Airbase defence:

the optimum strategy to counter modern threats to joint air operations

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"It is far easier and more effective to destroy the enemy's aerial power by destroying his nests and eggs on the ground than to hunt his flying birds in the air".[1]

This oft quoted but appropriate comment dating from 1921 on the fragility of air power while it is stranded on the ground is particularly apposite when discussing airbase defence strategies. Airfields are highly specific areas within the battlespace that require largely static, high technology facilities that are also relatively fragile (certainly on expeditionary operations where hardened facilities are not usually available). Destruction of aircraft or any of their key vital support facilities may severely degrade or even cease air operations. Put quite simply, without an effective defence that has been carefully planned and executed, the losses to the overall campaign architecture may become so great that commanders progress may be unacceptably delayed or changes to the strategic plan may be required until air power has been fully restored. Friendly casualties are likely to be increased as a consequence of these delays or changes to the plan. Airfield defence forms a key element in the defensive battle for air forces, arguably of similar importance to all of those defensive measures adopted whilst airborne. The aim of this essay is to discuss the optimum air asset defence strategy for expeditionary joint component operations.

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The need for airbase defence

In all cases, history has shown that attackers will conduct penetrating attacks only where airfield perimeters are weakly defended, preferring otherwise to conduct stand-off attacks. The unavailability of forces, mal-deployment, poor leadership or weak command and control have all been exploited by attackers, resulting in notable successes by units such as those conducted by the SAS in North Africa and German Paratroops on Crete during WW II, and the Viet Cong in Vietnam. More than 60% of attacks have had the relatively modest aim of destroying vital equipment rather than seizing the airfield and have resulted in over 2,000 aircraft being destroyed world-wide between1940 and 1992.[2] The more complex, and difficult, aim of capturing airfields would entail the use of larger formations of troops, whereas relatively small groups of attackers can achieve great effect against poorly defended air assets. Capturing airfields is now often deemed unnecessary in a manoeuvre-battle scenario where the real estate is often of more value to the fixed defender as opposed to the highly mobile attacker who can simply flank the area and move on after rendering it safe by forcing the enemy to cease his air operations. The time and effort required to re-activate severely shelled air bases, and in

particular aircraft operating surfaces, may be too great for the speed of the campaign, and the choice to simply destroy enemy air assets rather than the entire infrastructure will allow rapid re-occupation by friendly forces that can then operate more closely with frontline units in the Offensive Counter Air role.

Vital air power and its dramatic effect on the battlefield have been severely reduced where airfields have not been provided with adequate defences. In certain cases, such as North Africa during Operation TORCH allied attacks against axis airfields greatly affected the precarious balance of air power in the campaign, resulting in a favourable air situation and thus assisting an allied victory.[3] Modern airbases are necessarily large pieces of real estate, with even modest fixed wing bases requiring lengthy runways and comprehensive servicing facilities. The area covered comprises that inside the wire and a sizeable area of vital ground outside of the perimeter, from which stand-off weapons can be launched and in which the airfield and aircraft on approach or take-off are vulnerable to SAM attack. This results in large areas that need to be covered by observation, fire and patrolling around airfields (approx 100 sq km area for an average airbase[4]), highlights the requirement for a well sited observation post screen and a reaction force. In almost all cases where exterior patrolling has not been conduced, defenders have received extremely damaging attacks against their air assets. In the case of the Long Range Desert Group[5] (LRDG), operating deep in the Libyan Desert during WW II, patrols usually observed the target by day and laid-up in positions adjacent to airfields before attacking at night. It is assessed that had the German defenders conducted patrols, set-up listening posts and observation posts in the limited likely approaches to their airfields the LRDG would have been successfully interdicted and deterred from attacking their intended targets.

Ground defence

While much of the data applicable to airbase attacks concentrates only on those accurate records obtained from Main Operating Bases (MOBs), there is little doubt that effective attacks on smaller airstrips, dispersed facilities such as helicopter operating locations and other air asset locations have taken place and been successful. The concept of defence for these dispersed locations can be assumed to have synergy with fixed MOBs to a greater extent: the major issues being simply of scale. Forward operating bases and units placed far forward in the battle space may attract a greater intensity of enemy threat, and the decision to position air elements here must be fully understood and justified by planners. As ever, greater potency is becoming available from weapon systems such as attack helicopters that need to operate in forward areas. The effect of their subsequent loss will be felt more acutely.

