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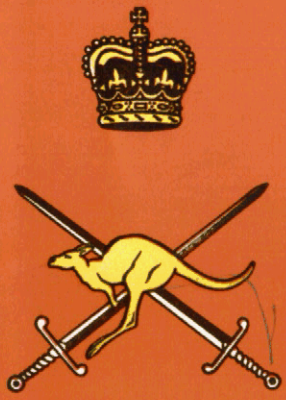

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Some thoughts on

AMBUSHES IN TROPICAL WARFARE

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PART 1—INTRODUCTION

General. Ambushes have been laid successfully under a variety of conditions involving forces up to battalion strength. However, even though such larger ambushes involve the same principles, the following remarks apply, unless otherwise stated, to strengths not larger than a rifle platoon.

Definition. An ambush is a trap by which troops in concealment attack an enemy by surprise. Suitable areas in the tropical zone where ambushes may be set are:—

(a) Watering points.
(b) Garden areas in rain forest.
(c) Approaches to and from villages.
(d) Communication zones.
(e) Areas where a distinct change in vegetation occurs, for example, the edge of rain forest and savannah, or grassland.

Aim. The aim of an ambush must be kept constantly in mind. Generally this will be either to:—

(a) Destroy as many of the enemy and/or his vehicles as possible, or,
(b) Harass him so that he has to use increasing numbers of troops on purely protective duties; or
(c) Obtain information of intelligence value, for example, identifications and documents.

Types. There are two types of ambushes:—

(a) Immediate.
(b) Deliberate.

An immediate ambush is one set with a minimum of planning to anticipate enemy action, or as a purely defensive technique by a force such as a patrol. Little time is available for reconnaissance and occupation, and the techniques of its operation, and its degree of success, depend almost entirely on the application of previous training and the initiative of the commander concerned.

A deliberate ambush is one planned and executed as a separate operation. Generally time will allow planning, preparation and rehearsal in great detail.

Successful ambushes have the following characteristics:—

(a) Surprise.
(b) Control.
(c) Maximum use of firepower available.
(d) Depth.
(e) Simplicity.
(f) Determination.
(g) A high standard of training and self discipline.

Surprise. The basic requirements to achieve surprise are:—

(a) Silence and stillness.
(b) Intelligent layout, siting and concealment.
(c) Carefully selected positions on innocent looking ground.
(d) A high standard of security at all stages of the ambush.

Control. Control, particularly in an immediate ambush, is difficult to achieve due to the dispersion of troops, the need for silence and the static position of the commander. It can be achieved by:—

(a) Careful briefing.
(b) Rehearsal.
(c) Well-known signals.
(d) Careful positioning of the commander.
(e) Discipline.
(f) Application of new equipments, such as helmet receivers.
(g) Internal organization. (See Part 4—Conduct, page 13.)

Firepower. The short killing time demands highly concentrated fire, which is achieved by:—

(a) Careful briefing.
(b) Accurate shooting and rigid fire control.
(c) Maximum use of automatic and self-loading weapons.
(d) Laying grenades or anti-personnel mines in necklaces and firing them by the commander or his second-in-command. Grenades should not be thrown unless it is certain that no casualties to our own troops will result.
(e) Alertness, to obtain maximum fire effect in the time available.
(f) A good fire plan, which must include enemy escape routes, and should, when possible, include the use of artillery and mortar fire.
(g) Using area weapons such as flame throwers and 60 mm mortars, particularly low angle fire.

Depth. The flanks and rear of an ambush are obvious places for enemy counter-attack, particularly if it is discovered prematurely, or it fires at part of a large force. Some depth can be provided by echeloning, but where it is considered important additional troops may be required in depth to prevent surprise and act as rear party. The insurance given by a strength increase must be related to a possible reduction in the chances of success.

Simplicity. The simpler the plan the greater the likelihood of success. If troops are a long time in a position, lengthy detailed orders are not likely to be remembered exactly, and consequently are either not carried out or are misinterpreted. This may occur even after detailed rehearsals.

Determination. Once sprung an ambush must be pressed with ruthless determination. Some men under excitement shoot ineffectively. This will require careful attention during training, particularly from the point of view of motivation. In addition, due to the limited arcs of fire, some enemy may escape the initial fire.

This can be overcome by the controlled firing of grenades or anti-personnel mines.

Self-Discipline. Remaining in a set ambush can be a boring and uncomfortable operation where the soldier may have to endure in silence insect bites, thirst, lack of a smoke and control a desire to move about to ease cramp or perform natural body functions. Systematic and continuous training is necessary to develop the requisite patience and self-discipline.

Where the aim is to kill as many enemy as possible it may be necessary to allow individuals to pass through unharmed. It requires much self-discipline and training to overcome any reluctance the inexperienced or over-anxious may have to allow this to happen. Clear orders about this must be issued to all members of the ambush party.

PART 2—PLANNING

General. The battalion commander states the aim. On company level all available information is studied to decide the type and duration of the ambush, its strength in men and firepower and security measures necessary.

Aim. If the aim is to cause confusion, lower enemy morale or force him to use larger escorts, the ambush can probably be set with only three or four men. However, if the aim is to take prisoners strength must be adjusted accordingly.

Information. During planning enemy characteristics, habits, organization and weapons must be carefully considered. Apart from operational experience additional information will be available from the Battalion and Brigade Intelligence Officer, or can be obtained by patrols or from local inhabitants if they are friendly and still in the area. Particular enemy information required may include:—

(a) Supply parties—times of movement, strength, protection used ahead, with, or behind, type of load carried.

(b) Aim of enemy patrols. Details of size, routes, habits as to time or locality, frequency and arms.

(c) Size of enemy working parties, ration parties and similar detached groups.

(d) Enemy system of escorting, for example, senior officers and supplies.

(e) What his counter-action has been when ambushed previously.

(f) Distances the enemy usually employs between men.

Information about the location and movement of all friendly forces, particularly patrols, defensive fire and harassing fire tasks is required, as these may restrict activity.

Ground. From a study of the information available the commander will select tentatively:—

(a) Suitable sites. Detailed reconnaissance will determine the site and method of occupation. When time permits an innocent looking

site, perhaps not ideally strong tactically, but one whose characteristics will not alert an approaching enemy, should be sought to assist in achieving surprise. In all cases concealed positions are required to bring the maximum volume of fire quickly on the enemy, who will suffer heavy casualties if the ambush is well sited. The length of these positions may be determined by known characteristic spacing the enemy uses between men. Specific information on enemy defensive fire tasks is required to avoid areas on which, or on the routes from which, enemy artillery or mortar fire can be brought quickly.

(b) Approaches to, and withdrawal routes from, the position.

(c) An assembly area close to the proposed ambush in which troops wait during the commander's reconnaissance and issue of final orders. This may also be the rendezvous.

(d) Enemy escape routes.

(e) The rendezvous where troops assemble when the ambush is completed.

Multiple Ambushes. Where there are a great number of approaches into a position a number of ambushes may be set to:—

(a) Cover alternative approaches.

(b) Kill any escaping enemy.

Multiple ambushes may be set near villages and in heavily cultivated areas where there are many tracks, and may also be used for internal security duties against forces who are not considered likely to reorganize and carry out counter measures. Careful planning must ensure that once one group springs the ambush, other groups act in concert. Difficulty may be experienced in obtaining a simple fire plan and in control.

Duration. Care must be exercised in deciding the length of time a position must be occupied. Temperature alone is not the deciding factor on physical endurance as both humidity and air movement play a large part in deciding the effective temperature, and hence the endurance of troops in a particular ambush position. Commanding officers should be guided by regimental medical officers in cases of doubt.

Security. In areas under direct enemy influence the attitude of local inhabitants must be considered, and in areas occupied or controlled by our forces indirect enemy influence must not be forgotten. Consequently special measures may be necessary to ensure security not only in the ambush, but also on the move to and from it. Where the ambush is discovered by a local inhabitant, either moving to, or in the position, it will be necessary to take him or her into safe custody as a safeguard against compromise. Hence the inclusion of someone with a knowledge of any local as well as enemy language is desirable.

Strength. In deciding the strength the following factors must be considered:—

(a) The aim.

(b) Enemy reactions and characteristics.

(c) Control and risk of compromise.

(d) The number of automatic weapons available.

(e) Own and enemy morale.

Consistent with the aim the strength of the ambush party should be kept as low as possible to facilitate control and reduce the possibility of compromise. Strength may be reduced by increasing the number of automatic weapons. Generally an ambush can successfully engage an enemy force larger than itself, provided it achieves surprise. With well-trained troops whose morale is high, large enemy forces may be engaged by relatively small ambushes.

A reserve is usually necessary, no matter how small, to exploit favourable opportunities and deal with the unexpected. The larger the strength the more difficult it is to achieve surprise, and considerably a larger number than actually necessary should never be used. For example, if an assault is to follow the springing of the ambush, the reserve may be only one or two men accompanying the commander.

The provision of a reserve must never be allowed to cloud the aim of the ambush, and the nomination of a reserve does not imply that an ambush position is a defended locality.

PART 3—OCCUPATION

General. The sequence of events for the occupation of a deliberate ambush is:—

(a) Reconnaissance.
(b) Issue of preliminary orders.
(c) Preparation, including rehearsal.
(d) Movement to the ambush.
(e) Final reconnaissance.
(f) Final orders.
(g) Occupation.

This sequence also applies to an immediate ambush, although as time will usually be short, parts may have to be telescoped or eliminated.

Reconnaissance. If possible the ambush commander and key members should carry out a reconnaissance prior to the issue of preliminary orders. When this is impossible or highly undesirable, reconnaissance may be confined to a study of air photographs, maps, and patrol reports.

During his reconnaissance the commander will select the:—

(a) Killing ground and ambush position.
(b) Route of the main body to the ambush.
(c) Rendezvous and routes to and from it.
(d) Assembly area, if the ambush is of long duration, involving reliefs (this could also be the rendezvous).
(e) Route of withdrawal.

Siting. The site selected should:—

(a) Be capable of being concealed, so that from the enemy's point of view it appears unoccupied.

(b) Not offer an easy escape to those enemy not killed in the opening fire. If this is unavoidable advantage should be taken of the fact that by siting a special group to cover these routes, or by mining them, preferably using electrical detonation.

(c) Allow lookouts to give warning some minutes before the first enemy enters the position.

(d) Be capable of being covered by all weapons to the maximum extent.

(e) Have a good covered approach avoiding contact with known enemy positions, or local inhabitants.

Surprise must not be lost through any member being sighted by local inhabitants or enemy patrols. No one should be allowed to walk on the killing ground as foot marks and disturbed earth will warn a sensitive enemy. Consequently all reconnaissance must be done from the rear of the ambush. Observing the ground from the enemy point of view, although desirable, can give away surprise.

It is of great value if an observation post can remain in the general area of the proposed ambush after the reconnaissance party has left. This ensures added security and up-to-date information when occupation begins.

