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The Cover

A troop of the 2nd Regiment, Royal Canadian Horse Artillery, firing in Korea. Guns are firing in the background, and in the foreground are the gun position officer and his assistants.

CANADIAN Army JOURNAL

The object of the Canadian Army Journal, which is published by the Directorate of Military Training under authority of the Chief of the General Staff, is to provide officers of the Active, Reserve and Supplementary Reserve Forces with information designed to keep them abreast of current military trends and topics, and to stimulate interest in current military affairs.

His Late Majesty King George VI

A portrait by Maurice Codner, R.P., of His Late Majesty King George VI, Captain General, the Honourable Artillery Company

ARMS and FIGHTING

By
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Introduction

"*Fighting has determined everything appertaining to arms and equipment, and these in turn modify the mode of fighting; there is, therefore, a reciprocity of action between the two.*"

The above quotation was written by Karl von Clausewitz, a Prussian General, in his treatise "On War" just after the close of the Napoleonic era more than one hundred years ago. This work, an unfinished philosophy of war, was published after Clausewitz' death in 1831 and, in succeeding years, it greatly influenced, not only German military doctrine, but that of most other nations as well.

In the past, the arrow and the sword had led to the employment of personal armour and the building of castles. The discovery of gunpowder and the invention of cannon and firearms defeated the castle and personal armour and displaced the arrow and the sword. The introduction of mobile artillery, used extensively by Napoleon, had made possible the effective concentration of artillery fire which, together with the development of improved small arms, gave rise to many of our modern tactical concepts.

It was in the light of such past events that Clausewitz had reached his conclusion on the relationship between fighting and arms. It is proposed to study his findings in the light of events since 1914 and then endeavour to forecast how fighting and equipment may influence each other in the next quarter century.

1914 to 1952

First World War

At the commencement of the First World War, the two dominant weapons were the machine gun and the quick-firing field gun. The machine gun heavily favoured the defence and used in a defensive role

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in conjunction with barbed wire, it ruled the battlefield leading to a state of siege warfare. The resultant widespread use of trench systems and fieldworks largely reduced the effectiveness of artillery.

One of the major tactical problems of the infantry attack was that of covering the last few hundred yards in the face of enemy machine gun fire. This problem was partially solved by the use of the artillery barrage which was employed to neutralize enemy fire while infantry advanced as close as possible behind it. To obtain greater effect against a well entrenched enemy, it became necessary to use artillery of heavier calibre. The widespread use of high explosive shell in place of shrapnel was also adopted.

Against the effect of these bombardments often had to be set the price of loss of surprise. Nevertheless, the effectiveness was such that it became necessary to set up elaborate counter-bombardment systems, employing sound ranging and flash spotting techniques, to locate the positions of enemy guns. In later years, the successful use of flash spotting was to lead to a requirement for flashless powder.

Artillery having met with only partial success, a radically new weapon was required to break the stalemate of siege warfare. In April 1915, the Germans first used poison gas. They achieved some limited success but the gases used were neutralized relatively easily and the weapon became ineffective.

The problem was eventually solved by the introduction of the tank towards the end of 1916. The tank provided weapon mobility and protection at the same time and was to revolutionize field tactics. Tanks were used as mobile screens of armoured batteries behind which infantry could advance against the strongest defensive systems of the day.

Before leaving the First World War, it is of interest to note that the state of siege warfare stalemate prevailing in the earlier years led to increased reliance on the naval blockade as a weapon and to the introduction of air attack on civil populations and industry. This form of attack was used on a vastly increased scale in the Second World War and was to lead to a demand for elaborate and costly anti-aircraft defence systems. The naval blockade gave impetus to the development and widespread use of the submarine which in turn necessitated the adoption of the convoy system.

Second World War

Between the First and Second World Wars, the two types of major equipment which advanced most were the airplane and the tank or armoured fighting vehicle, resulting

in the growth of large air forces and the mechanization of armies. At the beginning of the Second World War, these two had become dominant weapons and both were used successfully in conjunction as the core of the German offensives in Poland and Western Europe. As a result, fighting took on a much more mobile and fluid character.

Tactically, air bombardment was used in the role of long range artillery. Strategically, it was used as a weapon of terror and mass destruction against civilian populations and industry. An urgent requirement arose for improved anti-aircraft ground defences which was met to some degree by the introduction of radar, improved fire control instruments and higher velocity semi-automatic guns having increased rates of fire.

Armoured divisions, built around tanks and vehicle-borne infantry supported by self-propelled guns, were used to punch holes in strong defensive systems, to encircle the enemy and to disrupt his lines of communication. To meet this form of attack, defence in greater depth became necessary. A requirement arose for effective anti-tank weapons and a race began between gun and armour which is still in progress to-day.

Land mines were used on a large scale as part of integrated defence systems and proved to be effective weapons against personnel and vehicles of all types. Efficient mine detection and minefield clearance soon became major problems which even to-day are not satisfactorily solved.

The effective use of mortars on a large scale made it necessary to expand the counter-bombardment organization to include counter-mortar activities, radar and sound ranging being used to locate enemy mortar positions.

The increased mobility of warfare demanded improved field communications leading to the widespread use of wireless. Multi-channel and high speed line communication systems were introduced to cope with the increased volume of traffic and to conserve cable. Improved communications in turn enabled the principle of concentration of artillery fire to be developed to a very high degree and in a flexible manner. The fire of complete divisions and even corps was able to be brought down on specified targets at relatively short notice. Improved communications also had a profound effect upon tank tactics.

Another revolutionary development in land warfare arising from the advances made in aviation was the introduction of airborne units. It became possible to drop whole divisions of suitably equipped troops from the air behind enemy lines to secure strategic points and to harass the enemy rear. Thus was the mobility of warfare increased, still

further emphasizing the necessity for increased defence in depth. Headquarters and supply units in the rear now had to be capable of adequately defending themselves against sudden attack either from the air or from highly mobile armoured units.

Operations during the latter half of the Second World War called for an increasing number of amphibious assaults both in the European and Pacific theatres. These in turn gave rise to requirements for special amphibious assault equipment among which might be mentioned the various types of landing craft and the amphibious jeep. Since landing craft were not always able to approach close enough to shallow beaches, it became necessary to waterproof vehicles of all types and often the equipment contained in them so that they might wade ashore. The success achieved in the development of amphibious equipment and the waterproofing of existing equipment, in turn, permitted amphibious operations to be undertaken on a more ambitious scale. This culminated in the Normandy assault, in which whole divisions complete with their equipment were successfully landed in the space of a few hours.

Arising from the operational need to fight in tropical theatres, equipment had to be adapted to enable it to perform satisfactorily in dry and humid tropical climates. Such fighting had previously been seriously limited by the capabilities both of the soldier and his equipment but successful campaigns such as those in Burma and the Pacific islands were made possible largely by the effective tropicalization of Allied fighting equipment and improved tropical hygiene.

Towards the end of the Second World War, three major equipment developments made their appearance: the VT or proximity fuze, the guided missile and the atomic bomb. The former met the requirement for consistently obtaining airbursts at optimum height and appeared in time to materially influence the Battle of the Bulge and the closing stages of the Pacific campaign. The atomic bomb succeeded in bringing the Pacific campaign to an abrupt and successful conclusion by completely destroying the will to fight of the Japanese nation as a whole. The guided missile, as used in the forms of the V-1 and V-2, was not particularly effective. The influence of these three developments on the future pattern of fighting will be discussed later.

Thus it may be seen that Clausewitz' statement has been amply borne out by the experience of two recent world wars. Every weapon has been designed to meet certain operational requirements arising from the pattern of warfare obtaining at that time.

No sooner is a new weapon in the hands of troops than the pattern of warfare changes, on the one hand to enhance the effect of the weapon and on the other to minimize it.

1952 to 1975

The future is inclined to be somewhat obscured by the recent introduction of weapons of mass destruction, namely, the atomic, bacteriological and chemical warfare weapons. Experience in the use and effect of these weapons to date is very limited indeed and points towards their being most effective when used strategically against civilian populations rather than tactically against armies in the field. Rather than risk confusing the issue by discussing these weapons at the outset, it is proposed to consider first the future influence of fighting and equipment upon each other in the more orthodox fields.

Orthodox Warfare

The race between gun and armour may be expected to continue for some time with the tank becoming the main anti-tank weapon. Requirements may therefore arise for three major classes of tank, one for use in the tank destroyer role, one for use in the infantry support role and the other for use in the traditional cavalry role. Should it be found possible to combine an effective anti-tank and H.E. performance in the same gun, the first two classes would be merged into one, as in the past. Suitably stabilized tanks will be able to fire on the move, relying on their movement for protection, thereby speeding up the attack. Heavy tanks are costly and give rise to numerous movement and maintenance problems in the field. It may be concluded, therefore, that they would become rapidly outmoded in the event that a more effective method of destroying them should be discovered. Here, an analogy may be drawn with the heavy battleship. Meanwhile, the armoured division, possibly air transported as required, will continue as the main offensive component of an army.

So long as the tank continues to dominate the battlefield, infantry troops will demand an effective weapon with which to combat it at relatively close ranges. Mortars will continue to be used with improved accuracy up to minimum artillery range and their effect may be greatly increased by the use of proximity fuzed shell. The light machine gun and machine carbine may be expected to be combined in some degree with the rifle in the form of a fully automatic rifle so as to increase appreciably the firepower of the infantry section. Every effort will be made to reduce the load carried by the infantryman in order to increase his efficiency and endurance. Scientific-

ally designed clothing together with lighter and more efficient weapons will all assist to this end. Infantry is the one arm which will never be outmoded, even in a push-button war of mass destruction, since they will always be required to occupy ground won from an enemy. Any effort devoted to improving their fighting efficiency, at a time when vast sums of money are being expended upon costly and complicated new weapons as yet unproven as to their effectiveness, is, therefore, well spent.

As development continues, airborne troops will be less and less restricted by the availability and size of aircraft or by equipment dropping limitations. It may reasonably be anticipated that armies will be increasingly transported and supplied by air although the fuel supply problem may become a limiting factor.

Infantry, however they may be transported, will require intimate fire support immediately at hand. Field artillery will therefore continue to be required to meet this need. Improved accuracy of artillery fire should result in a corresponding economy in equipment and ammunition. Tactical aircraft will operate as air artillery to provide reinforcing fire support, and fire support for the initial stages of an airborne landing or a swift ground manœuvre.

The proximity fuze may be expected to have considerable impact on tactical doctrine. Infantry can no longer expect the same degree of protection from slit trenches or from dispersal in the open. Artillery must be provided with overhead protection if it is to survive counter bombardment fire. Armour, including armoured personnel carriers, can advance directly under a continuous VT-fuzed barrage. Beach assaults will prove more costly. Proximity fuzed shell fired from mortar, rocket launcher, tank gun or field gun may well lead to the reintroduction of some form of body armour. Not without justification has the VT fuze been referred to as the second most important development of the Second World War.

The improvement of artificial aids to vision at night, such as infra-red devices, may be anticipated, leading to a radical change in the form and scope of night operations. New and improved radar devices will assist in detecting enemy ground targets and improving artillery and tank fire control systems. Further improved communications will speed up the tempo on the battlefield.

Specially developed clothing and equipment will enable warfare to be conducted in the Arctic regions. However, the strategic requirement for flexibility in operations will demand that such equipment be also

capable of operating satisfactorily in the tropics.

Unorthodox Warfare

It is proposed now to return to the more unorthodox weapons referred to earlier and to consider their possible influence on existing tactical concepts. The atomic weapon, as known to-day, would appear to be limited tactically to use against large concentrations of troops, major strong points, large supply depots and key points on lines of communications such as railway centres and ports. Unless mobility, deception and ease of control are greatly increased, the concentration of appreciably superior forces will no longer be practicable. A large scale amphibious assault, such as that recently conducted on the Normandy beaches, would be inviting disaster. This will bring forth requirements for equipment to facilitate rapid concentration for battle.

Strategically, the bomb has enormous possibilities when used against industry and civilian populations. Defence against it will be mainly concerned with preventing it from being used.

The bacteriological weapon, although as yet unproven, provides a definite threat, the influence of which upon active operations seems likely to be similar to that of the atomic bomb although its effect cannot be instantaneous due to incubation time. It possesses the additional attraction to an aggressor that it will not destroy material. Its effect upon a civilian population may be comparable with that of the atomic bomb and the main defence problem will once again be to prevent its successful delivery.

The chemical warfare weapon has still not reached maturity. Its limitations in close combat are well established and it has failed to affect battle conditions fundamentally in the past. It might therefore be assumed that protective measures will be devised against future chemical agents as against past ones and it seems reasonable to assume that battle conditions will not be fundamentally affected in the future. As a weapon of mass destruction used against civilian population, chemical warfare represents a serious threat comparable with that of atomic and bacteriological warfare.

Summarizing, atomic, bacteriological and chemical warfare may all preclude concentrations of any type or magnitude in both forward areas and lines of communication in a theatre of operations. They will also limit the size of amphibious operations. They are likely to be used against large centres of civilian population and industry. It is of interest to note that these weapons may all be used by a nation on the verge of

defeat, if not to secure victory, to ensure that defeat is mutual.

Finally, it is proposed to consider the new vehicles by which these weapons may be delivered at long range: guided missiles, both in the form of pilotless aircraft and rockets. It is the supersonic rocket which offers the greatest possibilities and which can probably only be countered by another guided rocket. Although their effectiveness relative to their cost has yet to be determined, guided rockets carrying conventional high explosive warheads will be available to armies shortly for use in the roles of long range artillery and anti-aircraft artillery. In the former role, they may supplant tactical support aircraft having the added advantage that they can operate in any weather or conditions of visibility. In the anti-aircraft role, they may render bombing by piloted aircraft impracticable only to hasten bombing by pilotless aircraft and guided rockets.

Conclusion

It may be concluded that General Karl von Clausewitz' theory concerning the influence of fighting and equipment upon each other has been amply substantiated by the experience of two recent major conflicts. Consideration of the possible developments of the next quarter century does not indicate any likely departure from his doctrine.

Thus, each new offensive or defensive equipment and each change in tactics which is introduced into warfare brings forth in due course another equipment or change in tactics to restore the fighting balance. Major General J. F. C. Fuller has called this phenomenon the "Constant Tactical Factor". It might well be called the "Law of Conservation of the Species", for unless every type of offence can be countered, man may well annihilate himself. The hydrogen bomb is a case in point.

Warfare is no longer restricted to the battlefields as it was in Clausewitz' day, and in these days there are such things as psychological weapons and civilian "fronts". However, if his theory be broadened to cover every aspect of total warfare as practised nowadays, it will still be found to hold good.

Ammunition Boosters

The Army has ordered a quantity of ammunition boosters to be used in calibre .50 machine guns mounted on vehicles. This device, which has been used heretofore only on aircraft, is designed to feed the ammunition to the machine guns at a fast, even rate, eliminating "drag" of the ammunition belt. It is powered by a small high speed electrical motor. — *Combat Forces Journal (U.S.).*

THE SOVIET UNION'S AIRCRAFT INDUSTRY

DIGESTED FROM AN ARTICLE IN "AVIATION AGE" (U.S.)*

How big and how good is the Soviet aircraft industry? What is its ability to support an all-out war effort? To these $64 questions, the full answers probably lie locked in secret files in Moscow. However, rather general information can be obtained empirically by considering a number of factors upon which the production of airplanes and other war implements must necessarily draw.

Industry at Half Capacity

The sprawling, decentralized Soviet aircraft industry is probably operating at somewhat less than half its potential capacity. This potential has been estimated by economists and industrial experts in the United States from a low of 50,000 planes a year to as high as 100,000 aircraft a year by 1960, barring all-out war. We are inclined to believe that the latter figure is exceedingly high, allowing even for substantial satellite contributions. The lower figure is well within the bounds of reason, because the Soviets turned out 40,000 planes a year at the peak of their World War II effort.

The industry is represented, according to the best unofficial information, by 25 to 28 major airframe plants, between 12 to 15 power plant factories, and possibly some 40 odd makers of component parts. A large but indeterminate number of small units, camps, and "farms" contribute directly and indirectly. However, because of the wide use of slave labour and "emigrant workers" from Germany and other countries, probably just a handful of top officials actually know how many workers build airplanes.

Trust System

Production is controlled through what appears to be a fairly efficient system of trusts, or combines. The Electro Trust produces, through its string of plants, such items as radio, radar, electronic tubes, lights, and wiring. The Fine Mechanics Trust turns out aircraft instruments of all types, including optical items, gun sights, and bomb sights. Ordnance, ammunition, armour, and similar matériel come through the Arms Trust. The Rubber Trust contributes tires, fuel cells, tubing, and fittings of various types. All power plant pro-

* *The* Journal *reprints this digest from the* Military Review *(U.S.).—Editor.*

curement is controlled by the engine trust known as the Scientific Motor Institute. In peacetime, only the latter normally is devoted completely to aviation production; but only the Politburo knows whether or not the Soviet considers itself "at war" today.

Manpower Drafted

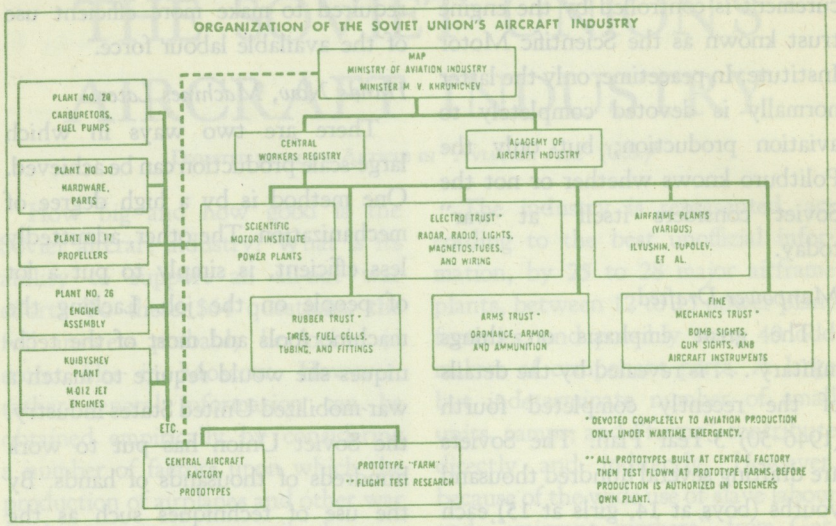
The great emphasis on things military . . . is revealed by the details of the recently completed fourth (1946–50) 5-Year Plan. The Soviets are drafting several hundred thousand youths (boys at 14, girls at 15) each year for compulsory vocational training. The Government specifies the trades into which these trainees must serve their apprenticeships, and tells them where to work after the training period is completed. Manpower is allotted by the Central Workers Registry in a totally ruthless manner, and the penalties for shifting jobs, absenteeism, or tardiness are stiff indeed. The manner in which labour is handled within the various plants will be examined later.

