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Setting The Pattern

by

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96

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DEDICATION

I would like to dedicate this thesis to my parents, Albert and Betty Gladman, whose unwavering support was an essential element in its successful completion.

TABLE OF CONTENTS

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Approval Pageii
Acknowledgementsiii
Dedicationiv
Table of Contentsv
CHAPTER ONE: INTRODUCTION1
CHAPTER TWO: COMMAND, CONTROL, AND COMMUNICATIONS12
CHAPTER THREE: INTELLIGENCE53
CHAPTER FOUR: OPERATIONS
CHAPTER FIVE: THE CAMPAIGN127
CHAPTER SIX: CONCLUSIONS168
BIBLIOGRAPHY178

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CHAPTER ONE: INTRODUCTION

During 1940-43, the Western Desert was a tactician's paradise, but a Quartermaster's hell. The seemingly endless desert of rock, salt marsh, sand, and dust storms were difficult on men, vehicles, and aircraft alike, and provided none of the resources which armies needed to live and fight. Certainly, the low force to space ratios and wide open spaces allowed brilliant mobile operations, but this freedom of movement came at a heavy price. The desert forced armies into an unprecedented reliance on supply columns, and deficiencies in supply were keenly felt. Usually armies can find some of their vital supplies in the areas they occupy, but not in the desert. Even water had to be trucked in over long and vulnerable road networks, and fuel, ammunition, spare parts, reinforcements, and food. Following the coast it is approximately 2250 kilometres from Tripoli (the German's main supply port throughout the campaign) to El Alamein; even as the crow flies, the distance would still be 1600 kilometres. Thus the side which could continuously interdict the other's supplies would gain a distinct advantage. Only one side tried to do so. The Germans, despite some success with interdiction in Spain, 1 did not engage in an interdiction campaign against the enemy's

supplies; the British did. The RAF had the opportunity to deliver a blow to a vital part of the German war machine, the effect of which destroyed the fighting ability of the Wehrmacht before the battle of El Alamein. Intelligence made this possible.

A central aspect of intelligence is its role as a force multiplier - a means to maximize the efficiency of the use of force. This value is most notable when intelligence lets one side throw its strength against an enemy's weakness, or aids its attack on a vulnerable and essential part of the enemy's forces. Supply formed such a target during the war in the desert. The desert provided nothing save "camel dung".² Everything which armies used to fight and survive had to be brought forward along perilous and fragile supply lines. Any interruption in those lines immediately and significantly degraded one's fighting ability. It was not, however, easy to prevent the enemy's supplies from reaching the front lines. The targets were a small number of enemy land convoys moving across several distinct road systems in an area of roughly two hundred thousand square miles, and they were attacked by a small number of British aircraft. Unless used with great efficiency, the impact of these forces would have been small. To make this a profitable

venture, the Royal Air Force had to expend fewer resources than it destroyed. Otherwise, interdiction would have proven a liability rather than a success. Intelligence provided the means by which the interdiction campaign became more cost-effective.

The war on supply has attracted mixed attention from scholars. On the one hand, the interdiction campaign against the sea supply routes from Italy to North Africa by air and naval forces based on Malta has become famous. This is especially true because of the role which Ultra played in this sometimes spectacular campaign. Through Italian records and those of Ultra, which provide a virtually complete record of how a secret source guided warships and aircraft to their targets, the results of the Royal Air Force and Royal Navy's attacks in the Mediterranean are readily quantifiable. Yet all this attention has created an imbalanced picture of the nature of the interdiction campaign, and it has also produced a paradox. It is now clear that most Italian merchant ships which sailed for Tripoli got there, and that Malta based interdiction did not severely disrupt Axis shipping to Africa until January 1943.³ Yet it is also clear that from November 1941 onward, lack of supply always threatened the Afrika Korps with

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destruction.

This contradiction can be explained if one addresses a topic which, until now, has not had a serious scholarly examination.⁴ By the middle of 1942, the Royal Air Force (RAF) had created an efficient system to attack the motorized supply columns on which the Axis forces depended. These attacks were guided by a wide variety of intelligence sources which could gather and disseminate information in time to be used by the RAF, and a command, control, and communication system which worked with remarkable speed and effect. Aircraft were launched directly at the target, maximizing the damage inflicted while minimizing the resources used. In 1942, this interdiction campaign crippled the supplies of Panzer Army Africa, and helped turn the tide of war in Africa. General Montgomery had a sledgehammer to use at the battle of El Alamein, but air interdiction had turned the Axis forces into an eggshell.

By this time the Axis forces facing the Eighth Army "were down to three basic loads of fuel - instead of the thirty or so which [Rommel] claimed were needed in Africa and eight to ten of ammunition."⁵ The term "load" refers to a standard periodic issue of fuel, ammunition, or other

supplies. A load of fuel, for example, was "the equivalent of a run per vehicle of 100 kilometres over good going."⁶ In particular, Panzer Army Africa's fuel situation was described as "very strained"⁷. Captured enemy documents revealed that most units were desperately short of ammunition, water, petrol, and "according to a pencilled note at the end of these deficiencies 'Vor allem Brot':above all bread."⁸ This severe shortage of rations, resulted in a "high rate of sickness",⁹ and low morale. These supply shortages completely eroded the ability of the Axis forces to resist an imminent British offensive, especially because this took the form of a prolonged battle of attrition - an attack on precisely the enemy's greatest weakness, its resources and ability to maintain them.

Yet here, as with all aspects of the British war in the desert, it was a long road to El Alamein. In 1940 the RAF had virtually no means to launch an air interdiction campaign. Only after a year did the RAF begin to develop the elements needed to conduct effective interdiction, and even then initial efforts bore little resemblance to the final form. At the beginning of the war, British air strength in the Middle East was weak, while its aircraft were not suitable for interdiction operations. They were an older generation of bomber aircraft, with light bomb loads and poor defensive armament which put them at great risk from any Axis fighter. The RAF was not ready to conduct a damaging aerial interdiction campaign, and its initial attempts in that direction were inconsistent and ineffective. These problems stemmed from the nature of British air doctrine between the wars and its failure to plan for war in the Middle East.

In 1918 the RAF practiced air interdiction with effect on the western front,⁸ but British air doctrine during the inter-war years overlooked the value of this kind of operation. Following the end of the First World War, defence spending fell heavily. Jealousy from the other services threatened the survival of the RAF, unless it could define a unique role for itself. The RAF found such a role in the form of strategic bombing, to the detriment of any sort of support to the army, including interdiction campaigns. In order to bolster its claim for continued independence, the RAF clung to the idea that strategic bombers would dominate the next war. It argued that the mere presence of bombers over the enemy's cities would destroy the enemy's will to resist, and the population would force the government to sue for peace.¹⁰ In fact, this

doctrine was supported by very little evidence. Still, the RAF clung to this theory, because it offered a role which could not easily be filled by the other services, but which attracted great funding from the politicians.

Strategic bombing became air doctrine, or more accurately an air dogma. The theory underlying this doctrine - that bombers would prove the decisive force in future wars - was never tested, and very little thought was given to the mechanics of delivering weapons onto their targets.¹¹ Almost no realistic effort was made to develop the means to translate the strategic bombing hypothesis into a sound doctrine or an effective fighting force. Consequently, the RAF misunderstood elementary matters regarding aircraft, defence against fighters, pilot training, or bomb-sights for precise bombing. When war came in 1940, the RAF squadrons in Egypt and North Africa were equipped with aircraft unsuited for any role, especially aerial interdiction against motorized transport supply columns.

Strategic bombing doctrine continued to reign supreme until the start of the Second World War, despite continued protests from key army figures who were concerned that the

RAF had no ability to support ground operations. Thus, General Ironside - the Chief of the Imperial General Staff wrote, in 1939, that he was disgusted "with the way in which the R.A.F. treat the co-operation of the Air Force with the Army".¹²

The RAF understood the potential value of army support, including interdiction, but deftly avoided requests for the development of air support aircraft.¹³ Indeed, air support for the army was literally one of the first victims of the development of strategic bombing by the RAF. Consequently, when the RAF was called on to aid the army in North Africa during 1940, it was not ready to do so. Developing the necessary skills and organization was difficult, timeconsuming, and costly. The campaign was initially weak, and remained so for the first year of the war against Italy and Germany. Once the necessary elements began to reach maturity, however, the entire campaign took off quickly. It became devastating - the most effective ground support campaign before the Persian Gulf War - and it directly altered the course of the war on the ground.

This paper will trace the nature of the learning curve in British air interdiction and the consequences of its

success. It will show how command structures, communications systems, and intelligence organizations evolved to the point where they could facilitate interdiction operations. It will describe how and why the RAF's air strength grew, and how its tactics changed to suit new types of aircraft. Finally, the dissertation will assess how air interdiction affected the desert campaign as a whole, showing why it was weak in 1940-41 and devastating in 1942, and that it proved more damaging to Axis supply than did the better known interdiction campaign conducted at sea. All this, in turn, will help to reshape our understanding of how the desert war was fought and won.

The study will cover the period of time from the beginning of the fighting in the desert to the battle of El Alamein. After El Alamein and Operation Torch, there was a major re-structuring of the air forces in Africa, and a fundamental change in command, control, communication and intelligence structures. However, these changes were based on British experience between 1940-42, and the interdiction story did not end at El Alamein. The pattern for interdiction operations was re-played with excellent results during the fighting in Tunisia, Italy, and Northwest Europe, and this pattern was first set in the desert campaign.

NOTES

¹ James S. Corum, "The Luftwaffe and the Coalition Air War in Spain, 1936-1939," in <u>Air Power: Theory and</u> Practice, ed. John Gooch (London: Frank Cass, 1995), p.84.

² Martin Van Creveld, <u>Supplying War</u>, (London: Cambridge University Press, 1977), p.182.

³ James J. Sadkovich, <u>The Italian Navy In World War</u> II, (London: Greenwood Press, 1994), p.331.

⁴ For examples, see Richard Townshend Bickers, <u>The</u> <u>Desert Air War</u>, (London: Leo Cooper, 1991); and Richard H. Kohn and Joseph P. Harahan, <u>Air Interdiction in World War</u> <u>II, Korea, and Vietnam</u>, (Washington: Office of Air Force History, United States Air Force, 1986). Despite their value, neither of these books adequately analyze what was required for effective air interdiction operations, and both overlook the role of the campaigns in the desert in developing a template to draw upon in future campaigns.

⁵ Van Creveld, p.198.

⁶ Erwin Rommel, <u>The Rommel Papers</u>, ed. B.H. Liddell Hart, (London: Collins, 1953), p.280.

⁷ United Kingdom Public Record Office (hereafter referred to as PRO) Defe 3 (hereafter referred to as Ultra) QT 3024 Part Two 8/10/42.

⁸ PRO WO 169/3802 GHQ, MEF Intelligence Summary No.604 13.10.42 to 14.10.42.

⁹ Ultra Qt 3024.

¹⁰ Christina J.M. Goulter, A Forgotten Offensive:

Royal Air Force Coastal Command's Anti-Shipping Campaign, 1940-1945, (London: Frank Cass, 1995), pp.41-42; Scot Robertson, <u>The Development of RAF Strategic Bombing</u> Doctrine, 1919-1939, (London: PRAEGER, 1995), pp.45-46; R.J. Overy, "Air Power and Deterrence Theory Before 1939, Journal of Strategic Studies, Vol. 15 No.1 (March 1992), p.74; Allan D. English, "The RAF Staff College and the Evolution of British Strategic Bombing Policy, 1922-1929," Journal of Strategic Studies, Vol. 16 No.3 (September 1993), pp.408-409.

¹¹ Robertson, pp.95-96.

¹² General Sir Edmund Ironside, <u>Time Unguarded: The</u> <u>Ironside Diaries 1937-1940</u>, ed. Roderick Macleod and Denis Kelly, (Westport: Greenwood Press, 1962), p.140.

¹³ John Robert Ferris, <u>Men, Money And Diplomacy: The</u> <u>Evolution of British Strategic Policy, 1919-26,</u> (Ithaca: Cornell University Press, 1989), p.37.

CHAPTER TWO: COMMAND, CONTROL, AND COMMUNICATIONS

In order to mount a successful interdiction campaign, several factors had to be in place. Every element of the military machine had to function at high efficiency. Intelligence had to be collected in real time, assessment of information and decision for action needed to be immediate and accurate, and the air force had then to strike fast and hard over great distances. Those who were in a position to initiate policy had to understand the benefit of attacking enemy logistics, the nature of the means needed to do so, and the role of intelligence in facilitating such action. The intelligence, from tactical or photographic reconnaissance, ground observation, human or signals sources, signals intelligence, or from whatever other source, had to be gathered.

However, the multiplying role of intelligence in combat could be degraded - or perhaps eliminated - by weaknesses in the C³ system (the relationship between command, control, and communications) of the force trying to make use of it. Merely to know of the existence of a motorized transport (MT) convoy, for example, was useful only if the information reached a squadron in time to launch a raid. Once the

information was assessed, and the target pinpointed, the race began. Since motorized transport vehicles did not remain stationary, the response to intelligence had to be immediate. If action was stalled due to the failure of communications, or the convolution of command, the information might be rendered useless and the opportunity lost.

The useful life of any intelligence report varied with the distance between the aircraft's bases and the target, the speed of the column and aircraft, and the former's distance from its destination. The farther the aircraft from the target (or the faster the speed of the vehicles) the more the target would have moved from the place where it was originally located. This problem need not be a great obstacle, since the aircraft launched to attack could simply engage in a search for the target. If the time delay was measured in hours instead of minutes, however, or the convoy was close to its destination when it was located, any delay in responding to this information could put the convoy beyond reach of attack. Meanwhile, if enemy air strength was significant, the process of searching could endanger British aircraft.

In order to direct aircraft onto a target once it had been located, one needed a system of command, control, and communications which facilitated the flow of information up and orders down the chain of command. If the information could be passed rapidly, reasoned decisions concerning the acceptability of the proposed target could be made, and effective orders could be issued to the appropriate The relationship between the power of squadrons. communications and the exercise of command was symbiotic. Without effective communications, and the flow of intelligence and orders it made possible, commanders could not know how a battle was unfolding, where potential targets were, or what enemy capabilities and intentions were. Conversely, good communications were worthless without effective commanders. This complex relationship between command, control, communications, and intelligence is commonly termed C³I. If one of these components fails, the effectiveness of the whole is necessarily degraded.

Not that there was a single blueprint for an effective C³I system. Each theatre of operations had its own special characteristics, which determined the required form for such a system. In a theatre where forces were large in number, defences were deep, and lightning quick breakthroughs

impossible, communications could rest upon thick layers of permanent land-lines. Conversely, in an environment where the battlefield was large, force to space ratios were low, and operations were of a mobile nature, communications based on land-lines or civilian telephone circuits were extremely vulnerable to enemy action, and insufficiently flexible to meet tactical needs. Any C³I system needed to be tailored to meet the requirements of the theatre, and a balance had to be struck between conflicting imperatives. On the one hand, although land-lines were difficult to maintain and were not well suited for mobile theatres, they carried more traffic and were much more secure than radio communications. On the other hand, radio messages could be intercepted by anyone within range able to receive the correct frequency. The solution to this problem could seriously cripple the communication system.

Again, in theory although command structures should be as simple as possible, under

...the stress of war, some or all command links will disappear, the transmission of orders and information will be unexpectedly delayed, action and knowledge alike will be hampered. To survive these conditions the sub-units of an army must co-operate without coordination from above, while headquarters must act even when enveloped in the fog of war. This is most likely to occur when an army has many intermediate levels of command, each an independent centre of power with a small span of command, all connected by rigid hierarchical bonds which can maintain control over large segments of an army even when under the gravest stress known to man.¹

Against this, having too many levels of command carried its own penalties.

Every armed force required a hierarchical command structure. Ideally, there would be few intermediate levels between the top levels of command and the fighting troops.² The more levels which exist, after all, the more likely that orders and directives would become confused. As well, intermediate levels of command had access neither to the fighting nor to the full picture. As headquarters became more remote, subordinates were more likely to develop negative feelings towards their superiors; the belief that headquarters did not understand their situation, or was just plain wrong in its decisions. This would foster resentment, and a tendency to misinterpret directives, and to follow different aims. Aside from this possibility, the more cumbersome the command structure the more degraded was the communication potential; since the information and orders had to travel through each tier of the structure. At a certain point, one would encounter unacceptable delays in transmitting intelligence up the chain of command, and in

the resulting flow of orders down to the fighting units. Such circumstances would prevent intelligence from being used to guide an interdiction campaign.

One cannot understand how far intelligence could assist the interdiction campaign without examining the command and communication structures of the army and the air force, and the relationship between them. Moreover, since the C³I systems of 1942 evolved from pre-war forms which did not stand up to the test of battle, one has to examine the evolution of command structures, communications and intelligence use over the course of the campaign. This chapter will describe the command structure of both the army and air forces during the desert war, and the communication system which linked them together. The next chapter will examine how the various types of intelligence were gathered, interpreted, and used to facilitate interdiction operations.

Ultimate responsibility for directing the course of the war always rested with political and military leaders in London. The command structure which controlled forces in the Middle East, however, changed significantly, as the theatre moved from a side-show to centre stage, and as the number of forces there increased. The highest military

authority for the land forces in North Africa throughout the campaign was the Commander-in-Chief, Middle East.³ When war was declared in 1939, his responsibilities were greatly increased. Originally, the C-in-C, Middle East, commanded all British land forces in Egypt, the Sudan, Palestine, Trans-Jordan and Cyprus.⁴ In 1939, forces in Aden, Iraq, British Somaliland, and those along the shores of the Persian Gulf were added to his command.⁵ In order to exert effective control over these forces, some intermediate levels of command were needed.

This intermediate structure under the C-in-C, Middle East changed dramatically as the campaign wore on. Although the Eighth Army is most often associated with the fighting in North Africa, this formation did not even exist when hostilities began. In 1940, combat troops in Egypt were organized into a formation known as the Western Desert Force which was, by the time of operation Battleaxe in June 1941, changed to XIII Corps.⁶ Only in September 1941 did the land force in the Western Desert reach "a size...to justify its assumption of the title 'Eighth Army'"⁷ By this time, there were sufficient troops to warrant an army headquarters with two subordinate corps (13 and 30 Corps) and a general reserve.⁸ This general structure continued down to the end

of the desert war.

The general relationship between the army and air forces in North Africa remained relatively constant between 1939-42. The only air forces which were not under the operational control of the Royal Air Force were the Army Cooperation squadrons which provided corps headquarters with tactical reconnaissance. While Army Co-operation Squadrons "...act[ed] in close co-operation with corps H.Q. and [were] under army control"⁹ the rest of the Air Forces operated as an entity separate from and independent of the army. Yet in practice, both services had to co-operate closely during day to day operations, and the main thrust of their operations was often intended to boost the position of the other. The course of land fighting often turned on air support, and success or failure on the ground determined the placing of forward air bases, an issue fundamental to the exercise of British air power in the desert and the Mediterranean.

Until the arrival of Montgomery and the associated rise in the fortunes of the Eighth Army, however, general relations between the air force and army were strained. The repeated failures in both attack and defence created frustration, and a need to find scapegoats. Each service blamed the other, while praising their own efforts. During the Battleaxe offensive, the commander of the RAF in the Middle East, Air Marshal Tedder, praised his own squadrons, but questioned the competence of the army's regiments.¹⁰ Tedder also knew that the army was developing a "first-class hate"¹¹ for the R.A.F. because of a perception that it had "let them down in Greece and Crete."¹² Even prior to the Crusader offensive in late 1941, relations were not what they should be. In a letter to his wife, Tedder displayed his concerns about the level of competency in the Eighth Army and the consequences of another failure. He wrote that if

the next show goes well and the soldiers do their stuff, then one should be fairly secure for some months, but if they make a mess of it again there is no question at all but that I shall be made a scapegoat...¹³

This sort of animosity and concerns about competence among senior commanders of services which were supposed to be working closely together degraded efficiency, though the practical degree to which this happened is difficult to determine. It is indicative, however, that while Bernard Montgomery was always somewhat self-satisfied, he felt that prior to his arrival the two services "were tending to drift

apart".¹⁴

By the time Montgomery took command of the Eighth Army, the distrust and animosity had begun to decline. The possibility of losing Egypt to the Germans forced these problems to the margins. Once the battle of El Alamein had been won, euphoria lessened tensions, and senior army and air force commanders were able to express their ideas about the relationship which had developed between the British Army and the RAF. These principles were expressed in 1943 by General Montgomery and Arthur "Mary" Coningham (the Air Officer Commanding Western Desert).

The commander of an Army in the field should have an air headquarters with him which will have direct control and command of such squadrons as may be allotted for operations in support of his Army. Such air resources will be in support of his Army and not under his command. -General Montgomery¹⁵

Similarly, Air Marshal "Mary" Coningham (a corruption of the original 'Maori' given because he was from New Zealand) echoed this sentiment when he said:

The soldier commands the land forces, the airman the air forces; both commanders work together and operate their respective forces in accordance with a combined Army/Air plan, the whole operations being directed by the Army Commander.-Air Marshal Coningham.¹⁶

These arrangements governed co-operation between Allied army and air forces until 1945. This arrangement was designed to prevent the dissipation of air resources into penny-packets, "...with each packet working on its own plan..."¹⁷ By keeping the air forces united, they could be used with maximum efficiency, sometimes being thrown in small numbers at fleeting targets of opportunity, or alternatively being used in one overwhelming blow. The alternative was inferior. Since lower levels of command were often not completely privy to all intelligence regarding enemy movements, and were most concerned with what was happening in front of them, naturally they would have used their aircraft to deal with immediate threats, regardless of the larger picture. Air Marshal Coningham summed up this argument when he said that:

A front formation reports a concentration of 200 M.T.and accompanying arms. Its request is turned down. Fifteen or twenty miles away, however, there is a concentration of 2000 or more, indicating an armoured division or even larger forces. This concentration we know from experience will probably affect the whole battle area perhaps 10, 18, or 24 hours later. It is this concentration which is receiving all the weight of air attack and that is why the comparatively little target on the front is ignored.¹⁸

Keeping the Air Force united, and controlled from a

Headquarters which received in real time all the available intelligence, allowed aircraft to be used in the most effective way possible. Indeed, in no other way could an effective air interdiction campaign have been possible, nor could intelligence have helped it so much, if at all.