Success against aircraft and air operations has been achieved largely on the ground by groups of regular, irregular or specialist forces approaching the airfield on foot and in vehicles in order to conduct a stand-off attack with the aim of destroying aircraft or facilities.[6] The enemy usually operate in groups of 4 to 30 personnel (the mode being 5 personnel[7]) with the aim of destroying or severely degrading materiel, aircraft or the vital support services that are needed to continue air operations. The mere threat, or potential for ground attacks, has caused disruption to allied efforts, and the need for dedicated airbase defence utilising specialist manoeuvre forces has long been recognised by the UK and written in to national doctrine.[8] Other nations have adopted a static, 'wire-walking' approach, relying on army units or coalition forces to dominate the large areas of interest and vital ground that exist in the vicinity of airfields e.g. French and USAF Security Forces. Recently, more progress had been made within 'wire-walking' protagonists as they realise the needs and benefits of a more holistic approach. Some of the lessons have been learned the hard way, with successful attacks against French and US facilities in North Africa and Vietnam respectively. The US forces in Vietnam discovered the benefits of creating defended zones around their airfields that were usually situated close to built-up areas. In order to avoid rocket or mortar attacks these zones could be as large as 10 km from the airfield perimeter, with the most vulnerable area being that zone between 5,000m and 10,000 m.[9] Within these

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huge areas, key terrain must be identified and the most likely weapon launch sites dominated by either view or patrolling in order to make the defender's task manageable. The USAF Security Forces became adept at defending American airbases with the assistance of Vietnamese levies and US ground forces, that operated outside the wire. Unfortunately, no specialised forces were trained or employed and success depended upon the local quality and training of the forces assigned; differences that caused some serious losses of US aircraft and facilities. The employment of levies in both Vietnam by the US Forces and earlier in Trans-Jordan and Iraq by the RAF Regiment has proven the efficacy of their unique local knowledge and understanding of the demography of the area, leading to a far more effective defence in areas where significant cultural, language and political differences exist between defender and the host nation.

Most defence plans have worked from the outside inwards, dealing with the longest range threat first and working inwards towards short-range threats. This approach has the advantage of eliminating the longer range artillery and rocket attacks that proved so destructive in Vietnam, but on the other hand is costly in terms of the manpower and the effort required. Recently, some have postulated the opposite approach and recommended securing the individual assets first and working outwards. This approach favours the internal security concerns initially and allows for lighter forces to be deployed, perhaps as part of an initial package to provide defence. It has particular value in mitigating suicide attacks and improvised explosive devices, but cannot deal with determined stand-off attacks very effectively. Logically, threats must be dealt with as they occur and cannot always be accurately pre-determined. A wide range of deployment options must be available to the defender if he is to defeat all reasonable threats that may range from individual suicide bombers to long range artillery, cruise missiles and mortars. The choice of which stance to adopt may lean towards close-in or ranging out to the most likely stand-off attack areas and will be informed by careful analysis of the most recent intelligence. Additionally, host-nation constraints may preclude external patrols; instead local security forces may provide sterile areas cleared of local civilians and strict control of entry procedures. Conversely, the area immediately surrounding the air base may be heavily populated (as were those at Da Nang and Tan Son Nhut in Vietnam[10]) or transited by the local population. The quality of local forces will range from rudimentary to extremely effective, and coalition partners may choose to defend their geographic boundaries alone. In all of these scenarios, close cooperation between commanders is required to ensure that defensive gaps are not left open and that fratricide is avoided.

Simple plans are always the best, and physical separation of activities between 'inside the wire' and 'outside the wire' provide clearly de-marked areas of operation. Within airfields national sectors are more easily defined by physical features such as runways etc, however the practical problems of managing the defence should not be underestimated, particularly where rules of engagement (and the willingness to use force) differ widely between coalition partners. In addition, the airfield must be considered as an entity by the Joint Force Land Component Commander and his staff. Formation boundaries should not be planned to bisect airfields since defenders will become greatly hindered in their attempts to control their area of responsibility if it is shared between adjacent brigade or other boundaries. This problem is made substantially worse if boundaries of different partner nations bisect airfields. Widely differing approaches to ground defence between coalition nations may cause fratricide if a combined C2 facility is not created. Inevitably, the key airfields will be shared by many partners and cultural differences need to be overcome in order to offer a robust defensive network between national sectors.