Factors affecting siting:—

(a) Setting an ambush on both sides of the killing ground has the advantage of preventing enemy escape. It may also be necessary with a large ambush to prevent it becoming too extended. However, it has the following disadvantages:—

(i) The track must be crossed. This should be done some considerable distance in rear, signs of crossing obliterated, and the approach made from the rear.

(ii) Danger to our own troops. This may be reduced by echeloning troops on opposite sides of the track, or laying down strict safety arcs. Even then there is always a danger that an excited soldier will traverse his weapon to kill an escaping enemy.

(iii) Difficulty of control, particularly if a change of plan is required.

(b) If an ambush is set on one side of the approach, control is easier. However, some enemy may escape from the far side unless some form of deterrent such as sharpened bamboo stakes[1], controlled firing of grenades or anti-personnel mines, or booby traps are used.

(c) On a hillside the question will arise whether the ambush should be laid up-hill or down-hill of the enemy, or a combination of both. Up-hill puts the ambushing party in a more advantageous position. But, the enemy will move away more quickly downhill than up. A few suitably disposed snipers can take care of this, particularly if the ambush is laid in a re-entrant.

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1. Made in all lengths, set in the ground at an angle of 45 degrees, parallel to and just off the track inside the undergrowth, these can pierce a walking man in ankle, knee, thigh or stomach, or transfix one running.

Whether a site is selected on one or both sides of the killing ground:—

(a) Light machine guns should be sited primarily to cover the maximum of the killing ground with a secondary task of covering possible enemy withdrawal routes.

(b) Machine carbines or self-loading rifles should be posted at each end of the ambush to seal it off once firing opens.

(c) Ground not covered by automatic weapons should be covered by riflemen.

(d) Sentry positions should be selected covering possible approaches, to alert the ambush before the enemy reaches the killing ground. They should not be so far in front, however, that the enemy can enter the area between the sentry and the ambush.

(e) Possible enemy escape routes should be covered by booby traps, mortar or rifle grenade fire.

Booby Traps. Too much reliance should not be placed on booby traps as a killing agent. They are a two-edged weapon and at best should be regarded as a means of achieving surprise. Their setting frequently involves crossing the track and interference with the undergrowth, thus increasing the possibility of alerting the enemy. Preferably electrically detonated types should be used, as others can be set off prematurely by dead-falls, birds or animals.

When necessary they can be used:—

(a) Off the track where the enemy who escape the ambush may try to find immediate cover.

(b) On possible enemy outflanking approaches.

(c) On the side of the track not occupied by the ambush; or

(d) Left on the main track by ambush parties in a rearguard action.

Preliminary Orders. The ambush commander should brief his party as completely as possible to reduce the time spent on final orders, and as early as possible to allow the maximum time for preparation and rehearsal.

The following points should be covered in orders:—

(a) Layout.

(b) Composition and tasks of groups.

(c) Weapons to be carried; any special instructions regarding dress and equipment.

(d) Formations during move in.

(e) Timings and routes to assembly area and/or ambush site. Time position is to be occupied.

(f) Position and direction of fire of groups or individuals in ambush position.

(g) Orders for springing, including method of alerting ambush and alternative methods of springing.

(h) Distribution of fire.

(j) Use of grenades.

(k) Location of rendezvous and routes to it.

(l) Deception plan.

(m) Action on ambush being discovered.

(n) Signals for:—

(i) Enemy are approaching.

(ii) Opening fire.

(iii) Ceasing fire.

(iv) Assault.

(v) Search party out.

(vi) Withdrawal.

(vii) Abandonment.

Signals may be used in a variety of ways, including bursts from automatic weapons, grenades (both smoke and high explosive), whistles or even bugles. They must be distinctive, particularly in the case of multiple ambushes.

Preparation. The success of an ambush will largely depend on the effectiveness of its preparation. For example, more fire-power is used than on other occasions and it may be necessary to issue extra automatic weapons or provide light machine guns and gunners from other sections. Consequently teamwork must be developed within the ambush party. Special stores such as trip flares may have to be assembled, prepared and tested. As there is only a short time to kill the enemy, failure of weapons or equipment must be avoided. Hence, all weapons and magazines must be cleaned and test fired during the preparatory stage.

If insect repellent is applied its smell is unmistakable to a trained soldier when used liberally by large numbers, particularly with a following wind. If not applied, it not only breaks down anti-malarial precautions, but may jeopardise surprise by undue movement to avoid bites or to retaliate against the biting insect. Usually it will be found better to apply the lotion.

The rehearsal should:—

(a) Show troops their relative positions to each other.

(b) Allow the command to see whether individual camouflage is satisfactory.

(c) Show whether all members can remain quite still for long periods, and whether any are affected by coughs or colds.

(d) Show how relief will be effected and by whom.

(e) Test communications to the sentries.

(f) Familiarise everybody with the procedure for opening fire, ceasing fire, and searching.

(g) Detail the withdrawal sequence.

Movement to the ambush area. It is unwise to move direct to the intended ambush position with the main body, even if previous reconnaissance has been carried out. The main body therefore assembles short of the ambush position, possibly at the intended rendezvous, whilst the reconnaissance party goes forward to see that no enemy are present and, if it has not previously been done, carry out reconnaissance.

Care must be taken to ensure the ambush party is not sighted, or the reconnaissance party do not leave a track leading to the ambush. Stealth and normal jungle craft such as not cutting undergrowth must be used. In the assembly area troops must not talk, smoke or leave any litter about.

Final orders. If reconnaissance is carried out before preliminary orders are issued, there should be little need for any further orders unless last-minute changes are necessary.

If preliminary orders are issued before reconnaissance, the original plan needs only confirmation plus any additional information obtained by reconnaissance. In any case final orders must be brief and include:—

(a) A description of the ambush area and killing ground.

(b) Final location of the commander.

(c) Any variations from the rehearsal in regard to individual tasks.

Occupation. Individual camouflage must be checked before troops move forward to occupy the position. Since no guarantee can be given that the enemy will not move onto the killing ground as the ambush is being laid, occupation must be carried out from the rear with only a few men moving at a time, stealthily.

The sequence for occupation is:—

(a) Sentries take up their position and communication cords are laid to the commander. These cords of rope, string or vine are tugged to give silent warning of the enemy approach. Prearranged codes can indicate the size and direction of the enemy party. They can be laid to everyone in the ambush.

(b) Automatic weapons are brought forward to cover the killing ground.

(c) Booby traps and trip flares are set in position by those detailed for this task.

(d) Mortars and/or grenade riflemen are placed in position.

(e) Troops are placed in depth to provide rear and flank protection.

(f) If reliefs are to be used (see Part 4—Conduct) they will be shown the ambush position and then moved to the rear.

The placing of an old piece of our own or enemy equipment close to a track in a not-too-obvious place, may act as a bait for the curious. Enemy collecting round it can provide a concentrated target. The success of such ruses depends on enemy training and whether they have been trapped similarly before. In addition the enemy may become suspicious and surprise prejudiced. Our own equipment must not be used in the enemy's rear areas or in other areas where the presence of our troops is not suspected.

PART 4—CONDUCT

Waiting. In order not to prejudice surprise troops must be trained to select a comfortable position and remain in it without smoking, undue movement or noise, for the duration of the ambush or until relieved. Special instructions should be issued regarding eating and drinking.

There should be no movement of friendly forces anywhere near the position, unless the details are known to every member of the party. Even then the practice is dangerous. For this reason multiple ambushes must be carefully controlled to prevent collisions.

All weapons are cocked as the sound or movement of cocking, even from the half-cocked position, will warn the enemy. The possibility of

an accidental discharge can be minimised by training and a careful weapon check before leaving the ambush.

In an immediate ambush it may not be possible to post sentries, but all members must keep the killing ground continually under observation. In a deliberate ambush, however, if all members are watching the killing ground, no rest is possible for the whole party, perceptions become blunted and attention is distracted from the task of observation, which requires complete concentration of all the senses. The killing ground must be under observation all the time, although only the sentries, the commander or his second-in-command and/or the person detailed to spring the ambush need be observing. All other members of the ambush may relax, provided that as soon as they are alerted they are in a position to fire their weapons on their tasks without any undue movement. Where additional observation is necessary the party should be organized into groups of two to six men so that one of two can watch while the others relax. A leader should be nominated for each group. The size of the group will be decided primarily on its task in relation to the layout of the ambush. This internal organization greatly assists the safe withdrawal of the ambush party as groups can be checked through a rendezvous more easily than individuals.

Reliefs. Whether troops in an ambush position will require relief will depend on the number of troops available, and the duration of the ambush. Although reliefs should be made only when essential, care must be taken that troops do not stay too long merely to avoid the problem of relief. Under conditions of high temperature and humidity, and little air movement (frequently met in grasslands), it can be physically dangerous for troops to remain too long.

Generally, one of three situations will exist:—

(a) No troops are available for relief.

(b) In an ambush the size of a platoon or larger relief is effected by changing over the ambush troops with those providing depth.

(c) Relief is provided from troops resting in an assembly area. Usually, in this case:—

(i) Fresh troops from the assembly area relieve the ambush.

(ii) Troops relieved from the ambush go back to positions in depth.

(iii) Troops relieved from positions in depth return to assembly area to eat and sleep.

Relief is always done to a prearranged plan, quietly, slowly, one at a time. Should the enemy enter the ambush whilst relief is taking place, one man's careful movement may not attract attention, whereas a number of men moving will prejudice surprise.

Springing. In close country any enemy will always be alert for ambush, but not necessarily at one particular moment more than at any other, unless he is alerted by unusual or suspicious movement, sounds, or odour.

When a sentry sights enemy he tugs the communication cord or gives the signal for the direction of

approach and size of the enemy party. The commander will spring the ambush when the maximum number of enemy are caught in it. The signal for springing can be an aimed burst, either from the commander or second-in-command's weapon, or a light machine gun either of them controls, or the controlled explosion of a grenade necklace or anti-personnel mines. Grenades may also be thrown provided no casualties will occur to the ambush party.

Provision must always be made for the accidental discharge of weapons, or where the enemy sights or fires at a member of the ambush who returns the fire in self-defence.

Fire discipline must be strictly observed, not only to prevent accidents, but also to use effectively the fire-power available. Lack of good fire discipline can cause confusion and prevent effective use of the surprise achieved.

Once sprung, the ambush must be pressed home with ruthless determination. All shots must be aimed to kill, and a natural tendency to fire high at the face of the enemy must be eliminated during training. Parties covering escape routes must be prepared to open fire with mortars and grenades (hand and/or rifle) as soon as the ambush is sprung.

Subsequent action. Enemy reaction to an ambush may be stereotyped and hence predictable, its form depending on national characteristics, training and equipment, the pattern being produced during operations. However, there are two common human reactions:—

(a) The leading elements, at least, dive for cover to the flank away from the fire positions of the ambush.

(b) The leading elements assault into the ambush, firing and throwing grenades.

Either reaction will occur within three to five seconds. In the first case for up to three minutes the enemy will be confused due to casualties and the effects of surprise, and junior leaders will lose some control. Panic may result, but with a well-trained enemy, counter-ambush drills or reconnaissance for an attack may be expected after the initial confusion. Hence, the maximum casualties must be inflicted within two to three minutes. An enemy assault into the ambush is dealt with by the grouping adopted within the ambushing party plus the dispositions of its members.