General organization within the Royal Air Force in the Mediterranean area also changed significantly during this period. In September 1939, Royal Air Force Middle East was but one of a number of RAF commands in that area; it existed along side, but did not command Royal Air Force units in Palestine and Trans-Jordan, British Forces in Iraq and Aden, and Royal Air Force Mediterranean.¹⁹ This arrangement changed on June 11 1940, when Sir Arthur Longmore, the Air Officer Commanding-in-Chief Middle East (A.O.C.-in-C. M.E.), became responsible for "all Royal Air Force units stationed or operating in...Egypt, Sudan, Palestine and Trans-Jordan, East Africa, Aden and Somaliland, Iraq and adjacent territories, Cyprus, Turkey, Balkans (Yugoslavia, Rumania, Bulgaria, Greece), Mediterranean Sea, Red Sea, Persian Gulf".²⁰ This area contained more than four and a half million square miles.²¹ Obviously, no one headquarters could control action on all of these fronts, especially since fighting often came to several of them at once. It

was simply not possible for one headquarters to control (operationally) all of these aircraft, see to their administrative needs, and ensure that they had sufficient supplies for daily operations.

Thus the Air Officers Commanding Iraq, Mediterranean, and Aden were left to control the administrative needs of their squadrons,²² while intermediate command levels were created to control aircraft in various parts of the theatre. For instance, the aircraft designated to run the air defence of Egypt were, at the beginning of hostilities, under the direction of No. 202 Group,²³ which in December 1941, became Air Headquarters, Egypt.²⁴ Similarly, the ancestor of the famed Western Desert Air Force was Air Headquarters Cyrenaica.²⁵ This formation was renamed 204 Group on 12 April, 1941,²⁶ and on 9th October 1941 became Air Headquarters, Western Desert.²⁷ Below these headquarters, the operational organization of aircraft was more permanently fixed. Individual aircraft were grouped into squadrons (each consisting of between twelve and sixteen aircraft), with between two and four squadrons organized into a Wing. Some squadrons, however, fell directly under a Group headquarters without an intermediate command level, as with No. 201 Group, which controlled the naval co-operation

forces based at Alexandria.²⁸

During battle, administrative and operational responsibilities were handled by separate headquarters. The advance headquarters handled operations, while the rear headquarters (often located far from the advance headquarters) took care of administrative requirements.²⁹ This arrangement was adopted by the Royal Air Force and the army, although the army's advance headquarters was termed main headquarters, and was capable of further subdivision. During operations, "Main H.Q. can throw off a Tac H.Q."³⁰, just a few officers responsible for directing units during operations. The Main headquarters was much larger, possessing a large operational staff, and was responsible for planning operations, as well as co-ordinating with other services.³¹ To ensure close co-operation between army and air forces, Tedder felt it necessary to move his advance headquarters adjacent to that of the land forces operating in the western desert.

The purpose of an efficient C³I system is to decrease the uncertainty which envelops the battlefield; uncertainty about what the enemy and one's own troops are doing. An efficient C³I system can allow rapid transmission of orders

and information, but even at best the information is fragmentary. Commanders may ignore intelligence, especially that which does not fit with their ideas of how the battle should be unfolding.³² Although intelligence can reduce uncertainty, it "...does not produce command decisions, a commander does."33 According to Carl von Clausewitz, only "the military genius" could act in the face of uncertainty. The military genius possessed "gifts of character, thought and action".³⁴ The commander had to possess an outstanding intellect; possessing "a strong [mind] rather than a brilliant one."³⁵ A military genius must be a passionate man, but must also possess "the gift of keeping calm even under the greatest stress".³⁶ This guality would allow a commander to react without undue emotion to intelligence reports. Equally important was determination; being able to "hold a consistent course of action amid confusion."37 Taken separately, without the complementary context provided by the others, these traits can be counter-productive. Determination could "degenerate into obstinacy."³⁸ Combined with a bold spirit, these attributes produce a commander who was willing to take action in the face of uncertainty.

During the inter-war years, the typical route for an officer to rise to high command was to first gain experience

as a regimental officer, and then as a staff officer. Bv the time one rose through these levels, his mental abilities were "...on the decline, or atrophied by much routine and detail."³⁹ These experiences were not conducive to producing military geniuses. Rising to high command took a long time, and many never got the opportunity. Most officers who "...should have risen to hold the top appointments in the late 1920s and early 1930s [were] kept waiting too long and as a result became frustrated and lost some of their zeal."40 While this characterized commanders in the field during 1939-41, these circumstances reversed themselves as the war progressed and all three services began to expand. Individuals rose rapidly through the ranks. By 1942, those occupying positions in the high command were frequently younger men whose intellect and energy had not yet atrophied, and whose zeal had not been eroded by career frustration - rather the opposite. At the beginning of the war in the desert, neither command structures nor commanders themselves were prepared to conduct interdiction operations. As the war progressed, however, this condition reversed itself, and by 1942 command structures were streamlined and efficient. Furthermore, commanders understood the value of interdiction and its requirements.

Without the ability to communicate efficiently, however, advances in these areas mattered little. Fortunately for the Allied cause, just as command structures were becoming tolerably efficient, so too were the communication systems of the army and air force. Those which existed in the desert at the beginning of the war were cumbersome, inefficient, and totally unsuited for interdiction operations. Again, by 1942 this condition had reversed itself. Technological problems had been solved, equipment difficulties had been addressed, communication networks had been simplified, and there were adequate numbers of efficient signals personnel. This long road had been travelled in a relatively short period of time and there was no shortage of setbacks, but without this minor miracle interdiction operations would have been prohibitively expensive.

Communication systems act as conduits for the smooth functioning of command. One could liken the relationship between command and communication to that of a human body and its nervous system. The nervous system carries commands to various parts of the body to enable it to do certain things. Any impairment of either part affects the whole. Without efficient communications, commanders had to rely on individual units to exercise their own initiative to achieve the desired goal. While it was possible to conduct interdiction operations with a slow and inefficient communications system, this would increasingly render intelligence useless, and put some targets beyond reach.

The experience of the First World War left a legacy which proved costly for the British army in the first three years of the Second World War. It was widely believed that this new war would take the form of the last war. Millions of men would again face each other across deep and formidable defences. Lightning quick breakthroughs would be impossible, and commanders would have hours or days to respond to an enemy offensive. Since the front would remain static, commanders could rely upon civilian telephone circuits and land-lines to communicate during operations. The folly of such beliefs became evident during the Battle The Germans had of France which commenced on 10 May 1940. no intention of re-fighting the First World War. They had stumbled on a new style of warfare which "...forced its foes to fight for high stakes at a fast pace."41 The inefficient and fragile communications of the British forces could not respond fast enough to this style of warfare. Poor communication ability, within both the army and the Royal

Air Force, affected British performance in the desert war, especially the interdiction campaign, until 1942.

Technology, however, provided the perfect communication system for use in the desert. Radio does provide virtually instantaneous communication and is more flexible than landlines or telephone circuits, but radio use carried its own penalties. These varied on whether one is referring to wireless telegraphy (W/T) or radio telephony (R/T), and which frequency band. Both W/T and R/T were available to British forces during the desert war. Wireless telegraphy (W/T) could carry the dots and dashes of morse code, but without the wire.⁴² The signal consisted of very rapid oscillations which were turned on or off, just like the current in a telegraph wire.⁴³ Radio telephony (R/T), transmitted the speaker's voice by a radio carrier wave by either amplitude or frequency modulation.⁴⁴ Amplitude modulation varies the strength of the radio signal depending on the audio pattern, while frequency modulation varies the frequency of the radio signal.

The electromagnetic spectrum has been separated into groups with common characteristics. These frequency bands range from extra low frequency (which has a frequency of 3 to 30 hertz) to visible light (which has a frequency between 428,000 and 750,000 gigahertz).⁴⁵ Only some of these frequencies were exploited during the Second World War. Both super high frequency and ultra high frequency were exclusively used for radar.⁴⁶ Most military communications were carried on the high frequency band, instead of the medium and low frequency (MF and LF) bands, so widely used by armies during the First World War.⁴⁷

The high frequency radio waveband had many significant advantages over low and medium frequencies. It can carry messages around the world due to reflection provided by the ionosphere.⁴⁸ Moreover, since HF radio waves are much shorter than either LF or MF, the power required to produce them shrinks dramatically, as does the size of the radio transmitter and receiver.⁴⁹ Physically smaller transmitters, receivers, and power supplies are more portable, and therefore more useful in a mobile environment. As well, the HF frequency band is much wider, allowing the simultaneous use of far more radio channels. To avoid interference, neighbouring channels must be at least 10,000 hertz apart. "When transmissions are spaced out at this interval, the LF band, which is 270,000 hertz wide, has room for only 27 channels... HF, 27,000,000 hertz wide, has room
for 2,700 channels."⁵⁰ When one considers all the traffic which radio handled, the operational benefit of so many channels is clear. The possibility of interference was more remote, and anyone attempting to listen in had a much more difficult task.

However, other characteristics of HF degrade its usefulness under some operational conditions, as is illustrated by an army report on a wireless exercise conducted on 12/13 August 1941. This reported R/T range at "up to 100 miles...between No.23 sets using good aerials and No.9 sets using vertical rod aerials, provided that the frequency chosen is fairly interference free."⁵¹ This performance was achieved during the day only. Experience proved that

interference experienced in the Western Desert is worst during the hours of darkness on frequencies between 2000 kc/s and 6500 kc/s. Except in cases of dust storms interference of a static nature is seldom experienced on any frequencies during the hours of daylight.⁵²

This interference was experienced by both R/T and W/T if they employed HF. Chief Signals Officer of the R.A.F. Middle East Command Group Captain W.E.G. Mann, indicated that the

aircraft R/T set in use, the T.R. 9D, worked on H.F., with a rather noisy background and a poor range in comparison with the distances over which our aircraft were called upon to operate. Really effective ground control of these aircraft was not possible during 1941.⁵³

These technical limitations created serious operational consequences. Aircraft could only receive updated intelligence for a limited period. Once they moved outside the range limit or the interference became too great, they were on their own. Aircraft on patrol could not be vectored onto targets due to problems with HF communication.

tactical reconnaissance R/T reports during flight were rarely made, partly on account of the poor performance of the T.R. 9D wireless equipment and of the even less adequate ground stations associated with it.⁵⁴

The problems associated purely with the radio set were reduced with the introduction of the Collins 18M,⁵⁵ but those related to the frequency band could not be overcome. When the technology permitted, very high frequency (VHF) radio sets were brought into use in England, but their introduction into the Middle East theatre was delayed. VHF R/T was used by the British during the Battle of Britain, but it did not enter service in the Middle East until 1942,⁵⁶ and when it arrived, it provided answers just for some of the problems of HF.

VHF radio waves act like light waves. Unlike HF, VHF radio waves are not reflected by the ionosphere.⁵⁷ Thus, in order to receive them, one must be in line of sight of the transmitter. While not suitable for ground to ground communication, VHF was ideal for air to air communication and air to ground communication.⁵⁸ VHF communication was superior to HF because:

Distant interference is eliminated. But between the ground and aircraft the range is much greater, depending on the height of the aircraft. It may be two, three, even four hundred kilometres. Between one aircraft and another the range is even greater.⁵⁹

By March 1942, VHF R/T equipment was tested and the "refitting of aircraft equipment was well under way."⁶⁰ This result was drastically improved efficiency of fighter and tactical reconnaissance aircraft. Tedder wrote:

On 31st May 1942, for instance, when No.73 Squadron were airborne with orders to strafe a certain position, the Army captured the point; within fourteen minutes the Squadron had been successfully re-directed by V.H.F. R/T to another target.⁶¹ Until the introduction of VHF R/T, the Desert Air Force was not using all available intelligence, and the interdiction campaign was not as effective as it might have been.

Aside from technical issues, some operational problems affected the various forms of radio communication. Given the non-specific direction of any radio transmission, anyone listening on the correct frequency had access to the information. The only way to prevent one's enemy from making use of one's own transmissions was to encode them; a cure almost as bad as the disease. Without an experienced operator, encoding or enciphering W/T messages can slow any communication system to the point where information becomes useless. A balance had to be struck between the need to transmit orders and information quickly, and the need to prevent the enemy from reading one's mail. Thus, one must be selective about what type of information should be enciphered or encoded. Some messages had a very short useful life. By the time the enemy intercepted the information, assessed it, and took action, the information was out of date. Tactical reconnaissance reports made by aircraft using R/T could not employ enciphering machines or complex codes; the information was passed "in the clear". Again, since German truck convoys often did not carry radio

sets, even if they intercepted an order to attack a convoy, there was no guarantee that the convoy could be warned. Moreover, supplies had to get to the front, and thus convoys could not turn back because of a possible threat. The only delay resulted from an attempt to encipher the orders to the squadrons, and these orders were often transmitted by landline. Messages of this type could be safely transmitted in the clear (without encoding or enciphering). On the other hand, some of the most important sources of intelligence could not be masked because they had a very long useful life. The enemy could easily process and make use of it for weeks or months after it was sent. Plans for upcoming offensives, operational orders, or information on the disposition of one's forces are but a few examples of this type of message. These must be guarded as closely as possible without crippling the communication system. British signals security was very poor until 1942, by which time the lessons had been driven home. Repeated German exploitation of poor signals security had forced the British to adopt protective measures. Unfortunately for the British, these measures were very slow in coming.

The consequences of signals security for the interdiction campaign depends on what aspect one is

referring. One could not mask the fact that MT columns were being targeted by the RAF. This fact was apparent even without it being intercepted, but there was very little which could be done to prevent attacks. Supplies still had to make their way to the front, and were therefore open to attack. Intelligence sources which were masked included those providing information on the German supply system, and those providing information on specific targets. If these sources had dried up, the interdiction campaign would have proved more difficult to conduct. It was therefore necessary to employ codes and ciphers to prevent German exploitation of radio transmissions. The resulting delay was unavoidable, but became less as communication systems were optimized and wireless operators became more proficient.

Part of the explanation for the poor quality of wireless operators comes from conditions during the interwar period. Budgetary stringency, which affected all services, was more acutely felt in the Royal Corps of Signals. It was "starved of funds, [and] denied the opportunity to train with higher formations and to prepare for mobile operations."⁶² The British army went to war in 1939 without a clear understanding of the war it was to

fight, and without a signals service able to function in a mobile environment. The problem became more severe as the Royal Corps of Signals simultaneously expanded and came to place greater emphasis on radio communication. It took a great deal of training to produce capable signals personnel, and they were "either good or useless. There is no halfway. To be good, they must have [had] long periods of combined training, and they must specialize in the particular job for which they [were] to be employed."⁶³ The growing pains experienced during this process proved costly for the British army in the western desert, and decreased the usefulness of information relevant to the interdiction campaign which was transmitted along army channels.

Over time, the structure of the army's communication system changed and became more efficient. Separation of operational and administrative links occurred in May of 1942, with beneficial results. The arrangement of links between corps and division were changed so that advance and rear divisional headquarters were in direct contact with advance and rear corps headquarters respectively.⁶⁴ The old arrangement had advance headquarters handling all traffic to both advance and rear corps headquarters.⁶⁵ Meanwhile the forward R/T links from division to brigade which "often had

some sixteen or more stations on it and could not possibly cope with cipher traffic or long written messages"⁶⁶ were augmented with W/T links. Once such measures were implemented, combined with improvements in the quality of signals personnel, information was passed through to the RAF with minimal delays.

Liaison between the services, which kept them 'in the military picture', was handled in the same way throughout the war. Air force officers were attached to division, corps, and army headquarters, and had wireless links to their own service. They signalled to the Royal Air Force any information coming though army channels which might be useful to the air force. Army officers were attached to air force units for the same purpose.⁶⁷ Since both services were separate entities which needed to co-operate closely, liaison was very important. It took place at all levels. At GHQ, beyond the weekly C-in-C's committee which dealt with all important operational and administrative questions, 68 daily liaison was maintained by an "Inter-Service Intelligence Staff Conference and an Inter-Service Operational Staff Conference".⁶⁹ In theory, constant liaison made it possible to co-ordinate operations and pass intelligence from one service to another with minimal

delays. However, the chain was only as strong as its weakest link, and frequently slow communication prevented optimum efficiency.

The Royal Air Force experienced similar difficulties, if on a much smaller scale. The army relied heavily on W/T to transmit operational and administrative traffic, which until 1942, with a poorly designed communication system, few adequate signals personnel, and headquarters constantly on the move during operations, meant that transmission delays were measured in hours (even for information with a very short life span).⁷⁰ The RAF, conversely, could rely more heavily on land-lines for operational and administrative communication, which, after all, could be conducted from relatively permanent positions. This was because the

Air Staff accepted the principle that the Fighter and Bomber Wings would always have their squadrons grouped round them sufficiently close to permit telephone communication using D.8 cable on the ground, and that the Fighter wings Headquarters would also be within D.8 distance of Advance Air Headquarters.⁷¹

In order to keep up with mobile operations, Air Formation Signals laid D.8 cable between Wings and their squadrons, as well as between Wings and Advanced Air Headquarters, after every move forward.⁷² It would have been foolish to rely totally upon landlines for important communication, even when conditions were static. Land-lines had weaknesses just as radio did. The movement of heavy transport or tanks cracked lines, and "desert dews cause[d] frequent earthing and constant line parties [had] to be employed."⁷³ Unless land lines were kept in optimum condition, they "cause[d] exhaustion to vocal chords"⁷⁴, and messages could be misunderstood with disastrous results. These lines also tended to become overloaded by administrative traffic. This problem was not overcome until February 1942, when it was "found necessary to provide separate channels of communication and organizations for operational, administrative, 'Y', and air reinforcement route services."⁷⁵

Just as wireless operators needed to be highly skilled, so did those handling land-line communications. Where this ability existed, the "telephone saved a considerable amount of signalling, especially to the Fighter Wings, and so improved the facilities for co-ordination between Bombers and their Fighter escorts."⁷⁶ In the absence of such ability, relayed messages were found to be "most unreliable"⁷⁷ because of errors committed by the operators. W/T was used as a stand-by should land line communications fail, or as the primary communication system where land lines were not practical. The Signals plan instituted in early 1942 provided two operational and one administrative W/T channel from the Wings to Advanced and rear Air Headquarters respectively.⁷⁸ Rear Headquarters was responsible for communicating with units in the rear areas, and Advanced Headquarters was responsible for "all forward independent unit communications, such as Advanced Air Stores Parks and Repair and Salvage Units."⁷⁹ With such extensive W/T links, both services needed good equipment and skilled personnel to operate it.

The RAF took a major step in October 1941 by establishing a Middle East Cypher School⁸⁰ to augment the inadequate supply of trained cypher staff from the United Kingdom. Even so, this school did not meet all of the air force's requirements, especially when the signals organization was expanded early in 1942 during the lull in ground operations following the stabilisation of the Gazala line.⁸¹ To meet this challenge, and to improve the general proficiency of cypher operators, the Middle East Signals School was opened in March 1942.⁸² This school had the dual purpose of bringing new signals personnel up to speed on the

equipment they would be using, and providing refresher training for older personnel whose skills had deteriorated. It was not until the middle of 1942 that the RAF's signals personnel reached their peak of efficiency. Given the importance of signals to the operation of the machine, the interdiction campaign could not have reached its zenith before this point, no matter what improvements occurred in intelligence or other matters.

As signals personnel were becoming more effective, so too was their equipment and the system which they served. In July 1941, the Air Ministry gave its permission for construction of signals specialist vehicles to begin in the Middle East. The new vehicles would replace existing vehicles which were "both cumbersome and unsuitable for operations in areas where good roads were lacking."83 They were found to be too light, too high off the ground, and did not possess any low-pressure sand tires.⁸⁴ By May 1942, a steady flow of general purpose W/T vehicles was being delivered to the RAF, providing excellent mobile This facility allowed the RAF to remove communications. signals equipment and staffs from squadrons, and re-organize them into mobile units under the command of major units.⁸⁵ Thus, the system was made more flexible because of increased

mobility, and was streamlined to promote efficiency while still providing effective communications.

Another major development in mid-1942 was the construction of the Telecommunication Centre, Middle East. This centre was designed to relieve the pressure of the main H.Q. signals station. The facilities were used on an "inter-Service 'common user' basis"⁸⁶, and were staffed by both army and air force personnel. There were some fifty W/T and fifty teleprinter circuits, and they handled an average of 450,000 groups per day.⁸⁷ The resulting improvements at all levels ensured the rapid transfer of orders and intelligence from both army and air force sources.

Altogether, these changes produced a markedly improved communication system, which increased command potential and usefulness of intelligence, and made the interdiction campaign more efficient and cost-effective. In 1940 the command and communication system of the interdiction campaign was simply inadequate. By mid-1942, reports from aircraft engaged in tactical reconnaissance could be signalled along army channels to the Royal Air Force, and down to squadrons in a matter of minutes. Often, intelligence from tactical or strategic reconnaissance could be relayed to fighter-bombers returning from a mission, which could then locate and strafe the target.⁸⁸ Incoming intelligence was dealt with quickly, and the decision to attack was made. Proficient mechanisms existed to track the status of aircraft already in the air, and determined whether they could undertake this operation. C³ had become remarkably efficient, at roughly the same time that intelligence did as well.

Notes

¹ John Ferris, "The British Army, Signals and Security," Michael I. Handel (ed.), <u>Intelligence and</u> <u>Military Operations</u>, (London: Frank Cass and Company Limited, 1990), p.257.

² Ibid., pp.256-257.