For the training of personnel such as supervisors and foremen, the Soviets set up, in 1947, an Academy of Aircraft Industry. They apparently have discovered that the civilian labour force is not limitless as the propagandists are wont to claim, and that improved supervision is required to make more efficient use of the available labour force.

Hands Now, Machines Later

There are two ways in which large-scale production can be achieved. One method is by a high degree of mechanization. The other, admittedly less efficient, is simply to put a lot of people on the job. Lacking the machine tools and most of the techniques she would require to match a war-mobilized United States industry, the Soviet Union has put to work hundreds of thousands of hands. By the use of techniques such as the "hole-production" method, or other industrial devices, the Soviet Union appears to have departmentalized work so that semi-skilled men and women can now produce airframes and small components. Proportionately fewer better-trained workers supervise the mating and the more intricate installations, while highly skilled personnel conduct the finishing and inspection processes.

To understand how well such a system works under pressure, we need only to consider our own wartime experience. For example, Curtiss-Wright operated two plants in the St. Louis area. The East Plant was manned almost exclusively by hurriedly imported sharecroppers and cotton-field workers. This personnel was supplied with highly simplified



production drawings and simple tools: one of these was a "torque wrench" that broke in half in the event that the worker applied too much muscle to a critical fitting. Under careful, sympathetic supervision, these workers soon were approaching the output of the other Curtiss-Wright plant which was manned by better trained machine-conscious personnel. Later on, the East Plant actually matched the output of the more skilled factory.

New Machines

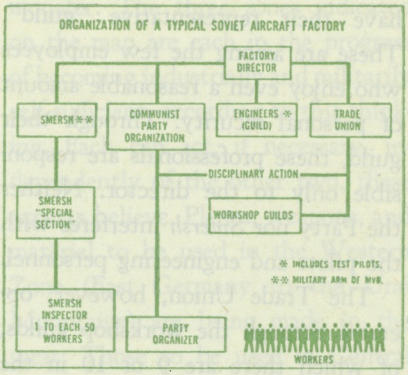
In the meantime, however, the Soviets probably hope to make such techniques less necessary by catching up technologically. They produced some 2,300 machine tools in 1950, compared with an output of about 500 in 1940. As German loot, the Soviets obtained at least two of the huge Wotan hydraulic die-forging presses. A report published in Switzerland more than a year ago stated that as early as 1949 the Soviets had in operation 150 of these presses, and were using the majority of them to make aircraft parts. (During the war, the Wotan press could turn out in a single operation the full set of spar components for a *Ju-88* fighter bomber.) For sheer size and capacity, the United States is just beginning to use presses comparable with the Wotan.

Another device by which the Soviets are beginning to utilize numbers of unskilled people in airplane fabrication is the German "hole-production" scheme. This is an

ingenious system which requires no fixtures or jogs, but permits assembly after the manner in which a toy erector set is put together. A welded steel "master body" serves as a master gauge from which the tools are fashioned to make plane components. Many of these parts are interchangeable, and they can be mated by unskilled or semi-skilled workers at a considerable saving of time and assembly space. The Soviets secured this system from the Henschel concern, one of the several German manufacturers to use the "hole-production" technique.

German Aid

In a number of other ways, German aid is contributing to the improved quality and quantity of Soviet aircraft production. Some of the top industrial organizers are known to have aided in the development and modernization of the Far East and Central Siberian plants. Many of these are underground factories developed along the lines of the German "complex" system. Among the experts known are Anton von Poller, formerly of Hitler's economic staff, Hugo Kreisbahn, Heinrich Kunze, Hugo Sandler, Gerhardt Wilfke, and Gustav Sartorius. These and other experts probably are responsible for the successful marriage which has been consummated between certain



of the German combines and the Soviet trusts.

The Russo-German combination benefits the Soviets in a less obvious way. Since the USSR is becoming rather hard pressed to feed itself—as revealed by the fact that almost 50 per cent of the civilian labour force is engaged in agriculture, and relatively few hands can be spared from the collective farms—this use of German and other emigrant help permits an industrial expansion which otherwise might not be possible at this time.

Plant Setup

The factory organization also is unique in many respects. The plant director is an individual of great responsibility. He is a combination of president, chief engineer, labour relations chief, and perhaps half a dozen other capacities common only to the Soviet system.

The engineers and test pilots each

have their representative "guild". These are among the few employees who enjoy even a reasonable amount of personal security. Through their guild, these professionals are responsible only to the director. Neither the Party nor *Smersh* interferes with the pilots and engineering personnel.

The Trade Union, however, operates through the workshop guilds, of which there are 9 or 10 in the larger plants. The Party organizer and *Smersh* inspectors function at the workers' level. The director is responsible to the Ministry for his production quota. If output lags, he has the Party take "disciplinary action" through the Trade Union. This might be accomplished in the following manner. A few "eager beavers" are shifted around to just the proper spots to show the workers how a real comrade operates. Their exemplary toil usually has the desired effect . . . An obvious case of loafing is "sabotage" . . . and the offenders are removed promptly to a slave labour camp.

There are still other reasons why Soviet production is high. Theoretically, the workers in defence industries put in a 10-hour day and work 5½ days a week. But either the organizer or the Trade Union representative can be counted upon to call a meeting an hour or so before quitting time or on the eve of a holiday. Using any number of excuses to make a plea for overtime work, he reminds everyone, for instance, that it is some celebrity's birthday and that, as good comrades, they should make him a present of so-and-so many extra units. A vote is taken in democratic fashion as the official asks, simply, "Who is against . . . ?" The use of such techniques makes the number of "man-hours" insignificant when Soviet production is evaluated by American standards.

Procurement Is Unique

If an aircraft engineer wants to design a new fighter, he must first have the permission of the Ministry of Aviation Industry. The engineer may, in rare instances, be given the go-ahead with the project, and a definite time in which to complete his work. On the other hand, the Ministry may decide that the engineer's talents can serve a more immediate need such as giving another designer a hand with his project. More frequently, the engineer is given a set of specifications laid down by the Air staff. He must complete his plans by a definite date and submit them to the TsKB, or Central Design Office, for approval. The new airplane is built, not at the engineer's plant, but at one of the several "prototype farms". The plane then is entered in a competition with the prototypes of other designers.

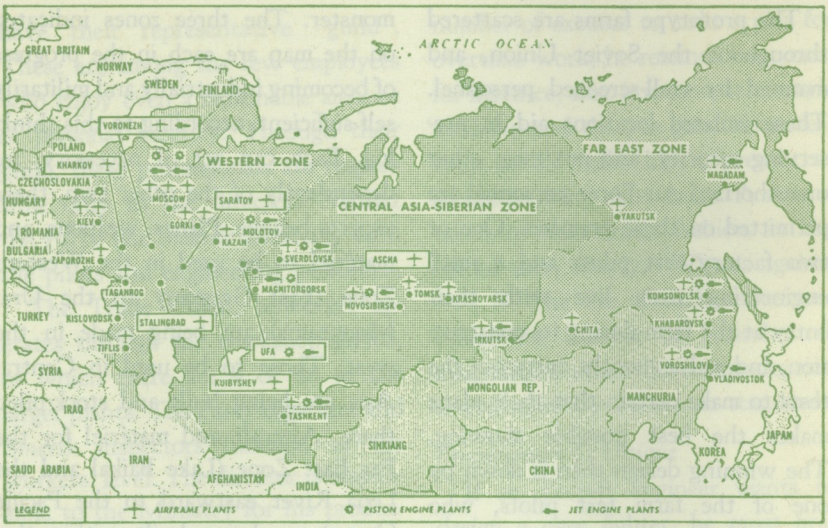
The prototype farms are scattered throughout the Soviet Union, and manned by well-screened personnel. These isolated locations aid in preserving security, and not even other unauthorized Air Force personnel are permitted on these premises. One or two factory test pilots and a small engineering team live with their entry at the farm during its construction, and, subsequently, carry out the tests to make certain that their plane makes the best possible showing. The winning design then is flown by one of the farm test pilots, who writes a critique on the airplane. The report is submitted, via the staff, to the Defence Commissar, Marshal Bulganin.

Orders then are passed, through the Ministry of Aviation Industry, to the agencies responsible for production. Arrangements for power plants are made through the Scientific Motor Institute, and for other components through the various trusts. Production of the fighter may take place in the engineer's plant and any other factories whose facilities are required. The system appears rather devious, by our standards, but it is evidently efficient in the Soviet Union.

Three Zones

Some politico-economic experts hold that the "Red Bear" is rapidly becoming a three-headed industrial monster. The three zones indicated on the map are each in the progress of becoming industrially and militarily self-sufficient, according to this thinking. Each can act, if necessary, independently of the other two, these experts believe. Planes, weapons, and matériel to be used in the Western Zone (East Germany to the Ural Mountains) are being made in the west. Those to be used in Central Asia are being built and stock-piled there. Aircraft and matériel for the Far East Zone (Lake Baikal and the Lena River eastward to the Pacific Ocean) are being built within this area.

This is a setup which is designed ostensibly to permit the USSR to fight a two- or three-front war—offensively or defensively. This interesting probability suggests an entirely new reasoning behind the postwar industrialization of Siberia and the Far East. It is widely known, for instance, that some of the newest and largest aircraft plants are located in or bordering upon the Maritime Provinces at Khabarovsk, Voroshilov, and Komsomolsk, among other places. The pursuit of this new scheme for self-sufficiency suggests why — in addition to the more obvious reasons — such efforts are being spent in the development of the "second Baku" oil fields in the Volga-Ural plain, the Arctic fields in Siberia, and the oil-



rich lands in the eastern Kazakh Province and the Far East.

Manchuria's Role

The extent to which Manchuria figures in this zonal picture also is significant. This is a prize second only to Germany in industrial and strategic value. Manchuria is not a satellite but, rather, a subsidiary. Mao Tse-Tung and the shadowy Liu Shao Ch'i are, so to speak, playing the role of junior partners working the other side of the street for the Cominform. The Communists have a going concern in this area as big as Texas and California combined, with its 43½ million inhabitants, the best rail network in all Asia, and a well-planned (ex-Japanese) heavy industry including aircraft facilities.

Soviet Stock Piles

Should the Soviet Union fight, the stocks of air matériel, other weapons, and strategic materials she has been accumulating ever since 1946 might count almost as much as her production flow. The importance of what she has on hand, compared with what she could produce during wartime, would be governed largely by the duration of any such war and by the supply requirements.

The enlightened ruler lays his plans well ahead, the good General cultivates his resources.—*Sun Tzu Wu, Chinese military writer, 514-495 B.C.*

THE ROLES OF RADAR

Factors Governing the Characteristics of Sets For Various Operations

By
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Introduction

Although the first operational radar set is only fifteen years old, it is the patriarch of a large family whose members extend over a remarkable range of sizes, shapes, and uses.

As in other fields of engineering, the designer of a particular radar is presented with a specification which his equipment must meet, expressed in terms of a desired performance standard for its special function, and (usually) with limitations on such factors as size, weight, power, and number of operators.

It is the purpose of this article to outline the basic relations which determine the performance of a radar set, and to show how many of the desirable features conflict with each other. The task of the designer is one of compromise, as he must adjust the variables within the framework of the laws imposed by Nature, in such a way as to obtain the best possible performance consistent with the physical limitations placed on him by the operational requirement.

The Fundamental Radar Equation

With most types of radar, energy (of power P watts) is radiated from an aerial (of area A sq. ft.) shaped in such a way as to focus or concentrate this radiated energy in a certain direction.

If an object such as an aircraft or ship (distant R miles from the radar) happens to lie in the path of this concentrated beam, then some of the energy will be reflected from its surface and reradiated back towards the radar. A sensitive receiver, tuned to the wavelength (λ centimetres) of the transmitted signal (and usually employing the same aerial as is used for transmitting) will amplify the power (S watts) of the echo and

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present it on some form of display.

S, the power of the reflected echo, is proportional to P, the power of the signal originally transmitted, and to σ, which represents the echoing area of the target. This seems quite logical, since one would expect the power of the reflected signal to be doubled if the transmitter power were doubled, or if the target presented twice the reflecting area.

The extent to which the aerial can concentrate the radiated energy depends on the ratio A/λ^2, corresponding to the area of the aerial (mirror, billboard, or lens) expressed in wavelength units. Thus, a 4 x 4 foot parabolic mirror can concentrate radiation on the so-called "microwave" 10 centimetre wavelength as effectively as a huge 40 x 40 foot billboard array using a wavelength of 1 metre. This factor explains the choice of short wavelengths whenever sharp beams are desired.

The path of propagation of the radiated energy (neglecting for the present reflections from the earth or sea) is along straight lines diverging from the transmitter, so that the energy density (in watts per sq. ft.) at a distance R miles from the radar will decrease with the factor $1/R^2$, corresponding to the increased area (proportional to $4\pi R^2$) of the spherical surfaces over which the energy is dispersed. The same factor $1/R^2$ enters again into the reduction in energy density of the echo reflected back from the target.

To build up the fundamental radar equation, then, we combine the following factors:

- P for the total power radiated by the transmitter.
- A/λ^2 for the concentrating effect of the aerial (supposing the main axis to be directed right at the target).
- $1/R^2$ for the decrease in energy density as the signal spreads out while it is travelling R miles to the target.
- σ for the reflecting area of the target.
- Another $1/R^2$ for the weakening of the reflected signal as it travels R miles back to the radar.
- A for the amount of reflected energy collected by the radar aerial.

Hence, the expression for the received signal power is

$$S \propto \frac{P \sigma A^2}{\lambda^2 R^4} \text{ watts.}$$

If we wish to consider the maximum range out to which it is possible to detect the presence of targets, then the value of S to insert in the formula will be S_{min}, representing the "minimum detectable signal", i.e. the smallest power for which it is still possible to recognize the presence of an echo.

Rearranging the equation, the relation for maximum range will now be:

$$R_{max} \propto \sqrt[4]{\frac{P\sigma}{S_{min}}} \sqrt[2]{\frac{A}{\lambda}} \text{miles.}$$

A number of interesting conclusions can be drawn from this relation. For one, the maximum range depends in a very insensitive way on the transmitter power P, size of target σ, and power of minimum detectable signal S_{min}. The fourth root changes so gradually that to double the maximum range it would be necessary to employ sixteen times the transmitter power, to have a target of sixteen times the area, or to have a receiver capable of detecting a signal of only one-sixteenth the power.

Obviously, to attempt to increase the range by the brute force method of raising the transmitter power will be extremely costly. Equivalent advantage can be gained by improving the ability of the receiver to detect weak signals, but, as will be explained, there are limits to the extent to which this is possible.

The echoing area of the target is, of course, beyond the control of the radar designer, except in special cases such as the marking of navigation channel buoys by radar reflectors. A number of important types of hostile targets are likely to present smaller echoing areas in the future. Examples are jet aircraft, whose smooth outlines and absence of propellors tend to reflect less energy than conventional types of the same dimensions, guided missiles which present a very small cross-section when viewed head-on (as they will be by intended recipients of their unwelcome attentions), and "snort" tubes of submarines which are obviously very much smaller than the part of the hull exposed when the vessel is on the surface.

However, the slow dependence of attainable range on target area is fortunate in the sense that an enormous reduction in σ (as, for example, the comparison of the side of a battleship to a "snort" tube) does not imply a corresponding reduction in the distance at which the object can be detected.

The maximum range is more sensitive to the area of the aerial, the square root dependency implying that multiplication of the area by four would double the range.

The dependence of range on wavelength λ is more complicated than is indicated by the isolated appearance of the explicit term in the formula, since a change in wavelength is likely to alter the attainable transmitter power, the echoing area, and the power of the smallest signal which can be detected. Moreover, as the wavelength is shortened an increasing proportion of the energy is absorbed by the atmosphere and scattered by rain clouds, with conse-

quent loss of range and confusion of the display.

The Desirability Of Having Many Pulses Striking The Target

Most radars transmit very short pulses of high energy, the transmitter remaining quiescent during the long intervals between pulses. During these long intervals the receiving system collects echo signals and presents them on some form of display, providing information as to the position of the objects causing the echoes.

In order to display very weak signals it is necessary to use amplifiers of high gain in the receiver. High gain short wave receivers designed to amplify short pulses produce within themselves a continuous fluctuating signal known as "noise". The power of this "noise" varies in a rapid random manner, and cannot be tuned out. The effect is analogous to the audible noise heard in a radio broadcast receiver, where the hissing or frying sound renders reception of distant stations difficult. Adjustment of the receiver gain (i.e. the volume control knob) affects both the wanted signal and the unwanted noise together, so that the factor governing the visibility (or audibility) of the signal is the signal-to-noise power ratio and not the magnitude of the receiver amplification. Since the noise power fluctuates in a random manner, at any instant it may be greater or less than its average value. Accordingly, a weak signal, with a power about equal to the average noise power, may or may not be obscured by the noise at the instant of reception. For this reason there is a definite advantage in repeating the transmission and display of the radar pulse as many times as possible, since the probability of being able to detect a weak signal in the presence of noise of about the same power is increased. The actual dependence of detection probability on number of pulses involves human factors such as visual perception. Experiment has shown that the relationship between the number of pulses (N) striking the target and the size of the minimum detectable signal S_{min} is

$$S_{min} \propto \frac{1}{\sqrt{N}}$$

It is only for signals about equal to noise power that this effect is important. If the signal is much weaker than the noise it cannot be seen in any case, while if it is much stronger then it will show up clearly on every pulse.

