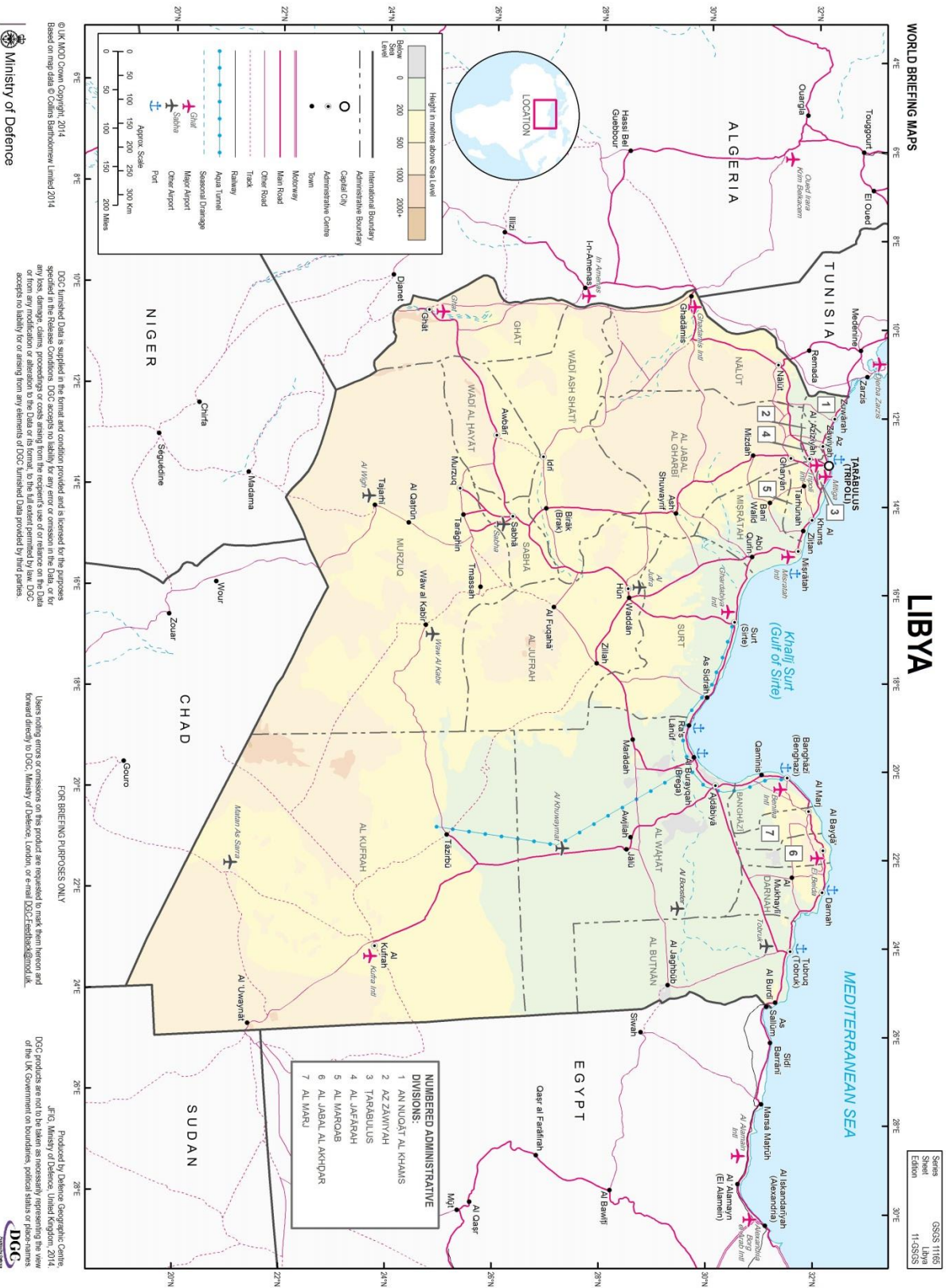


UK Air Power in Operation Unified Protector: Libya, 2011

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Introduction

Operation Unified Protector (UK name Operation Ellamy) was the seven-month campaign waged against the regime of Colonel Muammar Gaddafi in Libya by a coalition of NATO and allied states through the imposition of an air no-fly zone and a naval arms embargo. The operation (originally named Odyssey Dawn under a short period of American leadership), was launched at short notice in response to the regime's efforts to suppress the mass rebellion that engulfed Libya in February 2011, itself part of the broader wave of popular uprisings then sweeping through North Africa and the Middle East – the so-called Arab Spring. During the course of the operation, the deployed UK fixed and rotary-wing aircraft flew some 3,000 sorties out of a coalition total effort of 26,320, including 2,100 strike sorties out of 9,658; UK aircraft attacked 640 targets. This impressive effort was mounted alongside continuing operations in Afghanistan (Operation Herrick), which remained the main effort for UK defence.¹

At the start of the Libyan conflict the coalition confronted an adversary that still controlled most of the country. Assessments of regime strength at this stage can only be approximate, but the backbone of Gaddafi's army, the Regime Protection Force, was intact and numbered some 30 battalions, and he could also still call on the bulk of the far less capable Armed Personnel on Duty force of 85 battalions, as well as a 'People's Guard' of militia and mercenaries. Their inventory of heavy weapons – tanks, armoured fighting vehicles, artillery pieces and rocket launchers – was thought to number more than 3,300 deployed items, and Libya also had an air force and an Integrated Air Defence System (IADS). And yet, by mid-October, all that remained of Gaddafi's regime amounted to a handful of combatants with a single tank and a rocket launcher fighting desperately in defence of a tiny enclave in Sirte. Within days, even they would be overwhelmed.

This study summarises the Air Historical Branch narrative of Unified Protector and considers the RAF's contribution to the broader coalition air effort. It also corrects some of the errors and misconceptions that have crept into earlier histories of the operation. The initial objective is to consider the background to the Libyan crisis and how the UK's response first came to focus on the establishment of a no-fly zone; then,

after examining the creation of the coalition and the opening of hostilities under American leadership, the focus shifts to the transition to NATO Command and Control (C2) and the development of a longer-term concept of operations. The subsequent goal is to assess the impact of NATO's intervention in Libya, the coalition's analysis of how the operation was progressing, and the measures pursued to transform Unified Protector from an indefinite commitment to the protection of civilians into a campaign that would ultimately lead to the successful coercion or overthrow of Gaddafi's regime.