³ Barrie Pitt, <u>The Crucible of War: Western Desert</u> <u>1941,</u> (London: Johnathan Cape, 1980), p.483, also 488.

⁴ Ibid., p.1.

⁵ Ibid.

⁶ Ibid., p.483.

⁷ Ibid., p.338.

⁸ Public Record Office (hereafter cited as PRO) WO 212/430 Operational Order of Battle - Middle East Command, August 1942.

⁹ PRO AIR 23/6478 Battle of Cyrenaica 41/42, Notes on Fighter Organization and Control.

¹⁰ Lord Tedder, <u>With Prejudice: The War Memoirs of</u> <u>Marshal of the Royal Air Force Lord Tedder</u>, (Toronto: Little, Brown and Company, 1966), p.125.

¹¹ Ibid., p.113

¹² Ibid.

¹³ Ibid., p.189.

¹⁴ Montgomery of Alamein, <u>The Memoirs of Field-Marshal</u> <u>The Viscount Montgomery of Alamein, K.G.</u>, (London: Collins, 1958), p.109.

¹⁵ PRO AIR 23/1299, Air Power in the Land Battle (Air Ministry, 1943).

16 . Ibid.

¹⁷ . Ibid.

¹⁸ Ibid.

¹⁹ Denis Richards, <u>Royal Air Force, 1939-1945, Vol.I</u> <u>The Fight At Odds,</u> (London: Her Majesty's Stationery Office, 1953), p.407.

²⁰ Ibid., p.242.

²¹ Ibid.

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²² Ibid., p.409.

²³ PRO AIR 25 Index.

²⁴ Ibid., under 202 Group.

²⁵ Ibid., under 204 Group.

²⁶ Ibid.

²⁷ Ibid.

²⁸ PRO AIR 23/6200 Royal Air Force Operations in the Western Desert and Eastern Mediterranean 18/11/41 to 19/5/42, Unit Order of Battle, p.6.

²⁹ Stephen Brooks (ed.), <u>Montgomery and the Eighth</u> <u>Army: A Selection from the Diaries, Correspondence and</u> <u>other Papers of Field Marshal The Viscount Montgomery of</u> <u>Alamein, August 1942 to December 1943,</u> (London: The Bodley Head, 1991), pp.149-150.

³⁰ Ibid., p.150.

³¹ Ibid.

³² John Ferris and Michael I. Handel, "Clausewitz, Intelligence, Uncertainty and the Art of Command in Military Operations," <u>Intelligence and National Security</u>, Vol.10 No.1 (January 1995), p.2.

³³ Ibid., p.11.

³⁴ Ibid., p.4.

³⁵ Carl Von Clausewitz, <u>On War</u>, Michael Howard and Peter Paret (eds.), (New Jersey: Princeton University Press), p.103.

³⁶ Ibid., p.106.

³⁷ Ferris and Handel, p.4.

³⁸ Clausewitz, p.108.

³⁹ Brian Bond, <u>British Military Policy Between the Two</u> <u>World Wars,</u> (Oxford: Clarendon Press, 1980), p.52.

⁴⁰ Ibid.

⁴¹ John Ferris, "The British Army, Signals and Security", p.265.

⁴² Tony Devereux, <u>Messenger Gods of Battle</u>, (London: Brassey's (U.K.), 1991), p.13.

⁴³ Ibid., p.28.

⁴⁴ Ibid., p.29.

⁴⁵ Ibid., p.30.

⁴⁶ Ibid., p.38.

⁴⁷ Ibid., pp.80-81.

⁴⁸ J.A. Hulton, <u>The Story of the Ionosphere</u>, (London: Hulton Educational Publications, 1958), p.43.

⁴⁹ Devereux, p.37.

⁵⁰ Ibid.

⁵¹ PRO WO 169/1998, Report on Wireless Exercise 12/13 Aug. '41, dated 18.8.41 by Lieut. G.D. Curtin, Wireless Officer-Mobile Corps of Signals, p.3.

⁵² Ibid.

⁵³ PRO AIR 40/1817 Third Draft of a Signals Appendix for Marshal of the Royal Air Force Lord Tedder's Despatch on Middle East Operations, May 1941-Jan. 1943.

⁵⁴ Ibid.

⁵⁵ Ibid.

⁵⁶ Ibid.

⁵⁷ Devereux, p.82.

⁵⁸ Ibid.

⁵⁹ Ibid.

⁶⁰ PRO AIR 40/1817.

⁶¹ Ibid.

⁶² John Ferris, "The British Army, Signals and Security, p.260.

⁶³ PRO WO 204/6595, Report by Bedell Smith, dated 19 February, 1943.

⁶⁴ Imperial War Museum (IWM), 7th Armoured Division Secret Report on Operations 27 May to 31 July 1942, in the Papers of Brigadier H.N. Crawford, MBE DL JP, Appendix A, 7th Armoured Division W/T Communication as of 0600 27 May 1942.

⁶⁵ Ibid.

⁶⁶ Ibid.

 $^{67}\,$ PRO WO 201/488 Appendix B to D.O. Circular No 12. 16 January 1944.

 68 PRO CAB 106/535 Operations in the Middle East, 5 July 41-31 October 41.

⁶⁹ Ibid.

⁷⁰ PRO WO 169/3904, Eighth Army Main Headquarters Signals. There are numerous examples of signals being transmitted in excess of three hours from when they were received at Corps Headquarters.

⁷¹ PRO AIR 41/25, Brief Report on Communications in the Western Desert Operations 1941-42, Appendix D (i), p.1.

⁷² Ibid.,p.4.; also AIR 23/1344, memorandum from the Chief Signals Officer to the Air Officer Commanding-in-Chief, Middle East dated 13 April, 1941.

⁷³ PRO AIR 23/6478, p.10.

⁷⁴ Ibid.

⁷⁵ PRO AIR 23/6203, CSO HQ RAF ME 6 Feb. 1942, paragraph 3; also AIR 24/449, Desert Air Force Signals Instruction No.4-Operational W/T "Flash Channels, April 1944.

⁷⁶ PRO AIR 40/1817, pp.11-12.

⁷⁷ PRO AIR 23/6478, p.10.

⁷⁸ PRO AIR 40/1817, p.8.

⁷⁹ Ibid.

⁸⁰ Ibid., p.9.

⁸¹ Ibid.,p.18.

⁸² Ibid.,p.20.

⁸³ Ibid., p.9.

⁸⁴ PRO AIR 41/25, p.2.

⁸⁵ PRO AIR 40/1817, p.23.

⁸⁶ Ibid.,p.18.

⁸⁷ Ibid.

⁸⁸ PRO AIR 24/422, Operations Record Book of the Forward Desert Air Force, February 1942, p.3.

CHAPTER THREE: INTELLIGENCE

Intelligence was crucial to the success of the interdiction campaign in North Africa. The difficulty was to find targets and attack them, while using the minimum amount of precious British resources. In this process. intelligence aided the British land-based interdiction campaign on several levels. It provided background on the German supply network, on such issues as how supplies were brought from the ports to the front lines, and the standard routes and operating procedures for doing so. Knowledge of this type allowed the RAF to focus its reconnaissance aircraft on high-traffic areas, avoiding the waste of crucial and limited resources. Intelligence enabled the RAF to trace the efficiency of aerial interdiction, and adjust tactics and munitions to maximize the effect. It also allowed the RAF to pin-point targets which could then be attacked. Without target intelligence, pilots would have been forced to fly constantly over vast areas of desert in the hope of locating a target of opportunity to attack. These armed patrols would have fatigued pilots, wasted precious fuel, put time on engines, exposed aircraft needlessly to enemy fighters; indeed, without precise and accurate target information, the interdiction campaign might

have wasted more resources than it destroyed. Instead, intelligence let the Royal Air Force conserve its own resources while delivering a precise and damaging blow to a vulnerable part of the German war effort.

Many intelligence sources were available to British forces in the desert. Some were completely useless for interdiction operations, others provided operational or strategic intelligence, while still others provided both. Before examining how intelligence aided interdiction operations, it is necessary to consider the nature of intelligence.

The dictionary definition of intelligence, "information"¹, is inadequate for the historian's purposes. Intelligence refers to a process as well as a product-to the acquisition and interpretation of information. Before the raw information could be used to guide interdiction operations, its accuracy had to be assessed, it had to be considered in the context of other data, and decisions reached as to whether the target was worth attacking. Intelligence could only guide the interdiction campaign if it was related to the strength and capabilities of one's own forces. Intelligence could act as a force multiplier only if sufficient force existed to carry out operations. Commanders needed to know what their forces were capable of as much as they needed information on the enemy.

Before the Second World War, the RAF divided intelligence into two forms-Pure Intelligence and Fighting Intelligence.² Pure intelligence pertained to background issues, and fighting intelligence to the material used to guide specific operations.³ Modern historians use a different terminology, dividing intelligence into three forms: strategic, operational, and tactical. When referring to the interdiction campaign in North Africa, however, operational and strategic intelligence represent the most useful categories of intelligence.

Strategic intelligence referred to information which illuminated the set-up of the German supply system, the standard operating procedures for transferring supplies from ports to the front, the moral and material effect of the interdiction campaign on the German army, and the order of battle of the Luftwaffe. No single source provided all the required strategic intelligence. Instead, many sources were exploited to gather all the pieces of the puzzle, and much skill was required to deal effectively with it all. An

excellent example of the nature and value of strategic intelligence was a reconstruction of the enemy supply system, provided by captured enemy documents, which was circulated as Eighth Army daily intelligence summary number 46 for 10 November 1941, and as the HQ RAF, Middle East's weekly intelligence summary number 74.4 The intelligence indicated that Benghazi was the railhead for Cyrenaica, and received supplies either by sea or road from Tripoli.⁵ Food, ammunition and petrol, off-loaded in Tripoli, were "trans-shipped on to small steamers for Benghazi."⁶ These coastal steamers were the only ones that unloaded at Benghazi.⁷ Further information indicated the standard procedures, typical routes and schedules for transporting supplies from the ports to the forward dumps. This information would let the RAF focus its reconnaissance along these routes, increasing its ability to find targets for interdiction. However, one still had to confirm this information to eliminate the possibility that it was wrong or deceptive. Other sources of intelligence, such as photographic intelligence, could aid in this endeavour and could fill in missing pieces.

Operational intelligence aided the location of potential targets, and the prediction of possible threats

from enemy aircraft or anti-aircraft fire. Again, several sources provided operational intelligence, the most important of which were various forms of aerial reconnaissance. Guided by the information provided from strategic intelligence sources, reconnaissance aircraft provided constant information on convoys, and thus allowed the RAF to launch continuous attacks with little waste of effort. The Operations Record Book of 285 Air Reconnaissance Wing provides an excellent example of this process. On August 26 1942, a "recce had been made of the road East from Gambut, locating two convoys moving east. One of these was later attacked by Beaufighters with good results."⁸

Each type of intelligence had its own period of usefulness, after which the information was useless, and no further return could be made from the effort expended in gathering it. Operational intelligence required swift processing in order to be used before its life expired. Strategic intelligence did not require such urgency in processing, because shortness of time did not determine the success or failure of operations. However, strategic intelligence provided information which let the British determine whether the interdiction campaign was worth the price, how to make the attacks more damaging: indeed, it may have spurred the RAF to adopt interdiction operations. Although strategic intelligence did not have the high profile role of guiding aircraft to their targets, without it, the Royal Air Force could not have gauged the effect of aerial interdiction, or learned the layout and weaknesses of the German supply system.

Signals intelligence sources were by far the best sources for strategic intelligence. Both the high and low grade traffic of the enemy was exploited to focus operational intelligence, to track the progress of the interdiction campaign, and to learn of potential threats to operations.

Ultra, the most famous signals intelligence source of the war, was of relatively little operational use to the land based campaign against enemy supply. The term "ultra", referring to the security classification of the material, ultra top secret, emanated from solutions of high grade German cipher systems, especially the 'Enigma' and later the 'Geheimschreiber' cypher machines. At the start of the war, code-breaking of this nature was conducted by a few brilliant and eccentric mathematicians working at Bletchley Park. As the war progressed, their work was augmented by large numbers of very sophisticated electro-mechanical data processing machines. Individuals who knew nothing of codebreaking could operate these machines, and thus an almost automatic mechanism was in place for exploiting Ultra.

Ultra had no operational value for land-based interdiction operations: it was not used to guide aircraft onto targets. It was, however, very useful for major operations, strategy for the theatre, and interdiction on the Mediterranean.⁹ Ultra intercepts did help British Intelligence to understand how the war on supply (both on land and at sea) was affecting the German army's morale and its ability to fight. The role of Ultra varied over time. Through 1941-42, most Luftwaffe traffic and some Italian naval traffic was being read, but German Army traffic was only regularly vulnerable from May 1942, onward.¹⁰ Hence, Ultra always provided a good picture of enemy supplies entering North African ports and of the Luftwaffe's defence system and state, but not until the Gazala operation did it provide much material on the German Army. Throughout 1941-42, Ultra furnished British Intelligence with the enemy's own reports on aircraft serviceability and aviation fuel quantities.¹¹ Also available was material on which ports

and which roads were used for the unloading and movement of supplies. For example, on November 22, 1941, just before the British launched operation Crusader, road supply traffic from Tripoli to Benghazi was prohibited beyond "Arae Philaenorum on orders of German Army Command"¹². When combined with intelligence about the German road network, such information guided operational intelligence: it let the RAF focus its reconnaissance aircraft in areas where the supply convoys were likely to be.

From the summer of 1942 onward, however, Ultra uncovered the enemy's entire supply state. On October 8, 1942, for example, an ultra intercept illuminated all aspects of the German supply dilemma. Fuel and ammunition supplies were described as severely strained, but the rations situation was "extraordinarily bad."¹³ Fats were entirely lacking, flour would have lasted eleven days only if the bread ration were cut, "vegetables, fruit especially lemons, and extras such as jam either not available or completely insufficient."¹⁴ The result of this was undernourishment, a sharp decrease in efficiency, high rates of sickness, and undoubtedly poor morale.

Ultra was not the only source of signals intelligence

in World War Two. The RAF and British army also exploited low grade German signals. Though this activity, commonly known as "Y", is far less well known and less well studied than Ultra, it was beneficial to many military efforts, including the interdiction campaign. The British organization of Y was initially primitive and less well organised than its German counterpart,¹⁵ but by 1942 it rapidly became more effective and complex. Y units in the Middle East were divided into groups, depending upon the type of traffic they dealt with. There were three broad categories: W/T, R/T, and Radio Aids and non-Morse transmissions.¹⁶ Only W/T and R/T traffic were useful to the interdiction campaign. Y units dealing with W/T

demand[ed] a sizeable, highly skilled team whose training and experience need to have been extended over a period of at least one year before any reliable intelligence [could] be expected from them.¹⁷

R/T units, conversely, were smaller, because the material being handled was voice transmissions, and "codes used [were] comparatively simple and [could] be immediately exploited by linguists who [had] undergone the shorter period of training required."¹⁸ Prior to Operation Torch (on 8 November, 1942), four RAF "Y" units operated in the Middle East. Two small units at Gibraltar and Freetown

handled "local defence purposes"¹⁹. The main Y units were 162 Squadron, which investigated enemy radar facilities using its handful of aircraft, and the much larger 276 Wing which handled both W/T and R/T traffic analysis.²⁰ Both kinds of traffic analysis were useful to the interdiction campaign, but neither guided aircraft onto targets. Rather, they let the British determine the enemy's order of battle with surprising accuracy. They also served to locate individual enemy aircraft which were out of radar range, thus preventing them from threatening individual interdiction operations, as well as tracing patterns of air operation. Y was of particular value in "mobile warfare in which locations and conditions [were] continually changing and information about the enemy [was] consequently becoming out of date almost daily".²¹ In addition, Y sometimes intercepted vital information concerning the state of German supplies. For example, on May 20, 1942, RAF Y learned that the total stocks of aviation fuel in the whole of Libya was a paltry 3283 tons.²² Such information was used to confirm other sources and fill in missing pieces of the puzzle.

Another source was also fundamental to strategic intelligence. Interrogation of captured enemy personnel is one of the oldest forms of intelligence, and is still a very

reliable and fruitful means of answering certain questions. Reflecting Commonwealth experience by 1942, the New Zealand Military Forces estimated that "at least 40% of our intelligence has been obtained in this way while most essential confirmation of that obtained from other sources has also been obtained from prisoners of war."23 In particular, prisoner of war interrogation was the only source of intelligence which could consistently show the effect of aerial interdiction on German morale. In this case, signals intelligence could only supply indirect evidence, because such issues were not signalled: Hitler and senior German officers were not interested in acknowledging problems of this nature. Prisoner of war interrogations also provided an admirable means to reconstruct the enemy's organization and standard operating procedures, and to confirm intelligence gained through other sources.

Not that such information was easy to acquire. Few individuals were competent to interrogate prisoners with effect. Interpreters needed an intimate knowledge of the nuances of the prisoners' language and of their military terminology.²⁴ Many interpreters had spent years living in the Germany or Italy, and could speak the language without

inflection. This put the prisoners at ease, and made it easier to obtain information.²⁵ Unfortunately, such skills were quite rare, and those who had them were urgently desired for the "Y" service.²⁶ Nor was knowledge of a language the only essential element, an individual had to be "specially trained for Interrogation Duties"²⁷, and outstanding interrogators also possessed insights into how to manipulate different types of prisoner in order to acquire needed information.²⁸

There were no standard procedures for conducting an interrogation other than at the initial meeting. "No hard and fast rules [could] be laid down as regards the actual method of conducting an interrogation, every interpreter and every PW [was] different."²⁹ However, during the initial meeting, the prisoner was to be

smartly marched in by the sentries and made to stand to attention...Similarly the IO himself should preserve a strictly military at the beginning of the interrogation and should not be smoking. The whole idea [was] suitably to impress the PW and let him realize right away that he is up against something serious and not a kind of a tea party.³⁰

In August 1940, the ad hoc arrangements for POW interrogation were ended and Combined Services Detailed Intelligence Centre (Middle East), a copy of the one in London, was established.³¹ Intelligence officers from all three services were attached to the CSDIC to extract information from prisoners. The CSDIC in Cairo was divided into three identical huts, each with an exercise area, but one of the huts was "bugged" so that intelligence officers could overhear prisoner conversations.³² The huts each held twenty prisoners, though there were rarely more than thirty at any time.³³ The average length of time spent at CSDIC was six days³⁴, after which prisoners were transported to permanent camps.

The standard procedure was to accommodate arriving prisoners alone in their cells until after the initial interrogation. They were then "paired off with either the object of listening-in to the prisoners' conversation or with a stool pigeon primed with the information required from the prisoners."³⁵ Stool pigeons were prisoners who, in exchange for co-operation, received a sum of two pounds a week. They were also given aliases to protect their true identities.³⁶

Some intelligence officers were engaged in interrogation, while others listened in on prisoners' conversations in the "bugged" hut. The latter was wired to

the Operations Room, which was actually a series of rooms each with a listening table connected to a microphone.³⁷ The process of listening to prisoners' conversations was tedious, and had to be limited to two hour watches.³⁸

Prior to the battle of El Alamein in 1942, CSDIC Cairo also had one mobile unit which was employed near the front line so that prisoners could be interrogated immediately after capture, for tactical information.³⁹ This unit also combed the captured personnel, searching for those likely to produce important information. These prisoners would be immediately transported to CSDIC for a more detailed interrogation.⁴⁰ Since a maximum of sixty prisoners were housed at CSDIC, this phase of the process was crucial to the success of CSDIC. The initial performance of this unit during the Crusader offensive proved disappointing. Although technically, "the unit operated quite satisfactorily"⁴¹, there was poor liaison between the selecting parties and the unit's commanding officer, resulting in a poor selection of prisoners.⁴² These problems, however, did not shake the belief in the potential of this unit, and measures were adopted to fix them; indicating a belief in the importance of this unit in particular, and in prisoner of war interrogation in general.

A skilful interrogator could provide varied and often crucial information from prisoners. Thus, one report dated 5 May, 1942, from the Middle East CSDIC stated that one prisoner provided details "of the entire German sabotage organisation"43, and warned of planned sabotage raids on the railway near Mersa Matruh. Another prisoner provided the key to German high grade codes, and standard methods for laying mines⁴⁴. Although some interrogations revealed startling information of this type, generally CSDIC simply supplied a constant stream of small bits of reliable information, which, added to intelligence from other sources, could confirm suspicions and answer important questions. Such material was very important to the interdiction campaign because it provided a constant picture of the German supply situation, accurate "information on results of R.A.F. raids"45, and indications as to what effect the campaign was having on German morale.

Prisoner of war interrogation worked in conjunction with captured enemy documents and aerial reconnaissance to provide a remarkably detailed picture of the German supply network, the location of specific supplies, and the routes
which motorised transport used to move them to the front. To maximize the potential of captured enemy documents, the RAF standardised their procedures for dealing with them. Any documents found on prisoners were sent directly to the CSDIC, where they were sorted and used as background information against prisoners during the interrogation procedure.⁴⁶ Once this had been completed, documents would be forwarded to RAF Middle East. In May 1942, summaries of the German supply system were obtained which showed that the German army's rations depot was located 41.9 kilometres east of Derna, the ammunition depot was 36.2 kilometres from Derna, and the fuel and motorized transport depot was 38.3 kilometres east of Derna.47 Again, captured documents and POW information allowed the British to piece together the procedures followed in transporting supplies forward. For example, "stores of food, ammunition and petrol [were] driven in convoy from Tripoli to the forward dumps without re-loading"48.

Travelling time [was] from 0600-1600 hours daily, and the supply columns use[d] the main coastal road. On the Eastward journey, when loaded the Southern road between Barce and Giovanni Berta [was] used, and on the Westward(empty) journey, the Northern.⁴⁹

Additionally, the forward delivery points for all stores were known. Captured documents "as amended by air

photographs and recent P.W. [prisoner of war] statements showed that the munitions delivery point and ordnance store was 28 kilometres west of Tobruk."⁵⁰ Since British Intelligence also knew where the forward dumps were located, reconnaissance could easily locate important fuel and ammunition convoys. This detailed knowledge of the enemy's supply system helped to focus the interdiction campaign, and thus improve its cost-effectiveness.