Limitations on the Pulse Recurrence Frequency

Having established the desirability of producing a large number of radar pulses, it must now be shown that there is a limit to the rate at which successive pulses can follow each other. This is caused by the need to

wait until echoes have returned from targets at the longest displayed range, before transmitting the next pulse. Unless this is done, then echoes originating from two different pulses (but reflected from the same target) would appear on the same display at different ranges.

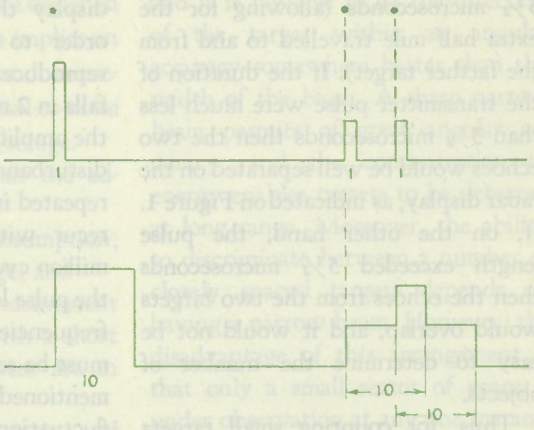

Fig. 1: Short and long pulse lengths.

The radiated energy travels with the speed of light (186,000 miles per second), so that the time taken for it to travel from the radar out to a target at the maximum displayed range R_m and back again will be $\frac{2R_m}{186000}$ seconds.

For example, if $R_m = 200$ miles then the minimum interval between successive pulses is 0.00022 seconds, or, stated another way, the maximum permissible pulse recurrence frequency (p) is 465 pulses per second.

We see that the two desirable features

(a) frequent repetition of pulses to ensure many strikes on the target; and

(b) a long interval between pulses, to permit display of a long maximum range,

are antagonistic to each other.

The Connection between Range Accuracy and Discrimination, Maximum Range, and Transmitter Power

The echo from a small target will produce a signal in the radar receiver which should last as long as the duration of the original transmitter pulse. If the radar is to have good discrimination in range, i.e. the ability to detect that several closely spaced targets are in fact separate and not just one large object, then the duration of the transmitter pulse must be kept very short. For example consider two targets in the same direction from the radar but half a mile apart. The energy pulse travels a mile in 1/186,000 of a second, or 5½ microseconds (millionths of a second), so that the time difference in reception at the radar will be

5½ microseconds (allowing for the extra half mile travelled to and from the farther target). If the duration of the transmitter pulse were much less than 5½ microseconds then the two echoes would be well separated on the radar display, as indicated on Figure 1. If, on the other hand, the pulse length exceeded 5½ microseconds then the echoes from the two targets would overlap, and it would not be easy to determine the number of objects.

Thus, for counting small targets (or for estimating the size, shape, or orientation of very large ones) it is advantageous to use a very short transmitter pulse length.

Another advantage of using a short transmitter pulse is that less power will be consumed by the transmitter, since it expends P watts during the duration of the pulse and no power in between pulses. Moreover, echoes from the earth or sea, which may obscure wanted signals, are less conspicuous if the pulse length is short.

Accordingly, the use of a very short pulse length is beneficial from the points of view of good range discrimination and low average power consumption, and it would appear desirable to reduce the length as much as is technically possible. However, a factor which has not been taken into consideration is the ability of the radar receiver to amplify and display these very short pulses. In order to react quickly enough to reproduce a pulse which rises and falls in 2 microseconds, the circuits in the amplifier must be able to react to disturbances which, if they were repeated in a regular sequence, would recur with a frequency of half a million cycles per second. The shorter the pulse length, the wider the band of frequencies up to which the amplifier must be sensitive. The receiver noise, mentioned already, consists of random fluctuations with a spectrum spread uniformly over all frequencies. Consequently, if the pass band of the amplifier is extended to higher frequencies then more noise is passed, and the background is increased above which the wanted signal must be detected.

This effect in the receiver exactly balances the saving in average transmitter power, since halving the pulse length will halve the average transmitter power, but will double the bandwidth necessary if the receiver is to amplify the shortened pulse. Twice as much noise power will be amplified, and the net result is to halve the signal-to-noise ratio, which, as we have already seen, is the true criterion of signal detectability.

If very accurate range measurement is desired (as is the case with fire-control radar) it is necessary to fix the position of the rising edge of the echo pulse. In order that this rise

steeply, the amplifier must be designed to react very rapidly. This implies an extra wide bandwidth, and consequently a deteriorated signal-to-noise ratio and reduced range coverage.

Hence, it is evident that the advantageous qualities
(a) low average power consumption;
(b) good resolution in range; and
(c) very accurate range measurement
are mutually consistent with a short pulse length, but that these are in direct opposition to
(d) a good signal-to-noise ratio, and hence long range.

Scanning Radars with Shaped Beams

The range from the radar station to the target is measured by timing the delay between emission of the transmitter pulse and reception of the reflected echo, but in order to establish the position of the target it is also necessary to know the direction in which it lies with respect to the radar. If the target is known to be on the surface of the earth or sea this direction can be expressed in terms of horizontal bearing angle, but in the case of aircraft or missile targets the extra co-ordinate of elevation angle is also required.

The radar display records the presence of the target somewhere in the beam of radiation, but cannot determine in which part of the beam the echo lies. If the beam is moved, the strength of the signal will change, and it is possible to fix the direction of the target within an angular accuracy somewhere better than the width of the beam. A sharp narrow beam permits of great angular accuracy, and the concentration of energy enables targets to be detected at long range. Moreover, the ability to discriminate between a number of closely spaced targets depends on having a narrow beam. However, the disadvantage of this arrangement is that only a small sector of space is under observation at any one instant. It may be said that such a radar concentrates on one narrow cone to the exclusion of all other directions, so that the price paid for a high quality of information from one region is blindness to events in all other regions.

A compromise lies in the possibility of scanning a large area by a moving narrow beam, but definite limitations to this method are established by some of the considerations already discussed.

Suppose, first, that it is desired to observe targets everywhere inside a cylindrical volume (e.g. within 200 miles from the radar and up to a height of 50,000 feet).

If the aerial is designed to concentrate the radiated energy into a narrow pie-shaped sector (as illustrated in Figure 2) which can be rotated horizontally through the complete circle at a speed of ω revolutions

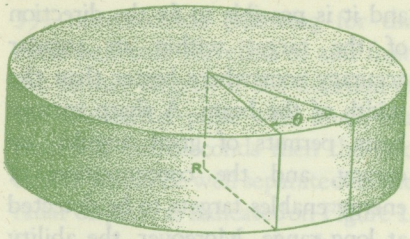

FIG. 2: Scan in bearing only.

per minute, then all directions can be observed and accurate bearing measurements made. However, no knowledge of target height can be obtained.

The speed of rotation ω is limited by the need for a considerable number of pulses to strike the target on each illumination, so that a high probability of detecting weak signals is ensured. If the beam has a horizontal width of θ degrees, and sweeps over the target at a speed of ω r.p.m., then the target will be illuminated for $\theta/6\omega$ seconds. If the radar emits p pulses per second then the number of pulses striking the target will be

$$N = \frac{p\theta}{6\omega}$$

pulses per illumination.

For example, if it is necessary to have at least 10 pulses per illumination, if the recurrence frequency p is limited to less than 465 pulses per second (so that 200 miles of range can be displayed), and if the beam width θ is 1°, then the speed of rotation ω must be less than 8 revolutions per minute. Thus, each target can be illuminated (and observed) at intervals of about 8 seconds.

A low speed or rotation is a handicap if the purpose of the radar is to obtain an up-to-date picture of air activity. For example, a bomber with a speed of 400 m.p.h. covers a mile every 9 seconds, and if it is taking evasive action any recorded track of its position can be in error by a number of miles unless plots are renewed several times a minute.

Thus we see that the desirable qualities:

(a) large N, for high probability of detection of weak signals;

(b) small p, to allow display of long maximum range;

(c) small θ, to permit accurate measurement of bearing and good discrimination between closely spaced targets; and

(d) large ω, so that information is renewed at frequent intervals, compete with one another, and that improvement in one aspect of performance can be obtained only at the expense of another.

For some roles it is not necessary

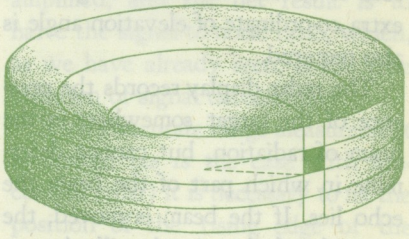

FIG. 3: Scan in bearing and elevation.

to search through 360°, and continuous rotation of the beam can be replaced by a rapid scan back and forth across a narrow sector. As an example, radar observation of fall of shot for naval, coast, or field artillery requires a high information rate, since the duration of the echo produced by the shellburst will be short, but the sector under surveillance need be only a few degrees wide, since the region into which the shells will fall is known in advance.

If the application requires the radar to produce information in angle of elevation as well as bearing, then the considerations already discussed are reinforced in another dimension.

The aerial can be designed to produce a "pencil-beam" of radiation, narrow both horizontally and vertically. The highly concentrated beam will permit great range to be attained, but a complete search of the sky up to some maximum angle of elevation will require a systematic scanning in both bearing and elevation (e.g. see Figure 3). To compare with the previous example, if the beam is 3° high, and searches up to 30° angle of elevation, while the other figures are unchanged (horizontal beamwidth 1°, 10 pulses per illumination, recurrence frequency low enough to permit display out to 200 miles range), then the time for a complete scanning cycle is 10 times as long (since 10 steps in elevation are required) and occupies nearly 80 seconds.

An information rate of 80 seconds would be unacceptably long for most applications, so that in the example considered one or more of the requirements for long range, accurate bearing, and accurate elevation would have to be relaxed in order to improve the frequency of plotting. However, the principle of rapid two-dimensional scanning by a pencil beam can be used when the operational role of the radar does not demand a long maximum range and/or when only a portion of space needs to be searched (as is the case with airborne interception and gunnery radar).

A general conclusion from this discussion of scanning radars is that
(a) accurate positional information regarding targets in a certain region; and
(b) general coverage of activity in all directions,
make conflicting demands, and improvement in one facility implies a reduction in the other. This is analogous to visual observation, where a high-powered telescope produces the most detailed vision of a certain small area, but low-powered binoculars are better for searching over a large area.

Reflections from the Earth and Sea

In the foregoing discussions we were assuming that the direction of

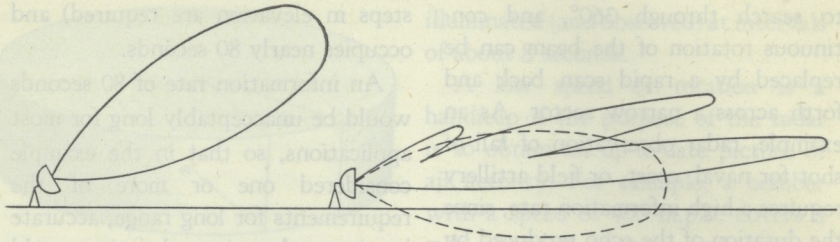

FIG. 4: Effect of ground reflection.

concentration of radiated energy could be completely controlled by the shape of the aerial. For an airborne radar, or a surface radar looking upward at a high angle of elevation, this is substantially true. If, however, some of the energy is directed against the surface of the earth or of the sea, then most of this will be reflected, and the result may be a systematic modification in the distribution of the energy. The interference between the direct and reflected radiation tends to divide the beam into separated lobes with gaps between them. Figure 4 illustrates a radar whose aerial concentrates the radiation into a vertical pattern approximately 30° wide. In A, the aerial is tilted up to an angle of elevation above 15°, so that very little energy strikes the ground. In B, the aerial has its axis horizontal. If the earth were far below it, the radiation pattern would follow the dashed curve, similar in shape to A. But with the aerial only a few wavelengths above the earth, half of the radiated energy will strike the ground, and the reflected waves will combine with the direct radiation in such a way that the resulting pattern consists of lobes and gaps.

The minimum at 0° elevation results from a cancellation in signal power between the direct and reflected waves, and (as was also true for the effectiveness of the aerial in concentrating energy into a narrow beam) the measure governing the sharpness of the distribution patterns is the number of wavelengths in the height of the transmitter above the reflecting surface. The angle of elevation of the centre of the lowest lobe can be halved by either doubling the height of the transmitter, or halving the wavelength of the radiation. Consequently, if strong echoes are desired from targets on or near the surface of the sea (or ground) it is necessary to site the aerial far above the surface and to employ as short a wavelength as possible.

Conflict of Desirable Characteristics

In the accompanying table (see page 28) a list is made of characteristics generally desirable in radar. As has been pointed out in several places already, a number of these characteristics are incompatible with one another.

Depending on the operational role for which the radar is intended, different combinations of these characteristics assume paramount importance. Across the top of the table are listed a number of roles for radar equipments, and in each column a cross is placed opposite the characteristics which are essential for that particular application. A dash indicates that the characteristic is of no importance, while a zero means that this capability is sacrificed for the benefit of a more necessary characteristic.

The remainder of this article consists of remarks regarding the contents of the table.

Long Range Early Warning Radars

Radar sited near the coastline or frontier to give advance warning of enemy air attack must be able to detect targets at very long range. The requisite high power and large aerial can be provided on a large fixed installation. With existing transmitting tubes it is most convenient to obtain the high power on the longer wavelengths.

At long range all angles of elevation will be low, and the distance at which low flyers can be detected will be dangerously short. Accordingly, special sets may be designed to give improved low cover, in which case they will be sited on cliffs, or on high towers, and will operate at short wavelength. High siting gives the additional advantage of moving the horizon (which limits the range of short wave radar in much the same way as it does visual observation) farther away.

For operations with field forces, mobile early warning radars may be required. In this case the size and height of the aerial and the freedom to choose high sites is limited, and the long range performance must suffer in consequence.

Shipborne Search and Navigation

The confined space and severe weather conditions met on shipboard impose a distinct limitation on the size of the radar aerials. For observation of other ships it is essential to direct a maximum of power near the surface of the sea. This demands high siting, which is limited by the extent and strength of the ship's superstructure.

For navigation, high discrimination permits recognition of individual buoys and configurations in coastline.

(X = Essential for role)
(0 = Sacrificed for more important qualities)
(— = Unimportant in this role)

DESIRABLE CHARACTERISTICS	Long Range EW	-Low Cover	-Mobile	Shipborne Search	Ship Navigation	G C I	Height-Finder	AA Tac. and Acq.	AA Fire-Control	Naval, Coast, Field Gunnery	Counter-Mortar	Airborne Warning and Gunnery	Airborne Search and Bombing	Aircraft Landing	Searchlight Control	Range finder Only
PERFORMANCE																
Large Volume of Cover			0						0		0	0				
Long Range	X				0	X				0	0		X		—	
Wide Vertical Angle					—	X	X	X	X	—			X		X	
Down to Low Angle		X	0	X	X					X					—	
Accurate Location of Target and Good Discrimination									X		X		0	X		
in range					X	X				X					—	X
in bearing					X	X				X					X	—
in elevation				—	—		X			—					X	—
Frequent Repetition of Information						X					X					
Large Traffic Handling Capacity						X	0	X	—	—	—	0		0	—	—
CONSTRUCTION																
Light	0		X			0					X	X	X		X	X
Small Exposed Area	0			X	X	0				X	X	X	X			
Easy Siting		0	X	0	0						X			—		

Accordingly, short pulses and narrow beams are employed. Since large aerials are undesirable, the narrow beams are obtained by using a short wavelength.

Ground Control of Interception by Fighter Aircraft (GCI)

A radar designed for the purpose of directing friendly fighters into a position from which they can attack enemy bombers must have long range and high cover if it is to control a high speed battle over a reasonable area, and must have sufficient discrimination to separate echoes in cases of intense air activity. The ability to count aircraft and determine formations is very useful. A high information rate is important, in case the bombers take evasive action, and a high traffic handling capacity is necessary if the facilities are not to be saturated in case of a heavy raid.

To meet these exacting demands it is necessary to design a heavy radar with a large rapidly revolving aerial and a powerful transmitter. If high traffic handling capacity is to be achieved, then the manpower and communication requirements dictate the construction of a very large station.

Height-Finder

The function of a height-finding radar is to measure accurate angles of elevation, to be used in conjunction with the range and bearing measurements of the main GCI or other radar in order to determine accurate height.

The usual design provides a "beaver-tail" beam very narrow in the vertical dimension, which scans from the horizontal up to 20° or 30°. To obtain a narrow beam with a rocking aerial of manageable size requires a short wavelength.

This so-called "nodding height-finder" concentrates on one target at a time, and so has a low traffic handling capacity.

Some GCI stations employ the "V-beam" principle of height-finding, which involves the provision of a second radar with its aerial mounted on the same turntable as the aerial of the main search radar. At the expense of additional complexity and extra displays, this allows simultaneous height-finding on a number of targets.

Anti-aircraft Tactical and Fire-Control

The contrary demands of high accuracy and of general surveillance over a large region make it impossible to combine in one radar the simultaneous functions of tactical control and of fire-control of anti-aircraft guns.

For tactical control it is necessary to be aware of the activity of all aircraft in the vicinity of the defended area, and to recognize any changes in their courses. Long range and good

discrimination (to aid in counting) are desirable, so that the beam will be concentrated in the horizontal plane by a broad aerial, and the rotation rate will be high.

For fire-control, on the other hand, the paramount need is for extreme accuracy. It will be necessary to ignore all but the single target under engagement, and to fix its position by the use of a short pulse and a rapid scan inside a narrow cone of vision.

Naval, Coast, and Field Gunnery

Observation of fall of shot, for correction of battery fire, requires very accurate discrimination in both range and bearing over a comparatively small region of the sea or ground in the neighbourhood of the target. The usual arrangement is to provide a rapid horizontal scan with a very narrow beam. For the coast, and especially the field artillery role it is important to have an inconspicuous aerial, so that very short wavelengths are necessary. Range can be sacrificed for discrimination, and short pulse lengths are used.

