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*A periodical review of military literature*

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## *Contents:*

3 Doctrine and Training in the German Army
*Captain R. J. O'Neill*

20 Protecting the Northern Approaches
*Lieutenant-Colonel R. Vardanega*

25 Africa
*Editorial Staff*

36 The Evolution of the Gun
*Major D. K. Baker*

47 Night Vision Aids
*Major I. J. Meibusch*

**LIHONS, August 1918. After the shattering blow inflicted on the Germans on 8th August 1918, the first day of the final offensive on the Somme, the Australians and Canadians, assisted by British cavalry, continued their drive. Dr. C. E. W. Bean** (Anzac to Amiens, **p. 474) wrote that "in three days of difficult, and badly co-ordinated, advances, supported at first only by a few batteries some of which galloped into action as in Wellington's time, and by a dwindling number of tanks which, being totally unscreened, were hit like nine-pins by German guns on Lihons heights, the southernmost Australian troops thrust to and over those heights."**
**This photograph shows a captured German trench near Lihons on 10th August 1918 when it was occupied by men of the 11th and 12th Battalions after heavy fighting.**

Photograph: *Australian War Memorial.*

# Doctrine and Training in the German Army 1919-1939

*Captain R. J. O'Neill,*
*Royal Australian Corps of Signals*

WHAT makes this story worth telling is the development of one idea: the Blitzkrieg. Between the two World Wars, most armies were carrying out experiments to improve their fighting methods. Apart from Germany, their efforts tended to be hesitant and spasmodic. High Commands and political leaders had to be urged by small groups of individuals, sometimes from outside the military establishment, to try new ideas; and when they had been tried, the wrong conclusions were often drawn. The German Army, on the other hand, had a greater grasp of the effects of technology on the battlefield, and went on to develop a new form of warfare by which its rivals, when it came to the test, were hopelessly outclassed. The German Army was by no means alone in perceiving the power of mechanised units to break the current stalemate caused by the dominance of the defence — indeed its best ideas came from abroad — nor did it lack a heavy group of conservatives who clung to the cavalry notions of the Great War. The German advantage consisted in sufficient, even barely sufficient, combination of factors, part random, part deliberate, to bring the idea to fruition.

### *The Preparation of the Soil, 1919-22*

Defeat is the best killer of complacency. The questing minds of Germany's military thinkers did not lack a perceptive guide to channel their new-born energies towards productivity. General Hans von Seeckt had a horror of trench-warfare and was determined that its power should be overcome. He had fought for most of the Great War on the Eastern Front and, as Chief of Staff to von Mackensen's Army of German and Austro-Hungarian divisions, had played a leading part in the great

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*He returned to Australia in December 1965, was transferred to the Royal Australian Infantry and posted to 5 RAR.*

*The essay is reproduced by courtesy of Cassell & Co. Ltd., from* The Theory and Practice of War *(1965), edited by Michael Howard (price 48/-).*

break-through that Mackensen made in May, 1915, at Gorlice-Tarnov, just north of the Carpathians, which cleared the Russians out of Galicia.

The strategic situation of Germany gave little cause to hope that she could survive another major war in the near future, and so an air of detachment could be permitted. The internal troubles of the early 1920s left little time for tactical training, while the Army, being composed of a selection of veterans, was already quite proficient in the basic elements of soldiering. What doctrine there was in the early years after the war seems to have consisted largely of keeping an open mind, of searching until the right riposte to the *Stellungskrieg* be discovered. Seeckt set in motion a thorough examination of all the major phases and problems of the Great War. He was not convinced that Germany's defeat had been brought about by any one obvious factor, but if there was a hidden truth lurking in the bewildering complexity of experience that was Germany's harvest of the war years, he was out to find it.

It is easy enough now, after another war and forty-five years, to see the bright needle that was eluding Seeckt's team in the haystack of the *Reichsarchiv,* but Seeckt never really had it in his grasp. He certainly played with it, turned it over in his hands one or twice and looked at it closely; but he laid it down, although still with an open mind. His desires for mobility seemed, at this time, to base themselves on cavalry concepts, but this was not a dogma. His writings of the period show that he wanted to establish, when the time was ripe, large units of motorized troops. Never again, he wrote, could cavalry be used in great masses for a dashing frontal attack.[1] His doubts concerning the use of mechanized armour were centred on practice rather than principle. He simply did not believe that a mechanical contraption could equal the cross-country performance, the speed, flexibility, invulnerability and firepower of cavalry, working with the close tactical support of aircraft. That he ever considered the combination of tanks and aircraft is doubtful; his papers certainly do not show this. But it is certain that he stimulated discussion of these ideas, making young officers receptive to what was being thought elsewhere and keen to get closer to a solution. Perhaps his greatest legacy to the field of doctrine was his refusal to be doctrinaire.

The training of higher commanders was led by Seeckt personally. He ridiculed the view that "a Commanding-General has nothing more to learn".[2] In early October 1921, the first *Fuhrerreise* took place, at Bad Kissingen. This tradition became so well established that it was continued, and further developed by Seeck's successors. Seeckt was particularly disturbed by the

1. Hans von Seeckt, *Gedanken eines Soldaten* (Leipzig 1929), pp. 120-121.

contrasts that the past had shown between the uniformly trained General Staff and the totally unco-ordinated outlook of the various higher commanders, and, through this concern, he was able to defeat yet another concomitant of the Versailles system: he kept his generals alert and conscious of the time to come when Germany would again have an adequate army. These exercises also led for the first time to the development of a unified doctrine for the handling of larger formations. The customary *Generalstabsreisen* were also recommenced, and ran unbroken throughout the whole period. One particularly valuable form of training was the introduction of the telephone battle for commanders and staffs. It must not be forgotten that the Army was also responsible for all air training and tactics until the Luftwaffe was formed and placed under Goering.

### *The Sowing of the Seed, 1922-28*

On 1st April 1922, Hauptmann Heinz Guderian received the somewhat puzzling appointment of a General Staff Officer on the staff of the Inspector of Transport, employed in the Motorized Transport Department. Guderian was a signals specialist and knew nothing about mechanical vehicles. However, as in most armies, he had to get down to the job and start learning. The inspector of Transport, General von Tschischwitz, was himself an original thinker and was making a lengthy study of the question of moving troops about in motorized vehicles. Guderian was pressed into service and some small test exercises were conducted in the attractive but difficult country of the Harz. Once Guderian had been made to think seriously about the problem his own views began to crystallize and Tschischwitz devoted a good deal of time to criticism and encouragement of his young assistant. Guderian thought that Germany's weakness effectively precluded the recurrence of strategic warfare in any conflicts that might arise in the foreseeable future.

If Germany did find herself at war, the relative smallness of her forces would require high mobility and exploitation of the principles of surprise and local concentration to offset the overall numerical superiority that an opponent would possess. As is so often the case with junior officers, Guderian felt acutely aware of the need for developing some form of defensive technique which would foil any aggressive intentions of neighbouring countries. He was not able to take the more relaxed view of Seeckt. He knew that the best way that Germany could defend herself at the time was by moving units about at high speed to crush the enemy's blows and keep him from making deep

2. Friedrich von Rabenau, *Seeckt — Aus Seinem Leben*, 1918-1936 (Leipzig 1940), p. 520.

penetration. This soon raised the problem of protecting the troops during movement and hence the use of armoured vehicles suggested itself.

While casting about for any available information on experiments that had been made with their use, he got to know a Leutnant Volckheim, who was engaged on a study of the use of armour in the Great War for another department of the General Staff. Volckheim was a mine of information, particularly on what had been done by the English and French. As part of the great renaissance of thought that was going on within the German High Command, a special periodical review, *Wehrgedanken des Auslands,* had been set up to give full coverage of the military field abroad. It is significant that the distribution of this confidential paper was not confined to the Reichswehr; certain civilian brains were also being stimulated by it.

Through studying these sources the English school of Fuller, Liddell Hart and Martel soon impinged upon Guderian. It provided the necessary impetus for him to get beyond the use of armour as a mobile defence and to its use in the attack. He recognized the fallacy of using armour merely as an infantry support weapon or for light, "cavalry" function. His resultant ideas were published to the whole army in the *Militar-Wochenblatt.* These articles aroused interest and he was encouraged by his superiors to write more. Guderian attributes his success to the old proverb: "In the country of the blind, the one-eyed man is king".[3]

During the winter of 1923-24, Guderian assisted the then Oberst-Leutnant von Brauchitsch in the conduct of exercises in co-operation between motorized troops and aircraft. His efficiency earned him a posting to *Wehrkreis II,* Stettin, as a General Staff instructor in tactics and military history. Here Guderian further developed his ideas in the course of his lecturing. It says a good deal for the degree of enlightenment within the German Army that he was allowed to do this, instead of being handed a detailed syllabus and told to teach that and nothing else. Furthermore, the standard of officers taking the course was such that Guderian was constantly stimulated to higher levels of thought — he dared not put across anything that was poorly conceived. His historical instruction led him farther on in the study of mobility through the use of cavalry tactics of the opening phases of the Great War.

While Guderian was thus accelerating himself along the line leading towards *Blitzkrieg, the Heeresleitung* was busy with building the Seecktian "Army of Leaders". One of its most significant pieces of work was the production of the training manual, *Fuhrung und Gefecht,* under the direction of Oberst

3. Heinz Guderian, *Panzer Leader* (London 1952), p. 20.

Herrgott of the Training Branch, General Staff.[4] Prior to 1914, each arm had had its own publications governing command and tactics and much disunity had arisen. *Fuhrung und Gefecht* united all these into a single set of principles for the Army and remained in use without modifications until the early 1930s. A welter of various training courses led to protests that the regimental training of the Army was being neglected, because officers were too often away from their units. The troubled internal circumstances of the time effectively prevented any large scale manoeuvres and the Army was totally dependent on company and battalion exercises; these were scarcely novel, but the official slogan was "Defeat boredom by activity". There were not many physically unfit soldiers in the German Army of those years.

In 1925, the first large manoeuvres were held. The shortage of man-power for the exercises was overcome by the use of *Zeitfreiwilligen* (short-term volunteers) who served for periods of a few weeks at a time. Training was stimulated by competitions of many varieties between the *Wehrkreise*. By this time, the significance of the tank was having a greater impact on Seeckt.[5] He began to see it as a special weapon with its own distinct role, quite apart from infantry, cavalry or artillery, but as yet attached no vital importance to it.[6] As a result of the secret negotiations with the Russians, training centres for military aviation and for tank warfare were to be set up, as well as factories for the production of aircraft, ammunition and poison gas. The tank centre was located near Kazan on the River Kama. The Russians were slow, however, and despite German exhortations, it was not in action until 1929.[7]

The manoeuvres of 1927 were the first to see the use of dummy tanks on a large scale, although no effort was made to relate the tactics of the tanks to the other arms. By this stage, Guderian had been at his instructional post for three years and had met with the approval of his superiors, and received good reports. His propensity for tactics and war games caused him to be posted to the Operations Branch of the General Staff, in the Transport Section. His post was newly created and its purpose was to produce tactics for moving troops by lorry. His plans were ambitious and soon struck resistance among, for instance, those who complained about the difficulties of putting gun horses on to lorries.

4. Waldemar Erfurth, *Die Geschichte des Deutschen Generalstabs*, 1918-1945 (Gottingen 1957), p. 129.
5. Von Seeckt, op. cit., p. 123:
'Die Motorisierung der Armeen ist eine der wichtigsten militarischen Entwicklungsfragen.' (Motorization of armies is one of the most important questions of military development.)
6. Ibid., p. 124.
7. The details of the operation of Kazan are well set out in John Erickson's *The Soviet High Command*, 1918-1941 (London 1962), pp. 251-271.

His next opportunity to work with tanks came in 1928, when he was asked to give a course of lectures on tank tactics for the Instructional Staff of the Motor Transport Section. Here he was an originator — no one had ever done anything like this in the German Army before. Fortunately he had one tool ready to hand: having built up his own translation service, he did not have to wait for the official distribution in order to read the new English books and articles and to circulate them amongst his associates; he had also had the rudimentary British manuals translated. These he used as the basis of German mechanized training for many years, until German books were written in the late 'thirties. But so far as practical experience of tanks went, Guderian had only that gleaned from the exercises with dummies, made of wood and canvas and pushed around by soldiers on foot. He was not to see his first "live" tank until he went to Sweden for four weeks in 1929.

### *Germination, 1929-35*

Although Guderian was the leading exponent of armoured warfare in the German Army, he was by no means alone in this field. During the interval in which he was at Stettin, the Motor Transport Section had been working in conjunction with the Army Ordnance Office and ten trial tanks were produced — two of each of five models. These were very rudimentary, with speeds of up to twelve miles per hour, lightly protected with mild steel and armed with 37-mm and 75-mm guns for light and medium models respectively. They were gas-proof with an all-round arc of fire, but without wireless of any sort and with the commander seated next to the driver in the body of the tank. In 1929 some of these tanks were shipped in pieces to Kazan, where they were re-assembled and put through trials. With them went one instructor and ten trainees. However it was the Soviet tanks that were used for instruction.