In any case, action after springing will take one of three forms, the action taken depending on the aim of the ambush, the size of the party ambushed and the degree of its confusion:—

(a) The dead and wounded are searched, the wounded evacuated if prisoners are required, and then the ambush withdrawn.

(b) An immediate assault is mounted from the ambush.

(c) The ambush is withdrawn and the position abandoned.

In an immediate ambush, the most satisfactory action will usually be to assault from the ambush position. Although it may be possible in the planning phase of a deliberate ambush to decide exactly what action will be carried out this may have to be varied by the commander after

assessing the results achieved initially.

When an ambush engages a force smaller than itself there is frequently no necessity to assault, since all the enemy will usually be killed or wounded. The enemy dead and wounded should be searched before the position is abandoned by a party previously nominated and rehearsed. A method is for one man to search while he is covered by two others. An approach to search any enemy lying on their backs should be made from the head, whereas the approach to search any enemy lying face downwards should commence at the feet. This is most necessary as the enemy may feign death or conceal grenades.

When an ambush engages a party larger than itself, its aim may usually be achieved best by an immediate assault from the ambush position. The initial fire fight should last no longer than about 15 or 20 seconds. The assault must take place immediately so that the initial shock period is reinforced and further confusion is caused to the enemy. A special party, with its necessary close protection element must be detailed to search for documents and identifications.

Even if the enemy has initiated an immediate automatic counter-ambush drill this will be usually frustrated by an immediate assault from the ambush position. Under most circumstances an immediate assault will ensure the success of an ambush, and in the worst case will ensure the least casualties.

The selection of a rendezvous may present some difficulties, although these can be overcome by good local knowledge of the area, or, after assaulting, continuing on for a definite distance, say 200 paces, and groups then moving individually to a known point. Unless all groups have a compass, proceeding on a selected bearing to a rendezvous, at the conclusion of the assault, is not satisfactory.

When an ambush engages an enemy party, the size of which makes it quite obvious that the aim of the ambush cannot be fully achieved, the ambush commander must make use of the surprise and confusion achieved to cause the maximum amount of damage to the enemy, and at the same time ensure a clean break. Any unnecessary lingering in the ambush position will merely court disaster.

The above will serve to emphasize the action to counter an ambush laid down in Infantry Training Volume IV (Australia) Tactics (Tropical Warfare), Part 1, Infantry Section Leading, Section 55, which is designed to cut the reaction time down as much as possible. An immediate assault secures the initiative, and reduces casualties, especially when directed against ambush positions which generally are not particularly suited for defence against organized attack.

Cease fire. The fire fight is of very short duration. The cease fire signal given in the ambush orders will be used when the commander considers he has got his maximum kill. All troops must be trained to listen for the cease fire and act on it immediately.

Withdrawal. It is during this phase that the ambush party may sustain its most serious casualties. Consequently if no assault is to take place,

withdrawal should be made during the period when the enemy is confused and has not re-established control. A rendezvous is necessary for the ambushing party. As members may take up to a matter of hours to collect here, it may be necessary in some circumstances to provide a check point for control purposes. The withdrawal is detailed previously and rehearsed, so that troops move out of the ambush and back to the rendezvous or assembly area in an orderly manner. More than one route of withdrawal may be necessary. It may be possible, and desirable, for a further ambush to be set on the withdrawal route.

A possible sequence for movement is:—

(a) Sentries.

(b) Ambush party by groups.

(c) Mortars and grenade riflemen.

(d) Troops in depth.

Casualties. Arrangements must be made before occupation for the evacuation of our own casualties or those of the enemy if necessary. Stretchers should be built and dumped at a known point in rear of ambush so that during the withdrawal no time would be lost in evacuating casualties.

Prisoners. Specific members of the ambush party must be detailed in orders, rehearsed and equipped with sticking plaster gags, tape, signal cable, or toggle ropes to ensure that prisoners are seized and escorted quickly and quietly to the rendezvous. Reserves should also be named for these tasks to provide for possible casualties. Prisoner snatching requires careful training and rehearsal.

When an ambush is completed further casualties may be inflicted on the enemy by sending a fighting patrol to the site, soon after the withdrawal of the ambush party. It has been characteristic of some enemies to send a patrol back to an ambush site to ensure that no bodies or material remain from which information can be obtained. Extreme caution is essential since if patrols are sent to successful ambush sites as a matter of routine, they may well be ambushed in their turn by an enemy who has studied our techniques.

PART 5—NIGHT AMBUSHES

Night ambushes have similar characteristics to ambushes in daylight, but are usually limited in scope by the terrain. For example, they can rarely be set at night successfully in heavy rain forest or secondary growth due to the difficulties of approach and control, particularly when it is raining. The following paragraphs outline points requiring emphasis in considering night ambushes set by day.

As shooting at night is less accurate, weapons must be sited to produce maximum effect quickly, hence:—

(a) Automatic weapons become the essential fire element, single shot weapons being slow to produce the necessary volume of fire.

(b) All weapons should have their arcs fixed by means of sticks to ensure accurate shooting over the killing ground.

(c) The ambush party must never move about. Any movement attributable to man must be enemy movement.

(d) Clear orders, precise fire control instructions, clear rendezvous and signals are essential.

(e) Groups within the ambush are sited much closer than by day. Control is paramount, and consequently an area ambush is rarely possible.

(f) Occupation of the ambush position is more difficult by night than by day, and consequently the position should be occupied before last light.

Consideration must be given to a method of illuminating the killing area at the moment the commander wishes to spring the ambush. Illumination can be provided by means of trip flares or air force ground marker flares, set off by the ambush commander, either electrically or by pulling a trip wire. The flares should be sited so that they will illuminate the enemy while at the same time members of the ambush are shielded from the direct glare of the light. This can be achieved by placing flares behind trees or in shallow holes.

The ability to raise searching difficulties on both sides of a subject will make us detect more easily the truth and error about the several points that arise.

—*Aristotle.*

SOME SOUND ADVICE

Major C. W. Wright,
Royal Australian Corps of Signals

WHY is it that in this electronic age so many public performances are spoilt by poor sound facilities? The answer is not the lack of technical resources, but simply that the organizers do not ensure that adequate sound amplification systems are installed.

During peacetime the standard of military training is largely determined by the successful performance of collective activities such as exercises, demonstrations, conferences and parades. It is therefore most important that performers and spectators are able to hear instructors and information passed to them.

The purpose of this paper is to explain the principles of sound amplification, so that users are aware of the considerations involved in the employment of public address systems.

The most important characteristics of sound will be summarized. Then an outline description of a public address system will be followed by advice on how best to employ the equipment under various conditions.

Characteristics of Sound

It is not generally realized that we spend three-quarters of our waking day in verbal communication.

When sound is originated, the air surrounding the source is caused to move backwards and forwards. The adjacent particles of air then become energized and move outwards in the form of sound waves. When these waves impinge on the human ear the eardrum vibrates in sympathy with the original sound.

Sound travels at a speed of approximately 1,000 feet a second, and is reflected by hard surfaces such as walls. These characteristics may cause echo and time lag effects which are most confusing to the ear.

When the volume of a sound is doubled the sensation of hearing does not increase in direct proportion. In practice, it is necessary to amplify sound a great many times before it can be heard beyond the natural range of a speaker's voice.

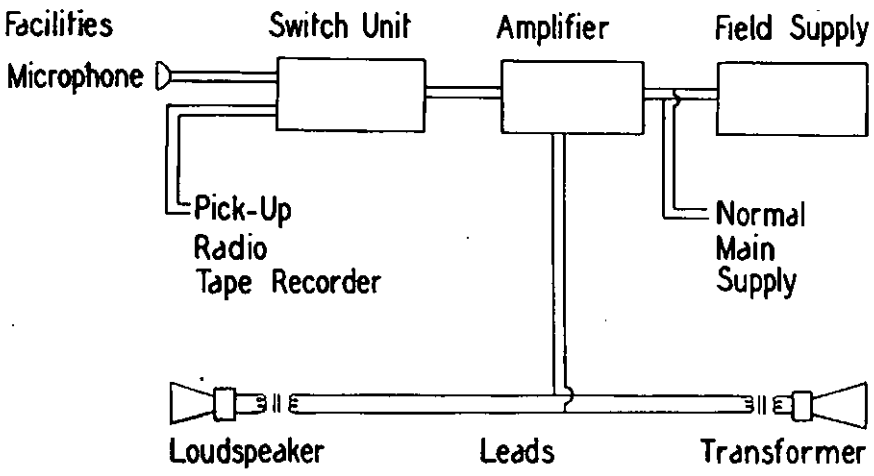
It is possible for a listener to believe that he is in a "dead spot" when echo effects drown the sound coming to him from the nearest loud speaker.

However, when suitable equipment is properly installed and operated all faulty sound effects can be completely neutralized.

Outline of Equipment

The purpose of a public address system is to change original sound

FIGURE I. PUBLIC ADDRESS SYSTEM



waves into electrical waves, so that they can be amplified, then converted back to sound waves by a loud-speaker. The sound can then be made audible to persons well beyond its natural range.

The component parts of the equipment are shown in Figure 1.

Microphones are devices which convert the sound energy received by them into electrical energy. There are three types of microphones commonly used with PA systems. The crystal microphone is now the most popular because of its good performance under all conditions. The dynamic microphone, which contains a moving coil, is mainly used for outside work. The velocity or moving ribbon microphone has directional properties which are particularly suitable for indoor work.

The microphone leads are designed to ensure that electrical waves are effectively transferred to the amplifier. Care must be taken that all joints are properly connected and free from moisture.

A control box called a mixer is used when it is necessary to connect more than one sound source to the amplifier. This facilitates switching without introducing any unwanted effects to the amplifier.

The amplifier unit uses electronic tubes to increase the volume of the original sound many thousands of times.

A transformer, consisting of two wire coils, is used to couple each loud-speaker to the amplifier. The total output power of the amplifier can then be matched to the network of loud-speakers.

Loudspeakers used for outside work are fitted with large horns or flares to enable the outcoming sound to be concentrated in the required direction. Most loudspeakers work on a similar principle to that of the dynamic microphone.

An adjustable resistance may be fitted to the speaker so that its volume can be varied independently of the amplifier.

Speaker leads must be well insulated and waterproofed in order to prevent hum effects being picked up from the ground.

The cabinet type of loudspeaker is used for indoor work. The cabinet protects the speaker, and ensures that sound in front and behind the diaphragm is kept in step.

In order to ensure flexibility it is desirable that the equipment be able to work from either power mains or batteries. In the latter case a unit called a converter is used to boost the supply.

Planning and Installation

The organizer should obtain advice concerning sound requirements at least five weeks before the date of the activity. An early inspection with a technical officer will enable him to determine whether to request civilian assistance or use his own resources.