Origins

In February 2011, following the overthrow of the Tunisian and Egyptian governments, multiple demonstrations against Colonel Gaddafi began in Libya and were violently suppressed by his security forces. The protestors then took up arms and at first achieved a significant measure of success. Libya was soon effectively divided between the west (including Tripoli) and Sebha in the south, which remained firmly under regime control, and the east, centred on Benghazi, where the rebels prevailed, although there were other pockets of resistance nearer Tripoli – notably in the port of Misratah, east of the capital, and in the Nafusah Mountains to the south-west.

The UK initially responded to the Libyan crisis by evacuating expatriates (under Operation Deference), and deploying a number of aircraft into theatre including a Nimrod R1, a VC-10 tanker and two E-3Ds, which flew in support of the C-130s conducting the evacuation. Then, on 23 February, President Sarkozy of France called for the imposition of EU sanctions on Libya and the establishment of a no-fly zone to prevent Gaddafi using air power against rebel forces. On the 26th, the United Nations (UN) passed a resolution (UNSCR 1970) demanding an end to the violence in Libya, imposing an arms embargo, freezing the overseas assets of the Gaddafi family and referring the regime leadership to the International Criminal Court. Meanwhile, the Prime Minister requested guidance from the Ministry of Defence (MOD) on possible options for military intervention if Gaddafi failed to heed international calls for restraint. On the 28th he addressed Parliament, calling on Gaddafi to relinquish power and announcing that he had asked the MOD and the Chief of the Defence Staff (CDS) to work with the UK's allies on plans for a military no-fly zone over Libya.

Two key issues – to an extent interrelated – subsequently dominated the development of British policy. The first centred on the nature of military action: how would a no-fly zone be enforced and what could it reasonably be expected to achieve? The second concerned participation in any prospective air operations over Libya: should a no-fly zone be established by the UK alone or by a coalition of states, or by NATO? In drawn-out deliberations over the following fortnight, the MOD and PJHQ urged caution and expressed doubts about the feasibility and effectiveness of a no-fly zone. The UK was already heavily committed in Afghanistan. To the MOD, it seemed unlikely that a no-fly zone on either the Iraqi or Bosnian model would influence events on the ground, and there were concerns within the department that a Bosnia-type situation might develop in which regime troops continued to attack the rebels while coalition aircraft patrolled overhead, unable to intervene under the terms of their mandate. By contrast, the Prime Minister strongly favoured a no-fly zone strategy applied under NATO auspices. Across NATO and the EU there were equally pronounced differences of opinion, but the prevailing view was that potential coalition or NATO intervention should be underpinned by demonstrable need, a clear legal basis and support from the region.

By the middle of March, these preconditions were all but satisfied. In Libya, regime forces had taken to the offensive, employing air power in support of operations to capture Ras Lanuf, seizing Brega and advancing on Ajdabiyah. World leaders were now confronted by the prospect of an imminent and bloody offensive against Benghazi and the outright suppression of the uprising. Meanwhile, both the Gulf Co-operation Council and the Arab League had proclaimed their support for a no-fly zone. Against this background, it was possible to secure stronger international backing for military action, and the UK began drafting another UNSCR. If the MOD influenced this process, it was chiefly by impressing on those involved that the no-fly zone concept should be extended beyond the limitations previously imposed. And so it was that when UNSCR 1973 was passed on the 17th, it not only banned all flights in Libyan airspace and the use of aircraft to attack the civilian population; it also authorised *all necessary measures* to protect civilians and civilian objects. Effectively, therefore, it permitted general air-to-ground action against the Libyan security forces.

By this time, NATO and its member states had initiated preparatory measures. CJO, Air Marshal Sir Stuart Peach, was appointed UK Joint Commander for the Operation, and the RAF was instructed to prepare a force comprising Tornado GR4s, Typhoons, Sentinels, the E-3Ds and the Nimrod R1 already deployed for Operation Deference and additional tankers. Short-term planning was based on the need to halt the regime forces' advance on Benghazi before the demands of the longer-term no-fly zone task were addressed. This suggested a US-led campaign at first, followed by a transition to NATO leadership after the initial objectives had been fulfilled – a sequence of events broadly approved by the Americans on the 18th. On the same day, an agreed statement was issued from Washington, London and Paris threatening military action if the advance on Benghazi continued and demanding the withdrawal of regime troops from Ajdabiyah and Misratah. The first air strikes were launched by the French Air Force the following afternoon in accordance with an agreed timetable that allowed for the possibility that French intervention might precede US and UK action by several hours.

Operation Odyssey Dawn

The Air Headquarters for the brief US-led Operation Odyssey Dawn was located at the USAF CAOC at Ramstein air base in Germany. The UK Joint Force Air Component Commander (JFACC) for the operation, the Air Officer Commanding 1 Group, Air Vice-Marshal Greg Bagwell, flew out to Ramstein on the 19th. At this stage, the coalition was confronted by five basic tasks. The first was the launch of the initial strikes against Libya and the deployment of British, French and US aircraft into theatre. Second, there was the expansion of the initial tri-nation venture into a far broader coalition of air forces functioning within a single Air Tasking Order (ATO) and in accordance with the same operation plan, Rules of Engagement (ROE) and Special Instructions (SPINS). Third, but concurrently, it was essential to ensure that operations over Libya effectively supported the key coalition goals of establishing a no-fly zone and protecting the Libyan people from Gaddafi's forces. Fourth, this had all to be achieved in such a way that the operation could be transferred relatively easily and seamlessly from American to NATO leadership. Finally, the transfer itself had to be implemented.

The initial American and British strikes were executed largely with Tomahawk Land Attack Missiles (TLAM) and with Storm Shadow missiles launched by UK-based Tornado GR4s and were primarily designed to degrade the Libyan Air Defence System and regime C2; the vast majority of targets were heavily damaged or destroyed. Within 48 hours, the Libyan air force had effectively been grounded and the IADS severely degraded. Then, with the number of aircraft committed to Odyssey Dawn increasing steadily, coalition targeting shifted towards regime ground forces in the east – the focus of French intervention from the outset. The RAF's GR4s and Typhoons now deployed forwards to Gioia del Colle in Italy. The fast jets that provided ground-attack, Suppression of Enemy Air Defences (SEAD) and air-to-air combat capabilities were reinforced by contributions from other NATO countries and allied – including Arab – nations, and augmented by airborne C2 and ISTAR platforms and more tankers.

Facing mounting losses, Gaddafi was left with little option but to withdraw his forces from Ajdabiyah back through Brega and along the coast. Although the coalition continued to attack ground targets in this region, the removal of any immediate threat to Benghazi at the same time allowed a higher proportion of the overall air effort to be directed towards Misratah. Regime forces sustained heavy losses in this area during the last week of March, and Libyan weapon storage areas were also targeted to restrict their supply of munitions. By the 28th, intelligence assessments of the situation in eastern Libya were becoming increasingly optimistic, and a rebel assault on the regime stronghold of Sirte was even predicted.