Counter Mortar

It is possible to locate enemy mortars by radar observation of their shells during the early part of their trajectory. A high information rate is required to ensure that the projectiles are detected during the short time taken to pass up through the beam. Consequently the area over which surveillance can be maintained is strictly limited. Accuracy demands good discrimination, and the small size of the target makes a highly concentrated beam obligatory. Accordingly, a short pulse length and short wavelength are indicated. Under these circumstances the range cannot be great, especially since proximity to the enemy makes a small inconspicuous aerial absolutely essential. It is unlikely that a large choice of sites will be afforded.

Airborne Warning and Gunnery

Interception and attack by night fighters, or warning and defence for night bombers, require radar for the dual role of search and fire-control. Any airborne equipment is subject to severe limitations on space and weight, and especially on the size of aerial which can be tolerated without serious adverse effect on the aerodynamic qualities of the aircraft. Searching the sky for an enemy and accurate location for gunnery pose competing requirements, and the compromise limits the sector of search to a cone ahead of a fighter and behind a bomber. Range is necessarily much shorter than would be desirable.

Airborne Search and Bombing

Air patrols over the sea, bad weather navigation, and blind bombing are all greatly aided by a downward-looking radar able to display

returns from all bearings. The restriction on space, weight, and aerial size are not quite as severe as for the previous categories of night fighters or bomber turrets. Moreover, longer range is required. The 360° coverage, together with a moderate information rate are obtained at the expense of high accuracy.

Aircraft Landing Aid

Ground radar to faciliate blind landings occupies a role for which both all-round surveillance with high traffic handling capability and accurate location of approaching targets would be valuable qualities. However, as has been seen so many times already, these two capabilities are incompatible and separate radars are required if both functions are to be performed simultaneously.

Searchlight Control

Direction of anti-aircraft searchlights for indication or illumination of enemy aircraft is a special function for which range information is not needed. Since it is convenient to mount the radar on the searchlight the size and weight of the aerial and other gear is limited. Long range and low angle cover are not needed, and a very simple design is adequate.

Rangefinder Only

For certain fire-control problems (e.g. day fighters or Light AA Artillery) it is desirable to use optical laying for bearing and elevation, (which is more accurate than can be achieved by radar) but to measure range by radar. The requirements for such a radar are extremely simple, since it need not have good angular discrimination and can be directed by the optical sighting system. A simple aerial and light construction are possible, since long range is not necessary.

The Water's Fine, But . . .

I discovered the following item in the 16 November 1951 issue of "The Spectator" (London). It is taken from a column written by "Janus" and entitled "A Spectator's Notebook".

> The first number of *Canal Zone* has reached my desk. It is what its name implies—a sheet published in the Suez Canal Zone for all the forces there, designed to give them an accurate summary of home and foreign—and particulary local—news . . . It is a wise departure, and deserves all success. Incidentally a deserved tribute to the way in which the Navy is keeping Canal traffic moving includes mention of a delivery of 34 tons of water to H.M.S. "Chequers" from an Army Lighter, accompanied by an exchange of courtesies between donor and recipient. "Water, with the compliments of all ranks of the Army at the port." "Thank you, Army, for the water. When does the beer follow?"

It sounds very British to me.—*J. M. Hitsman, Historical Section, Army Headquarters, Ottawa.*

A MAN IS AS IMPORTANT AS A MACHINE

By
Captain J. L. Hunter, PPCLI,
No. 1 Army Administrative Unit, Army Headquarters,
Ottawa*

Every gun, every vehicle and every other piece of heavy equipment in the Army has its own set of personal documents which accompany it throughout its service career. These documents are kept up to date by those who handle the equipment, and they reflect the state of the equipment at any given time. The documents are checked as a part of every regular inspection.

Every soldier, too, has all sorts of documents which follow him wherever he goes. However, there is at present no special document equivalent to a vehicle log book or gun history sheet maintained by the soldier's immediate commander, and showing his state at any given time. In this important respect soldiers receive less attention than machines, and one result is faulty man management. The platoon commander's well-known little black book is a step in the right direction, but its contents are not uniform and often meagre, and it has never been officially adopted in regulations.

Every junior officer should keep a record of each of his men. This record, which will be referred to hereafter as a log, should be kept in a small, looseleaf notebook, with two pages for each man. Ideally, the Army might adopt a suitable notebook as an official Canadian Army Book, and issue one to each junior commander, along with a supply of standardized printed first sheets, and blank second sheets. The form and maintenance procedure for these log books could then be laid down in orders. The books would be examined as a part of every unit and general inspection. Failure to keep these records up to date would reflect upon the officer responsible for them.

In the absence of an official book,

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junior officers should keep their own records.

It is proposed to discuss the information that should be kept in the official or unofficial log, sources of the information, and ways in which these notes should be used.

Information to be kept in the log has been grouped under four heads: Personal, Performance, Potential, and Periodic. The details are as follows:

Personal

(a) Number, rank and name.
(b) Date of birth.
(c) Religion.
(d) Marital status.
(e) Name of next of kin, relationship, and address.
(f) Number of children.
(g) Date of enlistment.
(h) Date of joining unit.
(i) M score (total and three subtotals, coded).
(j) Education.
(k) PULHEMS.
(m) Economic level (soldier's pre-enlistment income and present family status, as an indication of whether the man is likely to become a compassionate case for financial reasons).

Performance

(a) *Training:*
  (i) Basic unit weapons.
  (ii) Markmanship (rifle, LMG).
  (iii) Specialist training.
  (iv) Trades training.
  (v) Other courses.

(b) *Conduct:* A short record of offences and punishments, or a statement of the length of time without an entry on the conduct sheet.

(c) *Military Background:* Length of time in other units, and type of employment.

(d) *Leave:* A note of all annual leave completed and of any special, compassionate or sick leave granted.

Potential

In this section the commander should note the results of his observation and assessment of the man, as a guide to the man's future development. Information will fall under:

(a) *Trade or Specialist Potential:* The man's potential for training in a trade or specialty other than his present one. His previous civilian and military experience would be useful here, as would an extract of the information on his Personnel Selection documents. The man's own wishes and interests should also be considered.

(b) *Instructional ability.*

(c) *Leadership ability.*

Periodic

In this section the commander should note the results of periodic interviews with the man. It is considered that each man should be interviewed formally at least on the following occasions: on joining a unit, when leaving a unit (except for sick-

ness or wounds) and on each anniversary of his enlistment. Platoon commanders could conduct more frequent informal interviews during the evenings when his troops who live in barracks are "CB" for the usual "Make-and-Mend" periods.

At these interviews the commander should discuss the following matters:

(a) *Marital status:* Changes in status, new births, and particularly any kind of family difficulty.

(b) *Financial status:* Particularly debts, if any.

(c) *Performance:* Conduct. Strong and weak points in training. Man's views on past or future training and employment.

(d) *Present posting:* Man's views on present posting and location, and preferences for the future.

(e) *General:* Any other complaint.

In brief, the first section gives a basic picture of the man, the second section shows what he has done so far, and the third section shows what other things he may be expected to do. The fourth section provides a procedure for man management.

The main source of personal information about a man is the CAFB 1538, the Personnel Selection Record. This record is started when the man enlists, and additions are made to it whenever the man is interviewed by a Personnel Officer. This document was formerly held by the Personnel Officer on each station, but now it is kept with the regimental documents, where it is available to officers only. It should be read by all commanders, since it is the only source of M score and written personality assessment.

Sources of information about past training and conduct are the Individual Training Record and the Conduct Sheet. Current information on these two matters should be gained by observation.

A general source of information is the CA Bk 2 (Pt 1), the Soldier's Service Book. The information in this book, however, is greatly abbreviated, and not always complete. It should be used only when other sources are not available, as in the field, when documents and records are kept at the base.

The compilation of this log book would involve some duplication of information contained elsewhere. This is simply unavoidable, since other documents are not always easily available, and it is essential that junior commanders have their own records in their immediate possession.

Log books for men in a platoon should be kept by the platoon commander, for men in company headquarters by the Second-in-Command of the company, and for men in battalion headquarters by the assistant adjutant.

The log is of use in training and man management. In training, the commander must keep track of the

progress of his men, determine their capabilities, and attempt to employ each man at the level of his individual capability. The log provides a body of information which would assist, for instance, in assessing a slow learner to determine whether he was slow because he was dull, slow because he was lazy, or slow because he was distracted by some personal problem. Obviously, each of these cases would require different handling. A record of the decision in such a case would be of use to future commanders of the man.

Similarly, the log would aid in deciding what extra training or employment a fast learner should be given to keep him from becoming bored and losing interest. From among the smart, competent soldiers will come the potential instructors and NCO's, who should be identified and noted early, and encouraged as they develop.

At this point training and man management become merged. A happy soldier is one who is employed at work he likes and can do. In peacetime, his employment should have a future, although this is not so important during war. However, not all soldiers can advance all the way up the ladder of their occupation, because they are different in intelligence, education and personality. Some men will be able to reach the top in rank and group pay, while others will be limited to the first or second rung. Men who have reached the limit of their abilities pose a particular problem in peacetime. They must be handled with tact and sympathy, and made to realize that they are receiving all possible consideration. They must be persuaded to accept their lot, if possible, particularly if they seem unlikely to do better as civilians. It is felt that a number of men might be saved for long, regular service if their capabilities were examined early, and their limitations carefully explained to them. This implies, of course, some system other than a seniority list to let the smartest soldiers get ahead soonest, since they have the farthest to go. A log book is essential to this kind of personnel management.

The fourth section of the log deals purely with man management. Soldiers develop troubles just like machines, and they should be inspected periodically to ensure that they are running smoothly. The early discovery of instability, worry or grave discontentment will often enable a solution to be reached before the trouble becomes serious enough to cause a soldier to go AWL, slacken off in his work, or decide on termination of engagement as the only way out.

This kind of man management procedure is particularly important in the matter of re-engagements.

Present regulations require a man to state his intentions about re-engagement 120 days before his time is up. He must then be interviewed by a Personnel Officer.

These interviews are sometimes arranged so late that there is no time to save a man who is disgruntled and can see no answer to his problem. The question of re-engagement should be taken up by a regimental officer at least six months before a man's engagement ends. The man's hopes and desires should then be considered, along with his capabilities, in arranging for his next engagement. No man should be allowed to terminate his service only because he has a mistaken notion about the benefits of civilian life as compared with Army life, or only because he is dissatisfied with something that could be changed if caught in time.

When a man leaves a unit on posting or transfer, the log (official or unofficial) should be attached to his Personnel Selection documents for use by his next commander, or by Personnel Officers. At present one useful item of information that is missing from Personnel Selection documents is a periodic appraisal of conduct and performance by each man's company commander.

During active operations, the only source of information about incoming reinforcements will be their own Service Books, and logs should be prepared from these. When a man is evacuated for sickness or wounds, the log should be sent back to the base with the casualty returns. By the time the soldier has returned from hospital to his reinforcement unit, the log would be available for use by Personnel Officers who may have to re-allocate the man to different employment.

The preparation and maintenance of a log book would take time; but all commanders have time for the proper management of their men, for without men, commanders have simply no reason for existing.

Combat Boot

A new boot to keep the feet warm in 20 degrees below zero has been undergoing extensive testing by [U.S.] infantry troops in Korea. The rubber combat boot employs the "vapour barrier" principle which traps inner perspiration and keeps it warm at body temperature. The upper portion of the boot, a half-inch wool fleece liner, fits snugly about the leg and prevents heat from escaping. The boots can be worn in warmer weather without discomfort. Quite light in weight, the boots have a built-in-steel arch support for added comfort.—*U.S. Army Combat Forces Journal.*

BATTLEFRONT DUTY

National Defence Photograph

A smartly-dressed Provost Corps corporal directs traffic in front of a maze of tactical road signs at the Canadian Army's 25th Brigade Headquarters in Korea.

THE MAINTENANCE OF MILITARY SECURITY

CONDENSED FROM AN ARTICLE BY COLONEL ACHARD-JAMES
IN "REVUE MILITAIRE D'INFORMATION" (FRANCE)

There are very few fields in which the maintenance of secrecy is not an element of success. In fact, it is often the leading element of success.

Secrecy has a value of its own and one of its primary consequences is surprise. This often makes an action 10 times more effective than it would have been otherwise. Whether it be in domestic or foreign matters, a nation cannot conduct its affairs without secrecy.

Today, national defence reaches into all fields and all walks of life. Nearly everyone participates, in one way or another, in national defence and is aware of information pertaining to secret matters.

When a breach in security occurs, there is a switch over from total indifference to extreme measures. However, dominated by experimentation and of short duration, such measures usually have had no effect. The tendency seems to be to apply remedies as though the problem were a simple one. An analysis of the problem, however, will show its complexity.

What material is involved in a leak of secret information? Obviously, data which should remain concealed from the enemy. It may deal with equipment, forces, organization, methods, movements, actions, morale, means, or the efforts which have been or are being made to solve a particular problem. Therefore, it is obvious that one solution or measure will not apply to matters of such a varied nature.

Classified military information can be considered as falling into two categories. The first category includes information on things or events which exist at the present time; that is, equipment presently in use, a movement in execution, or an action in operation. The second category includes information on things or events which do not exist at the present time, but which will exist in the future; that is, equipment which is in the process of manufacture or development, and actions or movements which are contemplated.

Information falling in the first category is learned most often by direct observation; information in the

second category by conversations and documents.

Concealment from the enemy of existing facts, or of facts which are harbingers of future developments or events, poses many varied problems. However, these problems are relatively simple, and they can be solved by such measures as the executing of movements at night, the camouflaging of vehicles and equipment, and the employing of smoke screens.

The battle against the unwitting release of information is a problem which merits special attention. Generally, after such an incident, disciplinary action is recommended. However, it seems more logical to study the reasons for the unwitting release of information, and then to attack them systematically.

One of the most important causes is ignorance. This is the result of a lack of appreciation of secrecy in general.

The battle against ignorance is a matter of instruction and education.

As in all instruction, training can be conducted in two ways, namely:

1. *The informational method.*—Personnel must be made to understand the importance of secrecy by illustrating the relationship between the unwitting release of information and subsequent enemy action.

2. *The propagandistic method.*—Personnel must be made to realize the importance of secrecy through the use of posters or slogans.

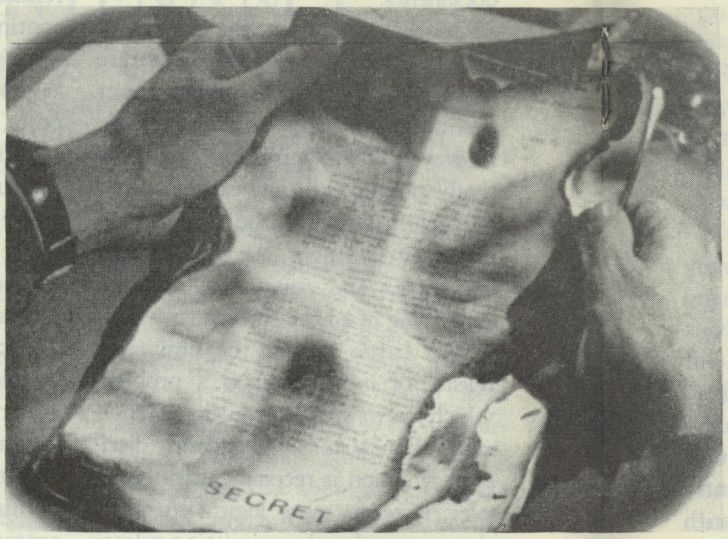
The battle against the unwitting release of information must include continual surveillance, by the military security agencies, of the personnel employed in the offices and command posts, as well as measures for safeguarding files and documents, the destruction of preliminary drafts, and security measures at places where secret matters are conducted.

The penalty should be severe against breaches of security discipline. The consequences are too serious to be tolerated.

Personnel who continue to release information, even though it is without intent, must be eliminated from positions where they will come in contact with classified information.

Often, large groups are briefed concerning future operations in which some classified information is presented. It is obvious that the larger the group, the greater the risks of having information released unwittingly. Therefore, each person should be told only what concerns him, and he should not be given such information until he is required to know it. Such a system would have several advantages. It would be easy to determine who had been given information, and the amount of information each person had been given. This system also would make it easier to modify plans if the enemy has been able to obtain some of the information which has been given out.

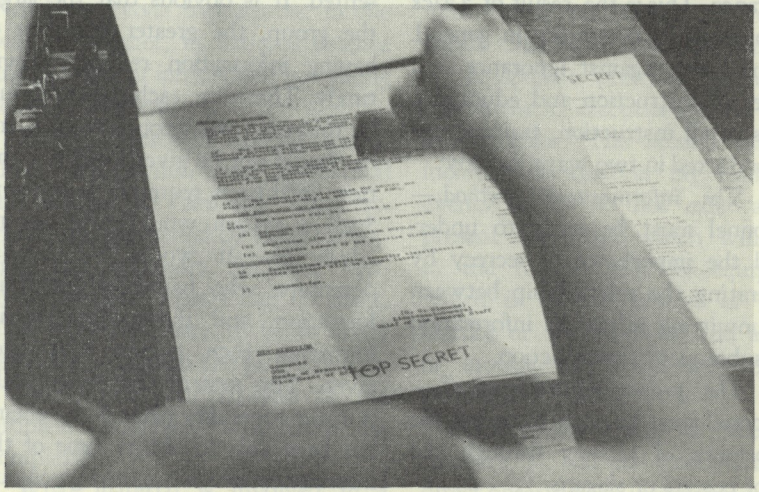
Check your Security!