"Manoeuvre is the decisive element at all levels in the defence. By combining movement with fire, the defending forces make the best use of the terrain assigned to them in order to inflict high losses on the enemy and at the same time avoid destruction by enemy fire. By manoeuvre, the commander concentrates combat power, permitting him to

create a favourable force ratio in order to defeat the enemy".[11] Although the RAF Regiment tends to specialise in the area defence of air assets, the concept of manoeuvre warfare remains extant. Post Op MERCURY, the German invasion of Crete in 1941, there has been a recognition in the UK of the need for specialist airbase defence forces. Those forces present on the island at the time were mal-deployed and ill-equipped (in the case of RAF tradesmen both mentally and in equipment terms) to face a determined enemy that attacked from an unexpected direction (by parachute, rather than by amphibious means as expected by the commander, Gen Freyberg, following ULTRA intelligence[12]). The following loss of Crete has been attributed largely to a poor understanding of the specific needs of airfield defence, the absolute requirement in this case to prevent the Germans from gaining their foothold at Maleme airfield and the poor use of reserves and tradesmen who were rendered useless due to a lack of available weapons and the will to deploy non-infantry troops in the defence of their own bases.

The need to defend against stand-off and penetrating attacks[13] provide all-round defence and defence in depth with the limited force sizes available lead naturally towards a manoeuvre strategy. The 'find-fix-strike' principle[14] results in a requirement to accurately observe and react to targets as they appear. Finding the enemy relies upon adequate 24-hour observation ability including thermal imagers and battlefield radar coupled with an infantryman's skills in knowing where to look. Once found the enemy must be fixed by holding him in such a position that he cannot become 'un-found' again. This may be done by a mixture of channelling into holding areas where he is no longer such a threat, by harassing fire, patrol activity (in vehicles, on foot or by air) or by illumination at night that will force him to remain where he has been fixed. The need to able to operate 24 hours a day results in a much greater reliance on night vision aids with a consequent training bill and logistics chain. The benefits, however, are a decrease in the number of personnel required to defend a base and the ability to find and fix an enemy without always relying on fire support. Finally, neutralising the threat by a strike could involve a direct assault, indirect fire or a combination of techniques that will render the enemy threat ineffective. More realistically, during periods of increased tension that fall short of general war, rules of engagement will dictate that the find might take place using sensors, the fix by illumination and the strike by arresting the suspects in co-ordination with host nation law enforcement agencies.

Type designed and equipped ground forces are required to increase the chance of a successful defence, particularly for forward deployed air assets such as helicopters or ground attack aircraft that may operate from bare base locations that do not benefit from any of the static defences usually built at permanent airbases. The use of non-dedicated forces has been largely discredited with army units often being re-assigned to more pressing tasks in forward areas. This development is coupled with the increase in terrorist activity post-9/11 and the subsequent attempts to shoot down aircraft on the approaches to both military and civil airports that have occurred, leading to greater thought being given to the mechanisms required to defeat this pressing threat. Novel approaches, including the use of pan-dimensional defences to reduce collateral damage, the inclusion of civilian agencies and the ever-present communication problems have tested defenders who have to succeed 100% of the time, whereas an attacker only needs to have one successful attack to achieve significant results. All of the most recent threats have forced defenders to modify their planning to take account of suicide attacks. Where terrorists are prepared to die for their cause routinely, the effects of collateral damage become significant in deciding how and where to neutralise the target. It may be appropriate to allow a 'controlled terrorist success' against a target if that area has been evacuated, rather than risking massive collateral damage in an uncontrolled crash following defensive action.

In the RAF Regiment field squadron the 81 mm mortar flight currently provides Mortar Fire Control parties (MFC) that make excellent use of Intelligence Surveillance Target Acquisition

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and Reconnaissance (ISTAR) assets in the form of MSTAR battlefield radar, thermal imagers and laser range finders linked to Special Purpose GPS Receivers (SPGR). The combination of the ISTAR and heavy degree of firepower available to the field squadron results in a high capability of finding and fixing the enemy while manoeuvre forces strike. Linked with the ability to project indirect fire out to nearly 6,000 m, the mortar flight provides the bulk of the squadron ISTAR capability by operating the sensors and performs the vital communications links between static OPs and manoeuvre elements that ensures the success of any strike. The indirect fire characteristics of the mortar, coupled with its firepower effect and accuracy when controlled by experienced crews equipped with the latest target finding and plotting aids give a field squadron the decisive edge. Unfortunately, bursting munitions often suffer from restrictive rules of engagement in operations other than war. In particular, high explosive rounds must be specifically requested prior to employment, although illumination and smoke may be authorised for more general use.