While air operations over Libya were progressing, Odyssey Dawn was being transformed into the NATO-led Operation Unified Protector. Planning was based on the establishment of a typical two-tier NATO headquarters structure comprising an Air Headquarters at Izmir in Turkey and a Combined Air Operations Centre (CAOC) at Poggio in Italy. They were to 'shadow' the ATO cycle maintained from Ramstein until the transition to NATO command, when they would take over responsibility for the process. Also within this period, it was essential to effect a formal Transfer of Authority (TOA) of Odyssey Dawn assets to NATO C2.

The transition was far from smooth. The schedule originally devised did not provide sufficient time for coalition members to familiarise themselves with such C2

fundamentals as ROE and target approval processes. Moreover, while it was clear that American combat air support for the operation would be substantially cut back after US leadership ceased, there was much uncertainty about the precise scale of the force reductions and thus about the shortfalls that would have to be made good by other coalition members. After the original timetable was delayed for 24 hours, TOA duly occurred on the 30th and the first NATO ATO ran from 0600Z on the 31st. However, the Americans imposed restrictions on the participation of their combat aircraft that prevented their assignment to ground attack missions that day, and operations by other coalition members were disrupted by adverse weather. US intelligence feeds available at the Ramstein CAOC were also suspended.

Unfortunately, at this critical juncture, there was a pronounced change in the tone of intelligence reporting on the situation in eastern Libya. The rebels' advance faltered, and they were then driven back through Brega and towards Ajdabiyah. On 1 April, coalition air power – bolstered again by the Americans – halted the regime offensive, but the damage had already been done. There would be no rebel counter-attack against Brega until the middle of July and the city would remain under regime control until 22 August. This situation was not entirely advantageous for the Libyan regime. Gaddafi's forces now found themselves dispersed across an enormous belt stretching from the Tunisian border in the west through Tripoli, Misratah and Sirte to Brega in the east. And yet, simultaneously, the dispersion of regime forces also created acute difficulties for the coalition. The available air resources had now to be spread even further across what was, in any case, a very large country.

Operation Unified Protector

And so, in less than ideal circumstances, Odyssey Dawn made way for Unified Protector. The post of Commander Joint Task Force (COM CJTF), Unified Protector, was assigned to the Deputy Commander of the Allied Joint Force Command, Naples, Lieutenant General Charles Bouchard of the Royal Canadian Air Force. A former helicopter pilot with a subsequent command specialisation in air defence, Bouchard was serving out the final appointment of his career. At the Izmir Air Headquarters, the USAF's Lieutenant General Ralph Jodice became the CFACC. The coupling of Naples and Izmir reflected a C2 relationship that was well established within NATO, but the

geographical separation of the Naples and Izmir headquarters and the Poggio CAOC quickly proved far from ideal.

The RAF experienced considerable difficulty securing a senior position within the command chain. In March 2011, there were no senior UK air officers in NATO's southern flank command apparatus. While two members of Bouchard's NATO-appointed senior staff – including his head of operations – were British, neither was an RAF officer. There proved to be no requirement for the UK JFACC after Unified Protector superseded Odyssey Dawn, so the role of UKACC passed to Air Commodore Edward Stringer, who effectively served as UK senior national representative to the CFACC. In other words, he was positioned alongside the formal command chain rather than inside it. Initially, the most senior RAF representative in the Air Headquarters was the head of strategy, although an RAF officer also assumed responsibility for intelligence in June.

This was but one manifestation of a broader problem that confronted the RAF during the early stages of the Libyan conflict. For some years the UK had collaborated closely with the United States in the Gulf and Afghanistan and had thereby maintained a full understanding of US C2 processes, but there was far less knowledge of NATO air C2. Indeed, over time, there had been a steady decline in UK investment in the alliance. The many and varied C2 problems encountered in this period extended beyond the sphere of personnel and appointments and into such critically important areas as deployable Communications and Information Systems (CIS) and CIS interoperability.

April was inevitably a month of consolidation. The critical immediate challenges involved establishing the new Air Headquarters on a sound footing, generating sufficient forces to sustain the campaign and, in Libya itself, stabilising the main battle zones.

Where the headquarters were concerned, their structure and functions had obviously to be shaped to meet the unique characteristics of the operation. These included the extensive geographical area over which it was conducted, with multiple fronts, the high fluidity of the battlespace, the very limited coalition intelligence picture, the fleeting nature of many ground targets, the similarities between the two ground forces, and the

location of many potential targets within conurbations such as Tripoli, Misratah and Brega, where there was inevitably a significant risk of collateral damage.

This was an environment in which the targeting process could become particularly challenging. Throughout the operation, air strikes against Libyan ground targets fell under two headings. While deliberate targets were pre-planned and specified by the ATO, dynamic targets were typically unanticipated, unplanned or newly detected. The overwhelming majority of air strikes and all deliberate attacks required prior clearance from the CAOC via a three-phase process involving Positive Identification (PID), the application of ROE and the preparation of a Collateral Damage Estimate (CDE). Targeting was subject to the approval of the various national representatives at the Air Headquarters (the so-called 'red card holders') and there were significant variations in ROE across the coalition. PID often proved very difficult when aircraft were compelled to operate at higher altitudes to reduce the threat from Libya's ground-based air defences.

The complexity of both the operational environment and the target clearance procedures quickly revealed weaknesses in the dual Air Headquarters and CAOC system and persuaded the CFACC to move forwards to Poggio with a number of his senior staff. Throughout April, early problems involving CIS, ATO production, targeting and airborne C2 were systematically addressed. Intelligence was completely overhauled to provide better support to the targeting mechanism. By the second half April these measures were bearing fruit, and the Poggio facility was assuming the proportions of a fully functional CAOC. The UK Air Component Headquarters developed more slowly but was firmly established by the end of the month.

The force generation task was tackled in a number of ways. A few relatively minor basing adjustments allowed better use to be made of available resources such as the RAF's E-3Ds, which were moved from Akrotiri to Trapani in Sicily, closer to Libya. But it proved more difficult to enlarge the coalition air order of battle. US ground-attack aircraft were withdrawn from Unified Protector on 7 April, and the only manned US combat aircraft subsequently committed to the operation were assigned to SEAD (broadly defined) and 'air presence'. To reconstruct the ground-attack force, France agreed to commit more aircraft to Unified Protector and operate more intensively. The

UK deployed four more GR4s, transferred two more aircraft formerly under national command to NATO, and declared four Typhoons as multi-role platforms; this number was increased to six in May. Italy and Belgium also contributed more aircraft. These various augmentations allowed the coalition to maintain a planned flying rate of around 50 ground-attack sorties and 10 SEAD sorties per day.