STIR THE ASHES

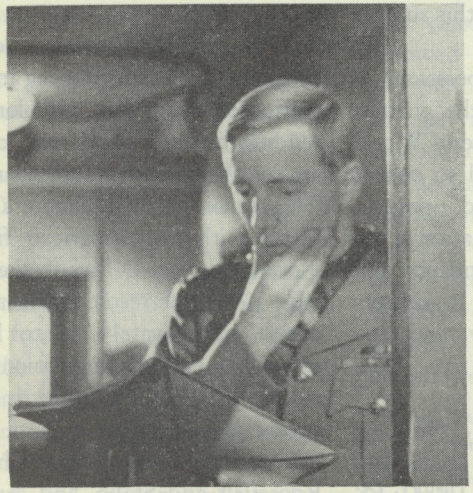
KNOW YOUR MESSENGER

These scenes are from the training film "Check Your Security" produced by the National Film Board in co-operation with the Directorate of Military Intelligence, Army Headquarters, Ottawa. Through the medium of an animated character called "ACORN", this film points out the basic principles of good office security and the correct procedures for the care and handling of classified information. "Check Your Security" (CA-51) is now available in Canadian Army Film Libraries.



TOP AND BOTTOM

"ACORN" The Call-Sign for Intelligence



KEEP IT COVERED

THE GREAT CROSS-CHANNEL ATTACK

Reviewed by Colonel C. P. Stacey, OBE, Director Historical Section, Army Headquarters, Ottawa

The United States Army's Historical Section (now known officially as the Office of the Chief of Military History) has been hard at work since 1945, pushing on with an enormous project of some 90 volumes, of which —disregarding four on the Army Air Forces published as a separate series—the seventh has just been published. It deals with the planning and execution of the Allied invasion of North-West Europe in June 1944. And the study which Mr. Gordon A. Harrison has produced on this subject is a very important book.*

Cross-Channel Attack possesses in an eminent degree all the virtues which students of the Second World War have already learned to expect of this series. It is based upon an extremely thorough examination of the American and German evidence and therefore is very accurate. It achieves an admirable objectivity and the narrative is strikingly free from national or other prejudice; if any element of prejudice is present—and it is hard to conceive of *any* book being wholly free from such—it appears rather in what is omitted than in what is printed. The maps and illustrations are extraordinarily fine. The book is clearly and competently written. With all this, it deals with one of the most vitally significant phases of the war. Obviously, then, this is a volume which intelligent officers will get hold of and study with care.

There are ten chapters. Seven of them deal with the planning and preparation of Operation "Overlord" (extending back to 1940); two of these are concerned with the German story. The remaining three chapters deal in detail with the American front in Normandy from D Day to the end of June 1944. The result of this arrangement, unfortunately, is to leave a somewhat peculiar impression on the reader. The first two-thirds of the book raise him to the highest level of international strategy, with Churchill, Roosevelt and Stalin, and carry him to London, Washington, Casablanca,

*Cross-Channel Attack. By Gordon A. Harrison. ("*United States Army in World War II: The European Theater of Operations.*") Office of the Chief of Military History, Department of the Army, Washington, D.C. 1951. $5.25.

Quebec and Teheran as the great plan slowly unfolds. The last third sets him down with a bump on "Omaha" Beach, and thereafter he is given a picture of the Normandy battle which is pretty narrowly limited to the U.S. sector and which sometimes gets down to company level. This is a history of the United States Army, and outsiders have no real right to complain; but this lack of balance both damages the book as an artistic production and lowers its value to students of war. One example of the treatment may be given. As readers of this review are aware, five seaborne assault divisions landed in Normandy on D Day, and one of them was the 3rd Canadian Infantry Division. That formation's operations on 6 June get one sentence. (We must certainly see to it that in the Canadian history the U.S. Army gets *two* sentences at the very least.)

The complicated planning story is admirably told, and the most captious critic will find it difficult to take much exception to it. Readers of Mr. Churchill's *Closing the Ring* will be interested in observing the manner in which the two books duplicate and confirm each other. In particular, they both, from their own viewpoints, give the same account of the very different approach of the British and the Americans to strategic questions. Says Harrison:

> The British said in effect, "How can we tell what we should do six months or a year hence until we know how we come out of next month's action?" The Americans retorted, "How do we know whether next month's action is wise unless we know where we want to be a year from now?" The positions were difficult to reconcile . . .

This conflict between flexibility and opportunism on one side, and a liking for long-term planning and long-term agreements on the other, has been pungently described by the British Prime Minister.

One tentative criticism may perhaps be offered. It would seem that Harrison's narrative gives rather too little credit to the Combined Commanders, the group of high-level British planners, with General Eisenhower associated with them, that considered the cross-Channel attack problem during 1942-43. The Combined Commanders' final plan, drawn in the spring of 1943, was considerably closer to the pattern actually followed in 1944 than was the COSSAC plan produced by General Morgan and his staff for the first Quebec conference.

The frankness of this book is beyond praise. As an instance, let us quote a passage dealing with the much-controverted question of whether or not there should be a ground commander-in-chief under Eisenhower:

> The issue of a ground commander for OVERLORD was raised in intramural discussions in the Operations Division of the War Department in September [1943] and came before the [U.S.] Joint Chiefs, but was

shelved there. The concept of a ground commander seemed objectionable on practical grounds. Since the supreme commander would be American, it was considered in September that the ground commander, if there was one, would also have to be American. But, as one officer in OPD pointed out, the "ruling factor" determining in practice the nationality of the ground commander would be the availability of a suitable individual to fill the position. He observed further that no U.S. commander had the battle experience and reputation to challenge the qualifications of the British generals, Montgomery and Alexander, for the job. The conclusion was obvious: it would be impolitic of the Americans to suggest the creation of the job.

It would have been easy to overlook or suppress this discussion, but the author, and the people responsible for the series as a whole, have preferred to publish the facts as they stand on the record.

The account given of German preparations and operations is most thorough and admirable, and in this respect particularly Mr. Harrison and the experts who have helped him dig the story out of the captured enemy records have placed all students of the war greatly in their debt. It is the fact—and here we come to a real weakness in the book—that a far better and more complete account is given of the German than of the Allied high-level direction of the fighting in Normandy. We are told all about Hitler and von Rundstedt and Rommel and their relations and discussions; but we are told next to nothing of the Allied command above Corps level. We learn that General Montgomery, who was controlling the ground battle, issued "his first written directive" on 18 June. But we know that written directives were a small part of his command technique. What had he been doing during the preceding twelve days? Presumably he had not been wholly idle; but you cannot learn from this book even when he came to Normandy or where he set up his headquarters. Part of the explanation may be that not all the vital records were available to Mr. Harrison; but the papers of 21 Army Group—which were certainly open to his inspection—would surely have yielded more than is presented here if they had been carefully examined. Whatever the reason, this book, excellent as it is, is far from telling the real story of Allied command in Normandy in June 1944. The whole question of whether Montgomery had a master plan before D Day, and if so what it was, is simply avoided. Perhaps the British official historians will fill the gap in due course. In the meantime, Chester Wilmot's fine unofficial book *The Struggle for Europe* (a more recent work than *Cross-Channel Attack*) makes a very trenchant presentation of the case for Montgomery.

We have emphasized that Mr. Harrison's book is in general very accurate and that the portions dealing with the Germans are exceptionally sound. But even Homer nodded, and

the place where Harrison nods is in a footnote on page 348:

> Apparently this [12th S.S. Panzer Division] reconnaissance unit tangled with the 3d Canadian Division near Authie and an engagement resulted heavy enough to give the Canadians the impression of an enemy counter-attack . . . The German *Seventh Army* war diary is, however, emphatic on the point that no attack by *I SS Panzer Corps* took place on 7 June. The narrative . . . of General Kraemer, chief of staff of the corps, confirms this.

This statement is going to astonish, and even incense, a good many ex-members of the 3rd Canadian Division. The North Nova Scotia Highlanders had 242 casualties on 7 June; 81 of them were fatal, and practically all of them were suffered in this attack at Authie. It takes more than an "impression" of an attack to inflict losses like this. And it was not the reconnaissance unit that did the damage. Kurt Meyer (then commanding the 25th S.S. Panzer Grenadier Regiment of the 12th S.S. Division) told Canadian interrogators later that this attack on 7 June was delivered by the 3rd Battalion of his own regiment and one of the division's two tank battalions, 40 or 50 tanks strong. It was a very powerful local attack.

Mark you, Mr. Harrison's statements about the evidence are perfectly true. The Seventh Army diary does say that the divisions of the 1st S.S. Panzer Corps didn't attack on 7 June; the chief of staff of the Corps did write later to the same effect. But both were wrong; and their wrongness is a tribute to the Allied air forces, which had disrupted the German communications in Normandy. Neither the Army diarist nor the Corps chief of staff was at Authie; but Kurt Meyer was, and so were the North Nova Scotia Highlanders. (Unfortunately, we have no diary for either the 12th S.S. Division or the 1st S.S. Corps; but it is a curious fact that, although the German Seventh Army didn't know about Meyer's attack, Army Group "B" did—thanks apparently to a wireless intercept from the 716th Division in the forward area—and recorded the information.) Perhaps this affair will give the reader some idea of the problems of evidence that confront the historian of modern military operations, and that make the writing of accurate history such a very slow business.

These criticisms of *Cross-Channel Attack*—some of them directed from a rather special and local viewpoint—are not much more than spots on the sun. This is an excellent book, a great contribution to the history of the Second World War and required reading for army officers interested in the literature of their profession. It increases the admiration which this reviewer—who claims to know something of such matters as the result of hard experience—feels for the achievement of those who are directing the

U.S. Army's historical programme. To them, as well as to Mr. Harrison, he now begs leave to lift his battered hat.

THE HOLDING ATTACK IN THE MEDITERRANEAN

Reviewed by Lt.-Col. G. W. L. Nicholson, Deputy Director, Historical Section, Army Headquarters, Ottawa

The growing number of books published by soldiers and statesmen who were in close touch with the Allied higher direction of the Second World War have established the subordinate position which the Italian campaign held in relation to the operations in North-West Europe—a status long suspected by the Canadian troops who fought on that "forgotten front" during the wet, frustrating autumn of 1944 and the weary winter months that followed. But to underrate the contribution of that campaign to the general victory would be as misleading to the student of military history as it would be unfair to the soldier who fought there. The recent publication of Lord Alexander's report to the Combined Chiefs of Staff on the final period of the campaign* should help to correct any such faulty evaluation.

The Report is the fourth by a Supreme Allied Commander Mediterranean to appear in print. It follows three by General Sir Henry Maitland Wilson (now Field-Marshal the Lord Wilson of Libya) covering the period from 8 January to 12 December 1944. Only the as yet unpublished reports by Sir Henry's predecessor, General Dwight D. Eisenhower, dealing with the campaign in Sicily and Italy during 1943, are required to complete a notable series. Fortunately, however, this gap has been to a large extent filled, particularly insofar as the operations on land are concerned, by the published *Despatches** of Lord Alexander in his earlier appointment of Commander-in-Chief of the Allied Armies in Italy (or the 15th Army Group, as the ground forces were earlier, and subsequently, known).

The Italian Campaign 12th December 1944 to 2nd May 1945, A Report to the Combined Chiefs of Staff by the Supreme Allied Commander Mediterranean, Field-Marshal the Viscount Alexander of Tunis (His Majesty's Stationery Office, 1951). Available from the United Kingdom Information Office, Ottawa, 75 cents postpaid.

The Conquest of Sicily from 10th July, 1943 to 17th August, 1943 (Supplement to the *London Gazette*, 12 February 1948).

The Allied Armies in Italy from 3rd September, 1943 to 12th December, 1944 (Supplement to the *London Gazette*, 12 June 1950).

Field-Marshal the Viscount Alexander of Tunis

Author of the report reviewed in the accompanying article, Field-Marshal Alexander was appointed Governor-General of Canada in 1945. On his retirement this year, he returned to England to take up his new appointment as Defence Minister in the British Government.

From the pen of Canada's seventeenth Governor-General has thus come a continuous account of the direction of the campaign in Italy which will place present and future military historians dealing with that theatre of operations deeply in his debt.

When the Field-Marshal relinquished to General Mark Clark command of the Allied ground forces in Italy in order to assume supreme authority over all three services in the Mediterranean, the Eighth Army's December offensive, which was to have paved the way for the Fifth Army's capture of Bologna before winter set in, was all but bogged down in the watery mazes of the Romagna, at the southern fringe of the Lombard plain. The 1st Canadian Corps in bitter fighting against a determined enemy who was aided by both terrain and weather had led the way across the Lamone River; and in the week before Christmas General McCreery's forces drove the Germans back to the line of the Senio. Before the Fifth Army's offensive through the mountains could be launched, however, the enemy, as though conforming to the pattern of the Ardennes offensive which was then raging on the Western front, struck a sudden blow against General Clark's lightly held western flank. Reinforcement of the threatened sector disrupted the Fifth Army's deployment for its assault on Bologna, and the target-date passed. On 30 December Alexander decided to go on to the defensive for the rest of the winter.

During the first three months of 1945 the main Allied effort in Italy was made in the air, as the Mediterranean Allied Tactical Air Force smashed at the enemy's communications through the Brenner and the north-eastern passes, while bombers of the Strategic Air Force struck at oil refineries and rail centres in Germany, Austria, Czechoslovakia and Hungary. M.A.T.A.F.'s campaign of interdiction was impressively successful. In spite of the enemy's employment of 55,000 men on repair work and another 50,000 on anti-aircraft defence, throughout the month of March, when the aerial attack reached its climax, virtually all routes leading to Germany were continuously blocked.

At a comparatively early stage in the planning for the spring offensive Field-Marshal Alexander knew that the 15th Army Group would launch its attack with considerably reduced forces. At the end of January he had attended the conference of the Combined Chiefs of Staff at Malta, where the decision was reached to withdraw from the Mediterranean Theatre for service in North-West Europe up to five British or Canadian divisions (actually only three were taken) and two U.S. fighter groups. The first troops to go were the Canadian Corps

(although quite properly the Report does not concern itself with the reasons for their selection). While their transfer by sea to southern France was accomplished without loss, the large-scale movement, notes the Supreme Commander, "provided one of the rare occasions in these months for a genuine naval action." On the night of 17 March the *Premuda*, a British-built destroyer, which from being the flagship of the Jugoslav Navy had passed through Italian into German hands, sailed from Genoa with two other German-manned destroyers, apparently with the intention of interfering with one of the Leghorn-Marseilles convoys. The enemy flotilla was intercepted off the northern tip of Corsica by two destroyers of the Royal Navy, and in the ensuing action both the *Premuda's* companion vessels were sunk.

Having stripped "Italy once more of tried and tested divisions for the benefit of the Western Front," the Combined Chiefs of Staff re-defined the Supreme Commander's role in a directive which set very modest aims and, writes Lord Alexander, "appeared to limit me to a mere offensive-defensive." While continuing to hold solidly the existing front and contain the German formations then in Italy, he was "to take advantage of any withdrawal or weakening of the enemy forces." Alexander wanted to "do something more drastic and decisive," and managed to win the support of the Chief of the Imperial General Staff, General Sir Alan Brooke. The result was the plan "to destroy the enemy south of the Po."

About one-third of the Supreme Commander's Report is devoted to the planning and execution of the great Allied offensive which opened on 9 April and ended 23 days later with the unconditional surrender of all enemy forces in Italy and Austria. Early in the planning the intended assault upon Bologna, objective of the autumn offensive, gave way to more ambitious aims involving wide-sweeping movements by both armies in order to encircle as many Germans as possible. It was once again the "strategy of the two-handed punch," which Alexander had successfully employed in the battle for Rome and in the assault on the Gothic Line.

The Eighth Army opened on the right with a two-corps attack between the Valli di Commachio and the Via Emilia, backed by 1500 guns and air support on a scale unprecedented in the Mediterranean Theatre—for by staggering the dates of each Army's offensive the Supreme Commander was able to provide each with the full strength of his air power. A British brigade in "Fantails" (landing vehicles, tracked) gained complete surprise by crossing the flooded flats on the enemy's left flank and landing

three miles behind his forward defences. Lord Alexander tells us that he had been convinced of the usefulness of these amphibians by General Foulkes, who before coming to Italy to command the 1st Canadian Corps had employed them successfully (as "Buffaloes") in the operations to clear the Scheldt.

On the morning of the 14th, when General McCreery's forces had closed up to their third river, General Truscott's Fifth Army, supported in its turn by impressive air strength, struck out from the northern fringes of the Etruscan Apennines. While the inner wings of the two armies closed in about Bologna, which was entered by Poles and Americans on 21 April, fast-moving columns drove northward on the outer flanks, to reach the Po within the next two days. The end was in sight. "For the first two weeks of the offensive, which brought us up to the Po," writes Lord Alexander, "we had been fighting a regular battle against opposition as strong as any we had met in Italy; but after the Po we were pursuing a routed enemy." While the Eighth Army headed up the eastern coast towards Trieste and the gateways to Austria, formations of the Fifth Army drove northward beyond Verona to the Brenner Pass, effectually sealing off Marshal Graziani's Ligurian Army and the other enemy forces in north-western Italy. In a general rising Italian partisans attacked retreating German columns and seized control of many cities and towns. There were wholesale surrenders, which culminated in the signing of the final instrument of capitulation on 29 April by representatives of General von Vietinghoff, Field-Marshal Kesselring's successor as Commander-in-Chief South-West. (To Kesselring, his "principal adversary" in 33 months of fighting in the Mediterranean Theatre, Lord Alexander attributes the quality of "obstinate steadfastness" rather than brilliant generalship—"though he could be out-thought, he could only with the greatest difficulty be outfought.")

Lord Alexander's readers will be grateful for the graphic account which he has appended of the negotiations leading to the final submission. Kesselring, who from 28 April was Supreme Commander of both the Western and Southern fronts, suspected that such discussions had begun and sent a General to replace von Vietinghoff. The suspense in which, nineteen months earlier, General Eisenhower awaited from the vacillating Badoglio confirmation of the Italian surrender was now repeated as Field-Marshal Alexander was kept waiting nearly three days for German acceptance of the conditions of capitulation, while von Vietinghoff and his would-be successor "alternately placed each other

under arrest or threatened to do so." The required acceptance arrived in time for hostilities to cease at noon on 2 May, when, in the first German capitulation of the war, nearly a million men laid down their arms.