HIGH VOLUME SYSTEM

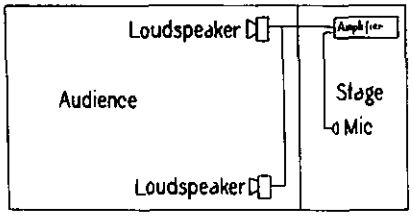
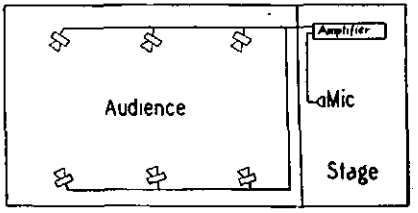


FIGURE 2.

Two suitable layouts for indoor performances are shown in Figures 2 and 3. Although Figure 3 is not so economical, it is generally preferred because it reduces echo effects, and the volume of sound can be reduced to a comfortable level.

FIGURE 3.
LOW VOLUME SYSTEM



When velocity microphones are used on the stage they must be placed to make maximum use of their directional characteristics as in Figure 4.

DIRECTIONAL MICROPHONES

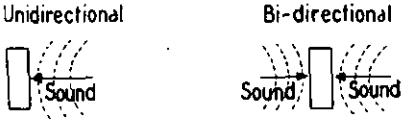


FIGURE 4.

When PA systems are used for field demonstrations the speakers may be arranged in a cluster, on a vehicle, as in Figure 5. Care must always be taken not to hold the microphone in front of the speakers. Otherwise a loud ringing noise called "feedback" will result.

A CLUSTER OF LOUDSPEAKERS

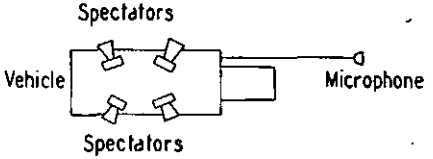


FIGURE 5.

Sports arenas and parade grounds generally provide the most difficult PA installation problems, and two possible layouts are included.

The circular system shown in Figure 6 is simple and effective

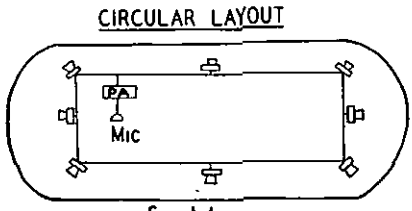


FIGURE 6.

when it is possible to have all the equipment and leads on the arena.

The broadside system as shown in Figure 7 overcomes the obstruction problems associated with Figure 6.

It is important that the speakers be raised on poles above the spectators, and their angle of elevation altered to suit wind conditions, as in Figure 8.

When buildings are located in front of the loudspeakers it may be necessary to reduce the volume of sound or alter the alignment of the speakers in order to overcome echo effects.

It is desirable that the monitor technician and the control equipment be located near the organiser, so that liaison is possible during the programme.

When the PA system layout has been determined an estimation of equipment requirements should then be made. It is wise practice to allow for the duplication of microphones, leads, amplifiers and batteries. Since PA equipment is always in demand, a definite request for procurement should be made one month in advance of the activity.

BROADSIDE LAYOUT

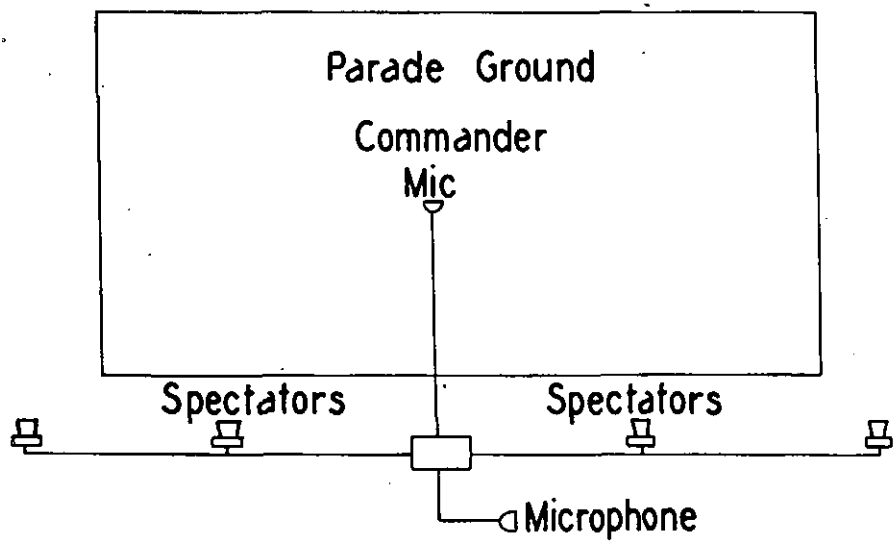


FIGURE 7.

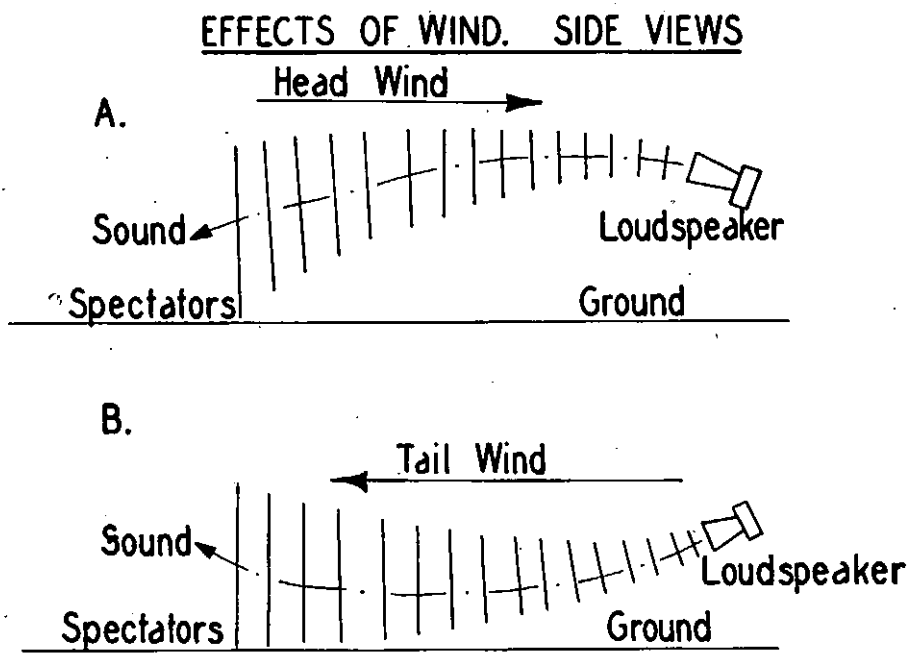


FIGURE 8.

It is suggested that at least three days be allowed to install equipment, carry out tests and perform rehearsals.

During that time the organizer should walk the whole area and satisfy himself on the following points:—

(a) That the sound coverage is even.

(b) That unfamiliar information is clearly understandable.

(c) That there are no "dead" spots or echo effects.

(d) That "out of phase" effects between speakers are eliminated by reversing the leads to the offending loudspeaker.

(e) That a reserve of amplification is available to allow for the increased sound absorption by spectators.

The Use of Microphones

There are certain points which the speakers must observe to ensure the successful operation of the equipment:—

(a) Before the performance they should carry out rehearsals to "get the feel" of the microphone.

(b) Switches fitted to microphones must be pressed before speaking.

(c) The mouth should be held slightly above the level of the microphone and about one foot from it. This, however, can vary with different microphones.

(d) Always think before speaking, and do not shout into the microphone.

(e) Concentrate on speaking and not the sound coming from the loudspeaker, otherwise the voice will lag.

(f) Keep the pitch of the voice raised at the end of sentences.

(g) On no account turn the head away from the microphone whilst speaking.

(h) The effects of wind can be reduced by covering the microphone with a handkerchief or using a specially built sound box.

Conclusion

Remember, the success of a performance depends on how clearly it can be seen and heard by the audience. An effective PA system can guarantee half that success before the programme commences!

COMPETITION FOR AUTHORS

The Board of Review has awarded first place and the prize of £5 for the best original article published in the April issue to "Tactical Implications of the Human Factors in Warfare," by Major J. O. Langtry, DCM, BSc, Royal Australian Infantry.

Strategic Review

THE NATURE OF THE CHALLENGE

MOST of us have a good general idea of the Communist theory propounded by Karl Marx, an important feature of which is that 'the inherent contradictions of capitalism will bring about its own downfall?' A good many of us, however, forget Nicolai Lenin and the addition he made to the original theory. Facing up squarely to the practical problem of transmuting Communism from theory to reality, Lenin concluded that it was by no means certain that the predicted changes in the social-economic structure would in fact take place unless the process was assisted, hastened and guided by a political party of dedicated revolutionaries willing to accept a rigid party discipline. Lenin demonstrated the worth of his idea by his brilliantly successful management of the Russian revolution. Ever since then his teaching has been an integral part of orthodox Communist doctrine.

Communist theories long ago developed a process of reasoning by means of which it can easily be proved that anything, positively anything, is justified if it contributes toward the attainment of the ultimate aim—the establishment of Communism throughout the world. It is the facility to think in this way, added to the fanatical teachings of Lenin, that makes modern Marxism-Leninism so dynamic, so ruthless and so dangerous.

The Communist Party founded by Lenin remains 'dedicated' in every sense of the term. It pursues its aim with a steadiness and singleness of purpose seldom equalled in human affairs. If it is rigid in its strict adherence to doctrine, it is anything but rigid in the means employed to implement its designs. It is extraordinarily flexible in its adaptation of means to ends. Only the aim remains constant; strategy and tactics are varied to extract the utmost advantage from every permutation and change in the general situation. Reversals of policy, withdrawals, changes of emphasis, are all parts of the basic grand design. The Party has no hesitancy in taking one step backwards if it appears that ultimately that will place it in a better position to take two steps forward. Expediency and expediency alone, is the keynote of all Communist action.

In all Communist countries the Party is the Government. Everything is done under Party direction, guidance and control. Nothing is done without Party approval. Since Party and Government are indistinguishable, it follows that we must regard every act of a Communist Government as an act inspired and approved

by the successors of Lenin's band of dedicated revolutionaries.

In our very human tendency towards escapism we are prone to see in events in Communist countries clefts in the monolithic structure of their political organization and departures from Communist doctrine. In fact any changes that have occurred recently in Russia and China are merely shifts in emphasis to extract the utmost value from conditions or developments within those countries. The liberalization measures initiated by Khrushchev are intended merely to enable the intellectual class nurtured by the Party to serve with greater efficiency the aims of Communism. And the Party will see to it that these measures do just that and nothing else. In China the 'Let a Hundred Flowers Bloom' speech of Mao Tse-tung was intended simply to bend certain Chinese traditions to the service of Communism. We delude ourselves if we imagine that any fundamental change in Communist policies or attitudes has taken place, or is likely to take place in the immediate future.

