissance dangerous. Air attacks on ports and airfields in Cyrenaica were particularly painful. Fighters also took a toll on air-transport flights bringing in aviation fuel. By 22 December, Me. 109s were nearly grounded. Transport pilots delivered enough to keep them flying, while Luftwaffe reinforcements facilitated increasingly serious attacks on British troops.[83]

As Operation CRUSADER ground to a halt, more Luftwaffe units arrived. Renewed German strength began to tell. Tedder pushed his staff to be ready for Operation ACROBAT, designed to drive Axis forces across Tripolitania and, if possible, out of North Africa. However, as supply lines lengthened, fighting units wore down, and diversions to the Far East continued, prospects dimmed. The Germans had gained local air superiority and were using Me. 109Fs to strafe ground forces. For the first time, the RAF could not keep them away from Army units.

Operation CRUSADER was a victory, if a hard-fought and incomplete one. The RAF and Army were learning to work together but were exhausted by the hard fighting and the long advance. As Rommel recouped his losses from convoys steaming into Tripoli, he planned a counterattack. His logistical situation improved as Kesselring gained control of the SLOCs. Intelligence reports confirmed the British were disorganized, spread out, and tired. Rommel realized that he had to act while the British were weak.[84]

The German counteroffensive began on 21 January 1942. Rommel destroyed several British units, and Panzer units advanced so quickly that they captured 25 aircraft and destroyed another 10 on the ground. This drove Coningham and Tedder to stand up the RAF Regiment, giving airfields dedicated defensive assets. WDAF raids slowed but could not stop Rommel's advance. Benghazi fell on 29 January. Luftwaffe air-ground cooperation was effective. Bombers inflicted significant damage, with air reconnaissance facilitating the effort. After these opening rounds, Luftwaffe units moved slowly to forward airfields, taking them out of the fight from 4 to 6 February.[85]

During Eighth Army's retreat, WDAF kept the Luftwaffe from causing serious damage. Tedder applauded the complementarity of effort but lamented that the Germans once again had the upper hand in the battle for the SLOCs, and that for the first time, the RAF had lost general air superiority. 'Our forward aerodromes,' Tedder sighed, 'lacking good anti-aircraft defences, had been bombed and shot up with impunity by the 109s with heavy losses to ourselves. We could only reply with night bombing raids.'[86]

Rommel's counter-offensive continued. However, whenever German units outran their fighter cover, they sustained heavy losses. 'Own fighter cover,' *Panzerarmee's* report said,

'was not possible since the ground organisation in Martuba could not function before midday on 6 February at the earliest.'[87] The Luftwaffe's shortage of motor vehicles once again hampered attacks on the retreating Eighth Army and protection of Axis troops. Nonetheless, in his summary of the offensive, Rommel said,

> Co-operation between Panzer Army Africa and Fliegerfuehrer Africa was always good and was strengthened and further improved by the frequent visits of Field Marshal Kesselring, who took a particular interest in the constant personal contact with Panzer Army Headquarters...Luftwaffe formations always provided excellent support for Panzer Army's operations...[88]

The Luftwaffe achieved its greatest feats during the six months after Kesselring's arrival.

By February 1942, improving British signals capabilities, better intelligence personnel, greater air-reconnaissance and photo reconnaissance resources, dedicated fighter-bombers, and better ground-attack tactics were coming together. As a result of experience gained during Operation CRUSADER, the air-tasking system could task fighter-bombers to bomb targets and re-task them in flight to strafe others. A new signals plan implemented in early 1942 underpinned these successes by giving all wings three radio links to joint headquarters. With all-terrain signals vehicles in place, tentacles advanced alongside Army units to provide terminal attack guidance based on visual acquisition of enemy positions. The Rover David system was developing and would soon come to fruition.[89]

Concurrently, mature AASCs began operations in March 1942, replacing the earlier Operation CRUSADER structure. Located at the combined Army/Air Headquarters or occasionally the corps level, it had two elements. The first had two Army staff officers and a small staff that controlled a wireless radio network consisting of 12 tentacles. These were assigned to forward brigades and divisions based on need for air support. The second element included an RAF officer with a small staff that controlled eight wireless sets through a FASL. In 1942, Coningham added two wireless sets at all RAF units on their airfields. This network distributed air-support notifications and intelligence. Changes in bomb-line calculations went hand-in-hand with these evolutions. Ground units reported their positions every two hours at minimum, and hourly when on the move. They also radioed in key terrain features to help aircrew navigate to target.[90]