Not the least gratifying aspect of the Report is the manner in which, to a far greater extent than in his earlier *Despatches*, the author appears to have drawn upon enemy documentary sources when describing German intentions and dispositions. Thus we are enabled to listen in to the perpetual argument that went on between von Vietinghoff and the High Command regarding Hitler's determination "to defend every inch of the North Italian areas;" and we are shown how the C.-in-C. South-West, completely taken in by the Allied cover-plan of simulating a landing north of the Po, shortly before the main offensive opened sent one of his two motorized divisions off to the Venice area—just as a year before when an Allied drive on Rome appeared imminent, his predecessor, fearing an amphibious assault north of the Tiber, had held the same formation at Civitavecchia, well away from the actual point of attack.

No one is better qualified to make an evaluation of the Italian campaign than the distinguished soldier who was responsible for directing the Allied operations during that period. In exactly twenty months his armies had fought their way up the length of Italy—at a cost of 312,000 casualties; enemy records give German losses up to the time of the capitulation as 536,000. Yet, as Lord Alexander points out, "any estimate of the value of the campaign must be expressed, not in terms of the ground gained . . . but in terms of its effect on the war as a whole." Committed to "a holding attack on a major scale," the Allied armies had been given the role of drawing in and "containing" the maximum number of enemy divisions that might otherwise oppose the forces of the United Nations on the main eastern or western fronts of Europe. According to the Report, "our strength was never allowed to grow above the minimum necessary for our task." Only in the period of the battle for Rome did the number of Allied formations in Italy exceed that of the enemy. During the critical summer of 1944 21 Allied divisions were holding 25 German divisions in the peninsula, and by the threat presented by their presence in the theatre tying down an additional 19 in the Balkans and eleven in southern France.

"The conclusion," writes Lord Alexander, "is that the campaign in Italy fulfilled its strategic mission." He has presented his case with considerable persuasiveness; nevertheless, it seems likely that the value to the Allies of the long and costly operation will continue to be debated for some time to come.

"Robot" Weather Stations

From "Armed Force" (U.S.)

Daily weather information is transmitted across the frozen waste of the Arctic region by a "robot" weather station that performs all weather observations, with the exception of measuring the ceiling and horizontal visibility, without the aid of technical or maintenance personnel.

The first Air Force "automatic weather station" was placed in experimental operation recently on Amchitka, a deserted island in the Aleutians. This "station", which replaced five trained weather technicians and additional staff members, is 50 times more powerful than any unit used previously, and has been tested at temperatures as low as 30 degrees below zero and in 180-mile-an-hour winds. Resembling an oversized truck, the equipment housing is 12 feet long and 6 feet wide.

A self-winding clock operates the meteorological instruments for a three-month period before servicing is needed. However, the Air Force hopes to increase this self-sufficiency period to 12 months.

The "robot" transmits its weather observations by Morse code through a programming unit which sends the information in established sequences.

Successful operation of this unit may result in similar units being placed in the polar region, where weather stations operated during the last war have since been abandoned.

"Dynamonster"

At the [U.S.] Army's Aberdeen Proving Ground ordnance experts now have a machine to test machines. Called the "dynamonster", the 60-ton equipment tester is used to take the wrinkles out of all types of military vehicles.

The huge machine, built at a cost of $250,000, can measure the power and performance of anything from the smallest jeep up to the army's heaviest tank.

The "dynamonster" gives information on such things as the pulling power of the engine, the speed of the vehicle, the amount of fuel it will use, its acceleration, and its manœuvrability.

Ordnance men at the testing area claim the machine has saved millions of dollars and countless lives by bringing out flaws before equipment is put into the hands of men in actual combat or training.—*Armed Force (U.S.).*

THE TURKISH SOLDIER — FIRST CLASS FIGHTER

R. M. Dobie in the "Army Information Digest" (U.S.)

Out from the khaki ranks standing stiffly at attention on a dusty drill field steps a Turkish private, selected at random for an interview with the American visitor. He has a strong, open face with well-cut features, bright eyes and the clear ruddy skin of a man who has lived close to the soil. Looking the interviewer straight in the eye, he answers the interpreter's questions with quick, frank phrases.

The scene is near Cankiri, Anatolia, Turkey, where recently I faced a company of Turkish infantry soldiers undergoing training at the Turkish Infantry School. To one side are the bleak military barracks. Men in khaki march back and forth over the dusty drill field. Nearby, burros huddle under a lone copse of trees.

For nearly five centuries Turks, like the man confronting me, have been fighting Russians in sporadic wars, except for those rare occasions when diplomacy made them allies to gain a common end.

The Turkish soldier gives his name Nazim Demirtas. He is twenty-two years old and comes from a small village near the town of Ordu about two hundred miles from the Russian border. He is married, the father of one child, and has already served some nine months of his two years of compulsory military training.

Like practically all of the other men in training at the Turkish Infantry School, Nazim has always been accustomed to a frugal, hard way of life. He expects no creature comforts in the army and is not disappointed when he receives none. He earns barely enough to cover the cost of coffee or a few packages of cigarettes. He has no pin-up girls over his locker; in fact he has no locker because he has few personal belongings.

When he entered the army, Nazim received one heavy wool uniform consisting of pants and jacket (no shirt or tie), heavy shoes, two pairs of socks, two pairs of undershorts and one undershirt. His head was shaved. If he had been physically or mentally unfit for field duty he would have been assigned to the non-combat functions important to every army. Illiteracy is no bar to military service. However, Private Demirtas is a literate soldier, being lucky

U.S. Army Photograph

The Turkish soldier, pledged to defend his homeland, has also volunteered to fight alongside United Nations forces in Korea.

enough to come from a village that had a school. About 60 per cent of the men around him, he says, can read and write and the army teaches the others.

Nazim is a bit puzzled when asked what he does for recreation. He really does not understand the meaning of the word. He says that he and his friends wrestle sometimes. There are no USO shows, no post exchanges, no motion picture theatres. He sleeps whenever he has a bit of free time—which is not often because the training day runs 12 hours or more.

To Nazim all this is not unusual. He worked hard on his parents' farm and he expects to work hard in the army. He answers reveille at 0600, has a breakfast of vegetable soup and thick bread served in a mess kit (no seconds and no coffee). He drills from 0700 to 1130, and at noon has a lunch of beans and rice with chips of meat mixed in. Again he has no coffee but is glad to get a helping of stewed plums for dessert. By 1300 he is back in the field and stays there until 1600. For supper he gets stew, bread and water. He attends class at 1915. Lights go out at 2000 hours.

Neither Private Demirtas nor his companions find anything unusual about all of this, even those who come from different environments. The man in ranks next to him, for example, is a small town merchant in civilian life but takes the rigours of training for granted. His father and grandfather both fought in wars against the Russians.

Private Demirtas' immediate superiors are as rugged and determined as he is. His corporal is twenty-seven years old, a regular army man who already has served nine years. He specializes in communications and can substitute as an anti-tank gunner or as a chauffeur. The first lieutenant in charge of the platoon is a graduate of the *lycee* (high school), was appointed to the Turkish Military Academy in Ankara and graduated with a commission after three years. He means to make the army his career and his greatest hope is to get a chance to go to Fort Benning in the United States when and if he is promoted to captain. He is better paid than the enlisted personnel but even if some day he reaches the exalted rank of a brigadier general, his pay and allowances will not equal those of a United States captain. And living costs in Turkey are high.

Would Nazim volunteer to fight in Korea and win the coveted red insignia of star and crescent which veterans of Korea wear on their right sleeves? Yes, he would volunteer. He is ready to die for his country. Some American officers who have served with the Turkish forces in Korea have observed that the Turkish

soldier is almost too willing to die. Given a hill to hold, Nazim and his companions would die before retreating. He has a somewhat oriental disregard for life; but now he is being taught that often it is better to live and fight for his country rather than to die foolhardily.

The average Turkish soldier differs from the average American enlisted man in that he is rarely familiar with mechanical contrivances. Young Americans learn to tinker with cars and motors as a matter of course; the average Turk, on the other hand, has never ridden in an automobile, much less taken an engine apart, when he reports for military training. American officers serving with the United States Military Aid Mission in Turkey report that while the Turk learns the fundamentals about as rapidly as the typical American soldier, he is a bit slower in catching on to mechanical procedures and marksmanship. Frequently the Turk takes a week longer than the American to qualify as a marksman. Yet, what the Turk may lack in mechanical aptitude, he makes up in his rugged physique, his ability to endure privation and his will to learn.

Today the Turks are working hard to improve their supply system, to mechanize their forces, to standardize their weaponsand training procedures, to streamline their staff system. Their high morale and fighting spirit have proved an inspiration to all free nations.

As one United States Army colonel who knows them well said, "I'm glad these fellows are on our side."

Television for the Army

The U.S. Army Ordnance Department is now using Television to observe dangerous operations in ammunition storage areas. Since 1942, heavy concrete barricades have been used to protect personnel in the disassembly of Ordnance missiles. The operators work behind these barricades, manipulating various tools by remote control. Mirrors used to watch these operations were not satisfactory, but a TV camera and receiver will give a close-up view of proceedings. It is possible for a single camera to transmit identical images to as many as ten different viewers. It is entirely possible that the use of TV as a "seeing eye" could be extended to use in Artillery. An observation plane fitted with a TV camera could fly over enemy lines and transmit a picture of the area to staff officers.—"*The Island Gunner*", *8 AAOR, RCA, Victoria, B.C.*

ARMOUR versus AIRBORNE

By

LIEUT.-COL. VERNON G. GILBERT, ARTILLERY INSTRUCTOR,
COMMAND AND GENERAL STAFF COLLEGE, FORT LEAVENWORTH, KANSAS*

The purpose of this article is to discuss the employment of armour in the defence against airborne operations. A large-scale airborne assault that would disrupt our lines of communications, combined with a major ground attack to destroy or capture our army forces, is a situation which our commanders in the field have not yet had to face. Such a situation obviously calls for a diversion of a portion of our forces, preferably armoured units, to crush the aggressor airborne force. An enemy airhead can be reduced quickly by the skillful use of our armour.

The Airborne Assault

As background for our discussion, we shall limit our scope here to the strengths and weaknesses of an airborne assault and indicate how the use of armoured units against that force must take into consideration those strengths and weaknesses. Our plans for a defence against airborne attack should minimize the effects of airborne strengths and exploit the weaknesses.

THESE ARE THE STRENGTHS:

Flexibility.—An airborne force has the ability to strike at any of several objectives, deep behind or close in to the line of contact.

Surprise.—The speed and capacity of modern aircraft permit the delivery of large numbers of airborne troops with their equipment with little warning and in a short period of time. Included in this strength is the sizeable shock effect developed by the suddenness and speed of the attack.

Defence of the airhead.—The airhead has a circular shape, which facilitates the massing of reserves and artillery at threatened spots. Outside of the airhead line, a reconnaissance and security line is established. Defensive positions take full advantage of all suitable tank obstacles.

Air support.—At least local air superiority is a prerequisite to the initial assault. Air power also contributes to the support of the defence of the airhead.

THESE ARE THE WEAKNESSES:

Initial vulnerability.—Airborne

* *This article is reprinted from the* Military Review *(U.S.). In his preface, the Editor of the* Review *states: "The views expressed in this article are the author's and are not necessarily those of the Department of the Army or the Command and General Staff College."*—Editor.

troops are extremely vulnerable while they are landing and assembling. A battalion requires from 30 to 60 minutes after landing to organize and be ready for action as a battalion. During this period, troops are effective only as individuals and small units. After this period, the airborne force grows progressively stronger until the entire force occupies an organized defensive position.

Heavy equipment.—Heavy artillery and armour usually are absent from the airhead.

Mobility and fire power.—Once on the ground, airborne units lack transportation and their fire power is more restricted than in conventional ground units.

Characteristics of the Defence

Now that we have examined briefly the strong and weak points of an airborne assault, let us consider them in relation to the characteristics we want our plans and actions to possess in the defence against an airborne attack. First, we want a functioning warning system to neutralize airborne flexibility and surprise. We must obtain accurate, timely information of the enemy's approach and of the area in which he will operate, to include drop zones and landing zones, and of his contemplated action after landing. Then, with this early information and the aid of a continuous flow of intelligence, we can attack immediately with forces locally available to prevent the organization and consolidation of the airborne elements and thus take advantage of the initial period of weakness. In this early phase of our defensive operation, light armoured units can provide the warning net and the subsequent flow of information, and light and medium armour can be used to block, attack, disrupt the organization, and isolate airborne elements. These armoured units must be superior in mobility, armoured protection, and fire power to the airborne units they oppose. The armour is aided, in this respect, by the airborne's inherent lack of heavy equipment, mobility, and fire power as compared with conventional ground units.

So far, then, our plans should provide for the warning of an assault, and the location and isolation of the airborne force. The remainder of the plans for an active defence operation is concerned with the attack to destroy the airborne force. This attack may be made by local forces or by a mobile reserve. It *must* be made without delay, however, before the airborne force can be built up and before the airborne action has so disrupted our movement of supplies that our attack cannot be supported logistically. The attack to destroy the invaders should be supported by anti-aircraft artillery units, and the

plan of attack closely co-ordinated with our air force to neutralize enemy air superiority.

Armoured Units

Next, we shall consider existing armoured units, and how we can utilize them to conduct the defence against airborne attack. Warning and information can be provided by the light armoured battalion and the light armoured regiment (armoured cavalry regiment). These units are organized, trained, and equipped for reconnaissance, security, and short-period combat missions. With their light and medium armoured protection, multiple means of communication, and fire power, they can locate the airborne main effort, report it, and conduct limited offensive operations to destroy small airborne groups, disrupt movement, and isolate larger airborne units, delaying their movement toward airborne objectives.

The attack to destroy a large airborne force can be conducted by armoured units such as one or more armoured divisions, reinforced with anti-aircraft artillery and engineers. The armoured division, with its flexibility of organization, armoured protection, and controlled fire power, can be used as a nucleus for the mobile reserve to conduct the attack to destroy the airborne force.

Timing of Attacks

Local forces, naturally, to include service and anti-aircraft artillery units, will be the first to be involved in an enemy airborne assault. These local units should attack immediately, if only small airborne units drop or land in their vicinity. However, their actions should be limited to the defence of their installations and critical terrain features in their vicinity, if the airborne force in the area has overwhelming superiority and an attack would have no chance of success.

Mobile reconnaissance (light armoured) units in the area transmit flash reports of the airborne attack, and operate to locate the airborne main effort and report it. If the airborne force is small, these light armoured units attack at once to disrupt their organization, to prevent their movement, and to isolate the invader. If the airborne force is so large that an attack would have no chance of success, the local mobile reconnaissance force maintains contact with the airborne elements, conducts a delaying action, and co-ordinates and assists other local units in the defence of installations and critical terrain features.

The mobile reserve, preferably one or more armoured divisions, reinforced with anti-aircraft artillery and engineers, attacks without delay under one or more of the following conditions:

1. The location of the enemy air-

borne assault is nearby (within a few hours march).

2. Cross-country movement, or movement over concealed and covered routes, is feasible as protection against air attack.

3. Protection against enemy air attack can be provided by our air force.

The mobile reserve may defer its attack until early the following day under these conditions:

1. The location of the airborne assault is several hours marching distance away.

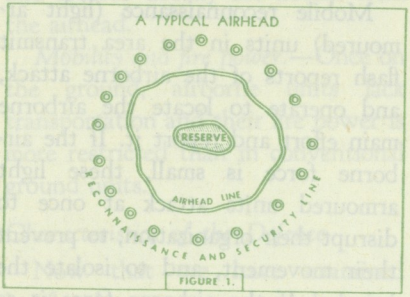


FIGURE 1.

2. The enemy air force has general air superiority and our air force cannot provide air defence for a movement in daylight.

3. Cross-country movement to the objective area is not feasible, and the mobile reserve must move on exposed routes and be subject to heavy losses from air attack while moving.

Conduct of the Attack

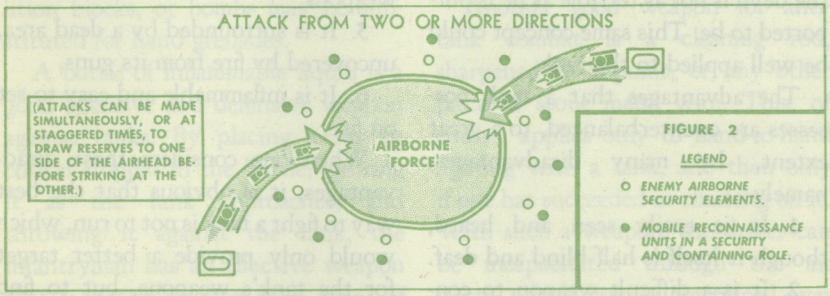
Speed and aggressiveness characterize the attack against an enemy airhead. An armoured attack, conducted quickly and vigorously, capitalizes on that period when the airborne forces are weakest and the armoured unit is exposed to air attack for a minimum period of time. Also, speed in the attack takes advantage of the airborne forces' restricted mobility. All friendly forces in the area, both service and combat, should be used during the attack of the mobile reserve to ensure success.

Comparative strengths and terrain permitting, the mobile reserve should attack from two or more directions against the enemy airhead. Compared with a main effort along one axis, an attack from two or more directions has several advantages. It provides maximum protection against enemy air attack by affording sufficient area for dispersion. It minimizes the airborne forces' ability to mass defensive combat power at a threatened point on the airhead line. It utilizes fully the control capability of armoured units, and should have a greater demoralizing effect because of the presence of tanks on two or more sides of the airhead.

Unity of Command

Unity of command should build up progressively with the arrival of friendly units in the area. Initially, the defence should be co-ordinated by the local area commander responsible for the integration of local installation plans with area plans for defence.

The first ground action is taken by local combat and service troops. The mobile reconnaissance unit commander should take command of all local forces in the area on the arrival of his unit. The mobile reserve commander takes command of all effective friendly forces in the area on the arrival of his unit. Unity of effort in the action is a prerequisite to the successful destruction of the enemy airborne force.