The tank centre had three main purposes: to train officers in the handling of tanks and tank units; to test German models; and to run comparison tests with foreign models on the proving ground. The training syllabus for both Soviet and German students was compiled by the Inspectorate of Motorized Units in Berlin. The instructional staff soon became all German in composition and taught theory, general mechanical and technical work, gunnery and communications. The school was visited each year by the German Chief of the General Staff (*Chef des Truppenamts*) from 1928 onwards. On 15th September 1929, Guderian's chief, Oberst Halm, was sent to Russia as Senior Officer attached to the Red Army Staff with the rank of Generalmajor. Other visitors to Kazan were Oberst Lutz (the first commander of Motorized Units, 1934) and Major Pirner,

who was responsible for the construction of the test model tanks. Early in 1930, the Soviet Government purchased sixty tanks from Britain — the Vickers Medium, six-ton and Carden-Lloyd types — which formed part of an equipment exchange programme between the Red Army and the German Army.

During the early years of the 'thirties, Guderian filled various posts in Berlin and began to work with intensity on theoretical aspects of tank use. During 1929 and 1930, as a consequence of the preparation for his great work on Sherman, Liddell Hart evolved the concept of the deep penetration role of armour, which was the first definition of what is now known as "Blitzkrieg". The content of this notion was divided into two categories, tactical and strategic. The tactical aspects were bound up with the selection of the point for penetration of the enemy front. The variability of the thrust point could be used to keep the opponent on the defensive and to defeat him by surprise. Airpower would also be exploited and used in close co-ordination with tanks to achieve tactical domination. The strategic aspects were associated with the thrust itself. The most vital consideration was the maintenance of momentum. After tactical surprise had been exploited to the utmost, strategic surprise could be obtained as the enemy would face a multiplicity of unknown thrusts severing his communications and breaking up counter-attacks before they were formed. Every time he moved his reserves they would arrive too late to prevent resistance from collapsing. But the essential condition for achieving this paralysing effect was the maintenance of pace. A torrent of tanks must pour through the gap at high speed to prevent the spearhead of the thrust from becoming too weak as it raced through to the other side and expanded. Sufficient tanks must be concentrated initially to provide the reservoir. For strategic penetration of hundreds of miles a concentration of a few divisions would be useless except against the weakest of foes. Whole armies of tanks were required. Commanders should not have to wait for orders. They should be told the general aim and left to achieve it in as independent and flexible a way as possible. The thrust should never be halted. It must swerve round opposition or punch straight through a weak point. In negotiating defiles, speed must be increased as the front of the thrust becomes narrowed. The stream must keep on pouring from start to finish at an even, fast pace. The thrust should move by night as well as by day. Supplies for several days of operations should be carried with the stream as an integral part. Commanders must have that feeling in their fingertips for detecting when resistance is stiffening, so that indirect approaches would always be used and put into effect before any appreciable slowing down had been forced.

In 1931-32, Guderian was in the right stage of development to absorb these ideas and to start turning them to practical effect. These were revolutionary theories, and would never be put into practice, Guderian realized, unless the tanks could be kept separate from infantry on foot. The maximum effects could be achieved only if the tanks were accompanied by supporting troops which could equal them in cross-country performance and speed. Special tank divisions containing infantry, artillery, engineers and signals units that were fully mobile must be formed. This was the stage at which Guderian resolved that his work must be the creation of Panzer divisions, the future teeth of the German Army.

All of these great developments to restore the power of the offensive were accompanied by attempts to improve the defensive. The doctrine of delaying defence had been formulated by General Beck in the early 1920s and had become firmly established. While in theory it enabled the defenders to withstand a higher attack-to-defence ratio, the doctrine was clumsy and dangerous in the hands of a non-expert. It faded out of use during 1934. The early 'thirties were busy years for General Beck. From 1930-32, he was working on his *magnum opus* — the manual *Truppenfuhrung*. This became the successor to Herrgott's *Fuhrung und Gefecht* and is one of the great classics of German military literature.

There were altercations over the nature of defended lines and fortified positions. One school propounded massive "Maginot Line"-type constructions which were cheap in terms of manpower but enormously costly and difficult to erect and lacking in any form of defence in depth. The counter-proposal was for a "Milky Way" system of pill-boxes, mutually supporting, and in great depth. The former won the day, but when the time came to build the Siegfried Line, opinion had swung back, and the Chief of Staff of the Fortifications Department was dismissed.[8] It was by then patently obvious that the "hard thin skin" approach was very inferior to the depth afforded by the "Milky Way" system.

One of the chief centres of activity was *Wehrkreis I*, in East Prussia. East Prussia was in an exposed position through the establishment of the Polish Corridor and Pilsudski's plans for a preventive war before Germany regained her strength. Consequently there tended to be a concentration of top men in *Wehrkreis I*. From 1929-32, General von Blomberg (later to be War Minister) was the Commanding General, with Oberst von Reichenau as his Chief of Staff. These two men were both of an adventurous frame of mind, always looking for new ideas and making their own experiments. Both of them were very

8. Letter of General Dittmar to Captain Liddell Hart (undated).

conscious of the foreign environment. They spoke fluent English and read widely in the works of the British school. They also ran a translation and distribution service which was put into top gear when they both went to the Reichswehr Ministry after Hitler came to power. Training of short-term volunteers reached such a pitch that recruits could produce accurate fire with field artillery in three weeks. Heavy artillery was one of the weapons forbidden to Germany; so where should the secret heavy artillery school be but Konigsberg? Also present in East Prussia at this time was Oberst-Leutnant Heinrici (later General-Oberst and Commander of the Fourth Army in Russia), who had begun to elaborate the theory of space-to-force relationship which he was to use at Orsha, in 1943, where he held attacks by thirty Russian divisions on a front of three and a half German divisions during five successive battles. When fully developed in the early forties, Heinrici's methods called for an attack ratio of six or seven to one, while he usually held his own against twelve to one.

In 1931 Guderian had been given command of his first motorized unit — a battalion that was composed of reconnaissance troops, a company of dummy tanks and a company of dummy anti-tank guns. This was a humble beginning, but to Guderian it was all that a set of building-blocks are to an intelligent child. In the spring, the Inspector of Motorized Units, General-Major Otto von Stulpnagel, was replaced by the keen, progressive General-Major Lutz.

Guderian's consistent drive and brilliance throughout this period are striking, as is also the fact that his merit was appreciated. He had no personal influence with the High Command, but it seemed to approve of him. He constantly got good opportunities and was making fairly rapid progress in his career, despite the numerous sharp clashes that this angular personality had with his superiors. He was not made to sacrifice his prospects for his ideas or vice-versa. Responsible people were taking such far-reaching decisions as the experiments with tanks in Russia, the tank field exercises and the organizational changes in the motorized units. Certainly there was plenty of room for improvement, as 1939-40 was to show, but considering that the German General Staff was not planning to be at full strength until 1944, and the slow progress that other armies were making, credit must be given where it is due.

Lutz soon took Guderian on as his right-hand man in the Inspectorate as Chief of Staff. Together they worked at making the Panzer arm into a decisive force. Their prime task was the creation of Panzer divisions, and then Panzer corps. They had to overcome strong resistance from the Inspectorate of Cavalry, while the infantry refused to regard the odd little

wood-and-canvas dummies as anything other than faintly ridiculous forbears of an infantry support weapon. Some cunning persuaded the Inspectorate of Cavalry to abdicate its reconnaissance functions in favour of the Panzers. A new Inspector tried to regain this lost ground by flooding the embryonic Panzer reconnaissance battalions with young cavalry officers, but Guderian and Lutz captured the imaginations of these infiltrators and the tables were turned.

The results of the field tests at Kazan were used to plan the tank that would be capable of making the decisive blow — the break-through and strategic penetration. Guderian did not bother about the time problem but designed what he knew he needed. He was fortunate in being free of the large stock of obsolete equipment which impeded other armies. His requirements were for two types of tank: a light and a medium. Both were to have an armour-piercing gun, machine-guns, radio-communications and a speed of the order of 25 miles per hour. There was a lot of trouble with the Army Ordnance Office to get big enough guns on the tanks, and compromises had to be made. These tanks were actually Panzers III and IV, which were not produced until 1938 and 1939 respectively. For the Polish campaign the Army had only one battalion of them. They were to form the great bulk of the German armour throughout most of the war, as the newer models, the Panther and the Tiger, did not appear in battle in appreciable quantities until 1943.

Obviously a stop-gap was needed for training purposes as no one knew when the proper tanks would appear. Accordingly a small five-ton runabout was designed that could be built around the British Carden-Lloyd chassis. This mini-tank was armed with two machine-guns and moved at 12 miles per hour. It was to be made by Krupp, but production difficulties threatened to delay its appearance beyond the desired 1934. A second stop-gap model was designed with a 20-mm gun and a machine-gun. It weighed 8.9 tons and was built by the Maschinenfabrik Augsburg-Nurnberg AG. Thus were Panzers I and II born. Little did their creators realize that they would be going to war in them, behind a maximum protection of fifteen millimetres of steel plate!

Like everything else in Germany, the Panzer idea was greatly affected by Hitler's accession to power. Besides having such men of foresight as General von Blomberg and General von Reichenau in key positions in the Reichswehr Ministry, the new Chancellor himself was interested in mechanized warfare. He saw Guderian's demonstrations of Panzer I's, scout cars, motor cycle troops and anti-tank guns and became enthusiastic. This

gave Guderian the reassuring knowledge that at the head of the Government was a sympathetic ear. All he had to do was to be able to beat his way through the thickets that surrounded the Fuhrer. However, Hitler was, even from the outset, a very mixed blessing for the Panzers. His attitude towards Russia caused the closure of all the German military establishments there, thus threatening the secrecy of the German armoured training.

In the autumn of 1933 came the first experiment in the system of trebling the size of the army that had been planned under Seeckt's direction in the early 'twenties. Battalion III of Infantry Regiment 9 (Prussian) was expanded to the size of a regiment and exercised against the other two battalions of Infantry Regiment 9, under Generalmajor Freiherr von Weichs at Spandau. The results were surprisingly good. The Army manoeuvres of 1933 further convinced Guderian that tanks must be used as the Army's principal weapon and must be provided with fully motorized support. On 1st February 1934, General der Artillerie Freiherr von Fritsch replaced General der Infanterie von Hammerstein as Army Commander-in-Chief. Fritsch was not a technically minded man but he was not opposed to Guderian's ideas. Guderian found him rather conservative but, to do Fritsch justice, it must be remembered that he had to balance the requirements of the whole Army against Guderian's urgent and revolutionary requests. These problems were often complicated by the slavish devotion of Blomberg, the Reichswehr Minister, to Hitler.

The new Chief of the General Staff, Beck, was a much more difficult man to handle. He was much more conservative and, because of his position, Guderian's plans often came directly before him. Manstein relates that Beck would sometimes "pour a little water in Guderian's wine"[9] to calm him down. Guderian certainly did not see things in this light and regarded Beck as a "centre of reaction at the very centre of the Army".[10] In all his writings Beck gives no indication that he really caught the essence of armoured warfare, but the conduct of his exercises suggests that he was sympathetic to the creation of the Panzers. The General Staff Exercises of May 1935 at Bad Elster, five months before the formation of the first Panzer divisions, studied the use of a whole Panzer corps. In the next exercises, in 1936 at Bad Nauheim, operations involving the use of Panzer armies were studied.

In October 1934, the long-awaited trebling of the Army began. Twenty-one infantry divisions were formed as the backbone, with the three cavalry divisions of the old Army

9. Erich von Manstein, *Aus einem Soldatenleben* (Bonn 1958), p. 241.
10. Guderian, op cit., p. 32.

remaining as they were. The first tentative step towards the development of a mass of armour was taken with the raising of the 1st Panzer Brigade. This consisted of three regiments of two battalions each, stationed at Zossen (Regiment 1), Ohrdruf (Regiment 2), Dresden and Kamenz (Regiment 3).[11] These units were gradually equipped with Panzer I's as they became available.

In 1934 and 1935, the 1st British Tank Brigade, under Hobart, was busy conducting experiments with the techniques of deep strategic penetration. By reading Liddell Hart's articles, Guderian discovered the details of these exercises and they were worked into his own field training for 1935 when, in July, at Munster Lager, the first manoeuvres for an entire Panzer division were held by General Lutz. This division had been built up out of various elements, chiefly the 3rd Cavalry Division and 1st Panzer Brigade, and was commanded by General von Weichs. The purpose of the exercises was not so much to instruct the members of the divisions as to demonstrate that the movement and control of large masses of tanks in battle was feasible. The exercises were a great success — so much so that someone remarked to Weichs that the tanks should be placed under the command of the Minister for Propaganda. Blomberg and Fritsch, particularly the former, were convinced that the time had arrived for the birth of the new arm in a suitably decisive manner.