Direct fire weapon systems offer utility against point targets in scenarios where rules of engagement insist on discrimination. A variety of machine guns, sniper weapons and grenade launchers have been used to provide the firepower

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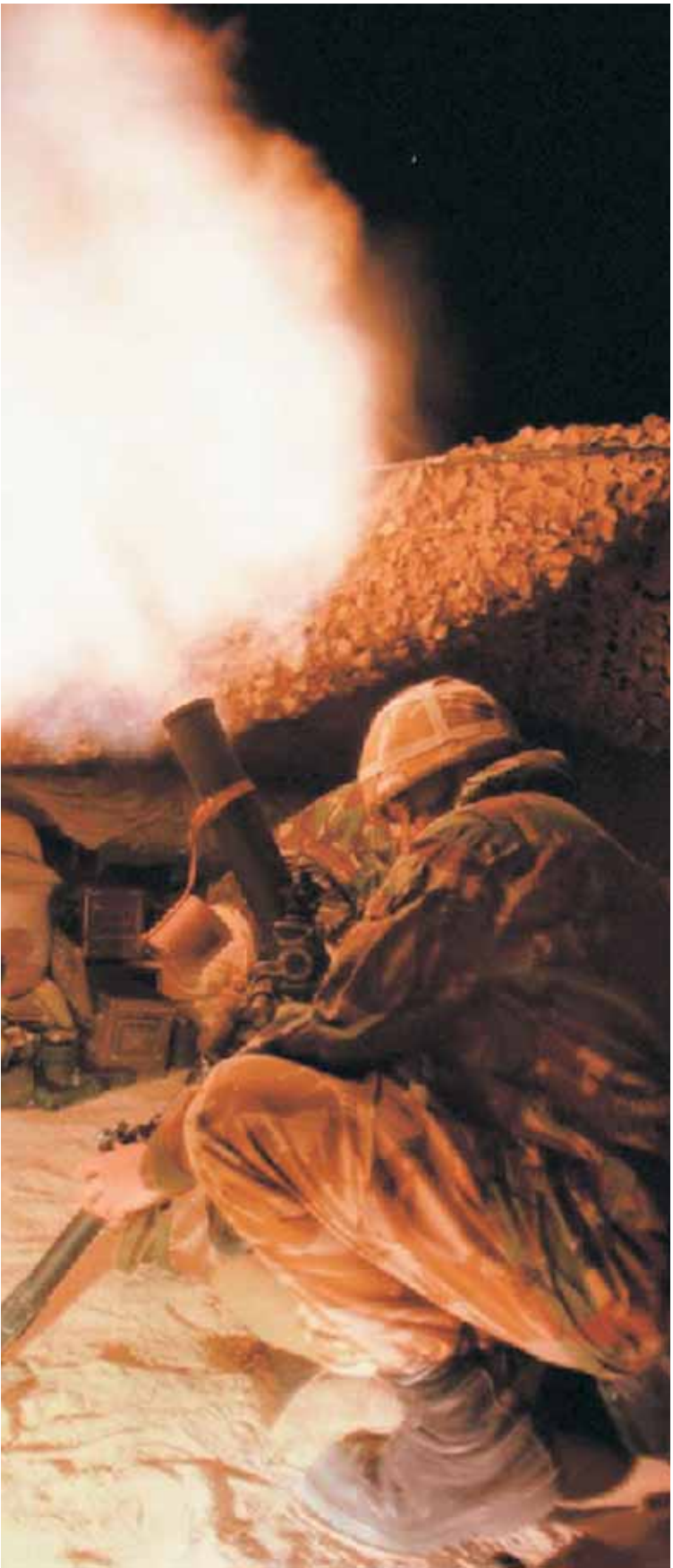
required. However, despite obvious advantages all point attack weapons lack the area coverage that bursting munitions provide. In addition, the relatively short range and line-of-sight requirements of most machine gun systems means that they must be transported to the firing point. In mobile scenarios, it might be expeditious to mount weapons on light vehicles, although targeting accuracy is generally compromised as a result.

As part of an overall weapon strategy the mixture of direct, indirect, point attack and area coverage systems seems to offer the greatest ability across the defensive scenario. Deconfliction with aircraft movements on approach and departure lanes is required if air ops are to continue. Only with local agreements between air traffic controllers and the deployed field squadron to establish agreed operating procedures can a mutually acceptable defence posture be maintained. Little doctrinal advice currently exists on this subject, but adhoc arrangements have been practised locally that have suited all partners. Issues such as the firing of munitions while aircraft operate locally, night vision blooming caused by infantry mortar illumination and communications difficulties all require careful planning if the air operations and ground defence are to work in harmony.