Air Support

During the conduct of the defence, air support may not be available because of the air situation. When the enemy has air superiority, the friendly air force concentrates on a counter-air effort. However, even if the enemy has general air superiority, close air support *can* be provided if the mission of the mobile reserve is of sufficient importance to the overall mission of the army-tactical air force team.

The armoured commander must be prepared to accept losses in an attack to destroy an airhead. However, losses from enemy air attack can be reduced by the adoption of the following measures:

1. Use of concealed routes or cross-country movement.

2. Dispersion and attack from two or more directions.

3. Speed and vigour in a co-ordinated attack to expose armoured forces for a minimum time.

4. Reinforcement with mobile anti-aircraft artillery units.

5. Co-ordination between the friendly air force and the ground commander.

Summary

In summary, these are the highlights which this article has stressed in the employment of armoured units against an enemy airborne operation:

1. Integrate armoured cavalry (light armoured) units into the organization of a warning system and an area defence plan.

2. Use reinforced armoured cavalry

INDIVIDUAL ANTI-TANK COMBAT

CAPTAIN ARKADY ROMANOWSKY IN "THE IRISH DEFENCE JOURNAL" (IRELAND)*

Written by a former Soviet Army officer, this article describes Soviet methods (individual action) of stopping and destroying tanks.—Editor.

There is a Russian folk saying that the devil is not as terrible as he is purported to be. This same concept could be well applied to the tank.

The advantages that a tank possesses are counterbalanced, to a great extent, by many disadvantages, namely:

1. It is easily seen and heard, though it itself is half blind and deaf.

2. It is a difficult weapon to conceal, because of its size.

3. It has less mobility than a man, and its movement is influenced, or even restricted, by the terrain over which it is operating.

4. Its fire is inaccurate and scattered on the move, and in a still position it presents a good target for enemy weapons.

5. It is surrounded by a dead area, uncovered by fire from its guns.

6. It is inflammable and easy to set on fire.

When one considers these disadvantages, it is obvious that the best way to fight a tank is not to run, which would only provide a better target for the tank's weapons, but to find cover and prepare for an assault on the the tank.

What, then, are these methods of assault, and how can they be best applied?

*This digest is reprinted from the Military Review (U.S.).—Editor.

ARMOUR versus AIRBORNE

(*Continued from preceding page*)

(light armoured) units or armoured divisions as the nucleus for the mobile reserve.

3. Establish unity of command over all friendly units in the area of the assault. Invest this command in the commander of the largest tactical unit present.

4. Conduct the attack with speed and vigour; the earlier the attack the better will be its effect.

5. When relative strengths and terrain permit, attack from two or more directions.

When a tank has been spotted, it is an easy job to tie three or four hand grenades together and throw them under the tank tracks. Of course, this will mean that the person throwing the grenades must remain concealed until the tank is within easy throwing distance. If successful, the tank tracks will be destroyed or badly damaged, and the fighting power of the tank will be lost. Anti-tank or anti-personnel mines, dynamite, demolition blocks, or bombs may be substituted for hand grenades.

A bottle of inflammable liquid is a good offensive and defensive weapon against tanks. By placing a rag or cotton stopper in the bottle, igniting it as the tank approaches, and throwing it against the tank, the infantryman has an effective weapon that is certain to stop most types of tanks.

By fastening wire hooks to smoke pots, and then hurling them onto the tanks, the infantryman has another weapon that is almost as dangerous to a tank as fire. These hooks often will catch in a slit or the smoke pots will remain suspended to some protrusion on the body of the tank. The smoke penetrates through every slit and fills the body of the tank, remaining inside long after the pot itself has stopped smoking. The driver and the entire crew are not only blinded, but suffocated as well. Their only road to escape is to open the turret and stick their heads out for fresh air. They are no longer capable of fighting.

If a shelter half is available, it can be put to good use. Thrown over the turret or in front of the vision slit, it will blind the tank and deprive it of its combat efficiency. If a shelter half is not available, a blanket or field coat can be used effectively.

Another good weapon for anti-tank combat is a cleaning rod, sharpened to a point, or any other piece of stout metal wire. This, of course, applies only to hand-to-hand fighting with a tank, and then only if one has succeeded in climbing on it. With such a weapon, the driver can be incapacitated through the air vents, which usually are placed over his head. Other slits also may be found to overcome the crew in a like manner. It also is possible to fire a pistol through the air vents, or even to introduce the muzzle, minus the foresight, into the inside of the tank.

Another method of combating tanks is to tie mines or grenades to a long piece of wire and stretch it between two slit trenches. Thus, two men, one in each trench, can wait for a tank to approach, and then move the explosives into its path.

TANKS IN DEFENCE IN KOREA

Lieut.-Col. George B. Pickett, U.S. Army,
in "Armour" (U.S.)*

A battered little village in Korea and some good tank terrain form the background for this story of American Armour in support of British, Canadian, Australian and Republic of Korea infantry — an example of United Nations teamwork that represents the spirit behind the forces fighting for freedom.

To most people on April 23, 1951, Kapyong was just another of a series of desolated little villages in Korea. It consists of two by-passes, a pile of destroyed native huts, and the shells of four stone buildings. If you drove through there, nothing unusual would appear to you unless you were a tanker. If you were a tanker, you'd see a sight seldom seen in Korea—good tank terrain! Kapyong sits on the Pukhan River about 12 miles west of Chunchon and 40 miles north-east of Seoul. This Seoul-Chunchon road was a Main Supply Route for IX Corps units during April, 1951. Opening north of Kapyong is a big (for Korea) wide valley in which two tank companies can manoeuvre cross-country. This valley runs north to the little crossroads village of Cheryong-ni, where it branches into a north-west and north-east branch. These branches are narrower than the main valley. Only one company can be deployed at a time across the branch valleys, which extend about three miles north-east and north-west from Cheryong-ni.

Elements of IX Corps were attacking north towards an objective south of Kumwha when the Communists began their offensive in the IX Corps zone in the evening of April 21.

On the evening of the 23rd, the 6th Republic of Korea (ROK) Division, the left unit of IX Corps, came under heavy enemy attack. The division fell back at eight o'clock, but even before that hour, enemy elements were in the rear of the division. By ten, the division was withdrawing. At eleven, it attemped unsuccessfully to reorganize in the vicinity of Sangnamiong.

During the afternoon and evening of the 23rd, Company A, 72nd Tank Battalion (less 3rd Platoon) and the

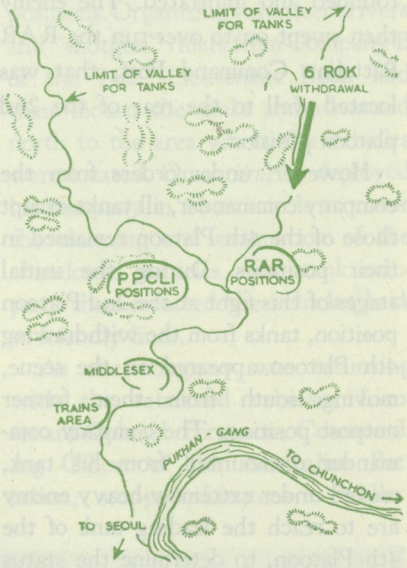
*This article has been condensed by the Australian Army Journal and is reprinted from that periodical.—Editor.

3rd Battalion, Royal Australian Regiment, of 27th British Commonwealth Brigade, moved into positions north of Cheryong-ni, in order to cover the withdrawal of the 6th ROK Division. At nine p.m. elements of the 6th ROK Division began a withdrawal south through the positions held by A Company, 72nd Tank Battalion, and the RAR Battalion. Leading elements of attacking Red forces were in contact with the rearmost withdrawing elements of the 6th ROK Division.

Dispositions

Lieutenant Kenneth W. Koch, the tank company commander, had placed his platoons so that the 4th Platoon was in an outpost position on the only north-south road in the area. The first platoon, Lieutenant Miller commanding, was in a position on a high ground area flanking this road on the west, and south of the 4th Platoon blocking position. The RAR Battalion was deployed on the ridge on the east flank of the road. The 2nd Platoon and Lieutenant Koch's command tank were deployed at a crossroad to the south of the other tank positions, where the north-south road joined a north-west-south-east road. The latter road was being used by elements of the 6th ROK Division as an avenue of withdrawal.

The first Red patrol hit and was destroyed by the 4th Platoon at its blocking positions at nine o'clock. Two hours later large numbers of enemy heavily attacked the friendly positions. One force struck directly at the 4th Platoon. The platoon leader was mortally wounded. He died almost immediately, but not before issuing the order to his platoon to make a fighting withdrawal to previously prepared alternate positions with the 2nd Platoon. Three other tank commanders were also seriously wounded in the attack which enveloped the 4th platoon. However, the platoon withdrew successfully to the alternate positions.



Concurrently with the attack on the 4th Platoon, other elements of the advancing Reds circled around the hill mass on the west of the

road. They by-passed the 1st Platoon, which could not locate the enemy below because of the lack of any kind of natural or artificial light. This attacking force swept around the hill mass and swung again to the east to strike at the 2nd platoon positions, which were soon surrounded and infiltrated. The enemy then swept on to over-run the RAR Battalion Command Post, that was located well to the rear of the 2nd platoon position.

However, under orders from the company commander, all tanks except those of the 4th Platoon remained in their positions. During the initial stages of this fight at the 2nd Platoon position, tanks from the withdrawing 4th Platoon appeared on the scene, moving south from their former outpost position. The company commander dismounted from his tank, moved under extremely heavy enemy fire to reach the leading tank of the 4th Platoon, to determine the status of its personnel. Upon learning of the heavy casualties in the platoon, he ordered all the wounded and dead, which included four of the five tank commanders, loaded on three of the tanks, and ordered the tanks to run the enemy force and return the wounded to the company trains area for treatment. He also instructed the ranking NCO in this group to obtain replacement crews from the company headquarters personnel and return immediately to the scene of battle.

Hot Action

The company commander then placed the remaining two tanks of the platoon into position with the 2nd Platoon and then, still under heavy enemy fire, returned to his command tank and continued to direct the action of his company. At one time the enemy succeeded in setting up a machine-gun emplacement between the command tank and that of the 2nd Platoon leader. This gun was reduced by tank fire. The Chinese attempted to mount the tanks and destroy them with grenades and satchel charges, but were destroyed by fire from adjacent tanks. One tank received a direct hit with a 3.5 rocket launcher that killed the loader and mortally wounded the tank commander. However, the position of the tanks was so encircled by this time that it was impossible to evacuate either of these two men or any of the less seriously wounded. The fighting continued with unabated fury until daylight.

At dawn the Reds began to withdraw. As they attempted to pull back along the west of the hill mass around which they had attacked the night before, the 1st Platoon opened fire. This placed the enemy force in a crossfire from sixteen tanks, for, by this time, the three tanks of

the 4th Platoon had returned to the 2nd Platoon positions after fighting back up the entire length of the route. This crossfire into the withdrawing enemy continued until all targets were either destroyed or dispersed. It was later determined that more than five hundred enemy were killed in this action.

At this time the tanks, then dangerously low on ammunition, were ordered by the commander of the 27th Brigade to withdraw. The RAR Battalion was also ordered to withdraw, but the enemy was still surrounding its position, preventing this.

Lieutenant Koch led his company to the trains area. This withdrawal was conducted under automatic weapons and mortar fire from enemy positions which had been established on the high ground flanking the road leading south to Kapyong. At the company trains area the tanks were refuelled and resupplied with ammunition.

Lieutenant Koch was informed that approximately fifty friendly vehicles belonging to the 2nd Chemical Mortar Battalion and Company B, 74th Engineer Battalion, had been abandoned in an area immediately south of the company's previous positions. Organizing volunteer drivers and "shotgun" riders from Company B of the 74th, Lieutenant Koch had them mount the tanks and advanced north to the area where the vehicles were located. On arrival he deployed his company in a semi-circle to cover the manning and evacuation of the abandoned vehicles. The tank company then escorted the vehicles back to friendly lines.

As the company was returning with the retrieved vehicles, Lieutenant-Colonel Ferguson, Commanding Officer of the Australian Battalion, stopped Lieutenant Miller,

National Defence Photograph

Men of the Royal 22nd Regiment now serving in Korea are brought in from patrol on tanks of the Lord Strathcona's Horse Regiment. Here they "disembark" and board waiting trucks from the 54 Transport Company, Royal Canadian Army Service Corps.

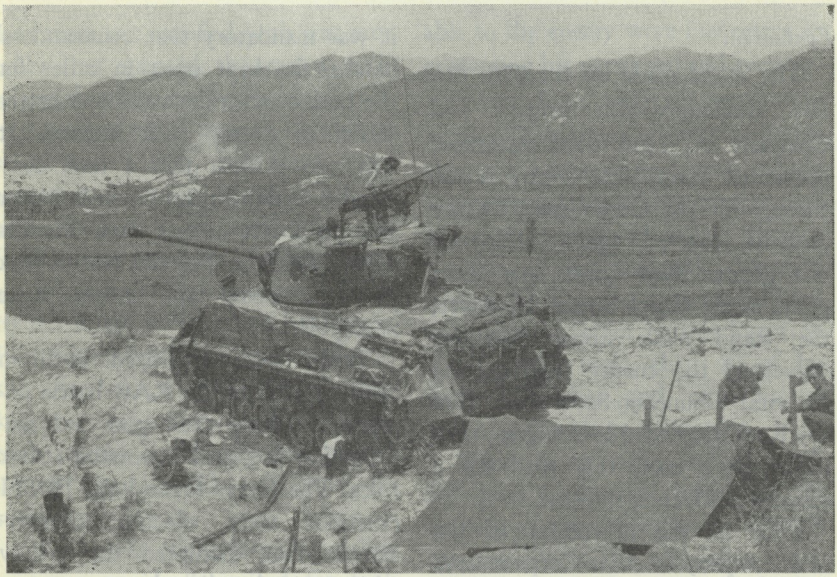
of the 1st Platoon, and asked him to take ammunition up to cut-off units of the RAR. Colonel Ferguson, riding as loader in Lieutenant Miller's tank, directed them up to the surrounded positions. There Lieutenant Miller picked up Australian wounded and placed them in and on the tanks. The tank crewmen got onto the rear decks of the tanks both to make room for the wounded inside the tanks and also to help hold the wounded on the outside while the tanks descended from the hills. The wounded were returned to safety. The platoon then returned to the cut-off RAR positions, delivered more ammunition, and brought out more wounded. Sixteen wounded Australians were evacuated during this action. Two tank crewmen were wounded during this phase of the action by the heavy fire placed on the tanks as they moved back and forth from Kapyong to the RAR positions at Cheryong-ni.

Tank Cover

Shortly before noon of the 24th, the plight of the encircled RAR Battalion was reported to Lieutenant Koch. The battalion had still been unable to disengage from the enemy and withdraw. In order to relieve the enemy pressure the tank company advanced back to the Cheryong-ni crossroads. Covering forces were despatched up the north-south road, enabling the RAR Battalion to disengage and initiate its withdrawal. The tank company then returned to its assembly area north of Kapyong.

About noon it was apparent that some relief would have to be sent to another element of the Commonwealth Brigade, the Princess Patricia's Canadian Light Infantry (PPCLI) Battalion. This unit was located on the high ground south-west of the Cheryong-ni crossroads. The north-west-south-east road ran to the north of the Canadian positions. At this time the enemy forces had partially overrun the PPCLI and were exerting heavy pressure on them.

Early in the afternoon of the 24th, Koch led a tank counter-attack into the area in rear of the Chinese Red force attacking the PPCLI. Moving directly to the north of the surrounded PPCLI, under heavy enemy fire, the tanks placed intense fire on the enemy forces, then withdrew south. Again at daylight on the 25th the company commander led two more tank counter-attacks into the same area, each time directing heavy machine-gun and tank cannon fire on the enemy, causing him to divert his effort. These counter-attacks, coupled with the gallant action of the PPCLI Battalion in placing continuous fire on the enemy and calling for artillery on their own positions, subsequently resulted in a lessening of enemy pressure and finally in an enemy withdrawal. The tank company re-



National Defence Photograph

A "C" Squadron tank of the Lord Strathcona's Horse Regiment stands guard over the 38th parallel in Korea in support of "B" Company, Royal 22nd Regiment.

turned to its assembly area north of Kapyong at about noon. The enemy made no further offensive efforts in the Cheryong-ni area that day.

During the Cheryong-ni-Kapyong action on 23-25 April, 1951, Company A, 72nd Tank Battalion (less 3rd Platoon) killed more than 800 Reds, recovered approximately 50 abandoned UN vehicles, covered the withdrawal of the surrounded RAR Battalion, and relieved the enemy pressure on the PPLCI Battalion sufficiently for it to withdraw on order.

No tanks were lost during this period, although two received 3.5 rocket hits. Personnel casualties were surprisingly light. The 3rd Platoon, Company A, 72nd Tank Battalion (Lieutenant Monroe) did not participate in the action, but remained in Corps Reserve at Hongchon. Poor Monroe was like a fish on a hot griddle during the entire period and did everything short of creating a riot to be sent to Kapyong to join the company, but he could not be spared from the task he was performing at the time. The company (less 3rd Platoon) entered the action with 16 operational tanks and finished the action with 14 operational tanks.

Evaluation

The stand made by the 27th British Commonwealth Brigade and Company A, 72nd Tank Battalion, prevented a complete enemy breakthrough in the Corps zone. Enemy pressure exerted against Kapyong was greater than against any other point in the Corps sector. However, the stand made above Kapyong prevented the enemy from cutting the vital Chunchon-Seoul road. Had the Reds succeeded in doing so, they might have used this road for a successful advance on Seoul.

Prior to the movement of the tank company from its Corps reserve position at Hongchon to Kapyong, the company commander made an aerial reconnaissance of the entire sector of anticipated employment. One of the company officers and the IX Corps Armour Officer made a detailed tactical, terrain and trafficability reconnaissance of the area on April 16. These officers provided the company commander and the G-3 of IX Corps with marked maps showing assembly areas, objectives, firing positions, routes, and tank capacities of the valley areas. Prior to the enemy attack, the tank company commander had further reconnaissance conducted by his small unit leaders.