The most important sources of operational intelligence were visual and photographic reconnaissance, but they were dogged by many difficulties. Chief among them was the enemy's air forces, and the need to prevent the loss of the aircraft and pilots engaged in reconnaissance. Local air superiority was necessary to reconnaissance, though not necessarily air superiority or total air supremacy. Where fighter escort was not available, reconnaissance sorties were often cancelled⁵¹, and the efficacy of the rest was Even effectively armed reconnaissance aircraft degraded. were vulnerable, since their pilots generally looked at the ground for targets instead of scanning the sky for enemy aircraft. To reduce losses, reconnaissance aircraft were sent out in pairs. One aircraft would reconnoitre the target while the other aircraft (known as a weaver) watched

for enemy anti-aircraft emplacements or air attack.⁵² This method was certainly better than sending aircraft out on their own, but it also reduced the number of possible reconnaissance flights. In any case, missions without fighter escort were still very dangerous.

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Nor did the problems with reconnaissance end with the location of a convoy. Unless reconnaissance reports were quickly transmitted, aircraft could not be dispatched in time to intercept. Hence, the development of capable C^3 system was critical to the success of the interdiction campaign, and this process in turn was difficult.

These reconnaissance efforts were controlled by two different sets of commands. Each Corps of the Eighth Army "controlled one A.C. [army co-operation] squadron armed with 16 Hurricane I aircraft"⁵³ for tactical reconnaissance, while Eighth Army headquarters controlled another squadron which would reinforce the Corps' squadrons when needed.⁵⁴ These 50 odd aircraft operated up to seventy miles behind the front. The R.A.F.'s strategic reconnaissance began approximately where tactical reconnaissance ended⁵⁵, and continued on to varying distances depending on the information sought and the limitations of the aircraft. Originally, the tasks of the Strategic Reconnaissance Flight were strategic, but circumstances required them to undertake operational objectives as well⁵⁶. Both forms of reconnaissance brought back photographs and intelligence useful to the interdiction campaign.

Upon completion of all reconnaissance sorties, the pilots were de-briefed. Any urgent information was immediately flashed over R/T links up the chain of command to those who could use it.⁵⁷ This minimized delays between the receipt and the transmission of important intelligence. After the interrogation was completed, a more complete report of the operation was sent over the rear W/T link.⁵⁸ An Army Liaison Officer from an army co-operation squadron would phone the G3 Air at Corps, who would pass the information to the other Corps and to Eighth Army headquarters.⁵⁹ From there, the information would be transmitted to Air Headquarters, Western Desert and down to the squadrons. The squadron intelligence officer of the Royal Air Force's Strategic Reconnaissance Flight would relay the information to Wing headquarters, and then it would pass to Air Headquarters, Western Desert, and HQ Royal Air Force Middle East. Decisions were made on the information, and orders transmitted down to the squadrons.

Although this procedure functioned tolerably well, it had obvious problems. Intelligence of a limited life-span could not be used until the aircraft made its return journey, and landed and the pilot reached the de-briefing room. This delay rendered much intelligence less valuable or useless. In such cases, one had expended precious resources and risked the loss of others, but gained nothing. Until more rapid methods of transmitting information were developed, the interdiction campaign could not operate at peak efficiency.

This problem was solved through the introduction of VHF R/T in early 1942. This added a new dimension to the interdiction campaign, by letting reconnaissance pilots transmit their findings while they were still in the air. Although a distinct improvement over the previous procedure, this too had problems. VHF operates in a lineof-sight fashion. It cannot curve around the earth's surface; hence low flying aircraft could not relay their messages over great distances. To overcome this obstacle, pilots began using the Air Support Controls (ASC).

The ASC was introduced to North Africa to provide

rapid air support for the Army. These mobile units, manned by the RAF but with an Army staff attached, were assigned to each Corps headquarters to sort through requests for air support, and relay them to the RAF.⁶⁰ Air Support Controls were equipped with two "ROVER tentacles which [were] armoured scout cars containing additional facilities for "flicking" direct to rear links...and for comm by VHF to a/c in the air."61 There were seven forward W/T tentacles for communication with ASC HQ, which were allotted by army commanders to units in the field. There were also eight W/T sets, called Field Air Support Links (FASL), for controlling support aircraft and receiving intelligence from reconnaissance aircraft. To communicate with airfields, two W/T sets, known as Rear Air Support Links (RASL) were provided.⁶² The procedure for using the ASC's by tactical reconnaissance aircraft was standardised by May 1942⁶³, combined with other innovations such as message dropping from "Tac.R. aircraft onto forward troops and HQs" and transmitting messages via W/T from the Tac. R. aircraft.⁶⁴ Of course, only certain aircraft could engage in message dropping or W/T use. In particular, this could not be done by single seat fighters which provided a significant portion of reconnaissance information. However, aircraft which could use W/T or drop messages provided more useful reports

than they could have otherwise, and did not put any further strain on the ASC links.

Tactical and strategic reconnaissance also enabled British intelligence to gauge the accuracy of British pilots engaged in interdiction. Once a target was attacked, one or more tactical reconnaissance sorties were dispatched to observe (or take pictures) of the damage inflicted.⁶⁵ Tactics could be adjusted and munitions changed to increase the efficacy of the attacks, and the usefulness of interdiction as a whole could be gauged. Through reconnaissance, one could judge the impact on German supplies as compared with British losses suffered, and reach conclusions about whether interdiction was worth the price.

Tactical and strategic reconnaissance did not consist entirely of visual observation. The tactical and strategic reconnaissance squadrons also conducted oblique photographic reconnaissance, while high level photographs were taken by the Photo Reconnaissance Unit of the RAF.⁶⁶ Photographs were more useful than visual observation for judging the impact of interdiction. Pilots travelling in excess of three hundred miles per hour were not always accurate in their observations, while photographs (properly interpreted by experts) provided more information than pilot reports. Moreover, as the war diary of Panzer Army Africa noted, British photographic operations were intended to determine which areas contained targets for attack.⁶⁷ The drawback to photo reconnaissance was the time involved in developing and interpreting the pictures. This did not hamper its value for judging the effect of aerial interdiction, but it did pose serious problems for target location. In order to use photographic intelligence for operational purposes, an efficient mechanism was needed to develop the film, assess the photographs, and signal the information through the chain of command to those who could act on it.

Photographic reconnaissance for the army was handled by 40 army co-operation squadron, which was attached to 13 Corps.⁶⁸ The photographs were developed and printed at the squadron and the results were interpreted by a detachment of the Army Air Photo Interpretation Unit.⁶⁹ First phase interpretation results were telephoned to G3 Air at Corps and G2 Air at army headquarters. If the telephone lines were unavailable, information was sent over normal links which included the Air Support Control link for urgent information. A more complete interpretation was distributed by the quickest means available from the AAPIU to both Corps headquarters and to GSI Eighth Army, and distributed onwards as required.⁷⁰

The Royal Air Force also had its own Photo Reconnaissance Unit which was engaged in target location and damage assessment. Its procedures were similar to those followed by the AAPIU. The film was collected by the ALO on the landing ground and developed by the Middle East Interpretation Unit (MEIU).⁷¹ First phase interpretation was telephoned to the Senior Intelligence Officer Air Headquarters Western Desert.⁷² Orders then flowed downward to Wing headquarters, and subsequently to the appropriate squadrons. The full written report on the photographs was despatched by the next morning to "GSI Eighth Army and SIO Air HQ WD"⁷³ by hand, and to the two Corps "via G (Ops) Eighth Army by LO or next fastest means."74 Aside from the Photo Reconnaissance Unit, the Strategic Reconnaissance Flight and a South African squadron were also engaged in photographic reconnaissance for the RAF, 75 as were the two tactical reconnaissance squadrons operating under Army control.

To have more than one service control and conduct

reconnaissance was a mixed blessing. It did allow the army and the RAF each to meet its own reconnaissance needs quickly, but at the expense of overall efficiency. Without a centralised controlling formation, there was no coordination of effort, resulting in confusion and costly duplication of effort. The Army Co-operation squadrons were, in effect, independent units which moved with their respective Corps headquarters, they were difficult to administer and were "completely out of touch with the air situation".⁷⁶ Since these reconnaissance units were not all located in the same area, it took valuable time to transport the photographs to those who needed them. Moreover, supply problems hampered the photo reconnaissance efforts of the RAF's Strategic Reconnaissance Flight. In order to develop photographs, one needed quantities of water unavailable around Tmimi (where this unit was based)⁷⁷. Consequently, once removed from an airplane at Tmimi, the film had to be flown to rear headquarters at Maaten Bagush and Qasaba for processing, and the results flown back to advance headquarters.⁷⁸ The results, "due to the water problem, were always therefore very late and often uselessly stale on receipt."⁷⁹ Co-ordinating all reconnaissance efforts in a favourable location would have eliminated these problems.

Early in July 1942, all reconnaissance units were gathered together under the command of No. 285 Air Reconnaissance Wing. The objectives of the new formation were to "absorb all recce Units in the Western Desert"80, and to direct and co-ordinate "recce policy so that duplication was reduced to a minimum and the maximum use made of the flexibility of the Air arm."81 The Wing had its own headquarters, and controlled (both administratively and operationally) the Photo Reconnaissance detachment, Strategic Reconnaissance Flight, the South African Air Force's survey squadron, the Middle East Interpretation Unit, and the Army Air Photo Interpretation Unit.⁸² In theory, 285 Wing also controlled the two Army Cooperation squadrons, however in practice they continued to receive direction from their respective Corps headquarters.83 Indeed, this is an example of how a lack of cooperation between services can result in inefficiency. By continuing to exert control over these squadrons, the army was ensuring that its own needs were being met, but at the price of a wasteful duplication of effort. Despite this, and some unavoidable teething-pains, the new formation functioned smoothly, and put a stop to many unnecessary missions.⁸⁴ These changes marked the transition of aerial reconnaissance from an unrefined to a mature intelligence source. The

benefits of using this kind of intelligence had been realised, and efforts had been made to make each phase of intelligence gathering and use as smooth as possible.

The final form of reconnaissance which provided aid in interdiction operations came from an unusual source. Rommel's offensive in early 1941 had left Tobruk a besieged port held by British troops far behind the front. Between April and December 1941, these soldiers were in the unique position of being able to observe enemy motorised transport to and from the front lines, and were able to send daily reports via W/T links to Corps and Army headquarters.⁸⁵ Such reports may not have been useful to the RAF for locating targets, but further knowledge of German supply movements aided in focusing aerial reconnaissance.

Intelligence of all forms was a necessary condition for effective interdiction operations. It not only illuminated the Axis supply difficulties, but provided a means to increase their severity. Without intelligence, the RAF would have been unable to apply its force directly at supply columns. The process of patrolling with armed aircraft in the hopes of locating a convoy along several thousand kilometres of roads would have proven unproductive and unwise. Aircraft were a precious commodity during the campaign, and exposing them to enemy fighters and antiaircraft fire without a clear target would not have proven cost-effective. When mature, intelligence allowed the RAF to conserve its valuable aircraft while delivering a lightning-quick strike against an extremely fragile and essential part of the Axis war effort. It was not until the middle of 1942 that intelligence organizations and personnel were able to aid interdiction, and at the same time C³ structures reached proficient levels. When this occurred, the potency of the RAF's interdiction campaign increased dramatically.

Notes

¹ Julia Swannell (ed.), <u>The Little Oxford Dictionary</u>, (Oxford: Clarendon Press, 1980), p.298.

² John Ferris, "Airbandit: C³I and Strategic Air Defence during the First Battle of Britain, 1915-18," in Michael Dockrill and David French (eds.), <u>Strategy and</u> <u>Intelligence: British Policy During the First World War</u>, (London: The Hambledon Press, 1995), p.26.

³ Ibid.

⁴ PRO AIR 41/25 The Enemy Supply System in Libya, Appendix Z, 10 November, 1941.

⁵ Ibid.

⁶ Ibid.

⁷ Ibid.

⁸ PRO AIR 26/402 Operations Record Book No. 285 Wing, R.A.F. M.E., 26 August 1942.

⁹ This is the major theme of: Ralph Bennett, <u>Ultra and</u> <u>Mediterranean Strategy</u>, (New York: William Morrow and Company, Inc., 1989), especially chapter 12.

¹⁰ Ibid., p.19*n* and p.19.

¹¹ PRO DEFE/3 (hereafter cited as Ultra)QT 1123 AIR ONLY, 1741/10/9/42 GMT.

¹² Ultra MK 83 AL 81 WD 55 AIC, 2005/22/11/41.

¹³ Ultra QT 3024 Part Two, 0224G/8/10/42.

¹⁴ Ibid.

¹⁵ Hans-Otto Behrendt, <u>Rommel's Intelligence in the</u> <u>Desert Campaign 1941-1943</u>, (London: William Kimber, 1985). This is the main theme of Behrendt's account, and it was true until the middle of 1942, when British fortunes changed and their signals security was improved. For details on the RAF Y arrangements in the Mediterranean theatre see Aileen Clayton, <u>The Enemy is Listening</u>, (London: Hutchinson, 1980).

¹⁶ PRO AIR 40/2252 Mediterranean Air "Y", 18 September 1943, p.2.

¹⁷ Ibid.

¹⁸ Ibid.

¹⁹ Ibid., p.3.

²⁰ Ibid.

²¹ PRO AIR 23/1209 CISO Middle East, Intelligence Organization-Mobile Fighter Group, dated 31.5.43.

²² PRO AIR 40/2345 Y Daily Reports Middle East for May 20, 1942.

²³ Australian War Memorial (hereafter cited as AWM) 54[423/4/24] Memorandum from Army Headquarters New Zealand Military Forces on the Interrogation of Prisoners of War, 22 June, 1942.

²⁴ Raymond Toliver, <u>The Interrogator: the Story of</u> <u>Hanns Scharff, Luftwaffe's Master Interrogator</u>, (Fallbrook: Aero Publishers, Inc., 1978), p.24.; AWM 54[423/4/24] Report on Visit by Lt.Col. G.L. Harrison to Australia in Connection with Establishment of a CSDIC, May 1942.

²⁵ Toliver, pp.86-89.

²⁶ AWM 54[423/4/24] Report on Visit by Lt. Col. G.L. Harrison to Australia in Connection with Establishment of a CSDIC, May 1942, p.1.

²⁷ AWM 54[423/4/24] (C.S.D.I.C.) Cairo, Middle East Appendix B.

²⁸ Toliver, Chapter 5.

²⁹ AWM 54[423/4/24] (C.S.D.I.C.) Cairo, Middle East Appendix B, Method of Interrogation.

³⁰ Ibid.

³¹ F.H. Hinsley, <u>British Intelligence in the Second</u> <u>World War</u>, Vol.I, (London: Her Majesty's Stationery Office, 1979), p.205.

³² AWM 54[423/4/24] Notes on the Combined Services Detailed Interrogation Centre, Cairo, Middle East, p.1. No date provided.

³³ Ibid; Hinsley, p.205.

³⁴ AWM 54[423/4/24] Notes on the Combined Services Detailed Interrogation Centre, Cairo, Middle East, p.2.

³⁵ Ibid.

³⁶ Ibid.

³⁷ Ibid., p.3.

³⁸ Ibid.

³⁹ AWM 54[423/4/24] CSDIC Mobile Unit.

40 Ibid.

⁴¹ Ibid.

⁴² Ibid.

⁴³ AWM 54[423/4/24] CSDIC Cairo memorandum on Prisoner of War information given, May 5, 1942.

⁴⁴ Ibid.

⁴⁵ AWM 54[423/4/24] Memorandum entitled Items of RAF interest from PW Sources, May 7, 1942.

⁴⁶ AWM 54[423/4/24] (C.S.D.I.C.) Cairo, Middle East Appendix B, p.2.

⁴⁷ PRO CAB/106/1219 General Playfair's Correspondence about the Enemy Supply Situation for May, 1942.

⁴⁸ PRO AIR 41/25 Enemy Supply System in Libya, November 1941.

⁴⁹ Ibid.

⁵⁰ Ibid.

⁵¹ PRO AIR 23/6482 Signal from 253 Wing to 268 Wing, 3

November, 1941.

⁵² PRO PRO AIR 23/6472 Report on reconnaissance before and after the formation of 285 Wing, internal evidence indicates this report was written after May 1944.

⁵³ PRO AIR 23/1345 Answers to War Office Questions, 27 December 1941, p.2.

⁵⁴ Ibid.

⁵⁵ PRO AIR 23/6472.

⁵⁶ Royal Air Force Museum Middle East Review No. 2 January to March, 1943, RAF HQ ME, p.90.

⁵⁷ PRO WO 201/539 Instructions for the Collection and Quick Dissemination of Information, 9 May 1942.

⁵⁸ Ibid.

⁵⁹ Ibid.

⁶⁰ PRO WO/488 Appendix A to DO Circular No. 12 The Work and Organization of AL Sections in a Tactical Bomber Force, 16 January 1944.

^{61.} PRO WO 201/488 ALO Organization and Duties with No1 MORU & Wings Under Command Desert Air Force, dated 16 Jan. 1944.

⁶² John Herrington, <u>Air War Against Germany And Italy</u>, (Sydney: Halstead Press, 1962), p.195.

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⁶³ PRO WO 201/539.

⁶⁴ Ibid.

⁶⁵ PRO WO 201/631 Signal from Battle HQ 8th Army to Air Officer Commanding-in-Chief.

⁶⁶ PRO AIR 23/6472.

⁶⁷ PRO AIR 20/7706 War Diary of Panzer Army Africa 28 July-23 October 1942. p.8.

⁶⁸ PRO WO 201/539.

⁶⁹ PRO AIR 23/6472.

⁷⁰ PRO WO 201/539.

⁷¹ PRO AIR 23/6472.

⁷² PRO WO 201/539.

⁷³ Ibid.

⁷⁴ Ibid.

⁷⁵ Royal Air Force Museum Middle East Review No.2 January-March, 1943 RAF HQ Middle East, p.90.

⁷⁶ PRO AIR 23/6472.

⁷⁷ PRO AIR 23/1345.

⁷⁸ Ibid.

⁷⁹ Ibid.

⁸⁰ PRO AIR 23/6472.

⁸¹ Ibid.

⁸² Ibid.

⁸³ Ibid.

⁸⁴ Ibid.

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⁸⁵ PRO WO 201/2083 GHQ Middle East Forces Intelligence Summary No. 529 From 1200 hours 30.10.41 to 1200 hours 31.10.41.

CHAPTER FOUR: OPERATIONS

Just as British C³ structures and intelligence organization changed in response to lessons learned, so too did the mechanics of interdiction and its results. During the opening year of the desert war, the RAF did not possess sufficient aircraft to do more than destroy the occasional supply convoy; meanwhile, since there were too many demands on the limited air strength, the full potential of interdiction was not realized. Additionally, many of the aircraft in service were older generation bombers ill-suited to interdiction operations, and their tactics were crude, resulting in higher losses and inflicting minimal damage on the enemy. In short, the interdiction campaign received low priority, and was not very efficient.

However, the RAF did possess a number of advantages which quickly changed this situation. Specifically, it received continual reinforcements to the theatre, and instituted measures which kept their aircraft flying when their enemy's were grounded. Aircraft more suited to interdiction arrived in increasing numbers, and tactics evolved to maximize their potential. By early 1942, the RAF had built a remarkably effective tool for crippling their

enemy's supply network. By late 1942, it was hammering virtually every Axis supply convoy and thus destroyed the enemy's ability to fight. The following paragraphs will trace how the important elements of this tool evolved.

Until late 1941, the German and Italian air forces had greater numerical strength in the air above the desert than did the British.¹ For example, in June 1941, Air Marshal Tedder estimated the RAF's strength in Libya to be "sixty fighters, sixty-five medium bombers, twelve Army Cooperation fighters, and three and a half squadrons of heavy bombers"² - approximately 200 aircraft. In fact, the number was closer to 250.³ Against this, the Luftwaffe and the Regia Aeronautica had some 400 serviceable aircraft which could be sent into battle in Cyrenaica.⁴ Given the ever increasing need to provide close support for the army, RAF commanders could launch few interdiction missions. They needed far greater strength in aircraft before they could conduct an effective land based interdiction campaign. It took over a year for these conditions to be met. As British air strength grew, however, a more or less continual war against motorised supply columns became possible, and increasingly deadly. Indeed, as the Germans drove toward Cairo in June 1942, the "steady interdiction of supplies

became the most important factor in the dramatic failure of Rommel's last offensive in Egypt, at the Battle of Alam Halfa, at the end of August."⁵ Even when British air strength had eclipsed that of the Axis powers, however, interdiction was sometimes subordinated to ground operations. Thus when the Afrika Korps approached El Alamein, broader strategic concepts such as interdiction "were necessarily subordinated to the task of providing close-support to the Army"⁶, and all air power was directed toward aiding the Eighth Army whose position General Auchinleck termed "most precarious"⁷.