As planning for Operation HERCULES, the invasion of Malta, developed, Rommel prepared to launch a major offensive of his own: Operation THESEUS. With the logistical situation as good as it would ever be Rommel brought supplies and troops into place. On 30 April, he briefed senior officers on the offensive and said it would begin in early June, once Malta had fallen. If the capture of Malta took longer than expected, *Panzerarmee Afrika* might attack anyway based on the likelihood of success.[91]

Rommel proposed to destroy British forces in front of Tobruk, take the port, consolidate his logistical situation, and advance to Cairo. In a meeting on 28 April, Kesselring and Rommel reviewed guidance from Hitler. Malta had to be taken, since the Allies would otherwise win the logistical struggle once most Luftwaffe units returned to Russia. Kesselring also noted that reinforcements were pouring into North Africa at unprecedented rates. At a 6 May meeting of senior officers, Kesselring agreed to reinforce *Fliegerführer Afrika* with 90 aircraft and a Flak *Abteilung*, while Ju 88s and Me. 110s of *Fliegerkorps X* would support Rommel's offensive. Kesselring also noted that, due to delays in preparation, Operation HERCULES was postponed. Rommel's offensive would thus begin before Malta's capture.[92]

Operation THESEUS began on 26 May and ended four weeks later with the fall of Tobruk. Luftwaffe aircraft made substantial efforts at El Adem and Bir Hacheim. In one of their last great showings, Stukas engaged in mass attacks to support Rommel's advance in late May and early June. Piecemeal Eighth Army counterattacks were ineffective. British armour losses were high as commanders continued sending tanks to impale themselves on anti-tank guns. The RAF, already outnumbered, could not keep the Army's position from collapsing, but it once more played a pivotal role in saving it from destruction so it could fight again at El Alamein.[93]

Part of Tedder's challenge in protecting Eighth Army was the arrival of a new *Fliegerführer Afrika*, *General der Flieger* Hoffman von Waldau, formerly Luftwaffe High Command Chief of Staff, who understood the principles of air operations. However, von Waldau soon learned the difficulties of working with Rommel as the latter again disappeared with his staff. For two days, von Waldau's requests for information from ground forces went unanswered. Rommel's staff had not included von Waldau's in the preparation of the operations order. Air reconnaissance did reveal two concentrations of British forces, which Luftwaffe units attacked on 31 May and 1 June, and von Waldau finally located Rommel. Rommel ordered intensive air support for the assault on Bir Hacheim but failed to send in enough ground troops to capitalize on it. From 2 to 10 June, the Luftwaffe and Regia Aeronautica flew over 1,500 sorties. Waldau, fed up with repeated raids in support of too few attacking troops, informed Rommel on 9 June that Bir Hacheim had already absorbed 1,030 sorties—all of which, in the case of the fighters stuck in 'close' escort, could have been employed to gain air superiority, which von Waldau sought to achieve. On 10 June, the combination of three more major raids and sufficient ground forces forced the garrison to retreat.[94]

As the Luftwaffe exhausted itself over Bir Hacheim, Eighth Army bled out further north. British counterattacks were piecemeal, with a poor use of armour and absent or conflicting C2. The disaster in the Cauldron on 6 June was further proof that air support could not engage effectively without a clear bomb-line and in poor weather. All-out efforts to concentrate remaining air assets over advancing troops proved pivotal in the

speed and magnitude of the breakthrough. RAF planes attacked Axis troops heavily around El Adem on 15 June, allowing Eighth Army to retreat with minor additional losses. The 21st Panzer Division reported gloomily on the 'Continual attacks at quarter hour intervals by bombers and low flying aircraft.'[95]