### *Growth, 1935-39*

On 15th October 1935, the first three complete Panzer divisions were formed, along with three extra infantry divisions. The Panzer divisions were organized on the lines of the strategic-thrust principle. Each had a Panzer brigade and a motorized rifle (or Panzer grenadier) brigade as the main striking force. For reconnaissance, there was a special armoured car and motor-cycle battalion. The artillery, engineers, signals and anti-tank units were all motorized, but only partly capable of following the tanks across country. Both the General Staff and the Panzer officers wanted complete mobility for these units, but the bow-string of the German armaments industry was far too taut. Only one infantry battalion and one engineer company could be mounted on "half-track" vehicles. This unsatisfactory situation was to persist, in some cases, throughout the war. Even the best-equipped divisions only reached a stage where a whole Panzer grenadier regiment (i.e., half of the brigade), some anti-aircraft artillery and some field artillery and parts of the signals and engineer support units were on half-tracks. The tanks were chiefly the tiny, air-cooled, Panzer I, although the

11. Georg Tessin, *Formationsgeschichte der Wehrmacht*, 1933-1939 (Boppard am Rhein 1959), p. 186.

larger, water-cooled Panzer II was slowly coming into service. Initially, each brigade had 561 tanks, all of the Panzer I variety.[12]

The 2nd Panzer Division was commanded by Guderian, who was at the time only of the rank of Regimental Commander (Oberst). He had gone a stage further in considering how to deal with pockets of strong defence without robbing the attack of its momentum. Here he was utilizing Liddell Hart's concept of "tank marines", i.e. assault infantry, carried in armoured vehicles, who could accompany the main tank thrust to deal with particularly troublesome defended points. Detailed exercises were held, covering infantry-tank co-operation, in order to develop thoroughly the necessary tactics.

The night attack and the synchronization of air and tank attacks were also studied. All this was building up a force that could gain the advantage of surprise under almost any conditions and maintain it by a sustained speed of movement which would constantly outstrip the expectations of the enemy. The strategic use of huge masses of armour was studied by means of map exercises, designed to find out the limits of what could be used in the field for large-scale break-throughs and how those limits could be widened.

In trying to develop the principle of freedom for the tanks from the clogging influence of the infantry, difficulties arose with some of the senior infantry officers, who felt that they were being deprived of their necessary supporting weapon. Supply and ordnance staffs tended to dismiss the whole notion as impracticable fantasy and wanted to concentrate on other new ideas, such as the Infantry Assault Gun described in a pamphlet by the then Generalmajor von Manstein, Deputy Chief of the General Staff and head of the Operations Branch. Guderian himself opposed this project as he felt that it would interfere with the development of the tanks, but his opposition was of no avail. Manstein's ideas were fully adopted and proved to be highly successful during the war.

On 21st September 1936, on the Vogelsberg, the biggest manoeuvres since 1913 began. This was the test of the first year of the conscript army, and the troops had been carefully built up to it. Each of the individual *Wehrkreise* had conducted its own exercises up to divisional level. Eighty thousand troops took part. A corps of three divisions fought another of two. This was primarily an infantry exercise and as such showed how little the German infantry had changed since 1918. The proportions of artillery to infantry were the same and the transport and guns were still horse-drawn. A battalion of tanks (112 Pz. I) was used,

12. Letter of General Guderian to Captain Liddell Hart, 15th May 1949.

but only in support of an infantry attack. It was fairly obvious that the tanks, if used in this role, would have suffered heavy casualties at the hands of the new, improved anti-tank weapons. From this the cavalry school concluded that the tank was totally useless. The most striking feature of the manoeuvres was the use of armoured car and motor-cycle reconnaissance companies. Aerial fire control and command reconnaissance were also in vogue. The physical standard of the troops is evidenced by one battalion that marched 51 miles in 34 hours without a single man falling out.

However, the tank was not being neglected by the Planning Staff. After Hitler's order on 24th June 1937 to prepare a surprise attack on Czechoslovakia (*Fall Grun*) the plans made involved the use of a complete Panzer Army, although this was a thing that Germany did not then possess. De Gaulle's well-known book *Vers l'Armee de Metier* came to the notice of a few members of the German Army in 1937. This was a little too late to make much impact on them and they tended to regard it as too theoretical. However, it was eagerly read to discover what the French might do if they accepted de Gaulle's ideas: unfortunately the Germans need not have bothered.

Yet enlightenment within the High Command was still far from ideal. In October 1937, the 4th Panzer Brigade was formed to provide close support for the infantry. This brigade was composed of two regiments, the 7th and 8th Panzer, which had been formed twelve months previously and placed under the care of 1st and 3rd Panzer Divisions respectively, to receive their initial training;[13] so the move was a result of long-thought-out policy by the General Staff.

The 1937 exercises took place in brilliant late September weather on the broad, lake-dotted plains of Mecklenburg. These exercises involved land, sea and air forces in co-ordination. 300,000 men took part as two armies, of five and four divisions respectively, and battled for possession of the country between Strelitz and Schwerin. Rundstedt's Blue Army had the advantage of having the 3rd Panzer Division under command. On the final day, it made a massed attack on the Red Army, turning the southern flank in a style that made a huge impression on the watching Hitler and Mussolini. The vastness of the scope of these exercises had aroused troubled thoughts in the minds of many regimental officers. They thought it was expecting too much too soon from conscript troops. Yet, despite a lot of hard marching, discipline was maintained and much was learned by the participants. From the aromured side, many shortcomings in the supply and repair systems were evident. Despite earnest

13. Tessin, op. cit., p. 189.

recommendations from the Panzer Corps Commander, these failings were not remedied until they had been exposed to the full glare of world publicity, six months later.

During this time, the early German tanks had been getting a thorough trial in the Spanish Civil War. One and a half Panzer regiments were sent, although with only 180 tanks, under Oberst von Thoma.[14] Apart from small sub-unit tactics, not a great deal was learned from the Spanish experiences, as there was no use of tanks in significant numbers. Thoma continually had to resist Franco's tendency to scatter the tanks about too much. The Republican forces were equipped with Russian tanks, some thirty of which were captured, examined with great precision and used by the German crews against their former owners.

The operations of the German Panzer forces during the Austrian Anschluss gave rise to a great deal of criticism. Some of this was justified, but it should be borne in mind that in 48 hours, the 2nd Panzer Division covered 420 miles, while the Waffen S.S. Leibstandarte "Adolf Hitler" covered 598 miles, without any preparation of fuel, supply, or repair facilities beforehand.[15] Many of the troops had just been called up in the previous October.

The Anschluss focused enough attention on the Panzer question to assist the formation of two further Panzer divisions, the 4th and 5th, during the following months. But still the High Command felt unable to take the big gamble of confining all tanks to a deep-striking, spectacular role. Another independent Panzer Brigade, the 6th, was raised as an infantry support formation, while in November, three new Light divisions were added to the one that had been incorporated from the Austrian Army. The Light divisions were basically motorized infantry with a tank battalion and a reconnaissance regiment in each. This was a further reversion to the cavalry ethic of reconnoitring and skirmishing. It involved another defeat for the principle of concentration and further delayed the addition of more Panzer divisions. The Light divisions were shown in the Polish campaign to be of little value and were scrapped in 1940.

During 1938, the first Panzers III and IV appeared. The year was officially a "Small Exercise Year", with only individual divisional exercises, as the experience of the previous year indicated that a much greater consolidation of the basic essentials was necessary. Exercises went on in the late summer and early autumn, when the order came to prepare for entry into the Sudetenland. This time the operation went forward very smoothly, although not a huge amount was required of the infantry and Panzer divisions that took part. The operation was

14. Letter of General von Thoma to Captain Liddell Hart, 1st November 1945.
15. Guderian, op. cit., pp. 50-54.

a classic example of thorough preparation. The troops were even issued with a "Guide Book" for the operation containing, *inter alia,* detailed reproductions of each bridge in the area, and instructions for its demolition, topographical hints, and, for horsed units, an appendix with all the addresses and telephone numbers of the local German and Czech horse-butchers and knackers' yards, just in case. Every unit participating had been preparing studies entitled "Prospects of Success", which were basically very detailed appreciations of the situation. A regiment's study contained some 50,000 words. The maps issued showed the entire Czech dispositions with every single weapon down to light machine-guns. Nevertheless it could have been a very bloody battle for the Germans had they had to fight their way in. The Czech defences were well sited, protected by forests, strongly fortified and heavily manned.

On 20th November 1938, the post of Commander of Mobile Troops was formed. Naturally, the first incumbent was Guderian. The creation of this post was Hitler's own idea and it was by his order that Guderian occupied it. Hitler saw the difficulties that the new commander might have in dealing at close quarters with the Army High Command and gave Guderian the right of direct access whenever he felt himself blocked on a vital issue. Guderian was now in personal charge of the development and training of all the remaining cavalry and of the motorized units. He went to work with customary vigour. The first problem was that there were no specifically German training manuals for the Panzers. This was put right by dint of overworking his small staff. He also wanted to reorganize and re-equip the cavalry completely, forming divisions that would be easier to handle and administer. He made no progress on this point. Despite the large amount of currency gained by the Blitzkrieg idea, there were still appreciable segments of reaction and indifference within the German Army, as is shown by the writings of many middle-ranking officers in this period. Their doubts were not to exist for much longer.

Troubles were being experienced with the supply of tanks and it became necessary to reduce the number of tanks in a company from thirty-two to twenty-two. This reduced the number of tanks available for combat in a division from 433 to 299. Even when France was attacked, the total number of tanks and armoured cars on issue to the Panzer divisions was only 2,574.[16] Such was the effectiveness of the Blitzkrieg doctrine that this was enough to achieve in six weeks what the entire German Army had failed to do in four years when it relied on the muscles of horse and man.

16. Letter of General Guderian to Captain Liddell Hart, 30th July 1949; Guderian, *Panzer Leader* (London), p. 472.

## Conclusion

Thus it was that the technique of Blitzkrieg was developed. The early post-First World War years provided a good environment for the discovery of new ideas and once this potential value had been recognized they were developed and applied. Each idea had to vie with rivals, while its sponsors hoped that it would attract the favourable attention of the High Command. Blitzkrieg had dedicated sponsors who ensured that the technique was not choked by its competitors. The High Command eventually perceived its power and its development was turned into a rapid process of escalation.

The basic elements of this story are threefold: an idea, a man and an environment. The environment is that of hard work and intelligent application which has been, over the centuries, the most outstanding characteristic of the German Army. However, while it contributed to the German Army's success, it was not sufficiently strong to withstand the ruinous effects of Hitler.

Of the man, Field-Marshal von Manstein has written:

> In the overall reconstruction of the Army and the introduction of the weapons that were forbidden up till then, the question of the creation of a Panzer Arm stood out foremost . . . No one who is familiar with the development of this question will deny that the German Army would not have had the Panzer Arm without the perseverance and the striving temperament of Guderian.[17]

Of the idea, Guderian's own words are eloquent enough:

> It was principally the books and articles of the Englishmen, Fuller, Liddell Hart and Martel, that excited my interest and gave me food for thought. These far-sighted soldiers were even then trying to make of the tank something more than just an infantry support weapon. They envisaged it in relationship to the growing motorization of our age, and thus they became the pioneers of a new type of warfare on the largest scale.
>
> I learned from them the concentration of armour, as employed in the battle of Cambrai. Further, it was Liddell Hart who emphasized the use of armoured forces for long-range strokes, operations against the opposing army's communications, and also proposed a type of armoured division combining panzer and panzer-infantry units. Deeply impressed by these ideas, I tried to develop them in a sense practicable for our own army. So I owe many suggestions for our further development to Captain Liddell Hart.[18]

He sums this up, with characteristic generosity, in his acknowledgement in *Der Grosse Brockhaus:*

> *"Liddell Hart* — the creator of the theory of the conduct of mechanized war." □

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17. Manstein, op. cit., p. 240
18. Guderian, op. cit., p. 20.

NOTE ON SOURCES

Apart from the references given, most of the details of Guderian's career are found in his memoirs, *Panzer Leader*. The details of the exercises of the period come from British press reports and from German Army documents. The development of tactical ideas is taken from the German Army Documents, from the papers of Captain Liddell Hart and from conversations with retired German Generals.

# Protecting the Northern Approaches

*Lieutenant-Colonel R. Vardanega,*
*Royal Australian Army Service Corps*

**From Torres Strait to the western edge of the Timor Sea are the northern approaches; South, the wide brown land sleeps, and the dark, nomad tribes cannot tell friends from encroachers . . .**

### *Background to Danger*

AS the crow flies it is nearly two thousand miles from Port Hedland on the coast of Western Australia across the continent to Bowen on the Queensland coast. From Port Hedland to Darwin the distance is one thousand miles, and from Bowen to Cape York eight hundred miles.

North of the line Port Hedland-Bowen there are only two centres of population with more than 20,000 people. These are Cairns and Townsville. The distance by air from Cape York to Merauke (West Irian) is roughly the same as from Canberra to Newcastle, New South Wales.

On the shores of the Gulf of Carpentaria, at Weipa and Gove, are possibly the greatest deposits of bauxite in the world. Weipa can be recognized from the air only because the name is painted on the roof of a building, one of a cluster of huts at the edge of an inlet that appears to be as large as Sydney Harbour, Gove, no doubt, will acquire a rooftop identification and, perhaps also, the red scar on the ground to mark an airstrip.

Scattered across this vast expanse of land are the isolated homesteads of cattle stations, and the trees seem endless. When, on occasions, a high-flying jet aircraft passes over the most northerly of these outposts, it is a topic for conversation, and the sight of RAAF markings on an aircraft arouses delight.