By contrast, largely due to the scale of commitments in Afghanistan, it proved far more difficult to enlarge NATO's ISTAR force. Historically, it has generally been considered that the strategic focus or chief priorities of an air campaign can most accurately be identified from the apportionment of offensive air assets. Yet increasingly, with precision-guided weapons, only a limited kinetic effect may be needed to attack the highest-value targets in campaign terms. To a far greater extent, effort is now being expended on the extensive preliminary ISTAR activity that the prosecution of these targets invariably requires. ISTAR has become fundamental to the successful application of air power, and the prevailing shortage of collection platforms during Unified Protector was therefore a serious handicap. The RAF's Nimrod R1s – scheduled for retirement in the spring of 2011 – received a temporary stay of execution, but their extremely valuable contribution ended in June. The provision of more USAF tankers also allowed some ISTAR platforms to extend their time on task.

Nevertheless, resources were never adequate, and important command decisions – notably judgements on target clearance – had often to be made on the basis of far less information than would normally have supported comparable engagement decisions in Afghanistan. Apart from slowing down the approval process and thus reducing operational tempo, the lack of intelligence left those with delegated target authority in a very exposed position and compelled them to accept considerable risks. That very few mistakes were made despite the high pressure under which they were operating testifies to their ability and professionalism.

Despite the many problems posed by C2 and force generation, the coalition's primary mission was fulfilled in Libya itself. By the middle of April it was assessed that any threat from Libyan combat aircraft had been eliminated, that Gaddafi no longer possessed a strategic SAM capability (although tactical SAMs and MANPADs remained a source of concern), and that his IADS C2 was ineffectual. On the ground,

coalition aircraft had destroyed 176 main battle tanks, 108 other armoured vehicles, 50 artillery pieces and much else besides. The Libyan army had been subjected to sustained air attacks around Brega, which effectively ruled out any renewed advance towards Benghazi. Increasingly they assumed entirely defensive postures in the east and their main effort became the recapture of Misratah. Towards the end of the month, the situation at the port became desperate, but coalition air power ultimately played a vital role in halting the regime advance. Once the threat had been lifted, the rebel position at Misratah was bolstered by supplies and reinforcements shipped in from Benghazi.

On the other key front – the north-western mountains generally known as the Jebel Nafusah – the position was more complex. The main rebel towns endured heavy and sustained bombardments and repeated attacks by Gaddafi's forces, but (given the scale of commitments elsewhere in Libya) it was never possible for the regime to achieve a decisive advantage. Unfortunately, however, NATO found itself in a similar position. Heavily committed around Brega and Misratah, the coalition simply did not have the means to support the Jebel Nafusah rebels as well. Luckily, two of the Arab participants in Unified Protector, the UAE and Qatar, became increasingly committed to sustaining the Jebel's defence by providing Special Forces (SF) support, weapons, equipment and training under national rather than coalition auspices. France also became involved in these activities in due course.²

In the meantime, extended deliberations were taking place at Naples and Poggio, between the two headquarters and in national capitals over the more general direction of targeting. While it was obvious that many air strikes in Libya would continue to be reactive in nature, there was a strong case for arguing that greater effect could be achieved more economically by influencing the regime's behaviour – so-called 'force on mind'. This suggested that a higher proportion of attacks should target vital C2 nodes or key items of military infrastructure. One of the only examples of this approach during the early stages of the conflict occurred on 17-18 April in a UK-devised operation that successfully struck regime communications links between Tripoli and Brega, but it was very much the exception to the rule.

In the first week of May, to increase pressure on the Libyan regime, there was a pronounced shift in the focus of NATO targeting towards Tripoli. Further UK proposals were submitted to the CJTF HQ soon afterwards comprising a fully developed set of targets, a carefully sequenced implementation schedule and proposals for integrated information operations (IO). However, while NATO aircraft ultimately struck the nominated targets, the proposed sequencing and IO elements of the plan were not implemented.

The Search for a Strategy

By mid-May, the tone of coalition campaign assessments was beginning to change. Although Unified Protector's immediate objectives had been secured, the outlook for the future appeared less favourable. Time seemed to be on Gaddafi's side. His forces retained the initiative and they were adapting their tactics to reduce their vulnerability to air attack. The limitations of their rebel adversaries were becoming clearer every day. Equally it appeared that the regime was better placed than the rebels and the NATO-led coalition to sustain operations in the longer term. Yet the coalition was effectively committed to an open-ended campaign that lacked a clearly identified end state.

At first, two basic perceptions of Unified Protector had prevailed within NATO and among the other nations committed to the operation. Some governments chose to interpret the UN mandate narrowly, focusing on the objective of protecting Libyan civilians. Others, the UK included, believed Libyan civilians could never be fully protected while Gaddafi remained in power. Yet in time this difference was rendered less meaningful by the general realisation that air operations could not be continued indefinitely. Against this background, the search for a coherent strategy began.

A notable feature of Unified Protector was that the CJTF HQ did not assume a significant role in this process. The Naples headquarters sought neither to integrate the operations of its two components – air and maritime – nor to provide them with detailed strategic guidance. The development of an air campaign therefore became the focus of the strategy division at Poggio during May. The first task was to establish a clear end state for the operation, which was defined as follows:

An enduring condition exists where the population of Libya is not under attack or threat of attack, thereby meeting the conditions of UNSCR 1970 and 1973.

This provided the basis for a strategic plan that was developed throughout the month and presented to the COM CJTF on the 26th. The plan employed classic US four-line DIME (Diplomatic, Information, Military, Economic) principles and was designed to protect the Libyan population 'by forcing an enduring change in the behaviour of Belligerent Actors (BA)'. Its aims were to:

- Protect the population from attack from BA.
- Deny BA the ability to attack.
- Isolate BA from mechanisms of power.
 - o From support mechanisms
 - o Capital from regions
 - o Within regions

The strategy linked so-called 'decisive conditions' to objectives, tasks and targets within the component planning and joint planning processes. However, it also stressed that military operations had to be conducted in parallel and in coordination with extensive Strategic Communications (STRATCOM), IO and psychological warfare activity to stand any chance of exerting genuinely coercive effect. Clear and quantifiable measures of campaign progress were suggested and there was a detailed strategy-to-task breakdown. As far as the future direction of the air campaign was concerned, particular importance was attached to the sequenced targeting of command, control and communications to isolate the regime from the key instruments of power.