The availability of intelligence information is not usually a problem for formations that are co-located with flying units due to their air-intelligence gathering and analytical capability. The need for bespoke intelligence analysis in the specific ground role gives the ground commander the planning edge that he needs to deal with threats and mould his forces to meet them. Usually, the electronic access is available to glean local ground intelligence information and requests for information can be issued by collators to ease the flow. However, this task has skill-set and security clearance issues that are inextricably attached to it, and a trained analyst who is attached to the ground defence unit would achieve far greater quality results. This approach requires investment in training and cultural changes to the pre-conceived notions that dominate the employment potential of properly equipped personnel on front-line units. Use of other security agencies gives access to local knowledge that may not be available otherwise. This local knowledge greatly enhances the ability of the defender to do his job, and is of inestimable value but requires an investment in time, effort and staff work by planners to ensure that systems may be developed quickly once the deployment commences. Time and effort is also required to analyse all the available intelligence, a function that does not always exist at the appropriate level currently within units that are not equipped in terms of manpower or skill-sets to exploit that information which is available to them from both electronic and human sources. Limited size forces must have access to the best information if they are to operate effectively, and in addition to intelligence feeds, much information can be gathered locally from the indigenous population and security services leading to a requirement for attached interpreters. These higher level functions usually exist only at battalion-level and above. Greater flexibility is needed to ensure that the needs of airbase defenders are catered for by attaching personnel with the correct skills to conduct intelligence analysis at unit level. It is simply not adequate enough to plagiarise the



general intelligence summaries that are nearly always far too general or vague.

A level of local input is required from host nation and coalition intelligence/anti-terrorist organisations in addition to the local information gleaned by patrolling activities. Indeed, the role of interpreters can be expanded to include the production of correspondence in local languages to facilitate force protection initiatives between forces and necessary contract writing. Indigenous employees are usually the ideal group to employ, and with streamlined hiring and security vetting procedures followed by careful management, their role could produce far greater integration between deployed forces and the host nation. This micro-level of detail knits together with pan-dimensional sources to form the tapestry.

Defensive counter air battle

The immediate destruction of enemy fixed-wing air forces during the opening stages of any conflict has reduced the air breathing threat in most scenarios to a minimum. However, as the effectiveness of technology to defeat one threat improves, so does proliferation of states acquiring relatively cheap alternative methods of prosecuting attacks. These new threats have concentrated GBAD thinking recently with an increasing requirement to defeat these challenging targets in restricted airspace scenarios where having to take the first hit may be decisive, particularly if the enemy successfully delivers a Weapon of Mass Destruction/effect (WMD/e) at a strategic point. The enemy can regain some of the balance of air power if he chooses to employ relatively cheap forms of attack vehicle that may be armed with WMD/e in massed attacks that may only be semi-guided or unguided, but with potential to cause significant effects, whether real or psychological. Forcing allied forces to don protective clothing constantly throughout an already high heat stress environment will produce worthwhile effects for an enemy intent on delaying or affecting the prosecution of air power in a campaign.

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Picture (RAP) for early warning and situational awareness, and layer with coalition missile systems to provide an umbrella of coverage out to several tens of miles from the defended assets. Most in-service GBAD weapon systems were designed for Cold War operation and optimised against air breathing threats in all but a few cases. Few have an anti-ballistic missile capability. Even the threat of TBM attack may halt an expeditionary operation before it has begun[15] but this national capability is a subject that is not within the scope of this essay and will not be discussed.

Furthermore, many systems were designed to operate independently, and only recently have been equipped with appliqué data links as a first generation attempt to rectify the significant drawbacks that result from an inability to integrate into the wider airspace battle at an appropriate level. Without a RAP, ability to communicate by voice secure means, positively identify the target and assure the air-commander that fratricide risk has been minimised, GBAD systems remain tied to restrictive positive control methods that greatly reduce their effectiveness against the hard-to-hit target set. The simple matter is one of lack of decision-making time. If the target is not positively identified early enough for the GBAD system to react and engage (often with only a single-shot kill probability of 0.5), perhaps with two missiles, then the target will often become un-engageable and the attack will probably succeed. Airspace control is the key to effective GBAD, with defenders requiring the technical and cultural ability to fully integrate into the DCA battle. One of the key challenges is to gain the trust of friendly air staffs and operators who will naturally suspect that the major threat to their survival is from fratricide rather than any enemy ground or air fire.