These observations are merely statistics and, as such, they mean nothing. If Australia happened to be adjacent to an aggressive, well-armed neighbour with expansionist ambitions the statistics would be alarming. As it is, our nearest neighbour

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*After the war he commanded a CMF unit in the armoured brigade for a time and was then appointed to the Regular Army. His experience since 1945 covered command and training appointments until December 1955 when he graduated from Staff College. Since then his service has included General Staff, Logistic Staff and Service appointments at Command HQ and Army Headquarters. He is currently ADST (Plans and Equipment) at Army Headquarters, Canberra.*

has consistently displayed a desire for friendship with Australia. Despite the goodwill of present times, however, we live in one of the most unstable areas in the world and goodwill is no more enduring than the government that offers it. It can pass away and seem never to have existed at all.

An extensive and untenanted frontier is a permanent temptation to any with ambitions for quick gains at little effort, and to covert subversion. Perhaps one of the most difficult and illusive features associated with covert subversion is the problem of recognizing it. All too frequently subversion reaches the proportions of active insurgency before corrective action is taken. It is an illness which spreads silently.

The fundamental principle underlying defence preparations is similar to that which applies to home insurance: the possibility of the house being destroyed is remote; however the burden of modest annual premiums is as nothing compared with what could be the ruinous costs if the house were seriously damaged or entirely lost.

### *The Price of Liberty*

So far as Australia's northern approaches are concerned we cannot afford to forget that the price of liberty is eternal vigilance. The extent of the area requiring surveillance must rule out the feasibility of a foolproof cover, or a quick solution, especially when no immediate and positive threat exists. On the other hand the vastness of the area indicates that a framework for the development of techniques, for the compilation of data, and for establishing reliable sources of information could take years to emerge. Time lost, therefore, may not amount to a risk with the present so much as a gamble with the future.

This paper is not the proper medium for an exhaustive discussion as to what could be done, at relatively small cost. There are, however, a number of measures which could be put in hand.

### *From East to West*

Considered from east to west the northern approaches can be divided, for the sake of convenience, into four sectors, each sector having its own particular characteristics. These sectors are:

(*a*) The Torres Strait Islands;
(*b*) The Gulf of Carpentaria;
(*c*) The Northern Territory;
(*d*) The North-Western sector (including the Kimberley area).

### *The Torres Strait Islands*

More than six thousand people of mixed ancestry live in these beautiful islands. The principal population centre is on

Thursday Island, a former defence base, and there is a useful airfield on adjacent Horn Island. The Torres Strait group of islands has a romantic history and is possibly the least exploited of any major tourist attraction in Australia. The area is laced with dangerous coral reefs and the islands form a series of stepping-stones between Australia and New Guinea.

This is a lonely area and a sensitive one. Except for Thursday Island, these islands are sparsely populated and a pattern of illegal movement could be difficult to detect. There is also a need to give a sense of group unity to the inhabitants. An urgent need in the strait is a civil radio broadcasting station (either government or commercial) — a surprising omission in the area. The nearest Australian broadcasting stations are at Port Moresby (350 miles) and Cairns (nearly 500 miles). Neither of these two sources of news, educational or recreational programmes has any common interests with the people of Torres Strait.

A dozen or so miles away is Cape York, inhabited at lonely intervals by a few mission stations and cattle properties, and intersected by many tropical rivers. The peninsula comprises an area approximately as large as West Germany (over 55 million people) and is inhabited by less persons than the number of Australian servicemen in Malaysia and South Vietnam.

***The Gulf of Carpentaria***

The gulf extends for five hundred miles and at its southern extremity is further south than Cairns. Except for the small townships of Normanton and Burketown and a few scattered mission stations, the gulf coastline of more than one thousand miles is a potential haven for any who might wish to remain unseen. South-east and south of the gulf the country is liberally sprinkled with cattle properties where there seems to be very little scope for illegal activities or for movement of strangers; and the gulf country air services are regular links between the cities and these far off places.

***The Northern Territory***

This vast area has, unfortunately, the large Arnhem Land reserve occupying a substantial part of the northern sector. The existence of this reserve seems likely to retard close settlement in a distinctly frontier zone. Only time can show if the existence of the reserve is the basis for a problem in itself. Darwin is the thriving focal point of the Northern Territory and was the scene of numerous air attacks by the Japanese during the Second World War. The citizens of Darwin have an acute awareness of their geographical position. Darwin also enjoys the unique distinction of having been, before 1939, the first operational base for Australia's first regular army infantry battalion (in modified form). More Australians visit Darwin

than any other point on our northern coastline. This fact appears to encourage a rather unfortunate tendency to focus defence thinking in this direction, to the disadvantage of (say) the Torres Strait area.

### *The North-Western Sector*

This sector is the scene of increasing activity and it may well, eventually, support a greater population than any other area on the northern approaches. A start has been made on irrigation in the Ord River locality, and the uplands of the Kimberley Plateau are flanked on the coast by many protected ocean inlets. Yampi Sound is a major source of iron ore, and the coastal waters were once the working area of pearling fleets based on Broome. Perhaps pearls and pearl shell will one day secure a new lease of life in this area. However Japanese sponsored pearl culture enterprises have not, apparently, shown as much interest here as they are showing in the Torres Strait area.

### *Elementary Principles*

Every commander in the field is directly responsible for the close protection of the force under his command. Any arrangements he may make with flanking formations as regards protection in depth can never remove the personal responsibility for close protection of his command. This principle must be as applicable to national defence as it is to unit, etc., defence.

At the national level, protective measures must surely be those steps taken before the development of any real threat. The precautions taken after a threat emerges should probably be categorized as defensive rather than protective. Close protection at any level should include provision for the following:

(*a*) The gaining of information (on terrain, habits, approaches and so on).

(*b*) Familiarization of our troops with the locality.

(*c*) Denial of the opportunity for others to conduct unhindered reconnaissance.

(*d*) Warning devices.

(*e*) Time for the development of a sound defensive plan.

(*f*) *At the national level.* To give confidence to people living in sensitive areas and, as a consequence, to strengthen their will to resist subversion. And at the same time to demonstrate to allies that the nation has a sense of its own local responsibilities.

In the absence of any close protection procedures it is difficult to evolve a proper understanding of the problems which may be associated with active defence of an area.

***Conclusions***

Australian has been blessed with the unique geographic advantage of being an island continent with no racial problems of any significance. On the other hand there is a constant need to beware of complacency and to remain conscious of the special difficulties which go hand-in-hand with our geography, our small population on a vast continent, the political fluctuations in this part of the world and the variable attitudes towards "national sovereignty" which are noticeable in today's world.

The time may have passed when a nation's borders were inviolate. Given the fact, or fiction, of a seemingly good reason it seems that covert or overt aggression might be a greater risk in the future. Communist China's attack on India and the North Vietnamese aggression against South Vietnam are only two examples of this form of "assault without conscience". Aggressive war has ceased to be the prerogative of nations with great resources in armaments. In the right setting (applicable to our part of the globe) aggressive war can be waged with relatively little effort. Consider the formula: a carefully prepared excuse (especially against any nation lending itself to the "imperialist" label directly or by association), plus indifference on the part of others with nothing to lose or to gain, plus a few determined men (the world has a surplus of these), plus the absence of any time limits, plus suitable terrain, plus the preliminary of eroding subversion equals ruinous war.

Australia's northern approaches may appear to present insurmountable difficulties, by their very nature and extent. This, however, is as misleading as it is incorrect.

The first need is to separate the requirements for "protection" from those for "defence". The next step is to place these terms in their correct time frames: i.e., protective measures are taken before a threat develops, whereas defensive measures must be taken when a threat does develop. Protective action can be devised and applied at relatively little cost and provides, progressively, an increasing framework of knowledge for use as a basis for defensive action, when necessary.

Australians have a priceless heritage in the form of this island continent and they have known generations of progress under the protection of membership of the British Empire. However, we must now be counted as an adult nation in a world of independent, adult nations. In this respect we are playing our part outside Australia in the maintenance of peace and political stability in South-East Asia and we must inevitably accept the responsibility for ensuring that our own frontiers do not become the scene, or source, of added instability through any neglect of elementary precautions on our part. □

# Africa

WITH the constant change in National borders and identities, due to amalgamations, newly-acquired independence or the break-up of short-lived federations, it has become very difficult for any atlas to keep up to date. In fact, for such a reference work to be reliable, it would be necessary to acquire a new one annually. Even so by the time it was published it would most probably be out of date.

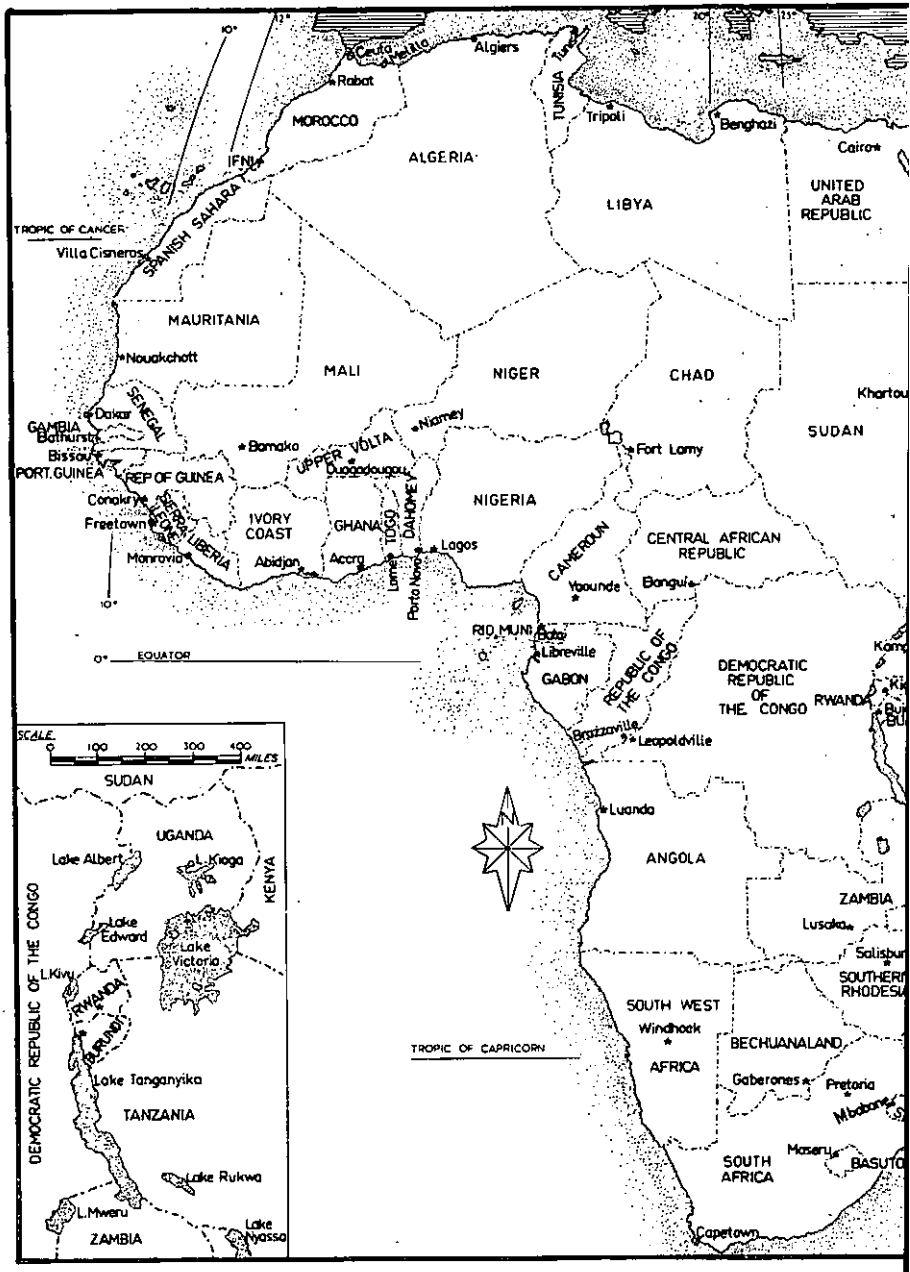
In January 1961 the *Australian Army Journal* published a map of Africa in an endeavour to give readers an up-to-date picture of the Continent. Since then there have been many changes and the map published, like so many others, is out of date.

Most of the national borders are closely related to the so-called Colonial borders. These borders were in the main decided at the Conference of Berlin in 1884-85 and were set, where possible, with geographical features such as rivers, lakes or mountain ranges in mind. Where this was not practicable the problem was solved geometrically with a straight line along a degree of latitude of longitude or a bearing. This, in Berlin, was a solution to the problem and allowed the signing of various treaties. Racially the results were less happy, as tribes inhabiting both sides of a river sometimes found part under one administration and the remainder under another. This has been the cause of certain tensions in the new countries. However, certain races formerly split in this manner have joined up with their fellows and become one nation, as is the case with Somalia.

It must be stressed that the demarkation lines shown on the map can in no way be considered official. They have been arrived at after consultation with many works, both modern and dated, and reference to innumerable maps. The purpose is to give readers a comprehensive idea of the nations involved in current affairs and no more.