RAF efforts slowed the Axis advance but could not halt it. In an indication that he was beginning to understand the importance of airfields, Rommel sent the *Afrika Korps* specifically after Gambut. 'Primarily,' he said, 'this advance was directed at the R.A.F. who, in their short flight time from neighbouring bases, were being unpleasantly attentive. We intended to clear them off their airfield near Gambut and keep them out of the way during our assault on Tobruk.'[96] Coningham ordered an evacuation on 17 June. Ground crews stayed in action until the last moment while generating 450 sorties a day—three for every available aircraft—to protect Eighth Army's withdrawal.[97]

Rommel and von Waldau met to coordinate the attack on Tobruk. It proved to be the best-coordinated Axis air-ground operation of the North African campaign. The assault began on 20 June with every available aircraft attacking the south-eastern sector of the defences. Tobruk fell the next day. Axis forces captured 45,000 troops, over 1,000 tanks, 400 guns, huge numbers of vehicles, and large quantities of fuel. The road to Cairo appeared tantalizingly open. It was the last time Axis air forces would play a major role in the Western Desert.[98]

Eighth Army was in full retreat toward El Alamein, with its two secure flanks: the Mediterranean and the Qattara Depression. Axis leaders now made two errors of strategic significance. First, Rommel miscalculated that he could overrun El Alamein. Had he paid closer attention to his intelligence officers, he would have understood that the British had been working on defences there for weeks and had strong reinforcements waiting to integrate Eighth Army's retreating elements. Second, he convinced Hitler and Mussolini to abandon Operation HERCULES. Malta thus continued its rebound as an offensive platform against Axis convoys even as the Americans delivered immense quantities of materiel to Suez after Tobruk fell.[99]

With Operation HERCULES off the table and Axis troops advancing into Egypt, Rommel's headquarters again kept the Luftwaffe in the dark until 13 June. Waldau received no insights regarding the reasons for the many disjointed air attacks Rommel's staff required, all of which involved heavy dive-bomber attacks with heavy fighter escort, giving the RAF major tactical advantages. A frustrated von Waldau lamented the fact that Army requests for air support were not based on a sound conception of combined-arms operations.[100]

Rommel believed that captured vehicles and supplies could carry his Army to the Nile Delta before Malta once again became a threat to Axis convoys. It was a fatal error in

judgment. Rommel underestimated British recuperative powers and downplayed the Luftwaffe's exhaustion. As Axis forces advanced, the RAF threw everything at them with hourly raids. Fighters flew up to seven sorties a day. Fighter-bombers savaged vehicle convoys, destroying 1,050 trucks. Tedder was certain that continuing raids on Lines of Communication would eventually allow Eighth Army to capitalize on the advantages thus accrued. As a result of this all-out air effort, the War Office said, there 'can be no doubt but that the RAF saved the Eighth Army.'[101]

Paradoxically, Rommel believed that the poor long-term logistical situation required him to gamble on an offensive. He had beaten the British several times and nearly annihilated Eighth Army. His troops sensed victory, he had captured immense amounts of supplies, and he felt that it was now or never. However, The British controlled the SLOCs again, this time permanently, and sank one-third of Axis tonnage bound for Africa from July to November. Surviving ships had to land supplies further from the front, making the shrinking vehicle pool cover huge distances. These worn-down convoys endured frequent air attacks. By the time Rommel's final offensives began, most of his trucks were destroyed or immobile. Fighting with too few supplies, aircraft, tanks, and guns, and too little fuel, Axis forces headed for disaster.[102]

Churchill and Brooke arrived in Egypt on 3 August for an inspection and to change the Army leadership. Churchill relieved Auchinleck and named General Harold Alexander overall commander. General Bernard Law Montgomery took command of Eighth Army, improving morale and operational acumen. Cooperation between the Services continued its rapid improvement. Montgomery briefed airmen and soldiers, saying

> I have brought you together to tell you that I have made a plan—and when I say I've made a plan it's not quite right because I've made a plan in conjunction with the Air Force. Every plan has to have an intention—mine is to go to Tripoli, and it's the intention of the Air Force too to go to Tripoli. In fact we're all going to Tripoli together.[103]

On 7 September, Tedder signalled Portal that he had 'Returned Saturday from visit to Western Desert. General feeling is that threat to Egypt has been scotched...Difference between this land battle and previous ones is that in this one soldiers have refused to play enemy game and send tanks against guns. Enemy has been forced to send his tanks against our guns.'[104] Liaison with the Army was much improved. Portal replied, 'We are deeply impressed by the remarkable effort put out by your squadrons and delighted by their success especially the splendid work done against the German troops and the Axis shipping...Delighted to hear of your good relations with the Army. Best wishes to you all.'[105]