Continual reinforcements and the development of an efficient repair and salvage system were major factors in the quantitative growth and the rise in qualitative effectiveness of the RAF, and allowed a more constant and efficient interdiction campaign. The British turned serviceability and reinforcements into trump cards. From 1940 onward Britain always matched or exceeded German aircraft production,⁸ and the latter always had to cover air requirements in three theatres, where the British had only two. Whereas the Mediterranean always ranked a poor third in German priorities, it ranked a strong second for Britain. The British had the political will to do anything to assure

victory in the Western Desert. This will to win ensured that commanders who were slow to achieve results were dismissed from their posts, and it also provided a continual supply of aircraft from England. Admittedly, these aircraft could be provided only through a roundabout and dangerous process. They were shipped in crates or flown in via Malta, Port Sudan and the Takoradi route.⁹ The latter was a crosscontinent route from Takoradi, a port on the Gold Coast (present day Ghana), to Abu Sueir in Egypt.¹⁰ In mid-1941, Tedder predicted the total number of aircraft arriving in Egypt from all of these routes would be "six hundred per month."11 Although Tedder's estimate was somewhat optimistic, between 11 February 1942, and 10 March 1942, 410 aircraft arrived in Egypt through the various routes.¹² British front line strength steadily grew, almost doubling between November 1941, and November 1942.¹³ Meanwhile, the bulk of the Luftwaffe was withdrawn from the Mediterranean theatre. Although the number of Axis aircraft in North Africa remained fairly constant,¹⁴ the withdrawal prevented a growth in its air strength and crippled its ability to replace losses.

Another by-product of the political commitment to victory in Africa was a campaign to increase the RAF's

serviceability rates. Prime Minister Winston Churchill, disgusted with the low numbers of operational aircraft, sent Air Vice Marshal G.G. Dawson to improve the situation. He became "Chief Maintenance and Supply Officer with the job of receiving, modifying, distributing, salvaging, and repairing the aircraft and spares in the Middle Eastern Air Command."¹⁵ Dawson focused on two distinct issues, recovery and repair. Each approach saved thousands of aircraft for the RAF, which not only received greater resources than its enemies did, but also did better at husbanding them. During the first two years of the campaign in the Western Desert, the best means for receiving aircraft was the Takoradi Aircraft, however, were often lost along this 3,697 route. mile route.¹⁶ The salvage units were charged with recovering them and bringing them back to be repaired. They also salvaged aircraft lost in action. During

one 17-week period of hard fighting in the desert more than 1,000 damaged aircraft of all types were scattered over some 100,000 miles of desert. A few of them were never found, perhaps never will be found. But during that period more than 800 of them were brought back to the various base depots, repaired and made operationally serviceable and flown back into the war.¹⁷

Extraordinary measures like these ensured that RAF squadrons got every aircraft possible.

The other way to preserve aircraft was to repair damage suffered during operations. Each squadron possessed its own mechanics, an engineering staff, and equipment to perform maintenance and repair battle damage, ¹⁸ but there were limits to their powers. Maintenance organisations to handle more severe damage were inadequate when the war began, but by mid-1941 the situation had changed. Many more maintenance facilities were deployed. They were adequately staffed and supplied, and were dispersed into protected locations to protect them from air attack. One unit, for example, was located in the Mokattam hills in the artificial caves created by the removal of stone to construct the pyramids.¹⁹ The whole system of repair and salvage was organised under number 206 Maintenance Group, commanded by Air Vice Marshal Dawson.²⁰ This arrangement ensured that maintenance and salvage would be given greater attention. Air Marshal Tedder was very impressed with this organization, especially the "much improved...rate of serviceability"²¹. Between May and November 1941, the number of serviceable aircraft rose from 200 to nearly 600,²² and although some of this was due to increased reinforcements, Dawson's work was "a major factor."²³ Even at their worst, RAF serviceability rates were better than

those of the Axis, and during the fifth week of the battle of El Alamein, they reached eighty-five per cent,²⁴ a full thirty percent above the German serviceability rates.²⁵ The effect of this cannot be underemphasised. Superiority in serviceability and recovery gave the RAF the same edge against the Luftwaffe that Panzer Divisions had against their British equivalents. For example, if the Axis air forces possessed 320 aircraft, with serviceability rate of fifty percent, while the British had 185 aircraft with a serviceability of eighty-five percent, the number of operational aircraft would be roughly even. Yet by 1942, the British were superior both in absolute numbers and the serviceability of aircraft.

While British air power was growing, the Luftwaffe experienced a continual drain of its air resources in the Mediterranean to other theatres, particularly the Russian front. This became particularly acute in May 1942, when "most of the German air forces were withdrawn from the Mediterranean theatre for use in the east."²⁶ In July 1942, Field Marshal Albert Kesselring wrote:

What with the resurgence of British sea and air activity against Axis convoys and the re-strengthening of Malta, particularly since the attack had to be abandoned, coupled with the ever-increasing demands on

the Luftwaffe, German supremacy in the Mediterranean was gradually crumbling away.²⁷

Not only did the Luftwaffe's strength decline: its serviceability rates were poor and getting worse. On 18 November 1942, the serviceablilty rate for all types of German aircraft in Cyrenaica was fifty-seven percent.²⁸ By 24 November 1942, this fell to forty-nine percent.²⁹ Poor serviceability particularly degraded the greatest air threat to the British interdiction campaign - the single engine fighter. At its height, in May 1942, the Luftwaffe possessed 150 single seat fighters in North Africa, but this unusually high number resulted from a transfer of seventy aircraft from Sicily to aid in the assault against Egypt.³⁰ By 24 November 1942, the Luftwaffe had just thirty-eight single engine fighters in Cyrenaica, of which just twentyone were operational. 31 By the middle of 1942, the combination of poor serviceability and lack of adequate and continual reinforcements made the Luftwaffe a paper tiger.

If one compared the air strengths of the RAF and Luftwaffe up to the end of 1942 on a graph (see Table 1)³², one would see that the RAF's numbers rose continuously throughout the desert war, while Axis numbers remained relatively static, and even dropped near the end of 1942. The RAF's gross numerical strength eclipsed that of the Axis in November 1941, but absolute numbers are not always the best criteria for judging strength. Rather, numbers of operational aircraft sufficiently supplied with fuel and ammunition would have been more accurate. During the Crusader operation, from November 1941-January 1942, the Axis forces possessed large numbers of reinforcement aircraft in "Tripolitania, Sicily and elsewhere, but the limiting factor was the quantity of fuel available at bases within reach of the forward area."33 From late 1941 to the end of the desert war the British had more operational aircraft than their enemy (see Table 2)³⁴. Moreover, the Axis supply situation was often precarious, and they often did not have enough fuel for their operational aircraft. This was good news for the interdiction campaign, because operations could be conducted with less harassment from the Luftwaffe and Regia Aeronautica. This did not mean that fighter cover was unnecessary. At no time until the battle of El Alamein did the British have complete domination of the air, while during the summer of 1942, the Germans introduced the Messerschmitt 109G,³⁵ which was far superior to all British fighters in the area except the Spitfire V. 36 After mid-1942, the threat of Axis air forces decreased, but they were still a danger to interdiction operations unless

appropriate protection was provided.

To press home interdiction attacks and to avoid losses, both bomber and fighter/bomber missions required a fighter escort. Italian and German fighters were easily a match for any British bomber. The Martin Maryland Reconnaissance-Bomber, for example, carried a crew of three, a maximum bomb-load of 2000 pounds, and was capable of 278 miles per hour.³⁷ Its most lethal opponent, the single engine Messerschmitt 109E and G, were respectively 70 and 130 miles per hour faster. The Me-109E was armed with three 20mm machine-quns and two 7.9mm machine-quns in the upper cowling, while the ME-109G carried one 20mm machine-gun and two 7.9mm machine-guns.³⁸ Without fighter cover the Maryland would have been helpless before the Messerschmitts. This was true of any other British bomber of the day, and many were even more vulnerable. Blenheim IV bombers, which had been in service since the first days of the war, were at least 140 miles per hour slower than the Messerschmitt 109G, and carried only half the bomb load of the Maryland. 39 German fighters also outmatched any British fighter/bomber which had not dropped its bombs, because the external stores decreased the aircraft's performance.⁴⁰ Even fighter strafing missions were at risk from enemy aircraft, because

pilots were occupied with their attack and had to concentrate on flying an irregular approach to avoid antiaircraft fire, and the black smoke associated with the attacks (especially if petrol trucks were destroyed) usually brought enemy fighters.⁴¹ The mere presence of friendly fighter cover also boosted morale, and enabled crews to concentrate on the task at hand.

The fighter cover for bomber and fighter/bomber missions was deployed at medium and high altitudes to allow the interception of enemy aircraft wherever they appeared. For example, on 1 September 1942, Nos. 7 and 127 Squadron SAAF provided fighter cover for three tank-buster Hurricanes on an interdiction mission. Eight Hurricane II B's of 7 Squadron provided medium cover, while top cover was provided by 127 Squadron.⁴² This arrangement was far better than keeping fighter cover at one altitude. Aircraft at high altitudes could see enemy fighters farther away, allowing more time to plan an intercept. Similarly, if all fighters gathered at medium altitudes, the enemy could launch a diving attack, perhaps out of the sun. If every friendly fighter stayed at high altitudes, low flying enemy fighters could have intercepted the bombers or fighter/bombers before their attack. The RAF found these arrangements so effective

that "the enemy rarely broke through [the] fighter escort".⁴³ Decreasing the threat from enemy aircraft allowed the roughly 20-25 squadrons engaged in interdiction operations (either exclusively or occasionally)⁴⁴ to concentrate more fully on their mission - to prevent whatever portion of the 60,000 tons of supplies the German army consumed each month while stopped at El Alamein,⁴⁵ from reaching the front. Accomplishing this task, while avoiding anti-aircraft fire, remained difficult throughout the campaign.

Over the course of the interdiction campaign, the RAF standardised the tactics for aircraft engaged in interdiction operations, and improved them. This increased the lethality of interdiction operations, and enabled aircraft to hit the target and escape before the antiaircraft defences became effective. At the beginning of the war, fighter pilots engaged in the practice of "hose-piping" the convoy.⁴⁶ Pilots would fly directly down the length of the convoy and spray machine gun fire at every truck. Intelligence brought back by attacking pilots and reconnaissance reports, however, revealed the inefficiency of this approach. Given the high speed of the aircraft, most bullets landed in between the trucks, while the enemy

could "fire a vertical barrage with effect"⁴⁷ against pilots flying down the length of the column. As a result, the procedures for attacking truck columns were changed to increase the damage inflicted while minimising the ground fire. That the RAF understood the value of attacking these targets and adopted a rational approach to doing so, is obvious from the fact that specific tactics were designed for each type of aircraft. The following paragraphs will outline the tactics used by bombers and fighters, and their results. This in turn leads to a central issue. To acquire a sense of the average damage inflicted during these attacks compared with losses suffered, is to evaluate the cost-effectiveness of the interdiction campaign.

A wide variety of aircraft were employed in interdiction operations in the Western Desert, including single and multi-engine fighters as well as light and medium bombers. The tactics varied from type to type, and were tailored to maximize the attributes of each variety of aircraft. Two varieties of single engine fighter were used in aerial interdiction: the P-40 Kittyhawk and several marks of Hawker Hurricane. Both aircraft were capable of speeds in excess of three hundred miles per hour, but the Hurricane's more rugged construction allowed it to absorb more damage as well as carry larger calibre guns (including the twin 40mm tank buster cannons)⁴⁸. By the end of 1940, the redoubtable Hurricane's days as an air superiority fighter were over, but it proved its worth as a fighter/bomber. It carried the same bomb load as some light bombers,⁴⁹ and could still handle many of the German and Italian fighters used in North Africa (except the Messerschmitt 109F and G, and the Italian Macchi MC.200 and MC.202)⁵⁰. Furthermore, there were quite a number of Hurricanes available in England.

Even more solid than the Hurricane were the Bristol Beaufighters and Blenheim fighters, and the light and medium bombers (specifically Blenheim bombers, Bostons, Beauforts and Marylands) which also flew a high percentage of the daylight interdiction missions during the initial stages of the desert war. With the exception of the Beaufighter (which was the most devastating interdiction weapon of the desert war) these aircraft proved a disappointment in an interdiction role, and from early 1942, they made up a steadily smaller portion of RAF strength and most interdiction operations were handled by fighter/bombers.⁵¹

Upon receiving orders to intercept a convoy, the squadron intelligence officer briefed all pilots about the size and location of the target, and the actual plan of attack. He was "the funnel through which all branches of intelligence reach[ed] the aircrews."52 The squadron intelligence officer gathered intelligence together into a form useable by aircrews, briefed them before missions, debriefed them after it, and relayed the results of the missions (including damage estimates, resistance encountered, and losses suffered) to Wing headquarters, Air Headquarters Western Desert, and HQ RAF Middle East.⁵³ Once the pre-flight briefing was completed, crews hurried to ready their aircraft for flight. During the trip to the target, they scanned the sky and ground for possible threats, and reviewed in their minds the tactics they would use to attack the target.

Aircraft types dictated tactics. Fighters possessed the high speed and manoeuvrability to press home attacks at low level. Some principles applied in either situation, although a distinction was always drawn between attacks on moving and dispersed convoys. When approaching a target, one flew at low level and at high speed to allow "sufficient surprise to counter light A.A. fire"⁵⁴. The approach to the

target was made "from the direction of the enemy's bases as this [gave British] fighters a quick getaway in the direction of friendly territory"⁵⁵, and often convinced the Germans that the aircraft were friendly.⁵⁶

When attacking a moving M.T. convoy, the fighter formation manoeuvred into position for a surprise approach. It then split in half, with one part acting as a decoy and a cover for the attacking aircraft, while the rest descended to ground level for the attack. The final nature of the attack depended on the terrain and the issue of whether the aircraft could approach perpendicular to the supply column. If so, each pilot selected a different vehicle to attack, and as it came into range raised the nose for a diving The aiming point was right behind the driver's cab attack. to maximize the chance of hitting most of the cargo (especially petrol), and killing the driver. If the attack could not be made parallel to the column, however, line of stern formation was adopted and again each pilot picked a different vehicle.⁵⁷

A dispersed convoy was a difficult target because its irregular shape did not allow it to "be attacked equally well from any direction"⁵⁸. Worse, heavy anti-aircraft fire
which increased losses was often encountered with this type of target.⁵⁹ Despite this, the pattern of attack was the same: pilots approached in line abreast, picked an individual target and fired at it.

Fighters could also drop bombs on stationary or moving supply columns. Aircraft like the Hawker Hurricane I "Hurribomber" were fitted with hard-points which could hold external bombs. Forty pound bombs dropped from 1,000 feet and fused to explode on contact were found to be the best for attacking convoys.⁶⁰ It was preferable to bomb moving MT columns, while again dispersed vehicles were "not considered a profitable target"⁶¹ due to the irregular shape and heavy anti-aircraft fire.

The bombing run was made at 1,000 feet, parallel to the MT column in line of stern formation with aircraft about 200 yards apart. Individual bombs or salvoes were released over the target with the pilot allowing for height and winddrift.⁶² "Very little practice [was] required before becoming adept in this method"⁶³, so few RAF resources were wasted in bringing a pilot up to speed on this style of attack. The break away was accomplished by flying as low and as fast as possible until well out of range of antiaircraft fire. Once out of range, aircraft could return to strafe the target. Again, the ideal approach was made perpendicular to the target's direction of movement in line abreast formation. These attacks were continued until all vehicles were destroyed, or ammunition was exhausted.⁶⁴

Bombers, lacking the speed or agility of fighters, needed different means to accomplish their missions while avoiding enemy fighters and anti-aircraft fire. In addition to fighter escort (which varied from eight aircraft to three full squadrons), bombers flew in close formations at medium altitudes so to concentrate the strength of their defensive fire, and to present the "minimum area for fighter attacks."⁶⁵ These formations consisted of "a box of six, nine or twelve aircraft"⁶⁶ each further separated into elements of three aircraft. These formations would appear as follows:



Although this protected bombers to a degree, formations did not provide immunity from enemy attack. B-17 Flying Fortresses in such formations over Germany without fighter cover suffered considerable losses to sleek, hard to hit German fighters. The bomber crews who flew interdiction missions in North Africa, however, usually had fighter cover.⁶⁸ Without such protection, the lightly armed Wellingtons and Marylands would have been easy prey for German fighter pilots. In fact, British fighter protection was so proficient that during the 1941 campaign in Libya, No.11 and 14 Squadrons "completed over 1000 aircraft sorties and did not lose one aircraft as a result of enemy fighter action."⁶⁹ However, Messerschmitt 109s were not the only threat to aircraft. Experience showed that bombing from "heights above 4000 feet provide[d] relative immunity from A.A. damage".⁷⁰ Under no circumstances were pilots to fly below 2000 feet, because fifty percent of the aircraft lost to anti-aircraft fire were lost below this altitude.⁷¹ These procedures were standardised in February, 1942 as a result of experience gained during operations.

The adoption of these tactics could not help but increase the efficiency of the interdiction campaign as a whole. Even if they did not increase the damage inflicted

during interdiction operations, merely reducing the loss of aircraft improved the ratio of resources used versus resources destroyed (as crudely measured by comparing the truckloads of supplies destroyed to pilots and aircraft lost).

Despite the improvement in tactics, not every bomb or bullet met its target. There is still considerable debate among historians regarding whether even the most advanced World War Two era bombers were ever able to achieve a high level of precision,⁷² and the bombers operating in North Africa until 1942, came largely from an older generation of aircraft. Newer bombers, which could deliver a greater number of bombs onto their targets, did come into service in North Africa, but even their accuracy was questionable. Given that large, unwieldy formations of bombers, flying above 4000 feet were often attempting to hit a straight line of vehicles moving on a narrow road, it is no wonder that problems with accuracy were encountered. Fighters and fighter/bombers, conversely, were far more manoeuvrable, and able to plan their approach more carefully. Even if their bombs missed, they could still inflict considerable damage with machine gun fire. Single engine fighters, moreover, were more fuel efficient than heavily laden bombers, and

consequently inflicted their damage on the Axis at the expenditure of fewer resources. The Martin Maryland Reconnaissance-Bomber, for example, carried a crew of three, a maximum bomb-load of 2000 pounds, and was capable of 278 miles per hour.⁷³ The Blenheim IV light bomber was slower, and carried a light payload of 1000 pounds of bombs matched by the Hawker Hurricane IIC Fighter/Bomber, except the Hurricane was 70 miles per hour faster and much more manoeuvrable.⁷⁴

The purpose of interdiction was to destroy enemy motorised transport vehicles, and certain criteria had to be met before a vehicle was officially deemed to be destroyed. An Air Ministry memorandum outlined the difference between a damaged and destroyed motor vehicle:

- (a) <u>Motor Vehicles Destroyed.</u> Motor transport will be claimed as destroyed if one or more of the following conditions is or are satisfied:-
 - (i) The vehicle is seen to burst into flames ("Flamer")
- or (ii) The vehicle is seen to explode or disintegrate,
- or (iii) The vehicle is seen to receive a direct hit from a bomb,
- or (iv) The vehicle proceeding at a high speed is seen to be hit causing loss of control resulting in the vehicle being wrecked.
- (b) Motor Vehicle-Damaged. A motor vehicle will be claimed as damaged if one or more of the

following conditions apply:-

- (i) The vehicle is seen to emit black smoke.
- (ii) The vehicle emits a cloud of steam indicating that the radiator has been hit.
- (iii)Repeated strikes (i.e. from a burst) with cannon or M.G. fire is seen to hit the vehicle.⁷⁵

Case studies of actual missions will show how the process of interdiction worked in mechanical terms, as well as illustrating its cost-effectiveness.

On 14 September 1941, 12 Squadron South African Air Force was ordered to attack "dispersed enemy M.T...near El Hamra position 545.320"⁷⁶ (military grid reference). Eleven Marylands were to fly the mission, with the first aircraft taking off at 1600 hours that day.⁷⁷ Each Maryland carried eight-250 pound general purpose bombs fused to detonate on impact, and also had a full load of ammunition "for all guns in proportion laid down."⁷⁸ Aircraft from B Flight were first into the air, and flew to "Sidi Haneish...at 4000ft to pick up fighter escort."⁷⁹ After a bombing run at 6000 feet, they returned directly to base.⁸⁰ The six aircraft from A Flight mirrored these procedures, and arrived on target "10mins after B Flight have left the target area."⁸¹ Cameras were carried (one by B Flight and two by A Flight) to record the bomb damage.⁸²

This was an almost perfect mission in technical terms, but to little tactical effect. Light and medium antiaircraft fire was encountered over the target, but no losses were experienced from anti-aircraft fire or enemy aircraft.⁸³ Thirty-eight out of A Flight's forty bombs fell in the target area, causing two fires. B Flight dropped forty-four out of forty-eight bombs in the target area, causing one additional fire.⁸⁴ The Senior Intelligence Officer 12 Squadron SAAF, however, could not confirm any considerable damage beyond the three fires reported⁸⁵, and since the target vehicles were dispersed, probably just these three vehicles were destroyed. In order to achieve this result, the RAF expended eighty-eight bombs, the fuel for eleven Marylands and their fighter escort, and risked their loss. Thus, in this instance a tolerably efficient C³I system allowed aircraft to locate and strike with efficiency a target, but because the aircraft were not particularly suited to the operation, no considerable damage was inflicted. At best, this was a marginally costefficient operation for the RAF.

Again, on 9th January 1942, intelligence reported a concentration of 300-400 MT "at pin-point xB7087 East of AGHEILA"⁸⁶, and were attacked by an unspecified number of

Blenheim bombers from No.11 Squadron RAF. Bombs dropped from 6000 feet, "were observed to straddle M.T. concentration..and three direct hits were seen but no fires were observed. All aircraft returned safely."⁸⁷ Once again, the bombers inflicted some damage, but not much. By contrast, on 31 December 1941, seven Wellingtons (a medium bomber with a 4000 pound bomb load)⁸⁸ dropped twenty-eight thousand pounds of bombs while attacking an "M.T. concentration near MARBLE ARCH landing-ground causing a series of explosions and destroying at least twelve vehicles."⁸⁹ This, however, appears to be the exception to the rule.