This survey embraces only the African mainland and Madagascar. The brief notes provided are designed to show each nation's origin. For purposes of clarity, and ease of identification and reference, the device of grouping newly-emerged nations that were formerly under French, British, Belgian or Italian control has been employed. This also may be an aid to an understanding of their customs, administration and language, but in no way suggests that any of the former

Acknowledgement is gratefully made to the Department of External Affairs, the Information Service of the British High Commission, the Press and Information Service of the French Embassy, the Embassy of Portugal and the Consul General of Spain.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SPANISH SAHARA
TROPIC OF CANCER
Villa Cisneros
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NIGER
CHAD
Khartoum
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Bamako
UPPER VOLTA
Ouagadougou
Niamey
Fort Lamy
REP OF GUINEA
Conakry
Freetown
SIERRA LEONE
LIBERIA
Monrovia
IVORY COAST
Abidjan
GHANA
Accra
TOGO
DAHOMEY
Lome
Porto Novo
Lagos
NIGERIA
CAMEROON
Yaounde
CENTRAL AFRICAN REPUBLIC
Bangui
EQUATOR
RIO MUNI
Bata
Libreville
GABON
REPUBLIC OF THE CONGO
Brazzaville
Leopoldville
DEMOCRATIC REPUBLIC OF THE CONGO
RWANDA
Luanda
ANGOLA
ZAMBIA
Lusaka
SOUTHERN RHODESIA
SOUTH WEST AFRICA
Windhoek
BECHUANALAND
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TANZANIA
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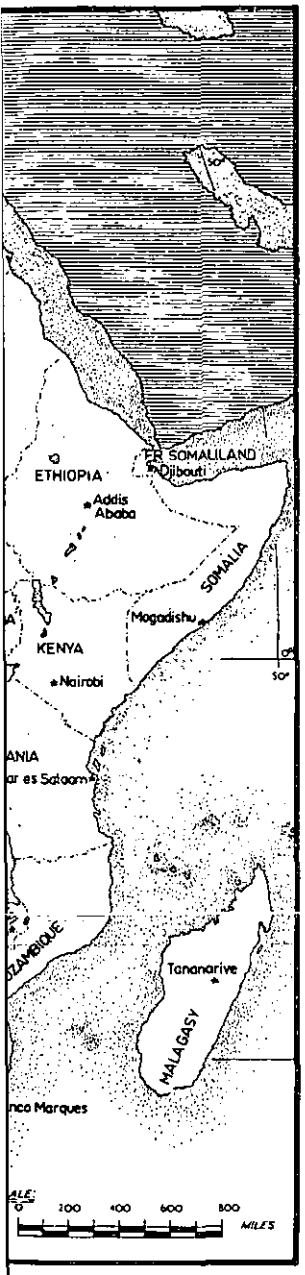


controls or associations persist. The nations within each group have been arranged alphabetically to facilitate reference and avoid offence.

Territories that have not achieved complete independence are listed separately.

### *The Established Nations*

As the majority of nations in Africa are commonly referred to as emerging nations, with their origins as independent nations dating from the end of the 1939-45 war, the nations in existence before that war are grouped under this heading.

*Ethiopia*

This nation is also referred to as Abyssinia and is a sovereign state with an Emperor. The country's history dates back to the Queen of Sheba. The former Italian possession of Eritrea, whose people are of the same heritage as the Abyssinians, is incorporated in Ethiopia as an autonomous state. The capital is Addis Ababa.

*Republic of Liberia*

Liberia has been a republic since 1847 and is the oldest republic in Africa. The capital is Monrovia.

*Republic of South Africa*

This was formerly the British Dominion of the Union of South Africa. It became a republic in 1961 and did not apply for admission to the Commonwealth as a republic. The capitals are Pretoria and Capetown.

*United Arab Republic*

Better known to Australian servicemen of World Wars I and II as Egypt. Formerly a monarchy, it became a republic and joined with Syria to become the United Arab Republic. Syria withdrew from the union though Egypt has since retained the title of United Arab Republic. The capital is Cairo.

### *The British Group*

The following nations were formerly either British Protectorates, Mandated Territories or Colonies or Joint Protectorates. With the exception of the Republic of Sudan and the Republic of Somalia, they are members of the British Commonwealth of Nations.

*The Gambia*

The smallest territory of the new nations, it was formerly the British possession and protectorate of Gambia. The Queen is head of State. The Gambia became independent on 18th February 1965. It will become a republic on 18th February 1966 with an Executive President. Its capital is Bathurst.

*The Republic of Ghana*

This republic comprises the former British Colony of the Gold Coast and adjoining protectorates and British Togoland. The territory of British Togoland was that part of German Togo placed under British mandate by the Treaty of Versailles and the League of Nations, and was placed under the Gold Coast for administrative purposes. Ghana gained its independence in 1957 and became a republic on 29th June 1960. Its capital is Accra.

*The Republic of Kenya*

A British protectorate since 1920, it achieved independence on 12th December 1963. It incorporates the coastal strip formerly known as the Kenya protectorate leased to the Crown by Zanzibar. Kenya became a republic on 12th December 1964; its capital is Nairobi.

*Malawi*

This nation was formerly the Protectorate of Nyasaland (also known at one stage as the British Central African Protectorate) and formed part of the short-lived Federation of Rhodesia and Nyasaland. It became independent on 6th July 1964 and the Queen is the head of State. Malawi will become a republic in June 1966; its capital is Zomba.

*Federal Republic of Nigeria*

This republic is composed of the former Colony and Protectorate of Nigeria and part of British Cameroons. The former German Colony of Kameroun was split after the 1914-18 War, part being placed under British and part under French Mandate, the British part coming under Nigeria for administrative purposes. On independence the southern part of British Cameroons joined the French Mandated Sector to become the

Federal Republic of Cameroun and the northern part joined Nigeria in the Federal Republic of Nigeria. The nation became independent on 1st October 1960. The capital is Lagos.

*Sierra Leone*

This nation was formerly the protectorate and Colony of Sierra Leone. It became independent on 27th April 1961. Queen Elizabeth II is Queen of Sierra Leone. The capital is Freetown.

*The Republic of Somalia*

The Republic of Somalia is the outcome of the union of the territories formerly known as British and Italian Somaliland. Independence was achieved on 1st July 1960; the capital is Mogadishu.

*The Republic of Sudan*

This country was formerly administered jointly by Britain and Egypt and was sometimes styled the Anglo-Egyptian Sudan. It became independent in 1956; its capital is Khartoum.

*United Republic of Tanzania*

This republic is the result of the union of the former Sultanate of Zanzibar, a British protectorate, and the territory of Tanganyika. The sultanate comprised the islands of Zanzibar, Pemba and Latham; Tanganyika, placed under British Mandate, was formerly part of the German Colony known as German East Africa in which was included a coastal strip purchased by the Germans from the Sultan of Zanzibar. Independence was gained by Tanganyika on 9th December 1961 and by Zanzibar on 10th December 1963, the countries becoming a United Republic on 26th April 1964. The capital is Dar es Salaam.

*Uganda*

From 1894 Uganda was a British Protectorate and included the Kingdom of Buganda. It attained independence on 9th October 1962. The head of state is the President, though the country is not officially a republic. The capital is Kampala.

*The Republic of Zambia*

This country was previously known as Northern Rhodesia, a British Protectorate which for a time formed part of the Federation of Rhodesia and Nyasaland. It achieved independence on 24th October 1964. The name of the country was taken from the river Zambesi which is part of its border. The capital is Lusaka.

### *The French Group*

This group comprises the new nations that were formerly French Overseas Territories, Colonies, Protectorates and Mandates. In the French system the overseas territories were represented in the National parliament, and classed as provinces of France. Similarly French territories in Africa were grouped as French West Africa and French Equatorial Africa.

Inclusion within the above heading does not mean that they are now members of the French Community, Algeria, Morocco and Tunisia being outside that union.

*The Republic of Algeria*

Algeria came under effective French control after the submission of the Berber Confederacies in 1857. It was administered as three departments of Metropolitan France and returned 30 members to the National Assembly. It attained independence on 3rd July 1962; its capital is Algiers.

*The Federal Republic of Cameroun*

After World War I the German Colony of Kamerun was partitioned. Two small sections, later known as British Cameroons, were placed under British Mandate and administered by Nigeria. The remainder was placed under French Mandate and was known as French Cameroons or Cameroun. Cameroun became independent as the Republic of Cameroun in January 1960. When Nigeria became independent the southern part of British Cameroon joined the Republic of Cameroun to form the Federal Republic of Cameroun on 1st October 1961. The capital is Yaounde.

*The Central African Republic*

This Republic was formerly the Colony of Ubangi Shari (Oubangi Chari), a part of French Equatorial Africa. It became a Territory in 1946 and achieved complete independence on 13th August 1960. The capital is Bangui.

*The Republic of Chad*

Formerly the Territory of Chad, a part of French Equatorial Africa. Independence dates from 11th August 1960; the capital is Fort Lamy.

*The Republic of the Congo*

This was formerly known as the French Congo and is not to be confused with the Democratic Republic of the Congo which was formerly Belgian Congo. The republic of the Congo gained its independence on 15th August 1960; its capital is Brazzaville.

*The Republic of Dahomey*

Formerly the French Colony of Dahomey. It was originally an African kingdom famous for an Amazonian Army. The republic was proclaimed on 1st August 1960. The capital it Porto Novo.

*The Gabon Republic*

This republic was formerly the French Colony of Gabon and became a republic on 17th August 1960. The capital is Libreville.

*The Republic of Guinea*

This republic was formerly the French Territory of Guinea. It attained independence on 2nd October 1958 after a referendum held four days earlier. The capital is Conakry.

*The Republic of the Ivory Coast*

Formerly the French Colony of the Ivory Coast, its independence was proclaimed on 7th August 1960. The capital is Abidjan.

*The Malagasy Republic*

Formerly the French Overseas Territory of Madagascar it is the fifth largest island in the world and is about 250 miles off the east African coast. Independence was attained on 26th June 1960, the name of the Republic being taken from the Malagasy people who live there. The capital is Tananarive.

*The Republic of Mali*

Formerly known as French Sudan or Soudan, part of French West Africa. Independence was proclaimed on 20th June 1960 and the Mali Federation was formed with Senegal. Senegal withdrew from the Federation on 20th August 1960 and the Mali Federation ceased to exist. On 22nd September 1960 the Sudanese Republic assumed the name of the Republic of Mali. The capital is Bamako.

*The Islamic Republic of Mauritania*

Formerly the French Colony of the same name, it was part of French West Africa. Independence was attained on 28th November 1960. The capital is Nouakchott.

*Morocco*

Formerly the Protectorates of French and Spanish Morocco. It became united and independent in 1956 as a Constitutional Monarchy. The capital is Rabat.

*The Republic of the Niger*

Formerly the Niger Colony, part of French West Africa, it gained independence on 3rd August 1960. The capital is Niamey.

*The Republic of Senegal*

Formerly the French Colony of the same name, it gained independence on 20th June 1960 and with the former French Soudan formed the Mali Federation which was dissolved on 20th September 1960. The Republic of Senegal resumed individual status on that day. The capital is Dakar.

*The Republic of Togo*

In 1918, part of the former German Colony of Togo was placed under British Mandate and attached to the Gold Coast; the remainder, the larger part, was placed under French Mandate. This latter part became an independent Republic on 27th April 1960. The capital is Lome.

*The Republic of Tunisia*

This republic was formerly the French Protectorate of Tunisia, which was nominally ruled by a Bey. It became independent in 1956. The capital is Tunis.

*The Republic of Upper Volta*

Formerly the French Colony of the same name. The river Volta which flows right through Ghana has its origins in this region, hence its name. Independence was proclaimed on 5th August 1960. The capital is Ouagadougou.

***Belgian Group***

*The Kingdom of Burundi*

In 1918, Ruanda Urundi, part of German East Africa, was placed under Belgian Mandate. The area known as Urundi became independent on 1st July 1962 as The Kingdom of Burundi. The capital is Bujumbura.

*The Democratic Republic of the Congo*

This was formerly known as the Belgian Congo and became independent on 30th June 1960; its capital is Leopoldville.

*The Republic of Rwanda*

Also spelt Ruanda. Formerly a part of Ruanda Urundi, it became independent on 1st July 1962. The capital is Kigali.

***Italian Group***

Only one of the former Italian possessions in Africa has become independent as a single nation. Eritrea has been absorbed into Ethiopia and Italian Somaliland joined British Somaliland to become the Republic of Somalia.

*The United Kingdom of Libya*

Up to the Italo-Turkish war of 1912, Libya, which comprises Tripolitania, Cyrenaica and Fezzan, was under Turkish Suzerainty. As a result of that war it came under Italian control and remained so until the 1939-45 war. In 1951 it became an independent Constitutional Monarchy under King Idris. Benghazi and Tripoli alternate as capital by law each two years.

Various areas in Africa have still not achieved independence. Their respective status varies from one to another. They are grouped in the following list under the heading of the nation of which they form part, or by which they are administered.

### France

*French Somaliland*

This region is a province of the Republic of France in the same way as many other French Overseas Territories (Territoire francais d'Outre Mer). It is represented by a member in the Chamber of Deputies. The capital is Djibouti.