The Communist Party has given ample proof that it has no inhibitions about the employment of force where the conditions are favourable. In Korea and Indo-China the force was applied indirectly by proxy. The Governments of Russia and China kept themselves in a position where they could counter any charge of being involved in those conflicts with an air of injured innocence. In those days only the West possessed the massive deterrent on a scale of superiority high enough to make it effective.

Somewhere about the middle of 1956 the Soviets apparently felt that they had sufficient nuclear headway to challenge the West more or less directly in the military field. The threat to bombard Britain with guided missiles at the time of the Suez crisis was only thinly disguised, while the Soviet Government made no bones at all about openly sending in their armies to crush the Hungarian revolt.

These events could mean that the present rulers of Russia are fools, or a group of irresponsibles prepared to gamble with the dread possibility of total nuclear war. Or they could mean that the Soviets consider that their own progress in nuclear science and guided ballistic missiles had established a state of nuclear equilibrium in which their preponderance of conventional military forces gives them the advantage for the time being.

If Khrushchev and his associates were fools or irresponsibles they could never, in the bitter struggle for power which characterises Soviet politics, have established themselves at the head of the Russian Government. Despite their theatrical posturings, we must rate them as shrewd, competent and ruthless men who will stop at nothing to gain their ends. If they consider that the present balance of military power confers the advantage on them, if they see in it a 'favourable moment' for the expansion of their authority and influence, we must expect in the immediate future an increase in Communist pressures, backed by the threat of armed force.

Soviet actions in the past suggest that Communism seeks to expand outwards from the centre. In this way the strong core can nourish the offshoots and the heartland can give

military and economic support to its satellites. The meeting line between the two great world power blocs lies in the periphery of the Eurasian continent, geographically vulnerable to just such Communist expansion. The industry and skilled population resources of Europe, the oil of the Middle East, the raw materials of Africa and South-East Asia—all are accessible via land bridges from the USSR. Moreover, these areas contain the bulk of the world's population to which the Soviets seek to spread the philosophy of Marxism-Leninism.

If any of these areas passes from the control of the West to the control of the Soviet the incidental transfer of resources will weaken the one while strengthening the other, to say nothing of the transfer of strategic advantages. If the Soviets were able to overrun Western Europe they would control about 55 per cent. of the world's production of finished steel and about 45 per cent. of the world's electric power production. In addition, they would be able to bend to their service a numerous and highly skilled labour force.

Although the conquest of Western Europe is a primary Soviet aim, any direct attack would probably result in full-scale nuclear war. Since the Soviet leaders are not likely to wish to bring catastrophic destruction upon the sacred soil of the Communist heart land, they will probably seek to achieve their European objectives through a strategy of indirect approach. Unfortunately for the West there exists a convenient line of indirect approach, the exploitation of which could bring the Soviets appreciably closer to their European objectives, and at the same time enable them to win other important economic and strategic advantages.

This line runs through the Middle East. That area contains 75 per cent. of the world's proven oil reserves, and a great deal of the world's current production comes from there. When this current production was temporarily interrupted during the Suez crisis very serious strains developed in the European economy. If the Soviets could gain control of this oil they could play havoc with the whole economic structure of Western Europe. The mere ability to exert such a stranglehold would place them in a very favourable bargaining position.

Nor is Persian and Arabian oil the only economic prize beckoning the Soviets towards the Middle East. Control of that area would bring them a big step nearer to the uranium and other minerals of the Congo basin, and to the natural resources recently discovered in the Sahara.

Immense strategic advantages would accrue to the Soviets if they could gain access to the Middle East. They would have outflanked the Dardanelles and won access to the Mediterranean, Africa and the Indian Ocean. They could establish air and submarine bases on the flank of the European communications with Australasia and the Far East. And they would have a convenient base from which to spread their influence along the southern shore of the Mediterranean to the Atalantic.

Economically and strategically the prize is a glittering one. It is no more than simple realism to expect the Soviets to make every effort to win it. Already they have gone a

long way towards securing a firm foothold in an area where local antagonisms have produced an explosive situation ripe for exploitation. In the immediate future we should expect to see intensification of Soviet efforts in this area, not inconceivably leading to the intervention of Communist bloc 'volunteers' on the Korea and Indo-China pattern.

At the moment most diplomatic activity seems to centre around the projected 'summit' conference. It is not improbable that the Soviet aim in this sphere of activity is to secure a tacit recognition of the status quo in eastern Europe. If they achieve that they will have secured their European flank to some extent at least, and gained a corresponding measure of freedom to concentrate on the Middle East.

E.G.K.

1 May 58.

Our leaders must be men who are convinced that war in itself is never an end, that it is never justified except as a means to a better peace. Hence their vision must extend beyond the concept of victory in battle, to that of a better world thereafter. Such men will seek to proportion and apply military power to the bare essentials of the military objective. At the same time, they will have the breadth of vision to combine military force into an integrated national strategy along with political, economic, and ideological factors which, in felicitous proportion, will generate maximum strength from the resources of the free world.

—*General Maxwell D. Taylor, US Army.*

AUSTRALIAN STAFF COLLEGE 1958 COURSE

Twenty Second Weekly Time Table 30 Jun - 4 Jul

AMENDMENT

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area is generally free of malaria. However, there are all the other tropical diseases—dengue and dysentery, respiratory tract disorders and rabies, tapeworms and tinea—a Medical Officer's paradise. As mentioned earlier, it is a very difficult part of the country in which to field an army.

The City of Bangkok has its special problems. The streets are narrow and the traffic congested, and, when the rivers bring down their waters to meet the incoming tides, parts of the city become flooded. The port, although comparatively modern, is situated about 18 kilometres from the mouth of the river, but the total length of the dredged channel is 35 kilometres. An obstruction in the channel, such as a sunken ship, would be a tremendous problem, for then overseas cargoes would have to be transferred to smaller craft and barges for the run up the river. The nuclear threat would preclude any concentration of troops, stores and equipment in the restricted area of the port; nevertheless the needs of the troops must be met and stores must be kept somewhere handy. In the wet season there are few hard standings outside the city area and the roads are too few and too narrow to allow roadside stacking. After all, Bangkok is known as the "Venice of the East" and rivers and large klongs have largely taken the place of roads. Perhaps it would be better to let the Navy fight the war in this area—ships and small craft, marines, frogmen and the like. This is no place for any self-respecting army.

Brigadier Fuller-Thorte no doubt felt the same way when, after fighting the Phantoms in the northern sector, where the battle had not gone well for the SEATO Forces, he received orders to occupy an intermediate position in the delta area as left forward brigade in the Divisional sector. This was depressing news in itself, but even worse was the Corps Commander's appreciation that if the Phantoms followed up the withdrawal of the forward troops closely, as was expected, contact with his troops in the new position could take place about mid-October—that is, right in the middle of the wet season. There were going to be problems.

* * * *

At first light on 5 September the Brigadier with his Reconnaissance Group climbed aboard his helicopter and left for the new area. With his map across his knees he started his appreciation, and the more he thought about his task the more he became convinced that his main problems would be administrative rather than tactical, although the siting of troops was sure to be very difficult. Drainage was one problem; protection from the elements was another. Even if the units occupied every piece of elevated ground, some troops would have to be dug-in in the flat, open paddyfields. That would be unavoidable and, when contact became imminent, these troops would just have to sit in their weapon pits with water all around them. Movement would have to be severely restricted, for men wearing boots filled with muddy water would soon suffer foot disorders. Movement barefooted could not be allowed because of the danger of hookworm. And another problem connected with movement—should he decide to employ a screen, could it be withdrawn

down a single, straight stretch of road or railway in broad daylight? Could it be withdrawn across the flat, open paddyfields? Either way was sure to be hazardous.

His problems were no greater than his supporting arms commanders'. Where could they site their heavy weapons? There were no laterals and the few engineers available could never construct them in time despite the abundance of road-making resources within 50 miles of his sector. Pioneer and labour companies would be needed by the dozen and, so far as he knew, there was none to be allotted.

At this juncture the Brigadier called to his two senior staff officers and said, "Take a look at this map. This is the sector allotted to us—from both inclusive the river and the main road, with the general line of foremost defended localities along the east-west stretch of the river and road from Bang Pa-in. As you can see there is not a piece of rising ground in the entire sector, scarcely any cover and no laterals. There are three or four creeks running in various directions and two klongs running generally east and west. When the rains start the area will become one large, muddy swamp, and as fast as the troops dig weapon pits they will fill with water. I can not see troops fighting well under these conditions."

The Brigade Major (a Staff College graduate, but nonetheless a free thinker), thought for a while and asked, "Sir, why can't we obtain thousands of large Shanghai jars and countersink them for use as weapon pits? Why can't we knock the sides out of some of them and cement the joins with mud or with mortar? We could make two or three-men pits quite simply. They could be kept reasonably dry and the occupants could obtain protection from the sun if the pits were covered with light bamboo frames with groundsheets stretched across them. At night the lids could be thrown back and used as dry palliases, with the men's waterproof mosquito nets erected on top."

The Brigadier said, "That's not a bad idea. I think it is very feasible and certainly solves the problem of storing ammunition, food and water. But what about battalion supporting weapons?"

"Well, the men could live in pits as I have described," replied the Brigade Major, "but medium machine guns and mortars would have to be mounted on heavily sandbagged bamboo frames."

"You mean mudbags, don't you," observed the Deputy Assistant Adjutant and Quartermaster-General. "Why can't the heavier weapons be mounted on boats, not those small unmanageable canoes, but large river barges?" he asked.

The Brigadier fixed him with a stare and said, "Bill, I think you have overlooked one small point. How do you propose to sail your large river barges into the positions selected when there are only two large klongs right in the rear of the brigade sector? However, I think you have an idea that will appeal to the gunners. They can mount their guns on the barges and the crews can occupy the covered portions. As a matter of fact, that wouldn't be a bad idea for brigade

headquarters—a floating headquarters, eh? I could never see myself living in one of those primitive, thatched roof huts that the peasants live in."

He continued: "Now let's have a look into the possibility of movement. Quite obviously movement within the position will have to be severely restricted, certainly when contact becomes imminent, but I am worried about the daylight withdrawal of any screen or patrols I order out. I could withdraw them as soon as they observe the enemy, but if I do, I might miss the chance of a nuclear target. What do you think, George?"

"Well, Sir," replied the Brigade Major, "I am sure the initial break from contact will be very difficult in daylight, but if some small delay can be imposed, the forward elements could be withdrawn in a number of ways. They could withdraw in fast launches down the river, keeping close to the cover on the banks; they could withdraw down the railway, using some kind of vehicle, perhaps rail jeeps if there are any; they could withdraw on bicycles and motor samlors along the tracks between villages; they could move in small-craft powered by outboard motors down the klongs alongside the main road, thus obtaining defilade from the road embankment; they could be withdrawn on a broad front across country in the balloon-tyred trucks ¼-ton of the 'Paddy Platoon' of the General Transport Company; or they could be lifted by helicopters if any could be made available."

"I think withdrawal via the river is out," said the Brigadier. "My map shows teak holding grounds along both banks, and the troops would be forced out into the open, making them just as vulnerable as they would be withdrawing down the road —or the railway for that matter. The other methods appear to be feasible, although I doubt whether we shall be able to get any helicopters at that stage of the battle. I shall discuss all these means of withdrawal with the patrol leaders or the screen commander when I brief them."