Generally, even though the standard of bombing was good and often very "profitable results were reported"⁹⁰, bomber missions seem to have expended considerable resources with poorer results than fighter-bomber missions. Any attempt to gauge whether interdiction missions flown by bombers were cost-effective must, of course, be related to the supply situations of the British and their enemies. Since the British enjoyed more consistent and reliable supply shipments throughout the campaign than the Axis, an even expenditure of resources through interdiction was to their benefit. Using bombers for interdiction in the desert was likely worth the effort, and many types were used throughout the campaign. Yet bombers clearly proved less costeffective than fighter/bombers in interdiction, a lesson which shaped operations until 1945. The desert war was a testing ground for all aspects of interdiction missions, and the German supply network was extraordinarily exposed. By mid-1942 fighter/bombers were conducting the bulk of interdiction missions.⁹¹

Fighters and fighter/bombers had advantages of speed and agility which enabled them to deliver more flexible and lethal strikes on motorised transport columns, and also to hold their own against German and Italian fighter aircraft. The Bristol Beaufighter was particularly well suited to the role, possessing a combination of speed, durability, reliability, and the ability to deliver a devastating punch to thin skinned vehicles. It was capable of 306 miles per hour at sea level, possessed two durable radial engines, and carried four 20mm Hispano cannons in its nose, as well as six .303in wing mounted Browning machine-guns.⁹² These aircraft were so effective that on 27 November 1941, Air Marshal Tedder contacted the Air Ministry in an attempt to secure a loan of some Beaufighters, which would operate from Malta, to attack road targets from Tripoli to Benghasi.⁹³ This route had "shown heavy traffic with petrol tankers, etc."⁹⁴, which were crucial to the enemy's petrol supply. A dramatic example of what even small numbers of these aircraft could do came on 2 January 1942. During a road strafing mission, four Beaufighters "shot up about 60 M.T. between AGEILA and SIRTE, destroying twelve including one petrol tanker, damaging thirty"⁹⁵. The Beaufighters suffered no losses and inflicted at least as much damage as the Wellington bomber mission mentioned earlier, at far less cost.

The Curtiss P-40 Kittyhawk and the Hawker Hurricane were the only single seat fighter/bombers in RAF service between 1940-42. Both were capable of over 320 miles per hour, but the Hurricane could carry heavier bomb loads (the Hurricane IIC could carry two 500 pound bombs to the Kittyhawk's total of 500 pounds)⁹⁶. Moreover, the Kittyhawk's six .5in wing mounted machine-guns were no match for the four wing mounted 20mm Hispano cannon of the Hurricane IIC (or the Hurricane IID's twin 40mm anti-tank cannon)⁹⁷. Both of these aircraft were employed in interdiction missions, with good results. For example, on 17 January 1942, three Hurricanes attacked MT on "NOFILLA-MERSA AUEGIA road, inflicting about 30 casualties on personnel and damaging 14 vehicles."⁹⁸ The attack also started two fires. Similarly, on 26 January 1942, a formation of 10 Kittyhawks swept the "ANTELAT-MSUS road in a highly successful ground strafe in which 20/25 vehicles and 20 personnel were hit."⁹⁹ Both of these missions were accomplished with no losses.

Such results proved that fighters and fighter/bombers were more suitable than bombers for interdiction, as the RAF quickly realized. In 1940, eight bomber and two fighter squadrons conducted RAF operations in the Western Desert.¹⁰⁰ By October 1941, prior to the Crusader operation, the RAF had sixteen bomber squadrons and nineteen fighter squadrons operating in the desert, and by October 1942, the ratio was twenty-seven fighter to twenty-one bomber squadrons¹⁰¹. However, there were few, if any, bomber squadrons engaged exclusively in interdiction operations. Much of the bomber force was directed towards close support, anti-shipping, or attacks on enemy landing grounds.¹⁰² Conversely, from mid 1942, onward, at least a dozen fighter/bomber squadrons seem to have been engaged exclusively in interdiction operations, while a further ten squadrons were employed in both interdiction and direct air support operations.¹⁰³ By the middle of 1942, these squadrons had the potential to be

devastating to the fragile German supply system; however,this had to wait until the fortunes of the British army changed.

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Table 1: Comparison of Air StrengthRoyal Air Force and Axis Air Forces



Table 2: Operational AircraftRoyal Air Force and Axis Air Forces



Notes

¹ For a comparison of air strengths at various points in the campaign, see the following sources. Denis Richards, <u>Royal Air Force, 1939-45</u>, Vol. II (London: Her Majesty's Stationery Office, 1961), pp.170-171; Marshal of the Royal Air Force Lord Tedder, <u>With Prejudice</u>, (Toronto: Little, Brown and Company, 1966), p.120; W.H. Tantum IV and E.J. Hoffschmidt, <u>The Rise and Fall of German Air Force</u>, (Greenwhich: WE Inc., 1969), pp.137-145; PRO AIR 40/1817, German Numbers in the Mediterranean, April 1943.

² Tedder, p.120.

³ Richards, II, p.166.

⁴ Tantum and Hoffschmidt, p.166.

⁵ PRO AIR 41/50, 1943 Air Historical Branch Narrative, written for the Air Ministry, entitled The Western Desert and Tunisia July 1942-May 1943, p.7.

- ⁶ Ibid.
- ⁷ Ibid.

⁸ R.A.C. Parker, <u>The Struggle for Survival</u>, (Oxford: Oxford University Press, 1990), p.133.

⁹ PRO AIR 23/6200, Aircraft Reinforcements to the Middle East Command 18 Nov-19 May, 1942.

¹⁰ Richards, I, pp.247-249.

¹¹ Tedder, p.155.

¹² PRO AIR 23/6200.

¹³ Richards, II, pp.170-171 also p.233.

¹⁴ Tantum and Hoffschmidt, p.140-144.

¹⁵ Tedder, p.109.

¹⁶ Ibid.

¹⁷ Air Ministry, <u>RAF Middle East: The Story of Air</u> <u>Operations February 1942-January 1943</u>, (London: Alabaster, Passmore & Sons, Ltd., 1945), p.34.

¹⁸ Ibid., pp.32-34; S.C. Gupta, <u>The Official History</u> of the Indian Armed Forces in the Second World War, History of the Indian Air Force 1933-45, (Delhi: National Printing Works, 1961), p.61.

¹⁹ Air Ministry, <u>RAF Middle East: The Story of Air</u> Operations February 1942 - January 1943, pp.34-35.

²⁰ Richards, II, p.165.

²¹ Tedder, p.189.

²² Richards, II, p.166.

²³ Ibid.

²⁴ Ibid., p.212.

²⁵ PRO AIR 40/1817, Marshal of the RAF Lord Tedder's Despatch on Middle East Operations May 1941-January 1942, section entitled German Numbers in the Mediterranean, April 1943.

²⁶ Tedder, p.293.

²⁷ Ibid.

²⁸ PRO AIR 40/1817, German Numbers in the Mediterranean, April 1943.

²⁹ Ibid.

³⁰ Tantum and Hoffschmidt, p.141.

³¹ PRO AIR 40/1817, German Numbers in the Mediterranean, April 1943.

³² Richards, Vol. II, pp.170-171; Tedder, p.120; Tantum IV and Hoffschmidt, pp.137-145.

³³ Basil Collier, <u>A History of Air Power</u>, (London: Weidenfeld and Nicolson, 1974), p.220.

³⁴ Richards, Vol. II, pp.170-171; Tedder, p.120; Tantum IV and Hoffschmidt, pp.137-145.

³⁵ Elke C. Weal and John A. Weal, <u>Combat Aircraft of</u> <u>World War Two</u>, (New York: Macmillan Publishing Co., Inc., 1977), p.123.

³⁶ Ibid., p.148.

³⁷ Ibid., p.204.

³⁸ Ibid., p.122-123.

³⁹ Michael J.F. Bowyer, <u>Aircraft of the Few</u>, (London: Patrick Stephens Limited, 1991), p.187.

⁴⁰ PRO AIR 23/1281 Middle East Tactical Memorandum -Hurricane I- Bombing and Ground Strafing Tactics, 5th February, 1942.

⁴¹ PRO AIR 23/1281 Middle East Tactical Memorandum No.9, Ground Strafing by Single Seat Fighters, February, 1942.

⁴² PRO AIR 26/22, War Diary of No.7 (SA) Wing: SAAF, 1 September 1942.

⁴³ PRO AIR 23/1281 Middle East Tactical Memorandum No. 10, Tactics Employed By Light Bomber Squadrons By Day Based Upon Experiences Gained Up To The Conclusion Of The Present Campaign (Phase I) In Libya, December 1941, p.2 paragraph 5.

⁴⁴ It is difficult to be precise regarding the number of squadrons involved exclusively in interdiction operations, however based on order of battle from Richards, II, pp.382-390, one can get a range of squadrons from aircraft types known to engage in interdiction operations.

⁴⁵ Martin Van Creveld, <u>Supplying War</u>, (Cambridge: Cambridge University Press, 1977), p.197.

⁴⁶ AIR 23/1281 Middle East Tactical Memorandum No.9, Ground Strafing by Single Seat Fighters, February 1942, pp. 1-2. ⁴⁷ Ibid., p.2.

⁴⁸ Weal, et al, p.144.

⁴⁹ Ibid., p.144 also pp.132-133. The Hurricane could carry two 500 pound bombs, equal to that carried by the Blenheim IV bomber.

⁵⁰ Ibid., p.157, also p.122.

⁵¹ Richards, II, pp.382-390. By late 1941, the number of fighter squadrons was beginning to match that of bombers.

⁵² PRO AIR 23/1209 Organization and Application of Air Intelligence in a Tactical Air Force, 31 January 1946.

⁵³ Ibid.; also Imperial War Museum Papers of Lt. Col. R.R. Prentice, War Intelligence course.

⁵⁴ AIR 23/1281 Middle East Tactical Memorandum No.9, February 1942, p.1.

⁵⁵ Ibid.

⁵⁶ Ibid.

⁵⁷ Ibid.

⁵⁸ Ibid.

⁵⁹ Ibid.

⁶⁰ AIR 23/1281 Middle East Tactical Memorandum -Hurricane I - Bombing and Ground Strafing Tactics, 5th February, 1942, p.1. ⁶¹ Ibid., p.2.

⁶² Ibid.

⁶³ Ibid.

⁶⁴ Ibid.

⁶⁵ PRO AIR 23/1281 Middle East Tactical Memorandum No.10., Tactics Employed By Day Based Upon Experiences Gained Up To The Conclusion Of The Present Campaign (Phase I) In Libya, December 1941.

⁶⁶ Ibid.

⁶⁷ Ibid.

⁶⁸ Ibid.

⁶⁹ Ibid.

⁷⁰ Ibid.

⁷¹ Ibid.

⁷² Ian Gooderson, "Heavy and Medium Bombers: How Successful Were They in Tactical Close Air Support During World War II?" <u>Journal of Strategic Studies</u>, Vol.15 No.3 (September 1992), p.371 and p.392.

⁷³ Weal, et al, p.204.

⁷⁴ Ibid., pp.132-133 also p.144.

⁷⁵ PRO AIR 23/1209 Organization and Application of Air Intelligence in a Tactical Air Force, 31 January, 1946.

⁷⁶ PRO AIR 23/6485 Operation Order No.164 of 12 Squadron, SAAF, 14 September 1941.

⁷⁷ Ibid.

⁷⁸ Ibid.

⁷⁹ Ibid.; also AIR 23/6485 Operation Report 0.0.164 of 12 Squadron, SAAF, 15 September 1941.

⁸⁰ AIR 23/6485 Operation Report 0.0.164 of 12 Squadron, SAAF, 15 September 1941.

⁸¹ Ibid.

⁸² Ibid.

⁸³ Ibid.

⁸⁴ Ibid.

⁸⁵ Ibid.

⁸⁶ PRO AIR 27/157 Operation Record Book No. 11 Squadron RAF, 9 January 1942.

⁸⁷ Ibid.

⁸⁸ Weal, et al, p.149.

⁸⁹ PRO AIR 24/1080 A.877 Operation Record Book

Appendices Middle East Air Staff, 1942, 2 January 1942.

⁹⁰ PRO AIR 23/1347 Secret Cypher Message from Air Marshal Tedder to the Air Ministry, Whitehall, 27 June 1942.

⁹¹ This assumption is based on the increasing number of fighter/bomber squadrons from late 1941 onward (see Richards, I, pp.385-390, also p.409.) their suitability to interdiction operations, and that bombers were being employed in different missions (see Richards, I, pp.204, 228, and 260; PRO AIR 24/1080 Operations Record Book Appendices Middle East Air Staff 1942, 2 January 1942).

⁹² Weal, et al, p.134.

⁹³ PRO AIR 23/1345, Secret Cypher Message from Air Marshal Tedder to the Air Ministry, Whitehall, 27 November 1941.

⁹⁴ Ibid.

⁹⁵ PRO AIR 24/1080 A.875, Operations Record Book Appendices Middle East Air Staff 1942, 2 January 1942.

⁹⁶ Weal, et al, p.144.

⁹⁷ Ibid., also p.144.

⁹⁸ PRO AIR 24/1080 A.874, Operations Record Book Appendices Middle East Air Staff 1942, Message to Air Ministry, Whitehall (R) AHQ Iraq, AHQ Aden, 207 Group, HQ RAF Malta, 203 Group, and Dechief Pretoria from HQ RAF ME, 17 January 1942.

⁹⁹ PRO AIR 27/873, Operations Record Book No. 112 Squadron, R.A.F., 26 January 1942. ¹⁰⁰ Richards, I, p.409.

¹⁰¹ Ibid., pp. 385-390.

¹⁰² Ibid.,pp.204, 228, 260; PRO AIR 24/1080 Operations Record Book Appendices Middle East Air Staff 1942, 2 January 1942.

¹⁰³ It is difficult to be precise about which squadrons were exclusively involved in interdiction operations. One can, however, get a fairly close estimate from understanding which types of aircraft were routinely used. In particular, PRO AIR 27/873, Operations Record Book 252 Sqn, ME, 1942; PRO AIR 26/22 War Diary of No.7 (SA) Wing, SAAF, 1942; PRO AIR 23/1347, 2 January 1942; PRO AIR 24/443 Operations Record Book of Forward Desert Air Force; PRO AIR 24/1080 Operations Record Book Appendices Middle East Air Staff 1942; PRO AIR 27/368 Operations Record Book 33 Squadron; PRO AIR 27/157 Operations Record Book No.11 Squadron RAF; PRO AIR 27/669 Operations Record Book 80 Squadron RAF. From examining operation record books of RAF units, one can get a clear picture of which aircraft were used in interdiction operations. One can then use a general order of battle, such as in Richards, II, pp.386-390, and determine how many squadrons used these aircraft. This would be the maximum number of units employed in interdiction. Further information from the unit record books shows which types of aircraft were employed only occasionally in interdiction. From this, one can get a tolerably accurate picture of the number of squadrons involved in interdiction operations both exclusively and occasionally.

CHAPTER FIVE: THE CAMPAIGN

The worth of the RAF's interdiction campaign can only be gauged when it is placed in the context of the desert campaign as a whole. The initial interdiction efforts were weak and ineffective, but by 1942 it had developed into a remarkably destructive tool; the single most important British combat arm in the desert campaign. Interdiction directly affected the land campaign, and set a pattern which was followed in Tunisia, Italy, and Northwest Europe.

At the outbreak of war in North Africa, the British had few aircraft in the theatre, and even fewer suitable for interdiction operations. They also had no recent experience and little doctrine in the matter. Thus, the RAF and the British Army were forced to develop all of the elements necessary for this campaign while they were fighting it, and doing so took time. Air interdiction played no part in the British campaign against Italian forces from July 1940-February 1941, even though these forces were vulnerable to it, nor was it of great value during the first year of the war against the Italians and Germans.

By the middle of 1941, interdiction operations began to

be conducted in earnest. Because few suitable aircraft were available, fighter/bombers had yet to make their debut, tactics were primitive, while intelligence organizations and command structures were not suited to manage interdiction, these initial efforts were ineffective. On the other hand, even at this time senior British commanders understood the potential of interdiction, which they defined as a priority in the preparatory phases of both British offensives between May and December 1941.

Operation Battleaxe, in June 1941, was intended to relieve the besieged port of Tobruk and recapture the airfields in eastern Cyrenaica.¹ As part of the preparation for this operation, the

Commander Western Desert Force regard[ed] it as most important to future operations that the maximum possible air resources be concentrated on the following tasks during the period up to and including 14 June:-

- (A) Up to 12 June
 - (a) Attack shipping in BENGHAZI harbour
 - (b) Attack MT convoys on the road BEHGHAZI-DERNA
- (B) 12-14 June
 - (a) Attack MT between TOBRUK and the frontier
 - (b) Attack all enemy LGs within reach.²

To accomplish these goals, and give as much close air support as possible to the ground forces, Tedder stripped the rest of his command of every available aircraft.³ Even with most of the RAF's strength involved in the battle, however, it was too weak to make much of a difference. When the offensive opened, the Germans had more than enough shells for their 88mm anti-tank guns to crush the British Crusader tanks which came at them, and ample gasoline to let Rommel's forces drive the attackers back to their start line.⁴ It took only three days for a qualitatively superior German army to blunt the Battleaxe, which scarcely even scratched its target. This victory stemmed from excellent command and personnel, the superb work of the German Y network which exploited poor British signals security and tipped the Germans off regarding the aims of the offensive, as well as severe problems with British forces.⁵ Thus, even had air interdiction performed as well as it was able to do a year later, the British offensive would still have failed. None the less, this operation showed that there were many obstacles to be overcome before interdiction could affect the course of the war on the ground. British aircraft and tactics were as yet unsuited for interdiction operations, C³I systems were unable to guide aircraft to their targets, and British ground forces were still unable to stand against

the Afrika Korps in a mobile battle. It took time to overcome these hindrances.

The RAF received its next opportunity to affect the course of fighting on the ground through interdiction in November 1941. At this point, the German and Italian forces held the Libyan side of the prewar Libyan-Egyptian frontier, with strong garrisons in the fortified towns of Bardia and Sollum, and smaller ones in positions down to the stronghold of Sidi Omar. Behind these strong points was roughly 1500 square miles of open desert and hills between the front and Tobruk, held by few Axis forces. Still farther behind, the main German and Italian strength was poised to assault the besieged British port of Tobruk.⁶ The aim of Crusader was nothing if not ambitious - to preempt Rommel's plan to take Tobruk, to destroy the entire German and Italian armies in Libya, and then to destroy the Axis base in Africa.⁷ The specific plan called for XIII Corps to

surround and capture from the rear the static defences along the frontier between Sollum and Sidi Omar, while the armour of XXX Corps crossed the frontier south of Sidi Omar, swung up towards Tobruk where, after defeating the Afrika Korps panzers en route, they would join hands with the Tobruk garrison and together sweep westwards, to break through the Axis forces in the Gazala line defences, and repossess themselves of Cyrenaica.⁸ This action was the first phase in a planned invasion of Tripolitania. With the Germans pushed out of Libya the British could then form the main front at the Northern, instead of the Western, extremity of the Middle East Command, and so stand guard against a German drive through the Caucasus.⁹ Air power figured prominently in the campaign plans. In particular, during the preparatory phase of the Crusader operation, the priorities for the RAF were to "weaken the enemy air force, and to prevent supplies from reaching the enemy air and military forces at the front."¹⁰

The RAF was better prepared to meet these objectives than it had been in June. RAF air strength grew continuously during the summer and fall of 1941. By the time of the Crusader offensive in November 1941, the RAF surpassed the Axis air forces in gross numbers of aircraft, and even more so in operational numbers. It also finally had begun to receive aircraft well suited to interdiction. The first squadron to use fighter/bombers in combat was 80 Squadron with its new Hurricane fighter/bombers each carrying eight forty pound bombs¹¹, adding a new and deadly dimension to the interdiction campaign.

Intelligence organizations and communication systems, however, were far from perfect: still unable to guide interdiction operations in a consistent fashion, or to use British resources with anywhere near full efficiency. Because of slow communication systems, which became overloaded with traffic once ground operations began, intelligence and orders could not flow through the command structure in time to quide precise interdiction strikes. Nor was intelligence particularly good either. Ultra provided little consistent information on the German army, Y organization was cumbersome and inefficient, and strategic and tactical reconnaissance was unfocused. Consequently, interdiction operations in the Crusader offensive were inefficient, but still they were effective. Indeed, they were fundamental to British victory in a close run affair.

On the ground, "Crusader" was an extraordinarily messy battle, marked by major errors of command and a complete collapse in communications on both sides. The British attack caught the Germans entirely by surprise, and smashed through the Axis defensive system, capturing or encircling large elements.¹² Then, British armoured forces drove into the desert while New Zealand infantry drove along the coast to relieve Tobruk.¹³ Here, however, British luck ended.

Its commanders lost their nerve, its armour stalled and was then decimated by a German counter-attack. In turn Rommel failed to make proper use of his victory. Instead of destroying the paralysed and temporarily fragmented British forces in front of him, he gathered the entire Afrika Korps around him and drove straight toward Egypt.¹⁴ For several days, the British and Axis forces in Libya were intermixed, fighting troops of one side crashing into the rear echelons and landing grounds of the other, spread over a battlefield of roughly 40,000 square miles.¹⁵

Ultimately, however, the British won the battle, for several reasons. The New Zealand Division over-ran the Afrika Korps' headquarters and came close to relieving Tobruk itself, forcing Rommel's forces to fall back hastily from the frontier. This turned all of the Afrika Korps' efforts of the last four days into ash. Though the Afrika Korps then drove the New Zealanders away from Tobruk, by this stage the Axis realized that British armour had recovered, that their own military position was too confused to allow anything other than a retreat or a stand up fight in which Axis forces would be in a confused state, and that the battle had turned to one of attrition which they could not win.¹⁶ In particular, Rommel realised that Axis supplies were in very poor shape, and would not allow them to fight effectively.