Complementarity is attained where coalition GBAD systems integrate into the defence and the layered concept plugs gaps (releasing airborne DCA assets further forward to deepen the defence) in capability that would otherwise cause concern that specific attack profiles could succeed. Ideally, a medium SAM system is teamed with short range (up to approx 10 km range) air defence platforms and very short range weapons (under 10 km approx)in a near real-time data network that is fed from the overarching radar coverage. Although currently limited, GBAD sensors should also feed back up to the overall RAP wherever possible. The coverage data from ground level to medium level obtained by the specially tuned Doppler shift radars that equip GBAD units could provide useful gap filling for airborne radars that are often limited by ground clutter. Many radars that equip ground based control and reporting centres are necessarily interrogating only above-height limits, leaving gaps in coverage that an enemy may exploit with a variety of threat vehicles. The need for data transmission capability in a network enabled capability for GBAD is beginning to be addressed in a variety of ways worldwide. The sub-one second latency required for air defence networks is challenging industry to provide adequate deployable communication networks into the field that can connect all sensors together in order to allow commanders to view the full RAP

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and pick-off the appropriate information to suit their essential needs. This capability will unlock the latent potential for in-service weapon systems that are currently hindered through restrictive engagement practices that attempt to avoid fratricide. For the future, new GBAD weapon systems will be designed from the outset to exist within a fully NEC battle space that can fully utilise their capabilities. Certain GBAD systems also offer unparalleled surveillance in the ground role with extremely effective thermal imagers that, while optimised to provide high resolution definition of air targets, can be programmed to conduct automated ground area searches during periods of lowered enemy air threat as a secondary role. In addition, the often remote nature of GBAD sites that require clear fields of view and fire for their effectiveness results in a defence problem and a solution at the same time. The extra guarding required to defend a remote site may be completed by a co-located active defence grouping.

GBAD can release air assets further forward, tap into and exploit the Recognised Air Picture (RAP) for early warning and situational awareness, and layer with coalition missile systems to provide an umbrella of coverage out to several tens of miles from the defended assets

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Commanding the force protection battle

Leaders in airfield defence have recognised the requirement for specialised units, formed from within their own organisations to eliminate their arbitrary re-allocation of forces to more pressing or seductive tasks during operations. Where airbase defenders are cultivated from within air forces there also exists the air force culture and air-mindedness[16] that assists in integration of C2 and harmony of aims between aircraft operators and defenders. Historically, this aspect of ownership has proved decisive with many airfields being lost to the enemy simply due to the pressure from land commanders to re-deploy infantry formations forward.

Far from being classic rear-area locations, airfields are now considered key ground, with any losses in scarce air assets likely to greatly affect the campaign outcome. The threats are not usually from predictable, regular formations but are likely to encompass specialist units, special forces, terrorist attack and other asymmetric threats. Unless airfields are located within lines of advance on potential battlefields it is unlikely that the defender will face main battle tanks as a threat, but almost all other types of attack are possible from both land and air. Indeed, an occasional airfield attack during WWII featured a submarine approach![17] Although this method of insertion is unusual it remains a sobering thought that attackers will exploit any weaknesses in defences and approach by any means. Vehicle and foot insertion methods are the most popular with an initial vehicle approach followed by foot patrol into a stand-off attack area. This method allows for heavy stores to be brought forward efficiently and then carried the final distance for the attack. The weight of mortar rounds and rockets may preclude long insertion marches and terrain will assist any vehicle approach where dead ground or foliage permit camouflage to within striking range. Even in a desert arena attackers may approach airfields with stealth as the Luftwaffe discovered to their cost in North Africa during WW 2. Long Range Desert Group and SAS patrols were able to lay-up in the vicinity of airfields by day using camouflage and attack at night, causing significant destruction for the numbers involved. Careful recce will expose the most likely lines of infiltration, exfiltration and weapon launch points. Defenders must conduct the same process when planning their defence and dominate the areas of interest by patrolling, observation or harassing fire. Luftwaffe commanders in the Western Libyan Desert did not appreciate the ability of determined troops to patrol for hundreds of miles by vehicle or foot in order to prosecute attacks and the lack of their own patrol activity in the vicinity of their airfields resulted in easily exploitable weaknesses. The SAS were able to infiltrate airfields and place demolition charges, damage or destroy facilities and aircraft and render airfields inactive. An Axis intelligence summary from April 1942 states:

"The LRDG plays an extremely important part in the enemy sabotage organisation. The selection and training of the men, the strength, speed and camouflage of the vehicles for the country in which they have to operate have enabled the group to carry out very effective work, particularly in the destruction of Axis aircraft on the landing grounds at Agedabia and Tamet".[18]

Clearly, the special forces-style attacks, begun by the LRDG and then bolstered by the SAS post-1942, caused the enemy much frustration and loss of vital equipment. With this requirement to defend large areas against a range of attacks, airbase defence has developed into a specialised business. Regular infantry formations are not equipped to provide the firepower, mobility or surveillance in sufficient numbers required to succeed. Therefore, a type-designed unit has been built within the RAF Regiment in order to provide the balance of skills, equipment and standard operating procedures that have been proven to be battle-winning against the range of threats. These may range from high tempo, challenging adversaries to asymmetric attacks by local levies or other irregular forces. The RAF Regiment Field Force units are equipped with a high degree of firepower that includes support weapons (81 mm mortar and Sustained Fire General Purpose Machine Gun, GPMG), snipers, and numerous GPMGs to replace the less powerful light support weapon (LSW). For illustrative purposes a field squadron deploys approximately the same firepower as a regular Army battalion and its size is akin to a Company Group, but this is where the similarities end. Each fire team

(four men) is equipped with mobility (Landrover, fitted-for-radio) and each man carries a weapon-mounted night fighting aid. Squadron surveillance comprises battlefield radar, thermal imagers and a suite of passive night aids. Recently, the addition of Landrover gunships has increased both firepower and the physical presence of patrols. In total, the force package can find the enemy effectively, fix him with support weapons and strike using highly mobile teams.

A C2 system that is expeditionary, equipped with air-minded and experienced personnel, placed near to the centre of the deployed hierarchy, who can plan and execute the defensive plan is required. Specialist teams are needed from the planning stages in order to ensure that air power may deploy and operate effectively. Moreover, the number of agencies involved (ranging from medics and policemen to logistics and engineering groups) mitigates an adhoc approach. Leadership is required in order to manage the disparate interests of operator versus support agencies. Once a steady state has been achieved, the tactical element of the C2 network may be withdrawn and replaced by a roulement in most circumstances, leading to a smaller number of deployable teams. In addition, training as a formed team is the best method of ensuring that force protection is guaranteed from the outset. Finding the time and suitable locations for training has challenged exercise planners, but over time a culture of expeditionary preparedness can be established if the key groups of leaders are developed. Annual training in basic skills can be topped up with individual and team exercises, but this approach relies upon a common set of operating procedures and some external validation if the final team exercise is to have the required beneficial effects. Time to complete this training during a build-up phase cannot be guaranteed, although the value of training while deployed in assembly areas cannot be overemphasised due to the acclimatisation benefits and relative lack of distractions when compared to the pre-deployment phase. In the ideal world trained teams would be held at short-notice standby and require only acclimatisation training once deployed.

The actual equipment required for C2 will depend on the type of location to be enabled, but as a general rule, should be lightweight, dismountable and weather-proof. Communications is one of the most challenging aspects initially and the ability to communicate to all sub-units and upward report by secure voice and data are essential. In addition, the ability to manage the local battle may result in requirements as diverse as local public address systems to management radios, mobile telephones and tactical radios. Public broadcast systems have great utility on fixed bases since they can give warnings of attack, all-clear information and better prepare personnel to survive myriad potential attacks.

Field defences on airbases often cause consternation due to the network of underground cable runs and pipelines that usually comprise the infrastructure. Building-up rather than digging positions may give the double benefit of increasing weapon and surveillance arcs over relatively flat ground. Tall buildings may limit arcs of view and fire but may be used to site positions on in order to turn their height to an observation advantage. Lightweight control of entry methods such as caltrops across entry points might be preferred to cumbersome barriers in an expeditionary scenario. Usually, novel approaches will enable reductions in the initial freight bill and greatly enhance deployability at a time where logistics planners scrutinise every item to reduce the overall freight costs. In the same vein, protected mobility might be essential in a high mine or sniper threat environment, but the weight of the vehicles, their lack of cross country mobility, in most cases, and the specialised servicing requirements often leads to them being excluded.