Turning to the Deputy Assistant Adjutant and Quartermaster-General the Brigadier asked, "Do you foresee any major problems in the maintenance of the brigade under the conditions we have been discussing, Bill."

"No, Sir, I don't," said the officer addressed, "although naturally we shall have to modify the present transport system and the method of making deliveries. I expect we shall be told to eat out the remaining stocks in the floating Advanced Base, and I suppose Division will deliver our requirements to an agreed spot on the river or perhaps along one of the main klongs, if there is any cover. Delivery to units could be made in a number of ways. The battalion covering the main road could be supplied by water buffalo pack or by towed bamboo sled; the forward battalion near the river could be supplied by small boats or barges; and the rear units and brigade headquarters by barges, assault boats or samlors, if they could be used. For the initial supply of defence stores — sandbags, bamboo poles, bamboo pickets, barbed wire and tools — I should like helicopter lifts or air drops. The Shanghai jars, if we can get them, could best be delivered by 'Paddy' jeeps towing

sleds, or water buffalo pack. Water supply presents no great problem. There is no reason why each major unit should not have its own bore. Reconnaissance boats lined with plastic could be used as storage tanks, and water could be reticulated down to sub-units by the use of split bamboo guttering running along the bunds. Of course, all troops should be ordered to trap their own rain water for drinking purposes. If bores cannot be sunk, I shall have to deliver water with the supplies, but I would be most anxious to reduce congestion on the few available klongs."

"You know," said the Brigadier, "it's a pity we need ammunition; otherwise we could almost live off the land."

"Well, Sir," commented the Deputy Assistant Adjutant and Quartermaster-General, "I doubt if our troops could live on a diet of rice and fish like the Phantoms do, but I see no reason why units should not appoint 'Fish Platoons' until contact became imminent."

"I was just thinking," said the Bridage Major, "what a lot of rubbish I was taught at the Staff College —movement by road, supply in the field, orthodox defensive layouts— what a shocking waste of time!"

"You're not right, you know," commented the wise Brigadier, "wars are not won by organization; it's the ability to reorganize that counts. After all, adaptability is a principle of war, only some people call it flexibility."

Can we use

ELECTRONIC DATA PROCESSING?

Major B. P. Sloan,
Royal Australian Army Ordnance Corps

MOST considered opinions place atomic energy and automatic computers on the same level as the two most important technological advances to have come out of World War 2. This is what Mr. F. Leary, an authority on data processing, had to say in the Radio and Television News of Jan 57: "You have probably read something about these so-called man-made brains. A search of the Journal, however, reveals nothing on computers or computer applications but many articles on the A bomb. This is understandable. The A bomb burst upon our awareness as a direct weapon of war, and its presence has only been too obvious ever since. The computer, on the other hand, was not a direct weapon of war (although it has played a large part in the science of ballistics), and its presence has only been widely felt in very recent years." I intend to write about the computer as an integral part of electronic data processing and of how it can serve the Army, particularly in the field of logistics.

My aim is to describe briefly in non-technical language electronic data processing machines (EDPM); to say something of the potential they represent to the Army and the army commander; and to express some of my own views on the introduction of EDPM to the Service.

What Is Electronic Data Processing?

A working definition is as follows:—

"Electronic data processing is the effective production, through the systematic organization of all related clerical routines and electronic machines, of essential information needed by management (Command) in its decision making, control and planning." This probably doesn't mean much to you now, so let us have a look at the historical development of EDPM and at some of the hardware and see if this will clarify the matter.

During the 1890s Dr. Herman Hollerith and Mr. James Powers each conceived the idea of punching data onto cards in the form of holes and processing the cards mechanically.[1] This represents the beginning of the relatively familiar punched card and electric accounting machines (EAM). Through the years better

1. See Maj D. J. P. Tier's article "The Supply System for the Nuclear Age" AAJ Mar 58.

ways and machines were developed for punching the cards, sorting them, collating them, adding and subtracting the data on the cards and printing out the processed data or end result. All of these machines were essentially mechanical by nature. During World War. II the US Navy and the US Army each independently sponsored the development of a computer designed to process ballistic data. One of these, the ENIAC, was an electronic digital computer. Both are the parents of the modern data processing type computer as produced by International Business Machines, Remington Rand, RCA, Burroughs, National Cash Register, etc. It but remained to bring the two streams together—the mechanical punched card stream and the electronic computer stream. This has been done in very recent years with EDPM. The electronic computer has been combined with traditional EAM with resulting modifications to the latter.

EDPM consists of a computer plus certain essential ancillary EAM equipment. A convenient way to sort out the hardware is to group it as follows:—

(a) Data originating machines.
(b) Data processing machines.
(c) Data reading machines.
(d) Data conversion machines.
(e) Data transmission machines.

A few words about each group will help to give a clearer picture of EDPM.

Data originating machines are the essential first step from raw data to machine language data. The most common machine is the typewriter-like key punch machine, which punches holes in a card to represent either numerical or alphabetic data or both. This and the source document is usually called the input of a system. There are now other machines, such as punched paper tape machines,[2] which do a similar job. The latest processing media or input is magnetic tape, but up to the present you must first get cards or paper tape in order to get magnetic tape.

Data processing machines are those which digest and work upon the input data. There are two groups —the EAM group, such as sorters, collators, calculators and accounting machines which have been in use for many years; and the commercial type electronic computers which have been in use in America only since the early fifties and are just now reaching Australia. I intend to concentrate upon the latter because they are less familiar and in my opinion offer greater potential.

An electronic digital computer can basically store or remember, add, compare, and discriminate between relative magnitudes for both ordinary numbers or alphabetic characters. It can also subtract, multiply and divide in a roundabout way. It uses a machine language of its own, such as a binary code or a bi-quinary code. It usually consists of an input device, a control panel, a magnetic storage device (varying capacities), an arithmetic unit, an output device and a power unit. It can be programmed, i.e., instructed what to do to the

2. See Maj D. J. P. Tier's article "The Supply System for the Nuclear Age" AAJ Mar 58.

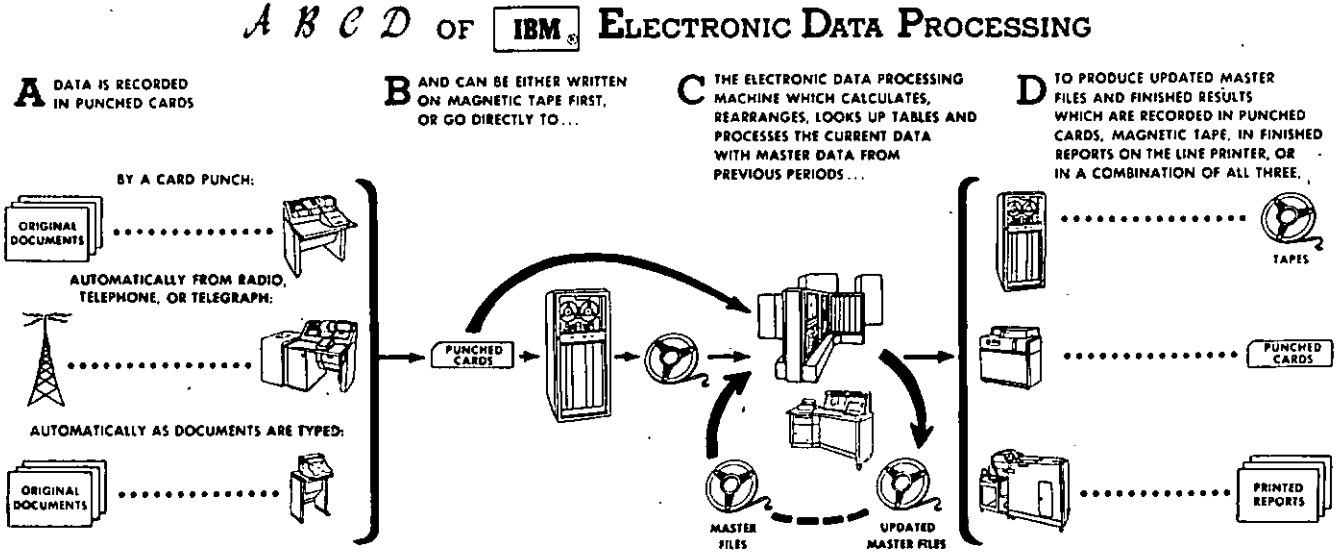
A B C D OF IBM ELECTRONIC DATA PROCESSING
A DATA IS RECORDED IN PUNCHED CARDS
BY A CARD PUNCH:
ORIGINAL DOCUMENTS
AUTOMATICALLY FROM RADIO, TELEPHONE, OR TELEGRAPH:
AUTOMATICALLY AS DOCUMENTS ARE TYPED:
ORIGINAL DOCUMENTS
B AND CAN BE EITHER WRITTEN ON MAGNETIC TAPE FIRST, OR GO DIRECTLY TO...
PUNCHED CARDS
C THE ELECTRONIC DATA PROCESSING MACHINE WHICH CALCULATES, REARRANGES, LOOKS UP TABLES AND PROCESSES THE CURRENT DATA WITH MASTER DATA FROM PREVIOUS PERIODS...
MASTER FILES
UPDATED MASTER FILES
D TO PRODUCE UPDATED MASTER FILES AND FINISHED RESULTS WHICH ARE RECORDED IN PUNCHED CARDS, MAGNETIC TAPE, IN FINISHED REPORTS ON THE LINE PRINTER, OR IN A COMBINATION OF ALL THREE.
TAPES
PUNCHED CARDS
PRINTED REPORTS

Figure 1.

routine mass of incoming data. The number and type of instructions vary. Based upon its ability to compare and discriminate, a computer can be empowered (programmed) to select a certain path of action or to stop. Thus a programme may have many sub routines each representing an alternative course of action. An organization may develop many programmes for many different applications. It does all of these things, and can do them consecutively, at amazing speeds and with a high degree of accuracy. Self-checking devices can be programmed in. A computer therefore has the following attributes which EAM has not or not in the same degree:

(a) Memory-storage.

(b) Ability to compare and ability to be empowered to choose and proceed to next step.

(c) Greater speed.

(d) Greater versatility of operations and more flexible programming.

(e) More expensive.

Data reading machines take over the processed data from the computer (or from EAM), and print it out in one of several ways. It may be a printed report or perhaps another punched card which has both the code holes and also letters and numerals you and I can read. This is usually called the output of a system.

Data conversion machines convert from one media to another, e.g., from punched cards to punched paper tape or to magnetic tape. This is necessary at times because all systems will not accept all media, and of course EAM only processes punched cards. The medium most commonly used now is the punched card; the fastest, most compact and latest is magnetic tape.

Data transmission equipment is used to send data in machine language, e.g., fed in as a punched card at Sydney and received as a punched card almost instantaneously at Melbourne. Punched paper tape transmission is quite common; punched card transmsision is very recent and as yet uncommon. The latter is relatively slow but accurate.