Intelligence pinpointed the start of Rommel's final offensive on 30-31 August. Air attacks

forced him to call it off almost immediately. Vehicles, artillery, and anti-aircraft positions suffered severe losses. Several units lost almost all of their vehicles. Consequently, Rommel ordered a major change in Army dispositions to create greater depth and breadth, reducing losses. This worked well in its stated purpose but placed his army in an unfavourable position to repel a major offensive.[106]

During the lull from early September to late October, British combined-arms initiatives came to fruition. As Montgomery put the finishing touches on his offensive (Operation LIGHTFOOT, to be followed by Operation SUPERCHARGE during the breakout phase), Tedder and Coningham readied RAFME. The ensuing victory at El Alamein—and the unbroken string of victories in the Western Desert afterwards—was due in large part to steady improvements in ground-air cooperation. The rapid learning that occurred in Tunisia after the Torch landings was also a product of the generally high levels of cooperation and innovation between British—and later Anglo-American—soldiers and airmen.

By the time the North Africa campaign ended on 13 May 1943, Axis ground and air units had suffered defeats from which they could not recover. They lost 250,000 men in Tunisia and another 250,000 or so in the Western Desert.[107] Air losses from June 1940 to May 1943 totalled around 9,700 aircraft. From January 1942 to May 1943, 40 percent of German aircraft produced went to the Mediterranean Theatre.[108] The Axis also lost 762 merchant ships there prior to the collapse in Tunisia—42 percent of shipping losses in the European Theatre. The Mediterranean Basin became a graveyard for Axis shipping, air forces, and field armies.[109]

The new Anglo-American ground-air capabilities that emerged in North Africa moved forward into Sicily and Italy and from there to France and Germany. Tedder's appointment as Eisenhower's Deputy Supreme Commander highlighted the degree to which soldiers and airmen had come to value co-equal and interdependent roles. The British and then the Americans had learned to maximize air-ground cooperation and in the process beat the Germans at their own game of *Bewegungskrieg*. British Army and RAF officers could look back on a well-earned victory gained in large part because they had learned together how to succeed.

NOTES

[1] The British Empire employed military units from the Dominions and other locations. In the interests of economy of verbiage, all such forces are referred to as "British." German and Italian forces are referred to individually, or collectively as "Axis."
[2] Richard Overy, *The Air War 1939-1945* (New York: Stein and Day, 1980), 107; Lord Arthur Tedder, *Air Power and War* (London: Hodder and Stoughton, 1947), 29-30, 89.
[3] Slessor to AC C. R. Cox (Army Co-operation Command, RAF), 25 August 1942, 1, AIR 75/43, The National Archives of the United Kingdom (henceforth "TNA").