The credit for this situation must be shared with the RAF and Royal Navy's sea interdiction campaign. The latter reached its peak of efficiency and effect during the Crusader offensive. During November 1941, only 37.6 percent of the supplies dispatched from Italy reached Libya.¹⁷ This was, however, the exception to the rule. During the whole of 1941, 88.9 percent of the supplies dispatched from Italy arrived in Libya.¹⁸ Because of the success of the sea interdiction campaign in November 1941, the Axis supply situation was precarious when the Eighth Army began its offensive, and the RAF's land based interdiction quickly made it worse. Aerial interdiction struck heavy blows against Axis supply columns, which were scattered in a disorganized state across the desert, first pursuing their own fighting forces and then fleeing from British ones. Tn absolute terms, air interdiction inflicted far less damage in November 1941 than would be the case a year later, but even so it helped salvage the day. Beaufighters from No.272 Squadron, Hurricanes from No.33 Squadron, Tomahawks of No.2 Squadron, SAAF, and the Hurricane fighter-bombers of No. 80 Squadron dealt heavily with transport vehicles.¹⁹ The

attacks on the German supply network quickly reduced enemy supplies to "a very low level",²⁰ putting the enemy air forces on the defensive. Combined with the damage from sea interdiction, this meant that the front could not be held. On 4 December Rommel ordered a general retreat, leaving 13800 German and Italian soldiers in Sollum and Bardia to their fates.²¹ Crusader was an Axis defeat, one in which air interdiction proved to be a British trump card. A battle which was being lost by British commanders and British armour was saved by the New Zealand Division, the RAF, the Royal Navy, and Erwin Rommel.

However, when the British pursued the retreating Afrika Korps, the RAF's power declined as British forces ran into supply difficulties of their own. Pursued by the British, the Germans withdrew westward until they consolidated their position at El Agheila. Both armies paused to replenish their supplies, and victory in the next round of fighting was decided by the first side to amass sufficient supplies to continue the offensive. The withdrawal had eased the Axis supply position, with their main forces now only 500 miles from Tripoli, instead of roughly 750 at Tobruk or 1000 at Bardia, and the British position was correspondingly worse. Men and equipment had been removed from North Africa to Malaya, Burma, and India, while the British forces were 1000 miles from their main supply base - Cairo and the Suez The RAF was unable to continue its large scale canal. interdiction operations because of supply and deployment difficulties of its own. For example, "half the fighter force had just moved back to Msus"22, some 200 miles behind the front, while the intelligence service was still not fully suited to guide interdiction operations. Meanwhile, at precisely this point the maritime interdiction campaign based on Malta almost completely collapsed, and would not recover at all until nine months later.²³ Hence, the result of the pursuit after Crusader was to turn the tables on the British, who were unable to overcome their logistical problems or to prevent the Germans from rebuilding their supplies quickly.

On 21 January 1942, "the improbable occurred, and without warning the enemy began to advance."²⁴ Immediately British ground forces in Libya were defeated. The same could not be said of the RAF's interdiction campaign. As the Germans advanced, they soon out-distanced their protective air cover, and the RAF once again attacked German supply convoys. The efficiency of this campaign was degraded by the constant need to abandon airfields and

retreat eastward, but its effect was notable. As the Germans advanced, they began to experience supply difficulties of their own, and the RAF made these difficulties worse. The German advance halted at the Gazala line, roughly thirty miles short of Tobruk, because of "resistance on the ground, resistance in the air, and sheer malnutrition."²⁵

Interdiction during and after the Crusader offensive was intermittent and often lacked any considerable punch, but the RAF had shown the potential of this kind of operation. It had also learned valuable lessons from the Crusader offensive, and shortly afterward the interdiction campaign became a devastating weapon. Indeed, for much of 1942, it was about the only effective tool available to the British army.

By mid-1942, all the factors necessary for an efficient interdiction campaign were in place. In this area, the RAF had come a long way with great speed. Its air strength was dramatically greater than that of the Axis, especially in operational numbers, it had aircraft well suited to the job, and tactics had evolved to maximize each aircraft's potential in interdiction. As a result, the RAF was continuously able to deliver more damaging strikes than before with decreased losses. Meanwhile, the RAF C³I system for interdiction had become arguably the best anywhere. Organizations and personnel had achieved a level of competence which enabled them to receive, process and transmit intelligence with a minimum of delay, and to guide interdiction operations in real time. Ultra and British Y organizations were providing regular information on the German supply network. Tactical and strategic reconnaissance still suffered from a lack of coordination, but were able to guide interdiction operations better than before because of the introduction of VHF R/T. This dramatically decreased the time needed to process aerial reconnaissance reports.

Between February 1942, and the time of the Gazala offensive in May, British Intelligence built up a detailed picture of the German supply network, its procedures, and its extraordinary fragility. The British intelligence system facilitated interdiction operations like never before, while the C³ systems now allowed orders or intelligence to be transmitted with remarkable effect. Secure and rapid communication was possible, command structures were simple, and commanders understood the value and requirements of interdiction - the need for reasoned decisions on the value of a particular target, followed by swiftly issued orders. The RAF stood ready to support the British Army's next battle. Unfortunately, the latter proved unready to fight it.

During the spring of 1942, the Luftwaffe waged an all out bombing offensive against Malta - the perceived thorn in the side of Axis ambitions in North Africa. This allowed Italian supply convoys to cross the Mediterranean with impunity, and caused Churchill to put pressure on Auchinleck for an offensive. Rommel's intelligence got wind of British preparations, and it was decided that the Afrika Korps should strike first.²⁶

The German offensive planned to forestall the British assault by defeating the Eighth Army on the Gazala line, capturing the port of Tobruk, and possibly clearing the desert as far forward as the Egyptian border.²⁷ Facing the Germans was the Eighth Army which had adopted a static defence from the coast to the stronghold of Bir Hacheim, roughly forty-five miles inland. Extensive minefields covered the length of the line, but were more densely concentrated in the northern and central sectors. Along the
length of the line, British and Italian infantry units directly faced each other. Further inland, British infantry brigades were grouped into several strongpoints, each of which "were provided with powerful artillery, infantry and armoured car units, and abundant supplies."²⁸ British armoured brigades were sprinkled behind the line to aid the infantry in either attack or defence.

To call the British defences a "Gazala line" was somewhat inaccurate, because few British forces were deployed on the forty-five miles north of Bir Hacheim, while in general the British left flank was open. Rommel believed that in "any North African desert position with an open southern flank, a rigid system of defence is bound to lead to disaster"²⁹, because the enemy can drive around the open flank and deliver a 'right hook'. This was exactly what Rommel planned to do. The German plan was for the Italian Sabratha, Trento, Brescia, and Pavia Divisions to mount a diversion towards Gazala, about halfway down the line to Bir Hacheim, while Rommel led the Afrika Korps (consisting of the 15th and 21st Panzer divisions) together with the 90th Light Division and the Italian XX Corps (consisting of the Ariete Armoured Division and the Trieste Motorised Division) around Bir Hacheim and the left flank of the British line.³⁰

Once this was complete, Rommel planned to turn north and engage the British armour while the Italian X Corps drove a gap through the centre of the British line, through which his supply columns could pass.³¹ The final phase of this offensive was the destruction of the Tobruk garrison, and the capture of the port. To accomplish these tasks, Rommel allotted ninety-six hours.³²

The opening round of Rommel's offensive worked quite well, and the panzers were by Bir Hachiem very quickly. The Italian Ariete division, however, failed in its attack on the Bir Hacheim strongpoint, the Afrika Korps bogged down without supplies behind British lines, and even worse, the Trieste division failed to create corridors through the line for supply convoys.³³ Rommel's attack had broken down entirely, because his plan was entirely unrealistic. Instead of a quick, clean decisive victory, he had produced a messy and prolonged battle of attrition, and left his forces to fight it from a desperately poor supply situation. In particular, the Afrika Korps was marooned behind British lines, and could be supplied only by trucks carrying supplies around Bir Hacheim or by small parties crossing the minefields, and these convoys were exposed to constant attacks by British forces.³⁴ At this point the RAF let

141

loose the hounds onto the Axis supply convoys.³⁵

RAF fighter/bombers showed the destructiveness of aerial interdiction as fighter/bombers "took advantage of the lack of protective air cover for the enemy M.T. columns"³⁶ and pounded them repeatedly. The Afrika Korps war diary for 29 May 1942, indicated the enemy had

evaluated the supply difficulties of the German spearhead correctly. By means of R.A.F. attacks and sorties of the French from Bir Hacheim he succeeded in dispersing considerable supply transports which were intended to reach D.A.K.³⁷

Intelligence on the enemy's supply network allowed the RAF to destroy perhaps the single most important and vulnerable component of Axis forces - the supplies intended for Rommel's spearhead. The results, during approximately one month of operations, were impressive. The daily fighter/bomber missions destroyed 1050 motorized transport, close to one third of the total Axis strength, in the Bir Hacheim area alone.³⁸ The

repeated attacks by the Kittybombers soon helped to bring the 'Cauldron' - as it became known - to the boil, and our pilots returned to report a stupendous confusion of vehicles shelled, bombed, colliding and running on to mines. Two attacks by the fighter bombers, operating from 6,000 feet but bombing from 1,000, were much remarked upon by our ground forces: both reduced some fifty or so enemy vehicles to blazing wrecks. Attacks against the supply line to the south of Bir Hakim were no less successful.³⁹

Though the literature on Gazala often misses this point, supply and interdiction was the key area where the British might have won the battle. RAF fighter/bomber attacks, combined with British and Free French raids against Italian supply convoys passing supplies to the Afrika Korps across the minefields, struck hard against the Axis weaknesses and prevented the enemy from deploying its strengths. Had the British army been able to hold its position at Gazala, the RAF certainly could have kept the pressure on supply, and bled the German army to impotence, perhaps to death. Air interdiction was as effective and Axis supplies as vulnerable at this point in Gazala as they ever were before El Alamein.

But the British could not understand the opportunity they had, or how to make use of it, and in the process the opportunity to employ aerial interdiction to its full potential was lost. In May-June 1942 British forces outnumbered the enemy in all areas,⁴⁰ had complete air superiority and the ability to use it effectively, so to aid ground operations against an enemy which had placed its head on the chopping block. Yet the British lost. A focus on the supply issue also illuminates the issue of how the battle of Gazala was lost. The turning point in the battle came when the British concluded that they could not continue the admittedly costly attacks on the Italian Trieste Division, and the German supply routes through Bir Hacheim, and abandoned that position and those raids. With this stroke, the British entirely eased the pressure on enemy supply, threw away their best and most cost-effective way to keep the initiative, freed enemy forces from a desperate position, and allowed their enemy to fight in the manner it wished to.

Once this happened, the British army was again unable to compete in a mobile environment, and its armoured forces were beaten. Much of the responsibility for the failure at Gazala must be levelled at senior British army commanders. Their inability to act quickly so to maximize their opportunities, or even to understand what they were, allowed the initiative to pass to the Germans. A South African staff officer expressed this sentiment as he waited for the decision whether to withdraw from the Gazala line:

Speed, I thought, must be the essence of any solution to the problem...Yet I had to wait another five hours

whilst the Generals - Lumsden and Gott - considered their plans inside a huge Armoured Control Vehicle.⁴¹

In the midst of such confusion on the ground, once tolerable wireless discipline and wireless communication broke down, which further eroded the ability of British commanders to receive intelligence or issue orders, or for their subordinates to execute them. When the decision was reached for the Eighth Army to abandon the Gazala line, Auchinleck ordered the Eighth Army to withdraw just some twenty miles to the Acroma-El Adem-El Gubi line.⁴² However, General Ritchie - commander of the Eighth Army - had already ordered the South Africans and 50th Division back to the Egyptian frontier, along with the remains of 2nd and 22nd Armoured Brigades.⁴³ This supposedly orderly withdrawal immediately became a rout. In the space of a month, the Eighth Army was soundly beaten. During the Gazala battle, and the subsequent retreat into Egypt, the Eight Army lost roughly 70,000 men either killed or captured, 44 and one of its most important supply bases - Tobruk.

The Eighth Army fell back into Egypt, until it consolidated its position at the El Alamein line. Between the collapse at Gazala and the consolidation of the El Alamein line, failures on the ground forced the RAF to spend its energies "evacuating their own landing-strips".⁴⁵ Thus it could not engage in a continual pounding of Rommel's supply columns. By the time it was ready to do so, the opportunity existed to employ interdiction to its full potential for the first time. The Germans were no longer able to engage in a war of manoeuvre, and the Eighth Army had a new commander who intended to adopt a new style of warfare, one better suited to his forces.

The German victory at Gazala had, ironically, solved the British supply problem. El Alamein was almost right next to the British logistical centres in Egypt. As the Axis forces moved deeper into Egypt, conversely, their supply lines became unprecedentedly long, and increasingly exposed. Moreover, in order to mount this advance, the Axis had to reduce their pressure on Malta, which within a few months again served as the base for a sea based attack on Axis logistics. This was alleviated somewhat by the capture of the port of Tobruk, and a sizeable amount of British supplies:

There were stacks of tinned beer, huts bursting with pure white flour, cigarettes, tobacco and jam; gallons of whiskey, priceless tinned food of all kinds; and tons of Khaki clothing...More important still, as Rommel's staff soon discovered, considerable stocks of water and, above all, vehicles and petrol had escaped

demolition.46

Because the harbour facilities at Tobruk were in some disrepair and limited in quantity, their capture did not end the reliance on motorized transport supply columns from Tripoli. Of the 60,000 tons needed each month, only one third came from Tobruk.⁴⁷ Supplies unloaded at Tobruk had to be driven over 375 miles to reach the El Alamein line, those from Tripoli roughly 1300, and those from Benghasi approximately 800 miles. As a result "thirty to fifty per cent of all the fuel landed in North Africa was wasted between Tripoli and the front."48 Furthermore, the Axis forces had few trucks to accomplish this task. The RAF's offensive, combined with normal desert wear and tear, depleted German M.T. stocks almost to nothing. Eighty-five percent of the total Axis trucks consisted of the roughly 2000 vehicles seized at Tobruk, 49 and this strength was far short of the approximately 10000-12000 motorized transport needed to provide full establishment for Rommel's forces and supply columns.⁵⁰

Rommel's aggressive pursuit of the Eighth Army into Egypt won him the admiration of Hitler and Mussolini, but it was done with no thought to supply. Rommel's foolish decision to keep his forces at El Alamein once his pursuit had stalled there allowed the RAF to engage in a continual pounding of these exposed supply lines. As General de Guinand, Montgomery's Chief of Staff, put it, the failure to hold at Gazala enabled

Rommel to have a go at capturing Cairo and the Middle East base; but it also stretched his communications to the breaking point and, at the same time, allowed the Eighth Army and Desert Air Force to fall back on their supplies to end up like a coiled spring to be released at Alamein.⁵¹

The continual aerial attacks against Rommel's supply columns eventually destroyed the German Army's ability to resist the Eighth Army's offensive.

El Alamein was located well inside the Egyptian border, respectively 80 and 170 miles from Alexandria and Cairo. The position had been consolidated after hard fighting, which made possible the static style of warfare which suited the British forces, and their new commander. Both Montgomery (the new commander of Eighth Army) and Alexander (the new Commander-in-Chief Middle East) had decided that the Eighth Army was to fight and, if necessary, die where it was. Montgomery made his position clear when he said "...there would be *no* withdrawal; we would fight on the ground we now held and if we couldn't stay there alive we would stay there dead."⁵² Montgomery's own preference was to wear his enemy down and make use of the British soldier's greatest strength - tenacity. Whatever might be said for or against this approach in general, at El Alamein it was perfectly suited to accentuate Axis weaknesses, and exploit British strengths.

When Montgomery took command, virtually the only reliable and effective forces under his command were Dominion infantry divisions and RAF support, and he knew it. Over the next few months, his operations hinged on them.⁵³ Montgomery also understood the gains to be made through attacks on enemy supply. He chose to fight high intensity set piece battles with a continuous front. He was technically skilful enough to do so in a cost efficient fashion. The enemy could only stand this approach if it could replace heavy losses of men and material, and get them to the front. The enemy, however, did not understand that the rules of desert war had changed, and that unless it devised some way to counter Montgomery's war against its logistic weaknesses, it would lose. For the first time, the Eighth Army was commanded by someone able to integrate air interdiction into an effective style of war, and who had no intention of fighting on Rommel's terms. Rather, he

4

attempted to fight World War One on wheels, slowing the pace of battle to suit the capabilities of the British forces and forcing Rommel into a pre-mature attack on his terms.

To facilitate this plan the British adopted a deep series of defences whose flanks were, uniquely, anchored by virtually impassable obstacles. On the northern side was the Mediterranean. Any attempt to land amphibious troops behind British lines would expose them to overwhelming air and sea attack. To the South was the Quattara depression, a salt marsh impassable to tanks.⁵⁴ Along the frontier between the two armies, the British prepared thick minefields.⁵⁵

Given Rommel's personality, it was a good bet that he would continue his attack, an assumption reinforced by British intelligence about the poor state of Axis supply. Ultra clearly revealed the German supply predicament, brought on by land and sea interdiction, and indicated that the Germans had to attack quickly or run out of petrol, ammunition, food, and water.⁵⁶ Prior to the battle of Alam Halfa, Rommel's divisions were 16,000 men under strength,⁵⁷

his transport composed as 85 per cent captured vehicles lacking spares, his fighting equipment 210 tanks and

150

175 troop-carriers under establishment, his ammunition scanty, the quality of his rations deplorable.⁵⁸

In spite of his supply problems, or because of them, Rommel had to push onwards and capture the British supply bases in Egypt. Furthermore, he was under extreme pressure from both Hitler and Mussolini to press onwards. On 29 June 1942, Mussolini had flown to Derna to take command for the triumphant entry into Cairo.⁵⁹ Rommel was also physically unwell, and this undoubtedly clouded his judgement. He was a tired and sick man who was suffering from "gastric and nasal disorders, and a poor circulation. It was in a mood of desperation and despondency that Rommel made his final fling."⁶⁰

After Montgomery's first tour of the field, he correctly concluded that Rommel's main effort would be towards the southern flank of the Eighth Army, followed by a "right hook in order to get in behind the Eighth Army."⁶¹ The line was held in the north by XXX Corps, and by XIII Corps to the south. Despite recent promises of reinforcements, including President Roosevelt's commitment to send some 300 Sherman tanks and 100 self-propelled guns from the United States,⁶² Montgomery had insufficient forces to hold the entire thirty-five mile front in depth. Consequently, "13 Corps on the left [was] rather thin on the ground. This has been done purposely in order to tempt Rommel wide out into the desert where he will use more petrol."⁶³

Montgomery was gambling a great deal on Rommel taking the bait. He had pulled the 9th Australian Division forward, and thus risked involving the only available reserve in a potential rout.⁶⁴ Much effort was devoted to ensuring Rommel attacked in the way Montgomery wished. An entire department of the Eight Army Staff was devoted to

confirm Rommel in the belief that his units would easily break through in the south. A map was put in his way on which the main minefields were omitted and bottomless quicksands were marked as negotiable by vehicles.⁶⁵

Montgomery intended to allow Rommel to break through the south end of the British line and then execute his right hook - directly into the main force of British armour which was dug-in at the western edge of the Alam Halfa Ridge in hull down positions,⁶⁶ the key to the entire Alamein position, roughly fifteen miles behind the front line. Here 131 and 133 Brigades of the newly arrived 44 Division could direct artillery, in addition to the fire from the protected British tanks, onto Rommel's advancing panzers.⁶⁷ Montgomery's intent was to force a prolonged battle of attrition, to which all of his forces were geared. He realised that to produce a battlefield draw of this sort would be a strategic victory for the British. By fighting in a manner suited to his troops, Montgomery would force Rommel to increase the consumption of his scarce supplies, while gaining little ground.

This provided an excellent context for air interdiction. In a prolonged and relatively static struggle, quantitative strength counted for more than quality, especially if that quality depended upon mobile conditions. German quality was offset by British numerical superiority and overwhelming firepower. Interdiction enabled the British to deny the Germans any increase in supply, thus starving them into paralysis and increasing British strength relative to that of their enemy.

Before and during this battle, the Desert Air Force continued its withering and "continuous attack on the African ports and the coastal road through and along which Rommel's supplies were forwarded to the front."⁶⁸ This weakened the whole offensive and prevented Rommel from exploiting any gains he made. The British forces,

153

conversely, were a very short distance away from their supply centres, and thus had far more ammunition, fuel, and reinforcements than their enemy.

Rommel's offensive commenced on the night of 30 August 1942, and unfolded according to British plan. To aid in his offensive, Rommel had been promised that an emergency 500 tons of petrol a day would be despatched by air", 69 and the despatch of tanker ships from Italy. Neither of these promises were fulfilled. Despite this, possibly because of it, Rommel's offensive went ahead. The Afrika Korps advanced slowly through British minefields which were considerably thicker than had been anticipated. During the penetration of the minefield, the commander of 21 Panzer Division (General Bismarck) was killed by a mine, and 15 Panzer Division's commander (General Nehring) wounded by an air attack. Consequently, the Afrika Korps was "attacking without its usual verve", 70 and neither speed nor surprise was possible. Despite these setbacks, despite his knowledge that the British would be expecting his advance, and despite the Afrika Korps' desperate shortage of ammunition and petrol, Rommel chose to continue the attack. On 31 August 1942, he turned part of the Afrika Korps north, directly at the main strength of British armour,⁷¹ bogging down the

German armour into a battle of attrition which he had desperately wished to avoid. Inexplicably, on 3 September, Rommel ordered 15 Panzer Division to drive, unsupported, towards Alam Halfa Ridge. It made no progress against the fire from "300 field and medium guns and 400 anti-tank guns, and two brigades of tanks",⁷² and retired with heavy losses. For the first time in the desert, the Afrika Korps had been forced to fight as the British wished, and had been defeated by superior British numbers, a style of war which suited those numbers, and withering RAF interdiction attacks.