The CFACC afterwards sought as far as possible to implement the main air proposals contained in the strategic plan, and the analysis behind these proposals was drawn on by the relevant staffs within the CAOC to inform targeting and ISTAR to support targeting. NATO aircraft in due course attacked many of the recommended targets

and target sets. And yet these new initiatives were rarely, if ever, accompanied by appropriate parallel activity at CJTF HQ level. Whereas the Air Headquarters stressed the importance of effects-based targeting and the force-on-mind approach, these concepts were not firmly established within NATO air targeting doctrine in 2011. Instead there was a preference for maximum kinetic effect and for hitting targets as and when they became available. A shift towards more systematic targeting and regular Joint Targeting Coordination Board meetings only occurred at Naples during the later months of Unified Protector.³

Meanwhile, quite separately, the French government tabled several proposals that included more strategic air-to-ground targeting, direct support to rebel forces in the form of arms, supplies and training, and the employment of carrier-based Attack Helicopters (AH). Subsequent deliberations effectively determined that there would be no shift in targeting beyond the ongoing reorientation towards Tripoli and ruled out any coalition strategy (as opposed to separate national strategies) that involved direct military support for the rebels beyond air support and the provision of non-lethal backing by mentoring teams already active in Benghazi, which was largely confined to C2 and logistics. Unified Protector had to be conducted within the parameters laid down by UNSCR 1973 and the North Atlantic Council.

Hence there was only scope to implement one of the French ideas under NATO auspices – the deployment of AH. This single measure, originally recommended to enhance tactical support to the rebels around Brega, now publically assumed the proportions of a strategy in itself. Yet there were pronounced differences of opinion regarding its likely effectiveness. Within the combined Air Headquarters/CAOC at Poggio, it was doubted that AH would exert strategic effect, and there were concerns that the deployment would divert senior command and staff effort and other scarce resources such as ISTAR and SEAD, which were of critical importance to broader air operations over Libya. These would prove to be very well founded. No less problematic was the vulnerability of AH; the loss of a single aircraft would have handed a significant propaganda victory to Gaddafi. The risks were highlighted on 18 June when a British Apache was nearly shot down by a MANPAD. Thereafter, as the new UKACC, Air Commodore Gary Waterfall noted, the balance of resources, risks and potential operational rewards had to be weighed with extreme care before Apache missions

were sanctioned. In the end, while a total of 44 missions were planned, only 22 were executed.

Coalition Victory

Ultimately, the decisive strategic initiative was devised by the main force contributors in close collaboration with NATO's Arab allies and the Libyan rebel leadership and was designed to exploit improved C2 and communications among the rebel forces (by then commonly known as the Free Libya Forces (FLF)). Launched early in July after a series of important rebel gains in the Jebel Nafusah, it was based on the concept of coordinated parallel operations including FLF offensives (supported by coalition air power) in areas like Brega and Misratah, and a further UK targeting and information operations plan designed to encourage upheaval and insurrection in Tripoli. This was referred to as 'Full-Spectrum Targeting'.⁴ The aim of combining these operations was to stretch regime forces to breaking point before a *coup de grace* was administered by an FLF assault from the Jebel.

The first of the coalition's four operational stages involved an offensive by rebel forces towards Brega, in the east. Despite the commitment of air support on a substantial scale, they were soon halted. Full-Spectrum Targeting was then initiated. Although the CJTF HQ had embraced the principles behind the concept, it proved necessary to narrow the targeting focus towards regime C2, which had largely been dispersed for its own protection by this stage of the conflict. Some of the new C2 facilities proved difficult to locate, but a list of appropriate targets was prepared in due course.

Full-Spectrum Targeting was originally divided between four phases – preparation, shaping, strike and exploitation. The shaping and strike phases were to be accompanied by IO such as leaflet dropping and radio broadcasts, and other supporting operations by a variety of coalition aircraft. However, in the middle of July, the plan was revised as it became clear that no rebel offensive in the Jebel Nafusah was imminent. Furthermore, the flow of intelligence from within Libya improved significantly in this period, providing greater clarity of the ground situation between Misratah and Zlitan, east of Tripoli, and suggesting that the FLF might soon achieve a breakthrough in this area. There was also a marked upsurge in the volume of targeting

information from the Zlitan front, which was complemented by the fusion of intelligence products from a range of UK and NATO agencies.

The intent had been that such targets would be struck dynamically, but all of them involved buildings, and the accompanying collateral damage estimates made dynamic attacks virtually impossible to prosecute. After much consideration, it was therefore decided to develop a new targeting and boarding process to treat targets as deliberate but then strike them dynamically within the ATO cycle. 'Deliberate-Dynamic' targeting was born.

And so it was that the shaping phase of the operation became largely focused on the Misratah to Zlitan front with the aim of employing air power to clear a path for a rebel advance. A breakthrough would have directly threatened Tripoli from the east, preventing any concentration of regime forces south of the capital to confront the projected FLF offensive from the Jebel Nafusah. The key role of Deliberate-Dynamic Targeting is illustrated by the fact that the NATO clearance process had at best produced an average of around seven deliberate targets per week during the preceding month. From the 18th, in a single morning, it was possible to clear twice this number for attack within the following 24 hours.

Deliberate-Dynamic Targeting resulted in a three-fold increase in the RAF's monthly strike rate against deliberate targets including C2 nodes, defensive positions, fielded forces, ordnance depots and fuel storage sites. In terms of both accuracy and effect, coalition air strikes in this period were particularly successful. Nevertheless, on the ground, the FLF were confronted by Gaddafi's 32nd Brigade – probably the best trained and equipped formation in the Libyan army – and stopped in their tracks. A significant degree of tension now began to develop between the various concurrent operations. Aircraft were frequently reapportioned between Brega, Zlitan and Tripoli, the stalled Brega offensive imposing a particularly severe drain on resources. The pressure of competing commitments became all the more acute when certain countries were compelled to withdraw aircraft from the coalition on sustainability grounds.

The majority of Full-Spectrum strike phase missions were not flown until 25-27 July. All the targets were destroyed, but the impact proved extremely difficult to measure. It was the delayed FLF offensive in the Jebel Nafusah, launched immediately afterwards, that finally ended the stalemate. On 6 August, the rebels captured the town of Bir Al Ghanam, only 80km from Tripoli, opening one of the major roads north out of the mountains and towards the coast. This now became their main axis of advance. Air support chiefly took the form of ISTAR and a relatively small number of Deliberate-Dynamic strikes against regime targets of particular importance, such as C2 nodes. Otherwise, coalition combat aircraft continued to operate over Tripoli, Zlitan and Brega, 'pinning' regime forces in these areas and exploiting the continuing flow of target intelligence while FLF forces edged forwards on the ground.