### Great Britain

*Basutoland*

A protectorate administered by a high commissioner responsible to the Commonwealth Relations Office. Until 1884, it was part of Cape Colony and is now self-governed through its parliament, the Pisto, progressing towards self-determination shortly. The capital is Maseru.

*Bechuanaland*

This region became a British Protectorate in 1895 and is administered by a high commissioner responsible to the Commonwealth Relations Office. It is expected that this protectorate will shortly become independent. The administrative seat is Gaberones.

*Southern Rhodesia*

A self-governing colony since 1923, it formed, for a time, part of the Federation of Rhodesia and Nyasaland which was dissolved on 31st December 1963. A Unilateral Declaration of Independence was made by Southern Rhodesia on 11th November 1965. The capital is Salisbury.

*Swaziland*

A protectorate administered by the Commonwealth Relations Office; since 1951 the native courts have been empowered to

administer both civil and criminal law. Progress is being made towards independence within a few years. The capital is Mbabane.

### *Portugal*

*Angola*

Also known as Portuguese West Africa. Portuguese interest dates from the 16th Century. It is a province of Portugal and returns seven members to the Portuguese Parliament. The capital is Luanda.

*(Portuguese) Guinea*

A province of Portugal, it returns a member to the Portuguese Parliament; its capital is Bissau.

*Mozambique*

Also known as Portuguese East Africa, it is a province of Portugal and as such returns seven members to the Portuguese Parliament. The capital is Laurenco Marques.

### *South Africa*

*South West Africa*

This was formerly German West Africa and after World War I was placed under South African Mandate by the Treaty of Versailles and the League of Nations. Its present status is of a United Nations Trust Territory under South African administration. The capital is Windhoek.

### *Spain*

*Ceuta*

Ceuta is a port on the coast of Morocco, opposite Gibraltar, formerly part of Spanish Morocco. It is incorporated in the province of Cadiz in Spain and occupies an area of 19 square kilometres.

*Ifni*

Ifni is an African province of Spain. Its area of 1,500 square kilometres was ceded by Morocco to Spain in 1860. As a province it is represented in the Spanish Cortes (parliament). The capital is Sidi Ifni

*Melilla*

Fortified port on the coast of Morocco, formerly part of Spanish Morocco. It is integrated in the province of Malaga

in Spain and occupies an area similar to Ceuta. It was the first place occupied by Spain on the African mainland.

*Rio Muni*

This is an African province of Spain, represented in the Cortes, the capital being Bata. It is also sometimes referred to as Spanish Guinea or Spanish Equatorial Guinea. However, in Spanish Guinea are included the off-shore islands of Fernando Po, Annobon, Corsico and the Elobeys which in themselves constitute a province, Spanish Guinea being in fact the two provinces.

*Spanish Sahara*

Also referred to as Rio De Oro. It is an African Province of Spain with representation in the Cortes.. The capital is Villa Cisneros. □

— G.M.C.

**A busy battalion has no time to mope and no matter how inactive the operational situation may be much can be done to maintain an offensive spirit and morale by fighting and reconnaissance patrols, raids, area improvement, training, range practices and plenty of hard work. A high standard of discipline was insisted upon, saluting, courtesy and team spirit developed. At the end of four months of hard campaigning the morale, esprit de corps and physical fitness of the brigade were far greater than when the brigade commenced the operation. Being busy is the complete answer to a fairly general belief that fighting troops suffer from a tropical tiredness after twelve months in New Guinea. Work, interest and insistence on efficiency will beat the tropics.**

— 15 *Aust Inf Bde, Report on Operations, Ramu Valley-Madang,* 1 *Jan to* 30 *Apr* 1944.

# The Evolution of The Gun

*Major D. K. Baker,*
*Royal Australian Artillery*

**Any great piece of artillerie to make in his discharge an exceeding great noyse and marvellous rore.**
— *Nicolas Tartaglia, 1537.*

## Introduction

SINCE the introduction of the 105-mm pack howitzer into service with the Royal Australian Artillery in 1962, there has been much discussion and muffled criticism from many older gunners in relation to its effectiveness. The three aspects mainly under attack are:

(i) range;
(ii) capacity for sustained firing;
(iii) ability to be successfully towed.

This criticism is based invariably on comparison with the 25-pounder, the well-known work horse of World War II, and undoubtedly a very fine artillery ordnance. It is surely, however, a ridiculous comparison, when one gun was designed for European or desert warfare, and the other for mountainous or "trackless" type warfare. It would have been wrong to have employed the pack howitzer in the Battle of El Alamein; it was equally wrong trying to deploy the standard 25-pounder across the Owen Stanley Ranges.

This article is not a condemnation or commendation of either or any particular equipment. It is simply a short historical survey of the development of the gun, and in conclusion a comparison of some of the more vital statistics of the current and recent equipments. It is hoped that it will perhaps persuade artillery officers to look more to means of capitalizing on the advantageous characteristics of the pack howitzer, while officers of other arms may realize that the gun is not just a rifled tube on two wheels, but a weapon that has been developed

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*Major Baker graduated from RMC in 1954 and was allotted to the RAA. After regimental postings for about 12 months he served for two years as adjutant of CMF field regiments, and was then posted as a troop commander with 1 Fd Regt RAA. He was a troop commander with 101 Fd Bty (1959-60) during the Malayan Emergency and with 26 Fd Regt RA when 101 Bty was stationed at Terendak as part of that British regiment. He joined 4 Fd Regt RAA in 1960 and from 1963 was for two years BMRA 3 Div. He is at present attending the 1966 course at the Australian Staff College.*

*The illustrations for figures 3, 4, 5, 7 and 8 have been reproduced from* The Story of the Gun *by Lieutenant A. W. Wilson, RA, published by the Royal Artillery Institution, Woolwich.*

continuously over 600 years. This account makes no reference to many types of artillery pieces. Heavy, siege, coastal and anti-aircraft guns, for example, are not mentioned. Also of necessity, due to considerations of space, the development of the gun in countries such as Germany, France, America and Russia has either been ignored or only lightly brushed over. The evolution developed in this article concerns only the British Service. Finally, also because of space, I have been forced to ignore the evolution of both the propellant and the projectile, each equally important stories in their own right.

### *The Birth of Artillery*

The history of modern artillery began with the discovery late in the Thirteenth Century, by a German Franciscan monk named Swartz, that missiles could be projected by firing a

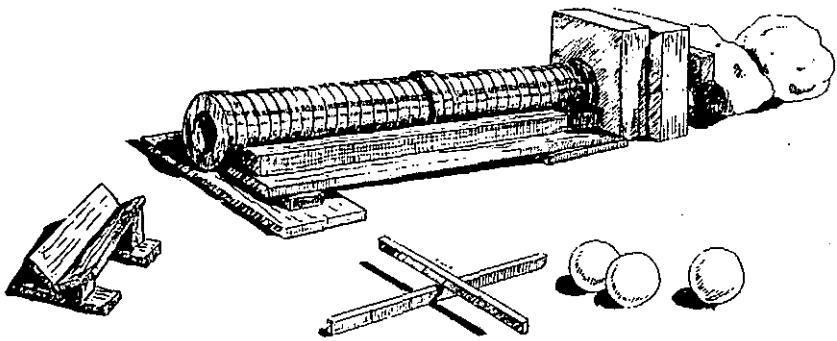

**Fig. 1. Primitive gun mounting.**

charge of powder under them. The first authentic record of the employment of cannon in anger was on 26th August 1346 in the Battle of Crecy. Although their effect is unknown, by the end of the Fourteenth Century the cannon had become a recognized weapon of war.

The cannon of those days was simply laid on the ground for firing and supported by a timber frame on each side, while the breech end rested against a strong wooden support driven into the ground. (See Fig 1.) Subsequently, the cannon was supported in massive timber cradles and secured to them by iron straps. To lay, the gun was lifted to required elevation by crossed stakes under the muzzle, and the breech was anchored by a spike driven into the ground.

### *Mobile Artillery*

It is not certain when wheel carriages were introduced during the Fifteenth Century, but it is interesting to note that these ancient carriages in general design contained the main principles embodied in the field carriage of today. The trail was

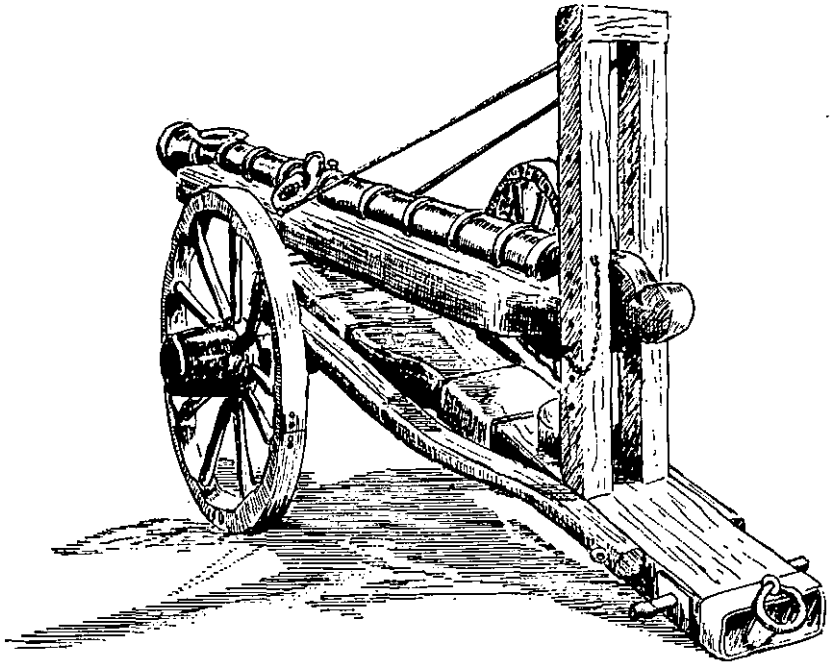

**Fig. 2. Early type of carriage and elevating arc.**

a solid bulk of timber, supported in front on an axletree of hardwood, the arms of which carried the wheels. The gun rested in a wooden cradle which in turn was carried in bearings in the trail immediately over the axletree, the cradle being provided with trunnions for the purpose. For giving elevation a wooden arc was fixed to the trail at the rear, and the breech could be moved up and down the arc and fixed at certain positions. (Fig. 2.)

The general desire to have cannons capable of firing the heaviest possible shot continued until the end of the Sixteenth Century, as their basic use was in the attack and defence of the fortress.

### *Field Artillery*

The Seventeenth Century saw the commencement of mobile warfare and artillery was modified accordingly. King Gustavus Adolphus of Sweden is the father of field artillery, and gave

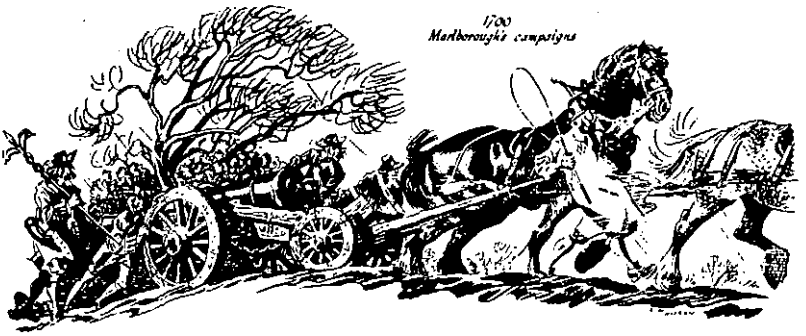


Fig. 3.

it its true position on the battlefield by organizing it as a mobile arm. He was responsible for introducing two guns on light carriages. The first was made of thin copper screwing into a brass breech and strengthened by bands of iron and leather. It was drawn by two men, but could withstand only a very light charge. Secondly, he introduced a 4-pounder weighing 5¼-cwt. and drawn by two horses. This was also the first gun to use a cartridge, as opposed to the system hitherto employed of ladling the powder.

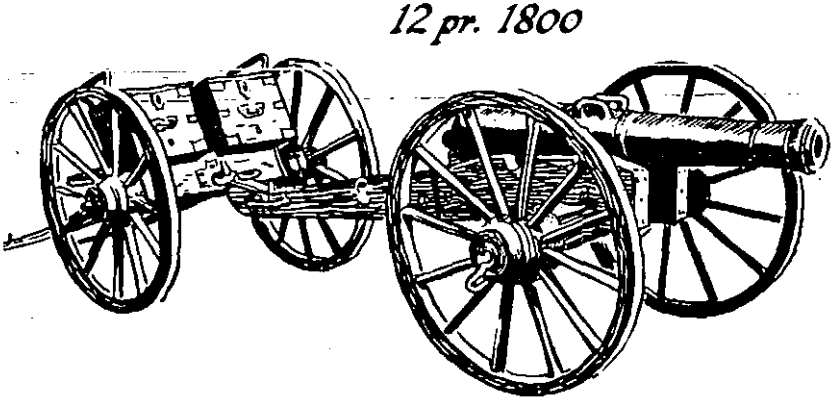


Fig. 4.