This time devoted to a description of EDPM should pay dividends in a clearer understanding of what are the more important aspects of this article—what is the potential of EDPM for the Army and how should we go about making use of it.

What Can EDPM Do for the Army?

You will all probably agree at once that the Army processes large volumes of relatively homogeneous data. The soldier has even coined his own words to describe it. The first part of this article in essence said that EDPM takes in data, sorts it, compares it, carries out calculations, stores it or prints it out in various ways and all at electronic speeds. These together are prima facie evidence that there is a use for EDPM in the Army. Here are some of the fields in which relatively homogeneous data is processed in some volume:—

Logistics

Issue to units of stores of all kinds, ammunition, rations, POL, etc.

Receipt of and payment for stores of all kinds.

Assessment of usage and requirements at various levels for stores of all kinds.

Procurement of stores, etc., and related financial estimates.

Cataloguing and introduction to the Service of all stores, etc.

Census of vehicles and warlike stores.

Repair for units of equipment and stores of all kinds.

Production planning, progressing repairs, determination of standards, equipment life, repair limits, etc.

Maintenance of records of buildings, property and real estate.

Movement of stores and personnel.

Personnel

Maintenance of personnel records of all kinds, processing of personal occurrence reports, preparation of consolidated strength returns, etc.

Maintenance of medical records.

Maintenance of pay records and processing of pay sheets, etc.

Miscellaneous

Special studies of the type usually conducted by Australian Army Operations Research Group.

Mapping and survey.

Communications and frequency control.

Technical intelligence.

Mobilization planning.

How Can EDPM Be Used?

Upon close examination it may be found that many of the above processes do not alone warrant electric accounting machines, let alone EDPM and an expensive computer. However, new equipments call for new organizations, and this is equally as valid in the field of logistics as in tactics. Many of the above potential uses would not, I believe, provide a sufficient economic load for an EDPM installation. I am equally as convinced that several combinations of these could be supported by an EDPM installation. This opens up a whole host of possibilities as far as organization is concerned, ranging from complete organizational integration to the retention of the present organizations and the formation of one or more all-purpose EDPM Service Centres designed to support designated units. We have insufficient information to come to any definite conclusion. But I think it is reasonable to say that EDPM and the Army logistic organization must be considered, if not together at least in close association.

Beside the very broad impact upon organization there is also an impact related to specific applications and services. The added speed given by EDPM and modern communications will make a re-examination of the whole question of centralization and decentralization well worth the effort. EDPM lends itself to centralized and duplicated recording and decentralized storage.

The next point, on this question of how, concerns systems and procedures. It would be folly indeed to believe that EDPM could be installed with possibly some organizational change, but little thought for the operating systems and procedures. Looking at our Army-wide logistic systems and procedures, one must conclude that they are not integrated. We can't even settle upon a basic unit indent or demand document, let alone upon an inte-

grated procedural flow. Of course, requirements do vary, and undoubtedly some of these are real and ought to influence systems and procedures. But, given good will, it seems to me that a much more highly integrated set of procedures could be evolved to ease the burden upon all, and not the least the unit QM. If this is the case today, it will become doubly important if EDPM is contemplated. Expensive machines must be made to work; why have a dog and bark yourself. Ideally a system should be designed so that it produces all the required data and documents automatically from just one source document. That is, a unit prepared indent should result in the posting of the stock record, preparation of voucher, preparation of depot replenishment demand containing full information, recording of dues in to the depot, and if necessary dues out to the unit, and all of this and more without direct human intervention beyond the original document and an EDPM programme. Only in this way will the full benefits of EDPM accrue. Similarly, there ought to be as much basic commonality as possible—particularly on input, i.e., the basic source documents.

Why EDPM?

Having scratched the surface of how, I want to examine the question of why is it better to use EDPM than the traditional manual methods or even electric accounting machines. The most potent reasons for change are usually expressed in terms of men and money, and EDPM is no exception. In the long run, EDPM must pay its way. This question of money and manpower is probably as difficult as any upon which to get hard, cold facts. Naturally the business machine firms claim considerable savings of this nature, but the literature is not studded with case examples. In Sep 55 a US Army Task Force EDPM for logistics had this to say—"Large-scale publicity and promotion efforts concerning electronic data processing systems have led many to the belief that another Industrial Revolution has arrived and that electronics is the panacea for office and business problems. Analysis of accomplishments in industry and government reveals that while a great deal of planning and study is being devoted to EDPM there is not a single tested and proven application in a major logistical type operation." But this did not prevent the same task force from recommending full steam ahead and concluding that "Government and industry are at the threshold of pay-off offered by this technique of automation." Since then at least four US technical corps have invested heavily in EDPM, and the US Army has acquired an extensive punched card to punched card communications system, specifically for data processing and logistic support. Then, of course, there are many variables represented by machines and systems, and all of this makes it difficult to come up with an answer that an organization can save so much money and men by adopting such and such an EDPM. But it is essential that this task be tackled.

Having accorded priority to money and men, I want now to limit this. These limitations which I am about to propose are far more significant for the Army than for a commercial organization. For the Army victory in war is the pay-off;

the pay-off is a measure of the victory for the commercial world.

The first consideration is flexibility. (A good old stand-by.) This manifests itself as far as EDPM is concerned in the following ways:—

(a) Providing certain precautions are taken, the one EDPM and EDPM operator can be used for any application.

(b) Records can be duplicated readily and dispersed or used as required.

(c) In the event of war, output can be more than doubled simply by going on to three shifts and diluting the existing trained labour force. EDPM can also readily be expanded on the building block principle.

(d) EDPM makes possible many processes and refinements not economically feasible under a manual system.

The second consideration is speed. It is assumed that EDPM will be accompanied by an equally efficient logistics communications system. Speed will mean:—

(a) Immediate reporting of the need for replenishment, procurement, etc.

(b) Immediate reporting and segregation for management action of items not available for issue.

(c) Quicker processing of the essential record-keeping element of a transaction. As the Americans like to say, EDPM "takes the order time out of order and shipping time." This can mean money in commerce—it can mean lives in the Army.

(d) Quicker reporting of stock situations, etc., to higher HQ.

Thirdly, as is usually the case with technological advances, it will require and provide scope for more concentrated effort of higher-skilled people—and I am not talking about machines. I am talking about managers—supply managers. EDPM will provide scope for management by exception. The non-routine is thrown out and highlighted. The skilled person concentrates upon the non-routine and decides upon a course of action. The routine is handled automatically.

Having said something of the potential uses of EDPM to the Army and something of how and why it ought to be used, I want to give some personal views on its introduction to the Service.

Major D. J. P. Tier in his article "The Supply System for the Nuclear Age" was writing more about EAM than EDPM. Nevertheless they are first cousins. However, he limited his scope primarily to the Corps, and this is undoubtedly a field for its employment. He probably knows of similar organizations and experiments in the Army/Corps areas by the British and Americans—particularly the latter's Operation MASS (Modern Army Supply System). What I particularly want to draw attention to is that application in the forward Corps areas should follow, and must be based upon application in the rear areas and know-how in the main support area. If we are to use EAM or EDPM in a theatre of operations in a future

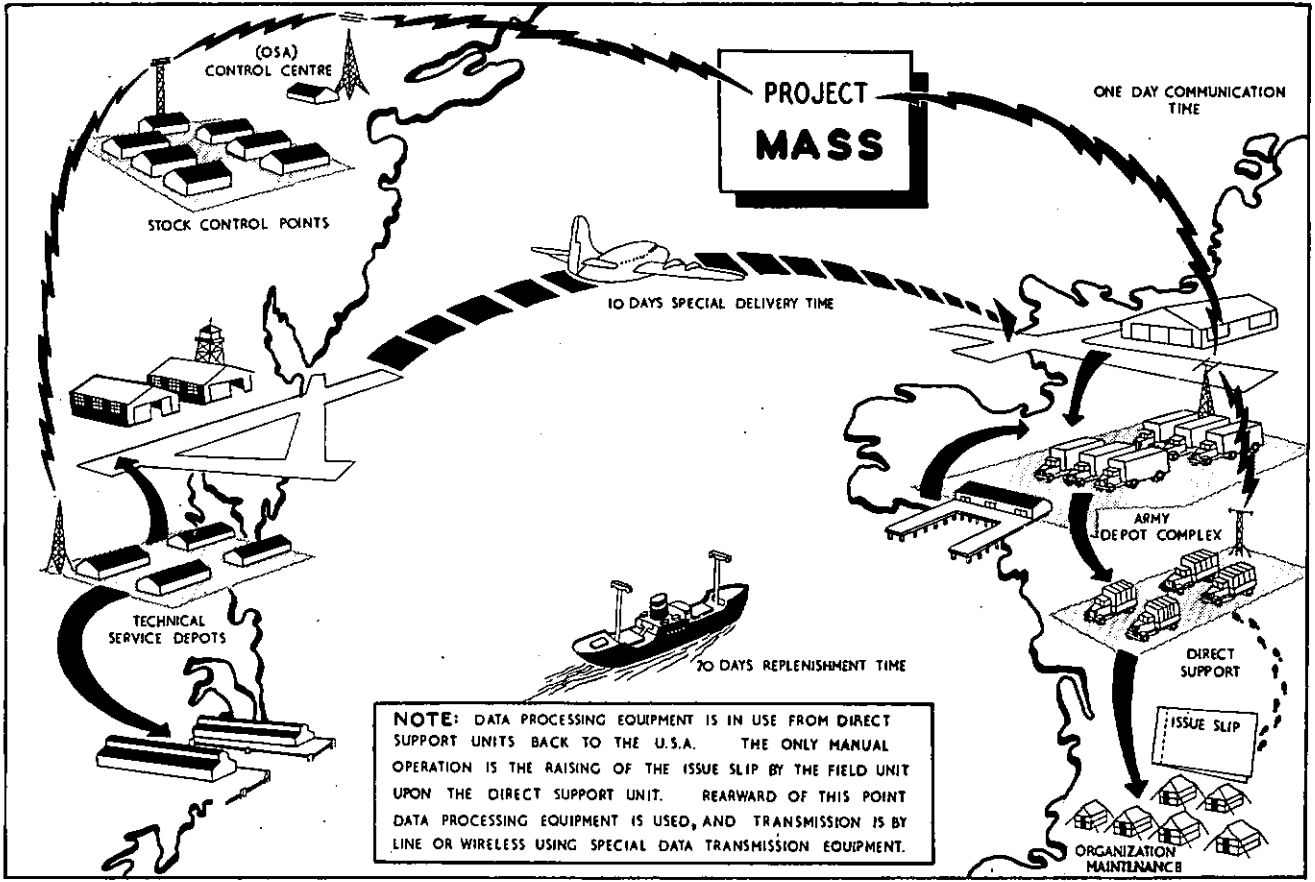
(OSA)
CONTROL CENTRE
STOCK CONTROL POINTS
PROJECT
MASS
ONE DAY COMMUNICATION
TIME
10 DAYS SPECIAL DELIVERY TIME
ARMY
DEPOT COMPLEX
TECHNICAL
SERVICE DEPOTS
70 DAYS REPLENISHMENT TIME
DIRECT
SUPPORT
ISSUE SLIP
ORGANIZATION
MAINTENANCE
NOTE: DATA PROCESSING EQUIPMENT IS IN USE FROM DIRECT SUPPORT UNITS BACK TO THE U.S.A. THE ONLY MANUAL OPERATION IS THE RAISING OF THE ISSUE SLIP BY THE FIELD UNIT UPON THE DIRECT SUPPORT UNIT. REARWARD OF THIS POINT DATA PROCESSING EQUIPMENT IS USED, AND TRANSMISSION IS BY LINE OR WIRELESS USING SPECIAL DATA TRANSMISSION EQUIPMENT.