By 19 August, regime resistance was collapsing, and the FLF were converging on Tripoli from west and east. At this stage, the coalition launched a second Full-Spectrum operation designed to complement the first, and this continued the following day. On the 21st, a mass insurrection began, and the FLF vanguard arrived in the Libyan capital soon afterwards. Initially, coalition assessments of the situation were predictably upbeat, and Gaddafi's apparently imminent overthrow led to the cancellation of all planned kinetic air activity that day. Aircraft were restricted to patrolling and maintaining presence.

Yet the euphoric mood that initially prevailed at Naples and Poggio gradually subsided as it became clear that the conflict was by no means at an end. Kinetic strikes resumed on the 22nd, although there was much uncertainty about the situation on the ground. Targeting opportunities were both limited and complex due to the presence of rebel troops, civilians and foreign media reporters, and the clearance of Tripoli ultimately involved a drawn-out and laborious process whereby rebel troops repeatedly advanced and then halted again, while the coalition arranged air support to deal with particularly tough pockets of resistance. The last and most significant, located in a compound south of the city, was under the command of Gaddafi's son Khamis. After it was repeatedly targeted from the air on the 26th, the rebels moved forward once more and the compound was overrun within a few hours, ending organised regime resistance in the Libyan capital.

The remaining regime forces then withdrew into central Libya, chiefly to Bani Walid and Sirte in the north and Sebha in the south. During the first week of September, there was some reduction in the intensity of coalition air operations while the rebel leadership sought unsuccessfully to persuade pro-Gaddafi forces in Sirte to surrender. Subsequently, efforts to subdue such areas as remained under Gaddafi's control imposed an even greater strain on coalition resources, and improvisation was often essential to make the best possible use of available air assets. This was especially true where deeper targets in the south were concerned.

By the last week of September, Sebha had fallen and regime forces in Bani Walid no longer posed a threat, so the coalition focus turned to Sirte, where a rebel ground offensive was keenly anticipated. However, any hopes that Sirte might be swiftly subjugated were soon dashed. The target set in the city proved particularly difficult to discern. There were few defined military facilities, and it was therefore necessary to classify civilian areas as military by function in order to meet the established targeting criteria – something that often required more intelligence than was actually forthcoming. As always, target identification was hampered by the dynamic nature of the conflict.

Eventually, the supply of intelligence improved, and Sirte was subjected to continuous air attack in late September and early October. Rebel forces approaching the city from east and west finally linked up on 4 October to split Gaddafi's remaining troops into northern and southern pockets. The main rebel effort was then directed towards the southern pocket, but progress was again slow and faltering. Regime troops often used local civilians as human shields, positioning their rocket launchers in civilian areas to limit the scope for their adversaries to employ heavy weapons or air power.

This occurred at a time of increasing concern within the coalition that the closing stages of the conflict might witness a major civilian casualty incident. Such fears soon led the COM CJTF to impose rigid restrictions on deliberate targeting, but dynamic targeting opportunities declined at the same time, partly because of a period of unfavourable weather and partly because there was insufficient intelligence on the location of ground targets and on their proximity to civilians and FLF units.

By the 9th, regime resistance in south-east Sirte had been overwhelmed and the focus of residual operations was moving into residential areas further north. Air missions on a much reduced scale now primarily took the form of armed over-watch as the rebels made their way slowly forwards. On the 14th, COM CJTF decreed that an organised military threat to civilians in Libya no longer existed. On this basis, he revoked all previously issued delegations of authority for the use of force, making himself the sole authority for any further air strikes. After more intense fighting on the ground, Gaddafi's capture and execution on 20 October effectively brought the conflict to an end. The final RAF sorties were flown on the 31st.

The RAF's Role

The UK Air Component at first consisted of a single Expeditionary Air Wing (EAW) numbered 906 and incorporating all RAF combat, ISTAR and AAR assets. Subsequently, at the end of April, the ISTAR and AAR elements were transformed into a second EAW numbered 907. The OC 907 EAW also functioned as Deputy UKACC. Later, in preparation for intensified operations in July and August, all deployed aircraft were incorporated back into one EAW numbered 906 under a single commander, leaving the Deputy ACC and other staff at Poggio free to focus on their core mission roles. At peak, some 945 RAF personnel were deployed on the operation; many more fulfilled supporting tasks from the UK.

The EAW concept, introduced in 2006, was devised with expeditionary operations in mind, needless to say. Yet the experience of Unified Protector drew attention to the important distinction that must be made between genuinely expeditionary capabilities and the capacity to sustain an enduring deployed operation – a fundamentally different proposition. During the planning and deployment period in March 2011, it was hard to break the Herrick mind-set that inevitably prevailed across the UK defence community and challenge rigid assumptions that might have been eminently applicable to a very well established deployed operation, but which were far less appropriate in more expeditionary circumstances. The problem was exacerbated by over-optimistic expectations of the base facilities available at Gioia del Colle. It was expected that a NATO base in a European country would offer abundant amenities and support; in fact the GR4 and Typhoon detachments initially found themselves in an austere

environment that lacked power, water, sanitation, food, transport, fuel and on-base or even near-base accommodation for ground personnel. The contrast with a prepared and fully functional airbase such as Kandahar could hardly have been more pronounced.

Yet although the deployment phase of the operation proved extremely difficult, the main problems were quickly overcome, and Unified Protector ultimately provided the RAF with justifiable grounds for optimism. British airmen played a key role in air C2 at the ACHQ/CAOC level, exerting considerable influence. This reflected the scale of the UK air contribution, the training and experience of RAF personnel, their appointment to pivotal positions in such areas as strategy and intelligence, historically close ties with the USAF and membership of the 5-Eyes community. Among other things, RAF officers helped to establish the new CAOC and were substantially responsible for producing the CFACC's strategic plan in May and the development of Deliberate-Dynamic Targeting later on. There was periodic friction within the UK command chain, both UKACCs evidently believing that they had been required to refer too many issues upwards to PJHQ or beyond, but tension between centralised and decentralised C2 structures, functions and processes is as old as warfare itself. A more recent C2 problem that reappeared during Unified Protector – a feature of every major UK air operation since the first Gulf War – concerned the supply of key C2 personnel such as targeteers and intelligence analysts, which barely satisfied the demand.