The limber was introduced in the late Seventeenth Century and was an important innovation, as it converted the carriage into a four-wheeled carriage for travelling, thus distributing the weight over four wheels. It allowed all gun stores and some ammunition to be transported as part of the gun. Movement of artillery was still slow, not so much due to the weight as to the fact that the gunners marched beside their gun. Horses and drivers were hired civilians, and were untrained and unreliable. A further improvement was made late in the Eighteenth Century when the French introduced wrought-iron carriages and wooden carriages strengthened with iron. They also introduced iron axletrees and enlarged the diameter of the wheels on the limber.

### *Horse Artillery*

The British first came into prominence as progressive artillerymen with the introduction in 1793 of Horse Artillery. Horse Artillery was perhaps the biggest step forward ever in gun mobility, with the possible exception of the recent introduction of the utility helicopter for vehicular movement. The 9-pounder gun, the first gun used by the horse artillery, is forever immortalized on the cap badge worn by all members of the Royal Regiment. Between 1793 and the Battle of Waterloo in 1815, the British continually outgunned the French, not by the number and range of their guns but by their mobility and speed of manoeuvre. This should be remembered when comparing our current equipments and establishments with those of the Chinese and Russians. Not only did the British reduce the weight of their guns, they also introduced a lighter towing horse which was capable of galloping while towing the gun. In addition the drivers were enlisted men rather than civilians,

**Fig. 5. 6-pounder Royal Horse Artillery, 1806-15.**

and all gunners were mounted either on the carriage or horse. Consequently, deployment could be carried out at horse pace rather than walking pace.

It is of interest to note that until the advent of the new tropical warfare establishment close-support artillery has always maintained an establishment and equipment table to

allow movement at the speed of the gun tower. In most cases this meant that the gun detachment was split between the gun and limber and the following ammunition waggon. In 150 years the establishment of close-support artillery has completed a full cycle and we, due to the concept of operations and likely environment restrictions, have reduced the speed of deployment to that of the gunner walking beside his gun. This is introduced only for its historical interest, and is in no way intended as a criticism of the new establishment, although such criticism would be legitimate if the use of helicopters was not contemplated.

### *Introduction of Rifle Ordnance*

Little improvement appears to have been made in artillery during the early part of the Nineteenth Century, many of the guns in the Crimean War having been employed at Waterloo 40 years before. Although the advantages of rifled ordnance had been foretold by Benjamin Robins in the middle of the previous century, it was not until 1846 that the French attempted to introduce rifled bores. The British first used a rifled ordnance at the siege of Sebastopol in 1854, but the revolution really occurred in 1859 with the introduction into the service of the Armstrong breech-loading rifled gun. This equipment also used for the first time the saddle for traversing the gun independently of the trail by the operation of a traversing wheel. Breech loaders were discarded during 1870-1880, but were introduced again with a field 15-pounder and a horse 12-pounder in 1881. These were the first guns with a high muzzle velocity (1,700 fps), and also introduced an arrangement for controlling recoil. This was done first by connecting the axletree with spiral springs and stays, and checking the trail movement by brakes on the hub of the wheels. The brakes only acted on recoil and did not prevent run up after firing. These guns also introduced the elevating gear consisting of a toothed arc operated through a worm and arc pinion, and finally were the first equipments to be fitted with telescopic sight. This sight did not allow indirect firing; in fact this was not introduced until the Boer War in 1899, when the British were first confronted with counter-battery fire from hidden gun positions.

### *Introduction of the Hydraulic Buffer*

The use of a hydraulic buffer using water was suggested about 1870, but the first success was obtained in 1890 by modifying the British 15-pounder. The gun was mounted on slides and attached to the piston of the buffer, and the carriage attached to the cylinder. After recoil of the gun, which was only about a four-inch movement in the slides, spiral springs which had

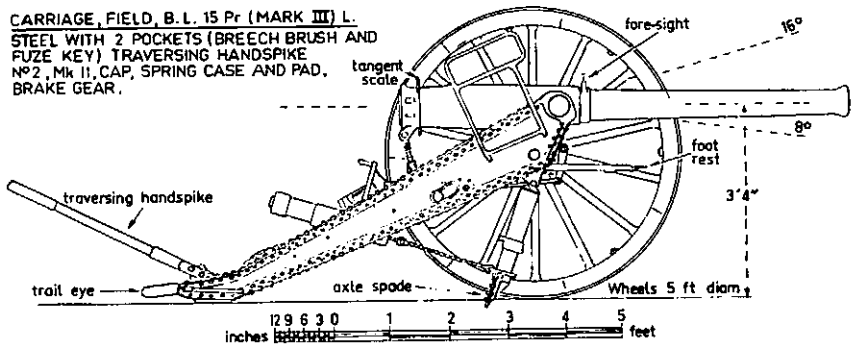


Fig. 6.

been compressed by the recoil pushed the upper structure of the gun back to its original position. A problem that had to be overcome was the anchoring of the carriage to the ground which was done by retaining the hub brakes and by introducing a spade, normally protruding downwards from the axle. (Fig. 6.) This anchoring restricted the zone of fire to the extent of the hand traverse, for quick response firing.

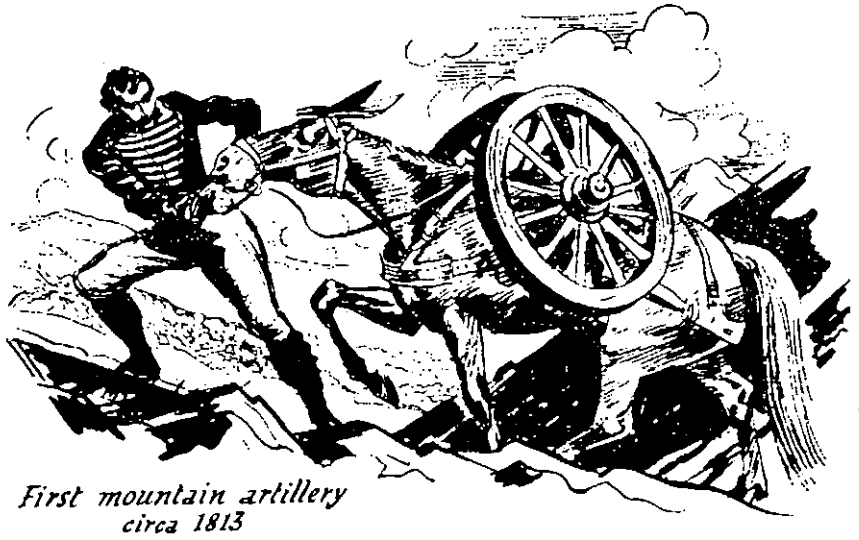


Fig. 7.

### *Mountain Artillery Equipment*

This section is devoted to mountain artillery equipment because the 150-mm L5 was designed by the Italians as a pack or mountain gun, and contains the characteristics developed from the history given below. It should be noted that the 105 pack was not designed to be towed behind a vehicle.

Mountain or pack artillery is a type specially adopted for roadless and mountainous countries, using as the normal method of transport pack mules or ponies. Consequently, the equipment must be of a size and weight within the power of the animal to carry it. When the gun or carriage is too large and heavy to be taken as a single load it has to be divided into sections of suitable dimensions.

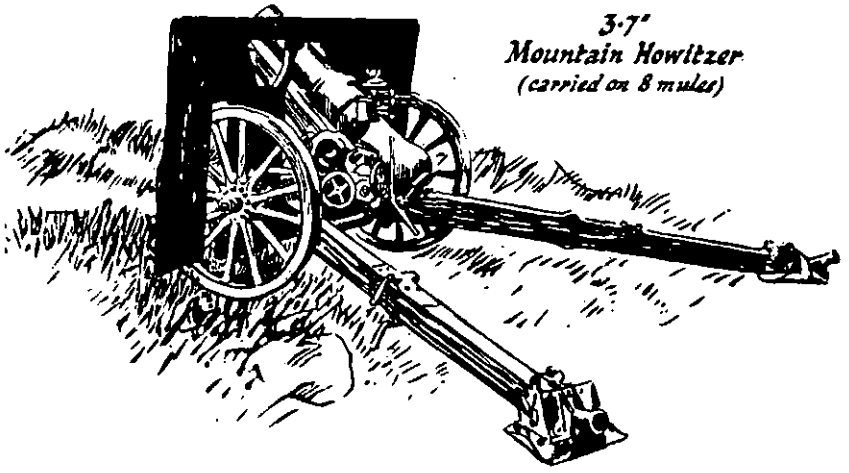


Fig. 8.

Mountain artillery was first employed at the end of the Eighteenth Century in the Pyrenees and in India. The early models were a one or two mule load of very simple design, but as the demand for gun power was increased so the weight and dimensions of the gun were increased, and the number of mule loads correspondingly increased. Many innovations have been used over the centuries. For example, in Egypt in 1800, horse barrows, using two carrying poles with a horse at either end proved to be very successful, and in India normal field guns were carried effectively on elephants.

### *Quick Firing Artillery*

Quick firing artillery was first introduced into the Navy, and describes those guns that have the charge loaded into the gun

by means of a light brass cartridge, which is also the gas seal of the breech on firing. This system was introduced into the army in 1901 by the advent of the 18-pounder for field artillery and the 13-pounder for horse artillery. Other improvements included a long recoil (49 inches), which gave a steady and continuous absorption of the recoil stress. This greatly reduced the weight of the gun, and also dispensed with the system of rigidly locking the carriage to the ground. A shield was also introduced to protect the detachment from infantry small arms fire. Finally for the first time the layer could work on his sights independently of the movement of the barrel, due to recoil; thus speed in laying was introduced. Closely following these two equipments was the 4.5-inch howitzer. This had a controlled recoil of 40 inches at a horizontal elevation, and 20 inches at maximum elevation. This allowed a low centre of gravity, vital for cross-country mobility. The barrel could also be quickly and independently raised to the horizontal for ease of loading without interfering with the layer's work on the sights.

### *First World War*

The First World War saw a big advance in the heavier guns, while the 13-pounder and 18-pounder stayed in service, although greatly modified to give much greater range and better ballistic characteristics. Recoil modifications resulted in dispensing with the springs in the recuperator and the introduction of an air recuperator also working on a hydraulic system. These guns were also modified for variable length of recoil, capitalizing on the success of the 4.5-inch howitzer recoil system.

The First World War caused the medium artillery classification to be introduced, and the 60-pounder gun and the 6-inch howitzer were the two equipments in British service.

### *Second World War*

The 18-pounder and 4.5-inch howitzer were still in service in the RAA up until about 1941. These were greatly improved on the original guns. For example, the maximum range of the 18-pounder had improved from 6,200 to 10,000 yards. The guns most remembered as Second World War equipments are the 25-pounder field gun and the 5.5-inch medium gun. The 25-pounder as a gun-howitzer was, in fact, designed in 1934 but was not developed, and the first 25-pounders were rebored 18-pounder Mark IV guns. In Australia, the standard 25-pounder was modified for use in the jungle and the "short" 25-pounder went into service. The weight of the gun was greatly reduced and it could be dropped in pieces by parachute. Ballistically it appears to have been almost comparable in standards to the normal 25-pounder. Its maximum range was about 87 per cent.

of the standard gun and the accuracy and fall of the shot about the same.

The gun, however, did not perform well as a firer, both in terms of sustained firing and in wear and tear on the gun detachments. As with the current pack gun, much of the criticism of the short 25-pounder arose because critics were expecting characteristics in the gun that the designers never intended.

The main innovations of the 25-pounder over previous equipments were:

(i) The introduction of a calibrating sight, whereby the loss of muzzle velocity due to barrel wear could be compensated for within the sight.

(ii) The use of a firing platform which greatly increased the speed of movement of the trail for large switches in bearing. Experiments with a firing platform had been previously carried out on the 18-pounder.

### Current Ordnance

The 105-mm pack howitzer has neither of these characteristics nor is it an equipment that can take really rough treatment either when on tow or during a heavy firing programme. However a look at a few facts and figures of the gun in relation to other equipments show its fantastically light all up weight in relation to the weight and range of the shell. (Fig. 9.)

**Fig. 9. Recent Equipments' range/weight ratios.**

| Equipment | Total Weight (lbs) | Weight of shell (lbs.) | Max. Range (metres) | Ratio: 1 lb. of gun to range | Ratio: 1 lb. of gun to wt/range of shell |
|---|---|---|---|---|---|
| 18-pr Mk IV | 2,821 | 18 | 9,000 | 1 lb. to 3.18 metres | 1 lb. to 57.2 lb./metres |
| 4.5-in How. | 3,010 | 35 | 6,120 | 1 lb. to 2.03 metres | 1 lb. to 71.1 lb./metres |
| 25-pr | 3,968 | 25 | 12,250 Ch Super | 1 lb. to 3.01 metres | 1 lb. to 75.3 lb./metres |
| 5.5-in | 12,768 | 82 | 16,500 | 1 lb. to 1.29 metres | 1 lb. to 105.8 lb./metres |
| 105-mm (towed) | 4,980 | 33 | 11,600 | 1 lb. to 2.21 metres | 1 lb. to 72.9 lb./metrse |
| 105-mm (pack) | 2,881 | 33 | 10,000 | 1 lb. to 3.47 metres | 1 lb. to 114.5 lb./metres |

The final column is the significant figure and is the ratio of weight of shell and range for each pound weight of gun. That is for each 1 lb. weight of gun, the weight-range ratio for:

25-pounder is 75.3 metre/lbs.