Summary

The need for air asset defence has been proven historically and the techniques required to ensure a successful defence have evolved rapidly in the past decade since expeditionary air operations have become increasingly common. The fundamental changes in philosophy that have been required by all personnel involved in air operations when they have suddenly been required to move away from fixed, often hardened Cold War main base locations

The fundamental changes in philosophy that have been required by all personnel involved in air operations when they have suddenly been required to move away from fixed, often hardened Cold Warmain base locations to austere locations must not be underestimated

to austere locations must not be underestimated. In many cases the resourceful leader has been a vital commodity. Able to build and operate high-technology equipment from harsh climatic conditions worldwide, is no longer considered difficult by leading players, particularly in the War Against Terrorism. Instead, rapidly deployable air power is relied upon in order to prosecute rapidly moving multi-dimensional conflicts. Concurrently, the threat environment has widened with air bases being generally further forward, and the rear areas threatened by terrorist action with the potential for WMD/e weapons to be employed anywhere.

Command and Control structures are key to winning the force protection battle, with the need for centralised command and decentralised control within a network enabled communication system that includes both encrypted voice and data transmission at latencies that allow near-real time updates to provide the required situational awareness. Specifically, within GBAD C2 near-real time means sub-one second latencies — a significant challenge to in-service networks, and an absolute necessity when defeating hard-to-hit targets. Future capabilities promise the kind of electronic ability and computing power that will be able to provide the speed necessary to command the battle at the pace that will destroy the enemy's ability to affect the decision cycle. With networked C2 systems and sensors greater synergy between air and ground platforms is created when all sensors feed into a RAP. Dynamic control becomes realistic and fratricide risk greatly reduced. In addition, the deployment of assets further forward will deepen air defences and reduce and effect of attacks. The relatively impermanent nature of air patrolling can be replaced to some degree by GBAD systems that have more permanence and cost less in general to provide.

Ground forces need to remain type-designed as light, deployable, and heavily armed with high numbers of night vision aids and ISTAR assets in order to achieve the ever-shortening time-scales required for deployments world-wide. A flexible approach will allow access to mission-centric equipment such as protected mobility. Linkages with host-nation and coalition forces need to be robust to avoid fratricide; ideally within joint operations rooms. Furthermore, boundaries must be agreed and deconflicted at the outset. Skills required on expeditionary operations include the need for accurate intelligence in order to inform the choice of defensive posture. Employment of locals to decipher local customs, translate documents, produce letters etc, and assist in patrolling activities will enable a much better local tapestry to be produced when all sources are merged. Training unit personnel in low-level intelligence skills might seem expensive but pays dividends quickly on operations.

Operations in the littoral are set to increase in frequency, as deployments require landing areas, beachheads and ports in order to deliver equipment. Vulnerabilities increase where assets are bunched and the operating procedures for defenders are complicated greatly due to the wide range of differing units involved, single-service interests and lack of universal communications. In future, more universality should decrease communication issues, but the battle space will remain challenging for all sensors due to the terrain nature of the littoral where optimisation for land or sea use become an Achilles heel.

The increase in terrorist and asymmetric threats will probably result in a continued requirement for 'professionalisation' within air asset defence. If lessons are to be learned, leaving this vital area in the hands of enthusiastic amateurs usually results in vital equipment being destroyed or rendered ineffective.

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Notes:

[1] Gen Giulio Douhet 1921.
[2] Snakes in the Eagles Nest, p xiv.
[3] Snakes in the Eagles Nest pp 40-44.
[4] RAF Regt Tactical Doctrine para 0324.
[5] LRDG, pp164-165.
[6] Snakes in the Eagles Nest p xvi.
[7] Snakes in the Eagles Nest p 58.
[8] Formation of the RAF Regiment on 1 Feb 1942.
[9] USAF, Attack on Udorn (26 Jul 68): Project CHECO Southeast Asia Report, 17 Dec 68.
[10] Snakes in the Eagles Nest, p 98. Da Nang and Tan Son Nhut were located adjacent to metropolitan Da Nang and Saigon respectively.
[11] ATP 35 (B) Para 0409.
[12] Crete, The Battle and the Resistance pp 156-7.
[13] RAF Regt Tactical Doctrine Para 0328 and 0329.
[14] RAF Regt Tactical Doctrine Para 0233.
[15] air power and Expeditionary Warfare, Goulter in air power 21.
[16] Flexibility of air-minded troops during WW II, Air Ministry Report, 1945.
[17] Snakes in the Eagles Nest- SBS raid on Kastelli Pediados, Crete 1942. P 118.
[18] LRDG, p 164.