At the tactical level, it is a fact that major combat operations invariably lead to the identification of multiple equipment deficiencies and proposals for enhancement, yet such recommendations were few during the conflict, and UK combat air capabilities quickly became central to the coalition effort. Throughout, the Tornado GR4 performed with characteristic effectiveness in the ground-attack and tactical reconnaissance roles. The detachment of 12 GR4s based at Gioia del Colle formed the spearhead of the UK air component in April, May and June and was enlarged to 16 aircraft in July to fulfil the requirements of the projected surge. Odyssey Dawn opened with GR4-launched Storm Shadow missiles amply demonstrating their combination of range, accuracy and penetration against targets in the Tripoli area, and the missile was also employed very successfully further south in August and September. However, the munition most commonly used by the GR4s over Libya was the 500lb Paveway IV.

Key design features such as in-cockpit programming and aircrew selection of weapon impact angle, attack direction and fuzing mode were especially valuable. Moreover, Paveway IV proved more accurate than earlier RAF PGMs and was better suited to scenarios in which there was a significant collateral damage risk. Some 900 of these weapons were ultimately released during Unified Protector.

No less successful was the GR4's Dual Mode Seeker Brimstone (DMSB). Pinpoint accuracy, 'man-in-the-loop' operation and a light anti-armour warhead combined to make DMSB a near perfect low collateral damage weapon, ideal for use against small targets in the built-up and populated environments where so much of the fighting took place. At the same time, in the reconnaissance role, the GR4 employed RAPTOR to image nearly 48,000 points of interest across Libya, and GR4s also provided extensive 'non-traditional' ISR using their Litening III targeting pods. Given the general paucity of ISTAR assets, this achievement was of critical importance. Ultimately, the GR4s flew nearly 1,500 sorties for 7,700 hours over the course of the operation.

Much attention inevitably focused on the Typhoon's performance in its new air-to-ground role. The deployed aircraft flew 578 sorties between March and their withdrawal in September for more than 3,000 hours. While the Typhoons could not at this stage carry Paveway IV or DMSB, their 1,000lb Enhanced Paveway IIs were regularly employed against targets involving lower collateral damage risks, and they ultimately released 234 of these munitions. Furthermore, the great potential of mixed Typhoon and GR4 formations was quickly realised. Unlike the GR4, the Typhoon was equipped with MIDS – the Multifunctional Information Distribution System, incorporating Link 16 and J-Voice. Via mixed formations, the benefits of MIDS and of the Typhoon's radar could be harnessed to the attack capabilities of the GR4, while the GR4 crews could pass on the benefits of their immense tactical experience to the Typhoon pilots. The variety of weapons available for attacking dynamic targets could also be extended.

Tactical success was not confined to the fast jets. Of Sentinel's achievements in the Libyan conflict, it can simply be noted that the operation led directly to the cancellation of plans to retire the aircraft from service in 2015. Apart from finding, identifying and tracking innumerable ground contacts, Sentinel regularly conducted change detection

and activity monitoring at key military facilities, and surveyed the various battle-fronts and traffic flows along the main supply routes. Moreover, its onboard analytical capability enabled the production and dissemination of analysed, real-time, actionable intelligence directly to the CAOC, other airborne ISTAR assets like the Nimrod R1s, or armed fast jets, although Sentinel's operators – V (AC) Squadron – also generated hundreds of post-mission intelligence products. Where such higher-value platforms were concerned, the principal constraint during the operation arose from their potential vulnerability to regime air defences. The assessed threat over Libya prevented the Sentinels from being exploited to their maximum potential for a time, although the range of their missions was gradually extended as the conflict wore on. They ultimately flew some 204 sorties during the operation for 2,228 hours.

Less conspicuous but no less important were the 8 Squadron E-3Ds and 101 Squadron VC-10 tankers that flew daily throughout the campaign. The two deployed E-3Ds mounted 225 sorties for 2,060 hours, providing airborne C2 for nearly 6,700 coalition air formations and coordinating humanitarian relief flights, AAR hook-ups and air strikes against hundreds of dynamic targets. The three deployed VC-10s flew 422 sorties for nearly 2,000 hours and offloaded nearly 10 million kg of fuel to RAF and coalition aircraft during the course of the operation. UK-based Tristars provided further AAR support, flying 55 sorties for approximately 430 hours.

For the UK, participation in Unified Protector was all the more challenging because of the parallel requirement to support Operation Herrick – a combination of commitments that substantially exceeded the planning assumptions of the recent Strategic Defence and Security Review and those that preceded them. Throughout, the number of deployed RAF personnel on Unified Protector never exceeded half the number deployed on Herrick; some 37 RAF aircraft were positioned in Afghanistan and the Gulf (including eight Tornado GR4s) during the Unified Protector surge. Against this background, it was inevitable that the various RAF force elements taking part in the Libyan conflict should have been severely stretched. Some GR4s flew in less than optimal equipment fits over Libya, and the expenditure of DMSB had to be monitored with particular care; employment of the weapon all but ceased in Afghanistan during 2011. The inventory of Litening III targeting pods could also barely meet combined

Herrick and Unified Protector requirements. The decline in RAF harmony breach rates visible since the end of Iraqi operations in 2009 was reversed.

More generally, intensive sortie rates over long distances sustained for months on end placed a heavy burden on the older aircraft fleets and created a high demand for spares support from the UK that was not always fulfilled very easily. Reduced serviceability was the inevitable consequence. It was remarkable in these circumstances that very few tasked missions were actually lost and that such losses as did take place were partly made good by scheduling extra sorties later on. A variety of expedients helped to sustain operational flying, but the UK air component primarily remained airborne through a brilliant and unstinting engineering effort at detachment level and, where the GR4s were concerned, by flying at less intensive rates than were recorded in earlier and shorter operations such as the two Gulf Wars.

Conclusion

The operation that began as Odyssey Dawn and was then transformed into Unified Protector was generated at very short notice and so with the absolute minimum of planning or preparation. The speed with which an effective coalition was created is itself one of the more remarkable features of the Libyan conflict. While early air missions partly took the form of deliberate attacks on Libyan military infrastructure, they predominantly involved disjointed and reactive dynamic strikes on regime forces as, when and where they were found, but the lack of any coherent plan was at first unimportant. The key objective was to halt the advance of Gaddafi's troops. This was successfully achieved, and they might have been pushed back further onto the defensive had there not been a temporary reduction of operational tempo during the transition from US to NATO leadership, which unfortunately coincided with a regime counter-offensive. Gaddafi was nevertheless forced to concede Benghazi to the rebels, and his subsequent attempts to capture Misratah similarly ended in failure. His forces suffered very heavy losses in this period.

And yet, from the coalition's perspective, this approach suffered from one fundamental drawback: it was open-ended. There was no air campaign as such. By May, this factor had become a source of mounting concern; it seemed that time was on Gaddafi's side.