105-mm M2A2 is 72.9 metre/lbs.

105-mm L5 pack howitzer is 114.5 metre/lbs.

This surely shows the vast increase in ballistic efficiency that has been achieved in the twenty years of development between 1939 and 1959. Coupled with this ballistic efficiency,

the 105 pack howitzer has three characteristics vital to our requirements:

(i) An all up weight of gun which can be carried as an *emergency* load by the RAAF utility helicopter, or more normally divided into two average loads, allowing for further internal loading in the aircraft.

(ii) A carriage and superstructure that can be dismantled in a matter of about four minutes to 13 loads, the heaviest of which can be carried quite easily by one mule or four men. The equipment can also be carried in every load-carrying vehicle in the current TW division.

(iii) A capacity for both high and low angle firing. This allows the gun to be sited if necessary anywhere a mortar can be sited, and target engagement can begin within minutes of dropping the trail, without any tree felling due to crest clearance problems.

### *Conclusion*

Throughout military history many new equipments have been introduced into armies with negative results, because tacticians employed the equipments in a similar manner to the equipments that had been superseded. The 105-mm pack howitzer is a highly efficient and mobile gun. We must forget how guns were deployed before 1961 and deploy this equipment in a manner that uses to advantage the characteristics that give this gun such flexibility. These characteristics are a result of hundreds of years of artillery experience and development aimed at improving the intimate and immediate fire support required by the infantry. This fire support requirement will continue while ever the infantry arm itself is needed on the battlefield. □

**Besides Darts and what projected Arrows, they invented a new kind of weapon also; in their hands they held a club about a cubit and a half in length; to this were affixed iron tubes, which being filled with sulphur and nitre, by the force of fire emitted iron balls. The blow, if it struck, was certain destruction; neither armour or shields were sufficient protection.**

— *An account of the Siege of Lucca,* 1430.

# Night Vision Aids

*Major I. J. Meibusch,*
*Royal Australian Artillery*

### *Introduction*

IN the formulation of the new organizations emphasis has been placed on increasing the fire support available to the infantry soldier, and because of this we must expect that our enemies will make more use of those conditions under which difficulties are encountered in its employment. While we have improved the volume of firepower available, there still remains the necessity to sight a target before maximum effect can be applied. This is so whether you consider the artillery observer needing to sight both his target and his ranging round, the anti-tank gunner needing to sight his tank, or the rifleman's need to sight his target. The balance has swung so sharply towards the domination of fire-power during daylight that this limitation has been exploited and night operations have become more frequent both in limited war and counter-insurgency operations.

Until recently the training and preparation of the troops involved have been major factors governing the employment of regular forces in night operations; now it is assumed that the slightly decreased chance of success because of control difficulties at night is preferable to the lower chance of success with effective fire support available to the enemy by day. Irregular forces, because of their usually intimate knowledge of the area in which they operate and often because of their usual inferiority in fire-power, have previously chosen darkness. This preference is likely to continue. For counter-insurgency, regular forces must be able to match the irregular forces' abilities in night operations. Realizing this, much research and development has gone into the problem of enabling the military arms and services to carry out their tasks by night with an effectiveness approaching that to be expected in daylight.

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### *Electromagnetic Spectrum*

Visible illumination is just one part of the electromagnetic spectrum but other parts can be used in night vision aids. These are shown in *Fig. 1.*

At night there is very little natural visible or near infra-red radiation present. Night vision in this region depends on the reflection of this ambient or artificially produced energy. All objects emit far infra-red thermal radiation, depending on their

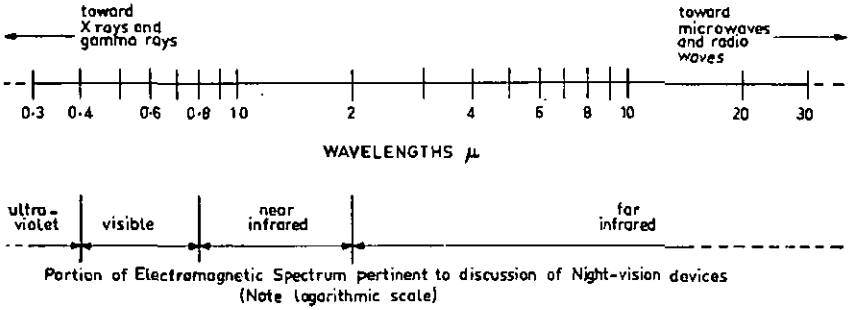


**Fig. 1.**

temperature and their emissivity so that, as a general rule, warmer objects will be thermally brighter than cooler objects; i.e., a man's face will be "brighter" than its immediate surroundings.

### *Principles*

There are then a number of ways in which we can improve our ability to see in the dark. Firstly the level of illumination by visible light can be actively increased by searchlights or flares until ordinary vision becomes possible. Secondly, targets can be illuminated by near infra-red projectors so that they can be viewed by using image conversion devices. Thirdly, the low level of energy present even on a dark night may be sufficient if special image intensification devices are used. Lastly, the fact that all objects emit far infra-red radiation, at a wavelength and intensity depending on temperature, can be used in a thermal imaging device.

### *Developments*

There is little likelihood that there will be any startlingly new development in providing visible light on the battlefield. Any development n this field appears likely to involve substantial costs for marginal improvements so that most effort has been expended exploring the possible advantages to be gained by devices employing the other three principles.

### *Active Near Infra-red*

There is specialized night vision equipment which employs active near infra-red projectors to illuminate the target in much the same way as a torch or searchlight. The infra-red searchlights and headlights at present on issue to some units are of this type. The reflected energy is collected in an image converter tube which presents a visible image to be viewed.

Much of this active equipment is commercially available and freely advertised in both military publications and those designed for the hunting, shooting and fishing fraternity. These devices suffer from three major disadvantages: firstly, the range of sufficient illumination can be greatly reduced by fog, mist, dust, haze or smoke; secondly, the equipment tends to be bulky and have a high power consumption; and thirdly, its use can be detected by the enemy if they happen to have suitable, rather simple, detection equipment. Hence emphasis has moved from the development of this type of equipment to the development of passive systems.

### *Image Intensifiers*

Image intensification is the amplification of images formed by visible light to permit vision under conditions of very faint natural illumination. It is in this passive, image intensification field that one can expect most effort to be concentrated in the near future. Night glasses, which improve light gathering and resolution by optical means have been in use for over a century, but it is only very recently that amplification of the signal by a combination of optical and electronic means became possible in military equipments. Considerable advances have already been made and the first details of equipment are being published in the unclassified press. These image intensification devices gather the very small amount of visible energy reflected from the target and use this energy to illuminate faintly a light sensitive screen called a photo-cathode. This photo-cathode emits electrons which are successively multiplied by electronic means until a viewable image is produced. An example is the device being developed by US Army Material Command. Three types are planned:

(*a*) A starlightscope weighing under six pounds which can be mounted on a rifle or used as a hand-held device;

(*b*) A night vision sight weighing less than 20 pounds for a crew-served weapon;

(*c*) A medium-range night-observation device weighing little more than 40 pounds which can be used for battlefield surveillance.

To get some idea of the improvement in night vision that an image intensification system makes possible consider the three systems shown in *Fig. 2.*

In this graph the angle $\alpha$ is the smallest angle which a test object must subtend in order to be detected by the eye, when perfect black/white contrast between object and background exists and L is the brightness level. Curve E represents the measured performance of the unaided eye after complete adaption and curves A, B, and C represent the calculated performance of the eye using particular systems, each having a different angular magnification. It is important to remember that for a given instrument size, field of view decreases as magnification increases. Owing to the limited resolution of the viewing screen (among other things) each of the image intensifier curves flattens out.

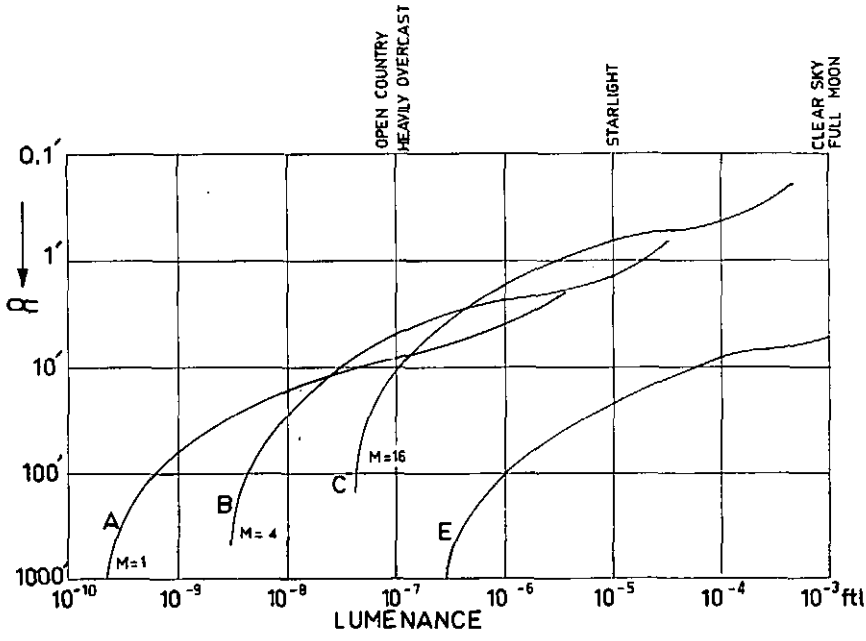


*Fig. 2.*

To put the angle $\alpha$ in proper perspective, it is helpful to remember that a man's head subtends the order of 10 minutes at 100 yards and that the figures given are for maximum contrast, whereas it is fairly easy to reduce the contrast to one-tenth of this by using good camouflage.

### *Thermal Imagins*

Far infra-red thermal imaging devices are designed to detect differences in temperature between a target and its background. The face of a man is likely to have a temperature of about 94°F., which is considerably higher than the background temperature in the tropics at night. When one considers all the military targets likely to occur one realizes that they are likely to be hotter than their surroundings. Because they are at different temperatures and are of different textures to their surrounds, the targets emit far infra-red radiation of different wave-lengths and intensities. These differences are detected. The problem is to engineer something that uses this principle and is acceptable as a military device. Such a device is likely to be attractive because it appears to be feasible, because its effectiveness is independent of the ambient light and because it needs a different camouflage technique to defeat equipment using visible light.

### *Limitations*

No night vision device is likely to be as efficient as the eye by day. All devices will be subject to the same line of sight disadvantages as the eye; in addition there may well be limitations of field of view, depth of focus, resolution, cost, bulk and complexity to balance the advantage of better performance at the lower ambient light level. Image intensification and thermal imaging devices will have a more severe depth of field limitation than the eye because of the need to present the image on a physical surface in one plane. All devices will suffer from resolution limitations which will affect the magnification required to achieve recognition and detection at the desired maximum range, which in turn will affect the field of view.

There is one fundamental limitation which applies to image intensification devices at very low levels of illumination. In image intensification devices the reflected energy from the target is used to illuminate faintly a photo-cathode which emits electrons. These electrons are multiplied to produce the amplified image on a suitable screen. The number of electrons emitted at a given illumination level is subject to random fluctuation, and when the level is low the proportional variation is high. Any amplification produces only "snow" because the signal to noise ratio is too small. One way to overcome this is to increase the output of photo-electrons by using a larger objective lens to gather more light, but small size is probably the most important characteristic needed for a military device, especially if it is to be used by infantry. Thus for a given objective lens diameter and hence bulk, there appears to be a fundamental illumination level below which targets cannot be resolved.

As security restrictions are lifted much more information on the performance of night vision aids will become available. There is one point to remember when evaluating their performance. As conditions for viewing deteriorate the ability of an observer to define detail gradually decreases until all detail disappears. Illumination level, weather, contrast, the nature of the target and the confidence of recognition all have an effect. When figures of performance are quoted they are meaningless unless the conditions under which these figures are obtained are quoted also.

***Potential***

The potential of this new field and the effect that it is likely to have on the conduct of warfare is tremendous. Training will be needed so that operators learn to cope with the disadvantages of the systems with minimum loss of efficiency and so that commanders can learn the capabilities of the devices to allow them to be employed to best advantage.

The introduction of night vision aids is likely to affect our manpower requirement, our need for other related equipments and our tactics. Maintenance difficulties associated with the complexity and cost of the aids will be high, so that it is unlikely that any army could afford to supply them to every soldier. In regular warfare the increased availability of night vision aids will certainly make it easer for the attacker to move, but on balance will tend to favour the defence. Ultimately both sides in a conflict between regular forces will be so equipped with effective fire-power and efficient night vision aids that both will be forced to proceed with equal caution by day and by night. War will then have moved another rung up the ladders of cost and complexity, which in turn may make it slightly less likely that a conflict between regular forces will eventuate. In the foreseeable future irregular forces are likely to suffer from a marked lack of logistic and maintenance backing, so that the advent of night vision aids is likely to place them at a disadvantage. We should be conducting studies now, before the introduction of night vision aids, to determine their effectiveness and their role relative to all other combat intelligence-gathering equipment becoming available. □

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