[4] Ibid., 4.
[5] Portal, "Command in the Middle East: Note by the Chief of the Air Staff," 11 September 1942, AIR 75/43, TNA.
[6] See these authors' views and detailed counterarguments in Robert S. Ehlers, Jr., *The Mediterranean Air War: Airpower and Allied Victory in World War II* (Lawrence: University Press of Kansas, 2015), Chapters 1-2.
[7] Douglas Porch, *The Path to Victory: The Mediterranean Theater in World War II* (New York: Farrar, Straus and Giroux, 2004), 10, 12.
[8] Gerhard Weinberg, *A World at Arms: A Global History of World War II* (Cambridge University Press, 1994), 307-348.
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[10] Major General John Strawson, in Derek Wood, ed., T*he End of the Beginning: Bracknell Paper No. 3, A Symposium on the Land/Air Cooperation in the Mediterranean War 1940-43* (Bracknell, UK: Royal Air Force Historical Society), 20 March 1992, Chapter 4, "The Shape and course of the Mediterranean War 1940-43," 14.
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[12] Strawson, in Wood, ed., *The End of the Beginning*, Chapter 4, 14.
[13] Major-General I. S. O. Playfair, *The Mediterranean and Middle East*, vol. I, *The Early Successes against Italy [to May 1941]* (Uckfield, UK: Naval and Military Press, 2004), 1-3. This and all subsequent volumes of British Official History are referred to henceforth as "BOH" with volume number.
[14] General Sir Archibald Wavell was the theater and senior ground commander. Other C-in-Cs included Air Chief Marshal Sir William Mitchell and Admiral Sir Andrew Cunningham. Wavell's successors were General Claude Auchinleck and General Harold Alexander. Mitchell's were Air Chief Marshal Sir Arthur Longmore and Air Chief Marshal Sir Arthur Tedder. Cunningham was eventually replaced by Admiral Sir John Cunningham.
[15] BOH I, 17-21; Humphrey Wynn, in Wood, ed., *The End of the Beginning*, Chapter 5, "The RAF in the Mediterranean Theatre," 21.
[16] For a detailed discussion of competing grand strategic aims, and the warring powers' different levels of interest in and engagement with combined-arms warfare, see Ehlers, *Mediterranean Air War, passim*.
[17] BOH I, 35-37; Roderic Owen, *The Desert Air Force; an Authoritative History Published in aid of the Royal Air Force Benevolent Fund* (London: Hutchinson, 1948), 90 (henceforth "Owen, *DAF*").
[18] GHQME, "Combined Plan for the Defence of Egypt 1939," February 1939, AIR 23/770, TNA, 11-16.
[19] Drummond, "Appendix 'C' to R.A.F. Middle East Operation Plan: Directive to Air Officer Commanding, Egypt Group," 11 May 1939, AIR 23/781, TNA, 1-4.
[20] BOH I, 56-73; Owen, *DAF*, 112.
[21] Longmore, "Despatch No. 1 on Middle East Air Operations, 13-5-40 to 31-12-40,"

1 February 1941, AIR 23/808, TNA., 4-5 (henceforth "Longmore, "Despatch No. 1").
[22] Longmore, *Sea to Sky*, 221-222; Air Marshal Sir Patrick Dunn, in Wood, ed., *The End of the Beginning*, Chapter 8, "Digest of the Group Discussions," 68; BOH I, 113-115.
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[25] BOH I, 185-187.
[26] Mr. Humphrey Wynn, in Wood, ed., *The End of the Beginning*, Chapter 5, 21.
[27] Ibid., 22-23; Owen, *DAF*, 59.
[28] BOH I, 208-209, 228; Longmore, *Sea to Sky*, 224; Hans Werner Neulen, *In the Skies of Europe: Air Forces Allied to the Luftwaffe, 1939-1945* (Ramsbury: Crowood), 2005, 46-47.
[29] BOH I, 252-254; Lord Arthur Tedder, *With Prejudice: The World War II Memoirs of Marshal of the Royal Air Force Lord Tedder, Deputy Supreme Commander of the Allied Expeditionary Force* (Boston: Little, Brown and Company, 1966), 34-35 (henceforth "Tedder, *WP*").
[30] BOH I, 261-264.
[31] R. Collishaw, "Brief Report on Royal Air Force Operations in the Western Desert From the Outbreak of War with Italy—The Capture of Cyrenaica to the Time of the Enemy Counter Offensive," 19 April 1941, AIR 23/6475, TNA, 1-3 (henceforth "Collishaw, 'Brief Report'").
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[34] Longmore, "Despatch No. 1," 5-6; BOH I, 292-294.
[35] Ibid., 6-8.
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[85] "War Diary of Panzer Army, 21 January – 6 February 1942," Trans. VII/118, Air Ministry A.H.B. 6, September 1952, AHB, 24-27; Felmy, 216-224; *DLM*, 348-349; BOH IV, 17.
[86] Tedder, WP, 242-243. Cross noted that the Luftwaffe missed yet another opportunity to savage RAF formations crowded onto several small airfields. "Fortunately," he said, "the Luftwaffe had been left far behind by the Wehrmacht and were out of range for we were certainly an excellent target." See *Straight and Level*, 174.
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[89] Operations Record Book of the Forward Desert Air Force, February 1942, AIR 24/443, TNA; War Diary of No. 2 AASC, 14 March and 9 May 1942, WO 169/6638, TNA; Tedder, *Report*, 74-75, Signals Appendix.
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