The strength of the RAF's attacks made the overall situation for Panzerarmee Afrika untenable. By the evening of 3 September, "there was only one petrol issue left for the Panzerarmee, the equivalent of a run per vehicle of 100 kilometres over good going."⁷³ - barely enough to withdraw to its start line. Rommel's fears had been realized: his decisive battle which "was on no account to become static",⁷⁴ had become exactly that, due largely to the RAF's interdiction campaign. Lack of supply had left Panzerarmee Africa unable to adapt to a changing battlefield. Rommel's assault on the El Alamein position was run on a shoestring because of supply, and when those supplies were denied him, his offensive failed. The "steady interdiction of supplies

155

became the most important factor in the dramatic failure of Rommel's last offensive in Egypt, at the Battle of Alam Halfa at the end of August."⁷⁵ This is meant to take nothing away from the ingenious battle plan inspired by Montgomery and executed by the Eighth Army. However, had Panzerarmee Afrika been fully supplied with petrol, ammunition, reinforcements, and food the result might well have been different.

The German forces were permitted to withdraw to their starting points primarily because Montgomery could not stand any deviation from a centrally controlled battle, and did not wish to allow Rommel the possibility of turning a victory into a defeat.⁷⁶ Although the Eighth Army let up on Rommel, the RAF did not. The interdiction missions were continued further reducing Rommel's ability to fight, and when the British broke through the Axis position at El Alamein on 2 November 1942, "Rommel's troops were down to three basic loads of fuel - instead of the thirty or so which he claimed were needed in Africa - and eight to ten of ammunition."⁷⁷ Montgomery, who was not noted for his overt praise of the RAF's role in the battle, admitted that intelligence had shown that the RAF was "playing a great part in inflicting moral and material damage on the enemy"⁷⁸

156

and had reduced them to such a poor state of supply that "a hard blow *now* will complete his overthrow."⁷⁹ The Eighth Army, on the other hand, was growing steadily stronger, and by the middle of October had over 220,000 men, 1,351 tanks of various types,⁸⁰ and clear air superiority. Rommel's forces, conversely, were significantly under strength. His panzer divisions had 220 panzers between them, most were older Mark IIIs.⁸¹ Supplementing this were some 340 Italian tanks, most of which were too light to be considered anything more than armoured cars.⁸² His troops numbered roughly 50,000 German and 62,000 Italian soldiers⁸³ who had little ammunition, reinforcements, or even food.

Rommel's foolish decision to remain deployed at El Alamein, when it was evident he could not break through the British line or alleviate his supply difficulties, turned his forces into an eggshell about to face a sledgehammer in the form of Montgomery and the RAF. The slow, grinding battle of attrition which Montgomery forced on the Germans not only held them at El Alamein, while the RAF went to work on their supply network, but also blunted the qualitative superiority. The stable battlefield also solved the problem of co-ordination of interdiction operations, because squadrons did not have to move. Intelligence could find the appropriate commanders, and orders could be transmitted with great speed. This let the RAF conduct relentless attacks against Rommel's supplies, destroying the Afrika Korps' ability to fight a war of attrition. German qualitative advantage was blunted by the static front, and interdiction ensured that the Germans could not accumulate supplies fast enough to fight a war of attrition, or even to receive what was necessary to live. They would prove unable to stand before the planned British offensive.

It was during the battle of El Alamein that the RAF's interdiction campaign paid its highest dividends. The daily attacks had continued since the battle of Alam Halfa, and destroyed the fighting ability of the Axis forces in both a moral and material sense. Indeed, interdiction forced Rommel to change his approach to operations, playing right into Montgomery's hands. Fuel shortages affected the deployment of armoured divisions. British material superiority on the ground and in the air, combined with the desperate shortage of petrol, forced Rommel to base his defence on a "fortified and infantry-held line".⁸⁴ He was forced to separate 15 and 21 Panzer Divisions (the bulk of the Afrika Korps) and deploy them at opposite ends of the line.⁸⁵ When the British attacked the northern sector on 23

October, General Stumme, who had taken command from an ill Rommel, forbade the "bombardment of the enemy assembly positions on the first night of the attack, on account of the ammunition shortage."86 In fact, the general impression within 21 Panzer Division was that the number of German artillery batteries roughly equalled that of the Eighth Army, but supply shortages prevented their use.⁸⁷ Furthermore, fuel shortage prevented a concentration of armoured forces for a counter-attack. Consequently, 15 Panzer Division was on its own to resist the British advance, and suffered heavy losses. By 2 November, the effective strength of 8th Panzer Regiment had been reduced to 8 serviceable tanks.⁸⁸ According to Rommel, since "the enemy was operating with astonishing hesitancy and caution, a concentrated attack by the whole of our armour could have been successful."89 Supply problems created by the RAF prevented Rommel from counter-attacking in force and perhaps stopping the British offensive in its tracks. Then, they forced Rommel to concentrate his weakened armour in one place, critically weakening the Axis defences on other sections of the line.90

The material losses inflicted on the Axis forces took an enormous toll on the morale of the fighting troops. There were increasingly high rates of sickness,⁹¹ and the mood of the soldiers was one of defeat. The constant air attack and lack of supplies began "to produce serious signs of fatigue and a sense of inferiority"⁹² among the Axis forces. This undoubtedly played a significant role in the relative ease of the final phase of the battle of El Alamein - Operation Supercharge.

Operation Supercharge, the break out from the El Alamein position, began in earnest on 2 November 1942,⁹³ and it took just three days to defeat the Axis forces and send them streaming westwards. Much of the credit for the deplorable state of the Axis forces, and thus the relative ease of Operation Supercharge, must be accorded to the RAF's land based interdiction campaign. Montgomery's single greatest weapon against the German Army at El Alamein was the Royal Air Force. In no other land campaign or battle of the Second World War did air power play a more fundamental role.

160

NOTES

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² PRO AIR 23/1391 Air Operations, 6 June 1941.

³ Air Marshal Tedder, With Prejudice: <u>The War Memoirs</u> of Marshal of the Royal Air Force Lord Tedder, (Toronto: Little, Brown and Company, 1966), p.124; Barrie Pitt, <u>The</u> <u>Crucible of War: Western Desert 1941</u>, (London: Jonathan Cape, 1980), p.296.

⁴ Pitt, p.309.

⁵ Ronald Lewin, <u>Rommel as Military Commander</u>, (London: B.T. Batsford, 1968), pp.45-46.

⁶ James Lucas, <u>Panzer Army Africa</u>, (London: MacDonald And Jane's, 1977), p.66.

⁷ Richards, II, p.171.

⁸ Pitt, p.340.

⁹ Richards, II, p.171.

¹⁰ PRO AIR 23/6479 Air Operations During Phase I, Oct. 14, 1941.

¹¹ Richards, II, p.175; I.S.O. Playfair, <u>The</u> <u>Mediterranean and Middle East</u>, Volume III, (London: Her <u>Majesty's Stationery Office</u>, 1960), p.66.

¹² Lewin, Rommel as Military Commander, p.66.

¹³ Ibid., Map 11, p.154.

¹⁴ Ibid., pp.76-78.

¹⁵ A rough estimate using the map in the front of Pitt.

¹⁶ Lewin, <u>Rommel as Military Commander</u>, p.83.

¹⁷ James J. Sadkovich, <u>The Italian Navy in World War</u> <u>II, London: Greenwood Press, 1994), p.344.</u>

¹⁸ Ibid.

¹⁹ Richards, II, p.175.

²⁰ Ibid., p.172.

²¹ Lewin, Rommel as Military Commander, p.96.

²² Richards, II, p.184.

²³ Sadkovich, p.344.

²⁴ Lewin, Rommel as Military Commander, p.96.

²⁵ Richards, II, p.187.

²⁶ Barrie Pitt, <u>Crucible of War: Year of Alamein</u> <u>1942,</u> (London: Jonathan Cape, 1982), p.29.

²⁷ Ibid.

²⁸ Ibid., p.31.

²⁹ Erwin Rommel, <u>The Rommel Papers</u>, ed. B.H. Liddel Hart, (London: Collins, 1953), p.194.

³⁰ Lewin, Rommel as Military Commander, pp.111-112.

³¹ Ibid.,p.110.; Duncan Anderson, <u>World At War</u>, (Singapore: Colour Library Books Ltd., 1991), p.240.

³² Anderson, p.241.

³³ Lewin, Rommel as Military Commander, p.114.

³⁴ Ibid., p.115.

³⁵ Richards, II, p.179.

³⁶ PRO AIR 23/1347 Secret Cypher Message from Air Marshal Tedder to the Chief of the Air Staff, 21 June 1942.

 $^{\rm 37}\,$ PRO CAB 106/1219 The enemy supply route round Bir Hacheim.

³⁸ PRO AIR 23/1347 Secret Cypher Message from Air Marshal Tedder to the Chief of the Air Staff, 21 June 1942.

³⁹ Richards, II, pp.199-200.

⁴⁰ Rommel, p.158.

⁴¹ Neil Orpen, <u>South African Forces in World War II</u>, <u>Vol.III War in the Desert</u>, (Cape Town: Purnell, 1971), p.268. ⁴² Pitt, Crucible of War: Year of Alamein 1942, p.82.

⁴³ Ibid., p. 80.

⁴⁴ Ibid., p. 149.

⁴⁵ Pitt, Crucible of War: Western Desert 1941, p.471.

⁴⁶ Major K.J. Macksey, <u>Afrika Korps</u>, (New York: Ballantine Books, 1968), p.85.

⁴⁷ Martin Van Creveld, <u>Supplying War: Logistics from</u> <u>Wallenstein to Patton.</u> (New York: Cambridge University Press, 1977), p.197.

⁴⁸ Ibid., p. 190.

⁴⁹ Rommel, p.245.

⁵⁰ Van Creveld, p.193. This figure is based upon Rommel's request in January 1942 for 8000 trucks for his supply columns. One must assume that he had some transport available, so one arrives at the rough figure of 10000-12000 to satisfy his needs.

⁵¹ Francis de Guinand, <u>Generals At War</u>, (London: Hodder and Stoughton, 1964), p.182.

⁵² B.L. Montgomery, <u>The Memoirs of Field-Marshal the</u> <u>Viscount Montgomery of Alamein</u>, (London: Collins, 1958), p.100.

⁵³ Ronald Lewin, <u>Montgomery as Military Commander</u>, (New York: Stein and Day, 1971), p.79. ⁵⁴ Field Marshal Earl Alexander of Tunis, <u>Memoirs</u>, ed. John North, (London: Cassell, 1962), p.49.

⁵⁵ Montgomery, p.103.

⁵⁶ Ultra QT 3024 8/10/42

⁵⁷ Lewin, Rommel as Military Commander, p.149.

⁵⁸ Lewin, Montgomery as Military Commander, p.55.

⁵⁹ Pitt, <u>Crucible of War: Year of Alamein 1942</u>, p.134.

⁶⁰ Lewin, Montgomery as Military Commander, p.55.

⁶¹ Montgomery, p.103.

⁶² Playfair, pp.278-279.

⁶³ Brian Horrocks, <u>A Full Life</u>, (London: Collins, 1960), p.108.

⁶⁴ Ibid.

⁶⁵ Wolf Heckmann, <u>Rommel's War in Africa</u>, (New York: Doubleday, 1981), p.311.

⁶⁶ Lewin, <u>Rommel as Military Commander</u>, pp.155-156, also 154.

⁶⁷ Ibid., p. 154.

⁶⁸ Ibid., p. 151.

⁶⁹ Pitt, <u>Crucible of War: Year of Alamein 1942</u>, p.224.

⁷⁰ Lewin, Rommel as Military Commander, p.157.

⁷¹ Pitt, <u>Crucible of War:</u> Year of Alamein 1942, pp.228-229.

⁷² David Hunt, <u>A Don At War</u>, (London: William Kimber, 1966), p.125.

⁷³ Lewin, Rommel as Military Commander, p.160.

⁷⁴ Rommel, p.274.

⁷⁵ PRO AIR 41/50 Air Historical Branch Narrative entitled Operations in Libya, The Western Desert and Tunisia July 1942-May 1943.

⁷⁶ Montgomery, p.110.

⁷⁷ Van Creveld, p.198.

⁷⁸ Montgomery, p.135.

⁷⁹ Ibid., p.136.

⁸⁰ Anderson, p.248.

⁸¹ Pitt, <u>Crucible of War: Year of Alamein 1942</u>, p.248.

⁸² Ibid.

⁸³ Ibid.

⁸⁴ Rommel, p.298.

⁸⁵ Pitt, <u>Crucible of War: Year of Alamein 1942</u>, p.285.

⁸⁶ Rommel, p.305.

⁸⁷ PRO AIR 20/7706 21st Panzer Division Report on the Battle of Alamein and the Retreat to Marsa El Brega, Appendix to the Report for the Period 23 October-20 November, 1942.

⁸⁸ PRO AIR 20/7706 15th Panzer Division Report on the Battle of Alamein and the Retreat to Marsa El Brega, 2 November 1942, p.17.

⁸⁹ Ibid., p. 308.

⁹⁰ Ibid.

⁹¹ Ultra QT3024 8/10/42

⁹² Rommel, p.307

⁹³ Pitt, <u>Crucible of War: Year of Alamein 1942</u>, p.391.

CHAPTER SIX: CONCLUSIONS

The campaigns in the Western Desert created unprecedented problems for military logistics. There were no local supplies which any armies could use, let alone highly mechanised forces, and due to a scarcity of large ports, items such as food, water, fuel and ammunition had to be transported over great distances. The price of highly mobile warfare in open country was increased consumption of fuel and spare parts, and these were virtually always in short supply. Without a constant and large flow of supplies from Europe, and its shipment to the front, any army in the Western Desert would collapse rapidly. This was precisely what happened to the German army in late 1942, largely due to its misunderstanding of the importance of supply and of the potential of British land based interdiction.

Throughout the desert campaign both sides faced great supply problems, but they proved to be greater for the Axis forces because their leaders did not take the campaign as seriously as the British. The German supplies had to come from central Europe, across the Alps, through Italy, across the Mediterranean, and to the front by truck. The British, on the other hand, at least possessed a base of considerable size in Egypt, generally giving them a much better supply situation. The bulk of British supplies came from England around the Cape of Good Hope, and to Egypt via the Suez canal. This route was much longer than its German counterpart, but victory in North Africa was vital to British political and military leaders and this commitment translated into adequate and continuous supply of the British forces. The Germans, conversely, had other fronts which were more important, while the economic base of Italy was simply too small to make up for the difference.¹

Under these circumstances, aerial interdiction offered the British a further opportunity to weaken their enemy in a crucial area where it was already weak - to deny their enemy what it needed to live and fight. This could only be done if the targets could be located and attacked without using too many precious British resources. This, in turn, could only occur if intelligence laid bare the entire German supply system, and guided RAF aircraft to their targets with a minimum of wasted effort, if intelligence personnel were efficient at processing and disseminating intelligence, and if the structures for gathering intelligence could gather and process a continual supply of reliable material. There was no template to draw on, and every necessary element in interdiction operations had to be learned, and then developed, by the British at a time of great stress. None the less, between roughly December 1941 and May 1942, all of the necessary components came to maturity and what emerged was the most effective air interdiction system anywhere. This fact has not been adequately understood by most historians. When it is fully understood, it will change our views of three important aspects of the Second World War. First, why the battle of El Alamein was won in the way it was; second, the real value of the maritime interdiction campaign on the Mediterranean, and the real causes for the Axis failure in the war of supply; and third, the roots of an important military tool of the Allies throughout the remainder of the war.

Throughout the war in North Africa, the RAF and Royal Navy fought a campaign to cut Axis traffic from Italy to North Africa. The Italian Navy and merchant fleet won this battle for control of these vital supply lines, except for a couple of periods when the British briefly interrupted this flow. However, from mid 1941 onward the Axis forces in the desert were experiencing almost continual supply difficulties. The damage inflicted by sea interdiction does not even come close to explaining the poor state of Axis supply.

During the first six months of the desert war, the Italians transported supplies to North Africa with impunity. It was not until the autumn of 1941 that the Royal Navy's Force K and aircraft based at Malta began to take a toll on the flow of supplies.² During 1941, the Axis forces ideally required roughly 60,000 tons of supplies per month, although Rommel acknowledged that they could function with 30,000-35,000 tons.³ Only during November 1941 were supply levels significantly less than the Afrika Korps' requirements. During this disastrous month, only 29,813 tons, of 79,208 tons dispatched from Italy, arrived.⁴ This was, however, the exception, and the naval threat to Axis convoys was largely removed in December 1941, with the "loss of Force K to an Italian minefield."⁵

The removal of Force K, and the aerial assault on Malta during the spring of 1942, allowed supplies to once again flow without much interference. From January to May 1942, 94.9 percent of supplies dispatched from Italy were received in Libya, and at no time were the quantities received in Libya less than the minimum monthly requirements.⁶ From July-November, the story is the same. Of the 443, 648 tons

of supplies dispatched from Italy, 331,146 tons arrived in Libya.7 Again, at no time did the amounts received fall under the amounts required. In fact, in only two months were the amounts received less than 60,000 tons. The war of supply was not won by the British on the Mediterranean. Victory in this most vital of areas came through Rommel's ill-conceived offensives in Libya and Egypt in 1942, which extended his already stretched supply lines to breaking point, and his decision to remain deployed in front of El Alamein when it was clear he could not break through. These conditions allowed the RAF's powerful land based interdiction campaign to obliterate the bulk of his supplies on their way to the front. This, in turn, ensured that the Axis forces in Egypt simply could not fight the kind of battle into which Montgomery forced them at El Alamein.

The RAF's land based interdiction campaign also set a pattern which was followed with excellent results in Tunisia, Italy, and Northwest Europe.

On 8 November 1942, the Allies, under the command of General Eisenhower, invaded French Morocco and Algeria. The Axis forces thus found themselves pushed from both east and west, and from both directions their supplies were targeted by Allied air forces. On 29 March 1943, the Desert Air Force "had its busiest day since the battle of El Alamein. Nearly 800 sorties were flown against supply traffic on the coast road."⁸ Operation FLAX was an attempt by Allied air forces to choke off Axis attempts to re-supply their forces by air.⁹ These operations made use of intelligence to locate incoming enemy transport aircraft, which were then attacked by Allied fighters. On 5 April 1943, two Allied flights attacked enemy transports over the Sicilian straits, while B-17's bombed the Bizerte and Tunis aerodromes to destroy those transports which got through.¹⁰ Operations such as these owed much to lessons learned by the RAF during the fighting in Libya and Egypt. Interdiction again proved extremely damaging to Axis efforts in Africa.

A similar story can be told of the Italian campaign, as Allied commanders made good use of their overwhelming air superiority to attacks German supply lines. During the summer and fall of 1944, Allied air forces destroyed all of the bridges over the Po,¹¹ so to disrupt the flow of supplies to the front. Furthermore, as the theatre commander General Alexander wrote, one of the primary roles of the Mediterranean Allied Tactical Air Force was to "strike continuously at every point of his system of supply, so that the labour of maintaining his fighting divisions in a fit state to resist was immensely multiplied."¹² A systematic approach was adopted to deliver the heaviest blows with the least confusion. There were "five routes leading from the Po Valley direct into Germany or Germancontrolled territory",¹³ and the M.A.T.A.F. created four zones of interdiction to deal with these main supply routes.¹⁴ From the fourth to the seventh of November 1944,

twenty-eight cuts were made in the Brenner Line between Verona and Trento and all the electrical power stations between these two points were destroyed or seriously damaged; the enemy never again used electric locomotives on this stretch of the line.¹⁵

Rail transport was the chief means of re-supply to German forces, and the M.A.T.A.F. was able to deliver damaging blows to this critical area.

In the days after the initial landings at Normandy, again, before the Allied armies had accumulated men and supplies to resist a serious German counter-attack, the whole operation was in jeopardy. Allied air forces were employed in an interdiction role to prevent the movement of German troops and supplies into the Normandy area. Just as in the desert campaign, pilots were briefed by intelligence officers about the location of suitable targets, and then sent to attack them.¹⁶

For the remainder of the war, German supply was targeted by Allied air forces operating legendary aircraft such as the Typhoon. The effect of such aircraft has perhaps been overestimated, but interdiction proved an effective tool in hastening the defeat of the German army. In Tunisia, Italy, and Northwest Europe, Allied air forces drew heavily on the experiences of the RAF in the desert to construct a system for efficient interdiction operations. Without this template to draw upon, interdiction efforts in these campaigns would have been inefficient. Thus the pattern set by the RAF's desert interdiction campaign altered the course of the land war from El Alamein to the end of the war.
NOTES

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² James J. Sadkovich, <u>The Italian Navy in World War</u> <u>II,</u> (London: Greenwood Press, 1994), p.341.

³ Erwin Rommel, <u>The Rommel Papers</u>, ed. B.H. Liddel Hart, (London: Collins, 1953), p.290.

⁴ Sadkovich, p.344.

⁵ Ibid., p. 342.

⁶ Ibid.,p.344

⁷ Ibid.

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⁸ I.S.O. Playfair, British Fortunes reach their Lowest Ebb, Volume III of <u>The Mediterranean and Middle East</u>, (London: Her Majesty's Stationery Office, 1960), p.359.

⁹ George F. Howe, <u>Northwest Africa: Seizing the</u> <u>Initiative in the West</u>, Volume 11 Part 1 of <u>United States</u> <u>Army in World War II</u>, (Washington: Office of the Chief of Military History Department of the Army, 1957), p.601.

¹⁰ · Ibid.

¹¹ Field-Marshal The Viscount Alexander of Tunis, <u>To</u> <u>The Combined Chiefs Of Staff On The Italian Campaign 12</u>. <u>December 1944 to 2nd May 1945</u>, (London: Her Majesty's Stationery Office, 1951), p.7. ¹² Ibid., pp.14-15.

¹³ · Ibid., p.15.

¹⁴ Ibid.

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¹⁵ Ibid., p.16.

¹⁶ Richard H. Kohn and Joseph P. Harahan (eds.), <u>Air</u> <u>Interdiction in World War II, Korea, and Vietnam,</u> (Washington: Office of Air Force History United States Air Force, 1986), pp.23-24.

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