If the coalition's goal of protecting Libyan civilians was to be secured in the long term, his behaviour had to be quickly and decisively altered; the only alternative was regime change. A means to achieve either of these ends at first proved elusive. While there was a partial reorientation of targeting towards Tripoli, the coalition was unable to reach agreement on further measures. Strategic proposals drawn up by the Air Headquarters were never fully embraced by the CJTF HQ, and attention was then diverted towards the Anglo-French AH deployment. This was publicly presented as a strategic measure but was, in truth, of little more than tactical significance.

Luckily, independent initiatives by the UAE, Qatar and France were in the meantime strengthening the rebel hold on the Jebel Nafusah, while broader training and mentoring activity was improving the capabilities of the FLF in the east. Gradually, it became clear that this approach might break the prevailing stalemate. Improvements in rebel C2 created scope to implement a more coordinated strategy across the main battlefronts backed by coalition air power and improved intelligence collection and processing, as well as faster exploitation in the form of Deliberate-Dynamic Targeting. Yet the FLF offensives towards Brega and Zlitan were quickly halted. Full-Spectrum and other air strikes in and around Tripoli subsequently maintained the pressure on Gaddafi, but coalition and regime forces were stretched to the absolute limit in the final week of July 2011. Fortunately, confronted by the FLF advance from the Jebel Nafusah, it was the regime that broke first, opening the way for the victorious rebel assault on the capital.

From this, it might appear that the decisive factor in Gaddafi's overthrow was the direct military support provided to the FLF – particularly in the west – but the reality is more complex. First, the FLF only triumphed after regime forces had been targeted from the air for a period of more than four months, during which time their strength and capability were very substantially written down either by direct attrition or desertion. Second, had Gaddafi been able to concentrate more of his forces in western Libya, the rebel offensive from the Jebel Nafusah might well have run into difficulties. The offensive was only successful because relentless pressure was maintained against the regime right across Libya, not only in the Brega and Zlitan sectors but also in Tripoli, where growing popular unrest imposed yet another burden on the over-extended loyalist security forces.

Air power was instrumental in achieving this effect. Its inherent speed, agility and reach prevented the rebels in Benghazi and Misratah from being overwhelmed in March and April, and coalition air operations later pinned regime forces in these sectors by supporting FLF counter-offensives. Moreover, throughout the advance from the Jebel Nafusah to Tripoli, air power provided vital support to the FLF in qualitative if not quantitative terms by repeatedly neutralising targets of particular tactical significance. Interventions of this nature continued throughout the final battle for Tripoli and the following seven-week campaign to overcome residual regime resistance in Sebha, Bani Walid and Sirte.

Yet if the RAF had good reason to be satisfied with the outcome of Unified Protector, the experience also compelled the UK defence community to confront some less palatable truths. It revealed an obvious need for more investment in NATO, particularly in the area of C2. While the RAF's contribution at Poggio was vitally important, it was denied any equivalent influence at the CJTF HQ. Had a UK airman of one-star rank been positioned there, his presence might well have helped to improve collaboration and coordination between the two command tiers.

More broadly, the operation highlighted NATO's dependence on the United States. The Americans not only played a key role in establishing and operating the Air Headquarters and CAOC; they also provided critical coalition capabilities in the form of ISTAR, AAR, SEAD and CIS. An absence of US support on this scale would have left gaping holes in the coalition order of battle that could not have been filled by any other single NATO country. Instead, it would have been necessary for alliance members to collaborate more closely and pool complimentary capabilities. Unified Protector certainly offered some important insights into how such a process might have worked but it also highlighted some of the potential difficulties, notably in the provision of adequate ISTAR and the distribution of intelligence.

Otherwise, the Libyan operation gave the MOD reason to reflect on the very nature of 21st century conflict. In the decade following the First Gulf War, western countries consistently sought to avoid the extensive commitment of ground forces due primarily to the costs and casualties involved. No-fly zones were established over Iraq and the

Former Yugoslavia, the Kosovo conflict was won without the launch of a ground offensive; in Afghanistan, the Taliban were overthrown by a combination of air power, SF and 'proxy' ground forces.

Yet the following decade witnessed a pronounced change – a renewed confidence in so-called 'boots on the ground' first exhibited in the second Gulf War but afterwards explicitly linked to the requirements of counter-insurgency (COIN) operations in Iraq and Afghanistan. These developments were accompanied by strident arguments to the effect that there had been a decisive shift in the nature of conflict towards COIN, which were regularly promoted alongside particular policy formulation, force structure and capability recommendations. The experience of Unified Protector, mounted without any major land deployments, clearly did not lend support to this stance and was thus an inconvenience to the more vociferous proponents of the boots-on-the-ground philosophy.

It would, of course, be quite wrong to maintain that Unified Protector somehow represented a turning point or a model for subsequent operations. The political advantages of the air and SF-based approach may be gauged from the fact that strategic victory was achieved in Libya in a period of just seven months with no formal land component, with no coalition casualties, with only a handful of civilians and rebels being killed by coalition fire and at a tiny fraction of the cost of the operations in Iraq and Afghanistan. They have since also been reflected in the RAF's extensive and protracted commitment to Operation Shader. Yet this does not necessarily mean that the nature of warfare has changed. Equally, however, no equivalent claim should have been made – let alone accepted – on the basis of the Iraqi and Afghan conflicts. The fact is that defence cannot simply prepare for one particular type of operation to the exclusion of all others. The key lesson of Unified Protector is that the armed forces must instead remain sufficiently flexible to respond to a broad range of operational contingencies despite the heavy cost and resource implications.

Notes

1. Unless otherwise stated, this paper is based on the Air Historical Branch narrative *The Royal Air Force in Operation Unified Protector*.
2. Camille Grand, 'The French Experience: Sarkozy's War?', p. 198, Bruce R. Nardulli, 'The Arab States' Experiences', pp. 341, 345, 346, 365-366, in Karl P. Mueller (ed), *Precision and Purpose: Airpower in the Libyan Civil War* (Rand, Santa Monica, 2015).
3. According to current NATO doctrine, the Joint Targeting Coordination Board is established by the Joint Force Commander (JFC). Typically, it reviews target information and develops targeting guidance and priorities while preparing and refining joint target lists for recommendation to the JFC. It is the primary agency for synchronising and managing joint targeting efforts. See AJP-3.9, *Allied Joint Doctrine for Joint Targeting*, Edition A, Version 1, April 2016, Chapter 4, Section V.
4. On Full-Spectrum Targeting see AJP-3.9, *Allied Joint Doctrine for Joint Targeting*, Chapter 1, Section V.