Poor Tank Hunting

During the close-in night fighting, it was mandatory that commanders' hatches be kept open in order for the tank commander to have a better vision of enemy tank hunters. It was also evident that a tank commander with an open hatch is better able to locate enemy tank hunters during daylight. For this reason tank losses to enemy tank hunters were negligible.

Tanks were employed both in close support of the RAR battle position, utilizing tank gun and machine-gun fire, and in counter-attack roles. The forays behind the PPCLI positions were effective counter-attacks that disrupted the enemy advance and relieved pressure on the friendly infantry forces. The size of the tank unit in the counter-attack may be as small as a platoon, yet still launch an effective counter-attack.

The initial action of the 4th Platoon was that of a combat outpost. Ordinarily, tanks on combat outpost are employed to support infantry, but in this engagement the tanks alone were a combat outpost.

Mutual confidence between tanks and infantry is essential in any combined arms action. The teamwork between the tank company and the RAR Battalion was outstanding. As the operations progressed, the RAR platoons looked for "their" tanks by the large red numbers on the turret. The individual infantry-

men were not satisfied with just any tanks, but wanted the crews with whom they had been operating.

A tank is not a weapon capable of continuous action, but most have a protected area in which it can be maintained and serviced when refuelling and resupply of ammunition are necessary. The resolute defence by the RAR, PPCLI, and Middlesex Battalions contributed materially to the effectiveness of the tank actions by providing a firm base from which tank attacks could sally and behind which they could withdraw to resupply.

The terrain of the Kapyong valley system was ideally suited for tank counter-attacks. The prior reconnaissance, terrain estimates, and trafficability studies materially contributed to the success of each counter-attack, since the platoon leaders were familiar with the routes, objectives, and possible enemy concentration areas. This prior information enabled the tanks to advance rapidly to known areas and to avoid adverse terrain and areas of poor trafficability.

The effectiveness of tanks against infantry in the open was demonstrated. The relative ineffectiveness of the rocket launcher in open terrain against a co-ordinated tank effort was readily apparent. Although two tanks were hit by rockets and casualties sustained, the rocket launchers available to the enemy were ineffective in protecting his personnel and preventing him from suffering staggering losses. This action clearly indicates that the rocket launcher is merely a supplemental anti-tank weapon and can not be regarded as the primary weapon of an anti-tank defensive system. One enemy tank would have been able to inflict greater losses on the friendly tanks than all of his rocket launcher and tank hunter teams were able to accomplish.

There is no substitute in battle for good leadership. Much of the success of this operation is directly attributable to the aggressive determination and outstanding leadership of the company commander and his platoon leaders.

Lessons Learned

1. Tanks should normally be included in the combat outpost when terrain permits. They may serve as the entire combat outpost; however, they must be screened by dismounted personnel at night.

2. Fewer tanks are lost to tank hunter teams when tank commanders fight with their hatches open than when "buttoned up". This does not apply to the driver.

3. A tank commander is more effective when he fights his crew than when he spends a large part of the action firing the turret-mounted .50 machine-gun. The turret gun is

advantageous when tanks are giving overhead fire support to advancing infantry, not in primarily tank actions.

4. Tank unit leaders command by means of their radio net and movement of their tank. A dismounted tank platoon leader is relatively ineffective in attempting to run around the battlefield to direct his tanks.

5. Mutual confidence between tanks and infantry is essential to the success of all operations.

6. Tanks employed on the MLR are very effective against enemy personnel in the open.

7. Rocket launchers are relatively ineffective against properly supported tank attacks in open terrain. They are effective against tanks operating in close terrain, defiles, woods, and built-up areas. When operating in such areas, tanks should be adequately supported by infantry.

8. The Reds attack principally at night. In the early light of morning, those enemy forces in the rear areas, during this operation apparently were still in their assembly or reserve positions, and not deployed. By attacking as soon as there was sufficient light, the tanks obtained surprise.

Summary

It has already been pointed out in several articles covering fighting in Korea that terrain has been the limiting factor relative to tank employment. However, in those areas where tanks can be employed, even if only a platoon can deploy up a small valley, tanks have spelled "SUCCESS" and casualties have been low. Success can also be obtained on the defensive by selecting a favourable tank "killing ground" and chopping up the enemy when he attempts to cross that area. Kapyong was such a "killing ground". It halted the Red advance in that sector.

Anti-Aircraft Training

A recent development of an American electronics firm provides the answer to scoring in air gunnery training.

A specially-designed miniature radio unit mounted in a towed sleeve target automatically transmits and records each shot in relation to the target instantaneously. It is not necessary to hit the target to record the shot—in fact, not many gunners do, especially beginners. The electronic device determines accurately the area of the shots in relation to the target—even misses are recorded. The gunners can then make corrections for errors immediately.—"*The Island Gunner*", *No. 8 Anti-Aircraft Operations Room, RCA, Victoria, B.C.*

FIRE FROM SMALL ARMS WEAPONS

By
CAPT. R. BROWNE, DIRECTORATE OF INFANTRY,
ARMY HEADQUARTERS, OTTAWA

There appears to be an increasing amount of debate in recent months on the premise that "volume of fire" rather than "accuracy of fire" has become more important to troops armed with small arms weapons.

At first glance it would appear that "volume of fire" concept is correct, since the development of small arms has resulted in weapons capable of full automatic and very rapid fire. From the days of the muzzle loader, through the breech loader, semi-automatic, until the production of today's rifles and machine-guns, it would appear that the greatest emphasis has been given to the development of weapons that will spit forth the greatest number of rounds in the shortest time.

Put a few of these rapidly firing weapons in the hands of a few soldiers facing an enemy and the picture is presented of a foe unable to move, beaten into the earth, unable to rise or advance because of the hail of bullets churning up the ground about them.

The other side of the picture, however, is presented by a certain colonel who watched an exercise during which a number of troops fired at an attacking enemy. The enemy was realistically presented by targets that kept bobbing up closer and closer to the firing line. He states the volume of fire was impressive. But after the smoke had cleared, and targets were examined, it was found only a few were hit. The majority of all targets were not hit.

It seems logical to assume that if these troops had been trained to a fair degree of efficiency — if they had been properly taught aiming, burst fire, etc. — the resulting number of target hits would have been much greater. If a soldier, figuratively speaking, closes his eyes and blazes away with a full magazine or belt without any attempt to control his aim, the results will always be poor no matter what weapon he may be using. By applying a few basic principles of firing technique nothing can possibly be lost by placing a rapidly firing weapon in the hands of an infantry soldier. Rather, much can be gained that could never be gained

if slow single shot weapons were used alone.

If a small number of men, for example a recce patrol, were presented as a target, then a single shot rifle would undoubtedly be the most effective. However, if this number were multiplied to present a target of approximately company strength, then the automatic weapon comes into its own. It is undeniable that the chance of killing all enemy is greater because more *aimed* rounds would be going their way in a shorter time and their opportunity to take advantage of cover is diminished. The danger of continuing to move over ground on which *aimed* rapid fire is coming is greatly increased, when compared to the danger of moving over ground exposed to single shot fire.

The whole principle of "beaten zone" and "danger area" bears out the fact that an enemy stands considerably less chance of survival when faced with *aimed* rapid fire as compared with *aimed* single shots.

The question is often asked, "Isn't it more apparent that a single shot which hits the target is more effective than a hundred rounds which miss?" You can only answer "yes". However, if one man is going to miss completely with several rounds from an automatic weapon, then that same man is going to miss completely with one or more rounds from a single shot weapon, assuming the same degree of training has been given on both weapons.

The purpose of all fire on the battlefield is to kill or immobilize the enemy. Neither automatic, nor single shot fire can do this unless the man on the trigger is trained properly. If fire being brought to bear on an enemy is aimed and accurate, the advantages of increased volume are unquestionable. Therefore, let the phrases "volume of fire" and "accuracy of fire" be consolidated and applied in training and operations as "volume of accurate fire".

The Ragged Levies

Lieut.-General Arthur Wellesley, one day in 1809, stood in Spain and surveyed the ragged levies sent him for his Peninsular Campaign against the French. "I don't know what effect these men will have on the enemy," said the man who was to go down in history as the Duke of Wellington, "but, by God, they frighten me."—*Extracted from a book review, "The Letters of Private Wheeler", published in* Time *magazine.*

CAPTURED WEAPONS

National Defence Photograph

When Chinese troops retreated after launching an attack on The Royal Canadian Regiment positions in Korea they left behind a great deal of equipment. Here the two soldiers in the foreground hold the 7.62mm DEGTYAREV, a Russian-type light machine-gun used extensively by Chinese and North Korean troops. The other RCRs hold Russian-made "Burp Guns", the P.P.S. (1943) 7.62mm machine carbine.

CHAPLAIN'S MEMORIAL FUND

From the Directorate of Public Relations (Army),
Army Headquarters, Ottawa

A Canadian Chaplains' Memorial Fund, created to provide educational opportunities for children, has been set up on a voluntary basis by the Royal Canadian Army Chaplain Corps (Protestant).

The first of its kind in Canada, the fund is designed for the advancement of education for children of corps members who lost their lives or died as a result of active service in the Army.

Col. C. G. F. Stone, MBE, Director of RCAChC and member of the administrative committee controlling the fund, said that only in very few cases were widowed mothers of service chaplains able to provide higher education for their children on pension income. The fund will provide grants to cover tuition and related educational expenses. Each case, Col. Stone said, will be studied with a view to providing maximum assistance in the field of education desired.

Children seeking a higher education with the intention of being ordained to the Christian Ministry may be given additional grants within the limits of the fund.

At the present time the fund is being maintained by annual donations from all Protestant Active Force chaplains in the Army, a group soon to reach 50 in number. Additional donations are being sought from all Protestant ex-chaplains who served in the Army during the last war.

Nine Protestant Army chaplains lost their lives on active service in the Second World War. They left behind eight orphaned children who will be among those considered for educational help.

The great value of chaplains' services to soldiers at peace or at war is reflected in the growing strength of the new corps. With an establishment of only 12 Protestant chaplains at the start of the peacetime active force, the number has grown to 50. They are serving wherever troops fight or train — in Korea, Japan, and Europe as well as isolated Canadian outposts.

Essentially a non-combatant in war, the Canadian Army Chaplain became as necessary in battle during

Flight Simulator

Future *F-86D Sabre* jet pilots will "shoot down" their first enemy planes without actually seeing the enemy or even leaving the ground. It is all a matter of electronics in the latest device for pre-combat training of [U.S.] Air Force fighter pilots.

This latest step in pilot training was revealed with the successful completion of tests of the *F-86D Sabre* flight simulator.

The new simulator, a 35,000-pound package of metal, wiring, electronic tubes, radar scopes, and servo mechanisms, is the first to combine the simulation of two planes—the one being flown and an approaching enemy plane. Thus, the future jet fighter pilot will not only learn how to handle his plane without taking it off the ground, but also how to bag an enemy plane as it approaches him at the speed of sound.

The new electro-mechanical trainer contains more than 100,000 parts, including 1,152 electronic tubes and 60 miles of wiring. It takes up 600 feet of floor space and stands 10 feet high.

Its cockpit will duplicate in every detail that of the *F-86D Sabre*. Heart of the trainer, and separate from the cockpit, is a battery of analogue computers, which provide the answers to how the pilot "flew the plane." If the pilot makes a mistake, the computers automatically change the cockpit instrument readings to conform to the actual conditions.

The simulator requires two instructors, one for flight performance and the other for radar operations. The latter also controls the simulated target which the pilot is required to attack.

The instructors can put the trainee-pilot through every imaginable set of emergency circumstances; and the beauty of it all is the fact that the pilot can make a mistake that would be fatal were he actually flying, and live to learn better. — *News Release.*

CHAPLAIN'S MEMORIAL FUND

(Continued from preceding page)

the Second World War as the guns with which soldiers fought. This is indicated in the casualty returns and awards for bravery and valor.

More than 40 peacetime Protestant chaplains are veterans and eight of them, a ratio of one in five, wear the Distinguished Service Order or Military Cross for devotion to duty and gallantry in battle. A number of them now serving actually fought with line units in the war and were ordained to the Christian Ministry later to become Army chaplains.

COMMANDOS IN KOREA

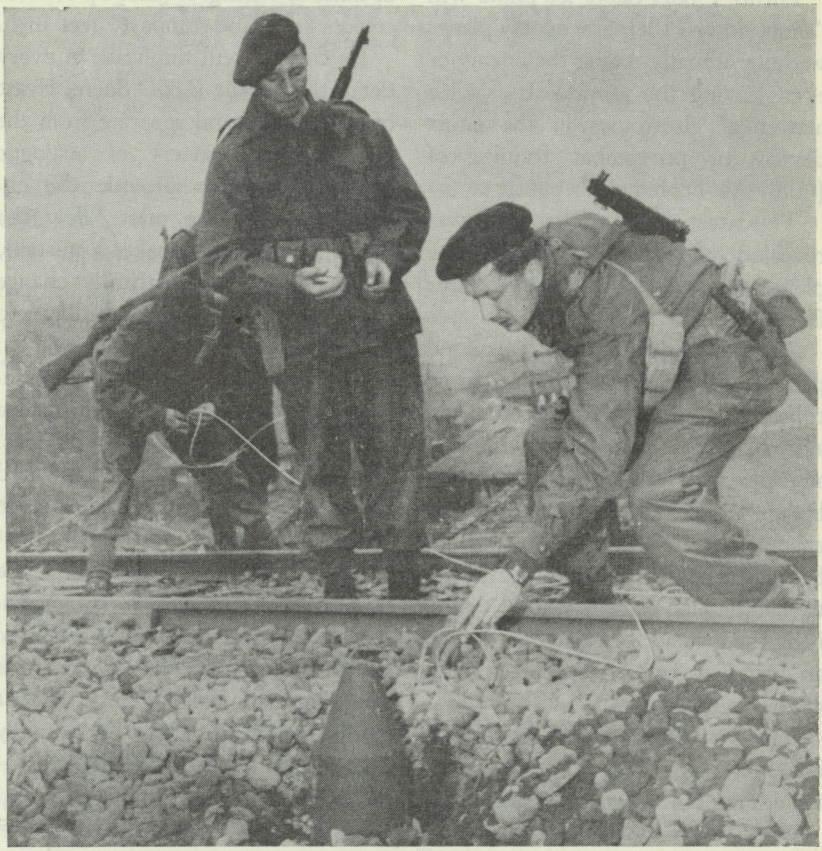


Photo by Courtesy U.K. Information Office, Ottawa

British Royal Marine Commandos place charges which later destroyed about 100 yards of enemy railway line in North Korea. The Commandos executed a daring raid 150 miles into Communist Korea to destroy this section of the line within a few miles of two enemy divisions eight miles south of Songjin, North Korea. The railway had carried Communist front-line supplies.

The Clerical Problem

ORGANIZATION and METHOD

Lieut.-Col. F. W. Speed, OBE, ED, in the Australian Army Journal

We are faced with the prospect that, unless diplomacy can find another solution, war may possibly break out within the next two years. So far as the Army is concerned this means that there is a real need for an increased tempo of preparation—and yet the shortage of manpower, military and civilian, prevents us from putting more men to work on the tasks still to be done.

One solution may lie in simplification of the methods by which the work is carried out. Simpler methods enable more work to be done in a given time. This applies both to the manual trades actually engaged in preparations for war and to the clerical and supervisory duties which are an inseparable part of the whole structure.

Organization and Method is an art which requires experience. But anyone who can think can solve individual problems of method. Therefore, if one is faced with a programme which appears insurmountable in the time available, it may be worth while to examine critically the methods by which the work is at present being done—to see whether these methods can be simplified. This applies particularly to clerical operations, which are so often involved and time-consuming.

The first step is to examine each task to find out whether it is one problem or a collection of lesser problems. If the latter, one must solve each individual problem, one at a time, in proper order.

The next step is to establish clearly the purpose it is desired to achieve. Unless there is an unmistakable and simple statement of aim, the investigator will easily be led into arriving at the wrong answer. The last state will then be worse than the first.

In establishing the aim, the investigator should arrive at a clear understanding of the way in which a proposed task will serve the practical needs of the Army. In so doing, he will be able to distinguish between

(a) ends—the way in which the product of the task is to be used; and

(b) means—the system by which the product is evolved.

Many clerical tasks, for example,

produce information. The way in which the information is to be used is the end; the system by which the information is recorded is the means.

With the aim or purpose clearly in mind the next step is to go straight back to the source of information. In the case of a stores accounting problem there is the point of preparation of the requisition or indent. In the case of a production records problem, it is the work bench.

At this point it is interesting to note the procedure which is then followed in professional Organization and Methods Sections.

The investigator is required to write each problem down in detail including any factors which govern the solution. He then sets out every possible solution he can think of with every conceivable advantage and disadvantage. Not until he has done this is he allowed to think of a conclusion.

The object of this procedure is to avoid the preconceived idea and to prevent an investigator putting forward a recommendation merely because he has seen it working elsewhere.

This, however, is the ideal method and may be too time-consuming for the average head of an army branch or section. Something less exacting will probably produce reasonably good results.

With the aim clearly in mind, therefore, and completely ignoring the existing system, seek to convert the initial information into the form required to fulfil the purpose in the shortest possible number of steps. In so doing it is important to reduce copying and all other clerical operations to the practical minimum.

The product of the exercise so far will be

(a) A step by step description of the processes involved.

(b) A rough layout for any printed form or forms required.

At this point, go back over the step by step description and use all the imagination you have at your command to eliminate those which, on reflection, are not really necessary. At this point, also, having clearly in mind what the new system is going to achieve—make certain that the job itself is really necessary. Ask yourself these questions:

1. Is it essential to do this job at all? Can it be cut out?

2. Is the job also being done elsewhere. In other words, is there duplication?

If the answers are that the job is essential and is not being duplicated elsewhere, the final step is to take the job notes and rough drafts of forms, and work out the actual method by which the job is to be done. This involves a decision as to whether manual methods or machine methods, or a combination of both, will be used.

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