Figure 2.

war, we must seriously begin to study and to use it in Australia now. The Americans have been using EAM for close on 20 years, but they recognized that EDPM was of sufficient importance to warrant top level consideration early in 1955. EDPM received the seal of approval from Deputy Chief of Staff for Logistics, and a Task Force was directed "to develop a programme for introducing electronic data processing systems into the management of Army logistic missions." It is correct that some independent moves had been made prior to this by some of the Technical Corps, but the programme really didn't get going vigorously until after top level endorsement. And that to me seems to be our first requirement—top level endorsement, not for a specific system or proposition, but endorsement of EDPM as a worthwhile means of tackling some of our logistics problems of a clerical procedural nature.

Obviously EDPM cannot be introduced overnight. Just as obviously it must be piecemeal. But it ought to be co-ordinated, and to an Army-wide plan which clearly lays down priorities and targets. For instance, if the Army does not set as its aim an integrated Army-wide data handling system, then it is more than probable that it will never be achieved. What is more likely to result is a series of independent developments which will present serious problems in the future when integration is attempted. Just a couple of simple examples will illustrate. There are two types of punched cards, 80-hole and 90-hole. If it is decided to begin EDPM at national stock control points (a central depot), then the system must already be thought right through to the area depots and to the units and back up to the procurement agency and sources of supply.

My next point is that you can't treat EDPM as just another office machine. It would be just as valid to say that a teleprinter was an office machine and should be introduced into the service in much the same way as a typewriter. It is potentially a powerful logistics tool, and it must be understood and capable of operation by people who in war will be operating in a Corps or Army area overseas. It will be too late to start teaching officers and soldiers on M-Day. Naturally these people will be supplemented by others drawn from the commercial world. On this score it is interesting to notice that the US QM Corps has the overall responsibility for office machines, but the US Signals Corps was given the overall responsibility (equipmentwise) for EDPM.

Finally, just as new weapons are a challenge to the Army to relate their capabilities to organizations, to movement and to ground, so EDPM will present a challenge to relate its capabilities to organizations, to procedures, and to the realities of war, i.e., to the A bomb and all its implications. It will call for a fresh approach and an avoidance of condemnation simply because something is new or because something is to be eliminated which has always been done in the past. This will call for some re-thinking at high places, including the Treasury. It is quite conceivable that the question of the elimination of visual records will arise; or internal checking may be virtually eliminated; or perhaps all transactions should be

single item transactions; or the substitution of a punched card for both indents, demands and vouchers; or it may be that unit ledgers as we know them today may be completely transformed and removed from the unit. There are dozens of possibilities, all of which probably only have two things in common—first, they will be made possible by EDPM, and second they will be a break with the past. Our destiny is in the future—let us look to the future.

Loyalty on the part of a subordinate means a true and voluntary compliance with the will and plans of a superior officer.

Everyone has a desire to have things their own way—that is very natural, and no man can be blamed for it; the milk and water man never amounts to very much, anyway.

There is a proper time and a proper way to represent your own ideas, but once a decision has been reached by a superior —once your duty has been laid down—it is time to put your personal views aside, and co-operate energetically and loyally to carry out the plan which it is your duty to follow.

Any leader who can't do that is not loyal, and if you are not loyal yourself, you must not be surprised if the men you lead are disloyal to you.

—Major-General J. M. A. Durrant.

Future Logistics

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SEVERAL articles have appeared recently in Australian Service publications stressing the importance of modern supply systems and integrated logistic support.

Field Marshal the Viscount Montgomery recently stated that four-fifths of all problems in World War II were logistical in nature. Bearing this in mind, one cannot help but ponder whether or not our present Australian logistical system could efficiently support a combat force in an overseas theatre under modern warfare conditions.

We should not underestimate the importance of inter-service logistics, more or less along the lines of the Single Manager Commodity Assignment System now in operation in the U.S.A. Under this system, one particular Corps is responsible for the procurement, receipt, storage, maintenance and issue of certain commodities for the whole of the US Services (US Navy, US Army, US Marine Corps and US Air Force).

As an example, the US Quartermaster Corps is responsible for all subsistence and clothing and textile items. The QM Corps administers the Single Manager Stock Fund from which commercial suppliers of subsistence, clothing and textiles are paid. Reimbursement is made by the Army, Navy, Air Force and Marine Corps on the basis of items withdrawn from the QM Corps subsistence and clothing and textile depots. The elimination of duplication and other advantages of such a system are left to the imagination.

This is only a stage towards the eventual solution. It would be an impossible task to disband the technical service Corps by one swift stroke, but that is the eventual requirement. There will be only one logistical Corps in the future providing integrated supply, repair, transportation, communication and construction support, not only in the Army but to all services in a combat theatre of operations.

The horse, the battleship, the manned fighter aircraft and the heavy tank are passing into history as mediums of war which have outlived their usefulness. Regiments with traditions dating back many years have been disbanded or amalgamated due to modern developments, and, distasteful as it may be to some, such a trend will continue.

Despite the wails, lamentations and sentimental feelings of many loyal and rugged soldiers and citizens, changes will and must occur in our Army which could well mean the end of the RAAOC, RAASC, RAE, etc., in their present form.

If you ask why, then a look into the not too distant future may provide the answer.

Wars are decided by manpower, firepower and mobility, or the protection provided by these factors. The 19th and early 20th Century wars brought forth mass tactics and bulk concentration of armies.

Behind heavily manned defences and continuously held lines, the supply services were able to function with very few combat casualties. Transportation and lines of communication provided the main problems.

World War II brought a change to these conditions by the introduction of armoured mobility and strategic air power. Destruction of logistic support often decided the outcome of a campaign to a greater extent than actual combat operations. The "round-the-clock" bombing operations of World War II, which were mainly anti-logistical in nature, helped to defeat Germany.

Most thermo-nuclear weapons have been designed to neutralize logistics, and this has necessitated the introduction of dispersed locations. Huge depots and congested ports of entry have gone forever. The strategy of Von Moltke has returned—advance divided and attack united.

Imagine what thermo-nuclear weapons would have done to the Allied Communications Zone during the European operations of World War II. Over 21 million tons of logistical support for US forces alone moved through the pandemonium of European ports. Handling, classification, storage, transfer and issue converted these 21 million tons to hundreds of millions through countless rehandlings from port to front.

The thermo-nuclear missile will ensure that this will never happen again. Protection can only be afforded by distance, dispersal and mobility.

How will a force be logistically supported if roads, large air bases, ports and railroads can be continuously damaged by missiles?

The modern conception is that the combat forces of the future will be organized on the Brigade Group or Combat Group principle. Large concentrations of men and equipment will attract thermo-nuclear attention and cannot normally be considered as a possibility for future combat requirements.

The logistical support to the Combat Groups will be provided by a small logistical unit which will contain a Supply Group, Transportation Group, Repair and Maintenance Group, Construction Group, Communications Group and Medical Group. The Supply Group will handle all the supply items previously the responsibility of RAAOC, RAASC, RAE, RAAMC, etc. How will such a system operate?

Transportation will undergo a radical change in its application to war. Supply by air will not take over from other systems, but will augment them to a greater extent than in the past. Transportation to

an overseas theatre will continue to be mainly by sea; however, the cargo submarine may also enter the field of transportation. Large convoys of ships will not be possible in the future, nor will large concentrations at established ports. Ocean shipping will have to unload through numerous widely scattered and mobile bases. Such unloading facilities can be provided by the use of prefabricated mono-rail systems capable of rapid erection and demolishing. Mono-rail appliances would simplify off-shore loading and make multiple off-loading points possible.

Sea transport would be augmented by water-based aircraft, which promises to revolutionize military logistics. The need for heavy duty airfields and elaborate airfield facilities does not exist in respect of water-based aircraft which are capable of landing and taking off from lakes, inland waterways and coastal waters, and do not require established ports.

Jet-propelled seaplanes of the "flying LST" type are already on the drawing boards or under construction. They are capable of flying thousands of miles at the speed of sound. The USA is producing a seaplane called the "Sea Mistress" with a load capacity of 130 tons and capable of transporting a fully equipped combat company.

One can visualize a "Flying LST" discharging its load from a ramp onto the beach. This load can then be transferred to "high lift" aircraft capable of short take-off and landing and being transported direct to a strip close to the Combat Group. In some cases, seaplanes could discharge their cargo at lakeside ramps or river banks.

Four cargo aircraft, each capable of lifting 50 tons, could easily satisfy a division's daily requirements from a main base thousands of miles away. Just imagine an Australian division in a country such as Borneo receiving its daily maintenance direct from Australia per medium of four aircraft. Whilst some theatre and combat reserves would have to be held, the great bulk of supplies would bypass large depots, transit areas and similar outdated concentrated installations.

Another recent development also shows promise of revolutionizing air transport. This is the introduction of the hydro-ski and hydro-lift. The hydro-ski lifts the hull of a flying boat out of the water at relatively slow forward speed, thus reducing the punishment absorbed by the hull as it ploughs through the sea. Once the hydro-ski reaches the surface it acts as an aquaplane until the craft is airborne. On take-off, hydro-skis emerge as planing surfaces after a short run at the low speed of 10 knots, thus eliminating the heavy spray normally occurring at higher speeds.

The hydro-lift resembles the hydro-ski, but is non-submersible and used only as an aquaplane. It permits a land plane to operate from virtually any surface, including water, snow, mud and runways. The purpose of the hydro-lift is to allow a land plane to operate from water. The hydro-lift skis include wheels which protrude from beneath to allow the aircraft to operate from land.

A speed of 15 miles an hour is sufficient to permit the hydro-lift

to keep the aircraft on the surface. To stop, the pilot must run the aircraft on to a beach or landing ramp.

For a water take-off the pilot begins from the beach or ramp, taxiing two or three times the length of the aircraft to pick up speed, then turns into the water for a normal take-off. In other words, as long as there is a stretch of water, land aircraft can take off without the necessity of long, vulnerable, conventional type runways.

In the USA a large aircraft (C123) was tested in this role and found to be satisfactory. It only takes one modern bomb or missile to destroy an aerodrome, thus aircraft capable of water landing and take-off possess many advantages.

The Supply Group with the combat force would need to be stocked with only very fast-moving items. By the use of transceivers, data processing machines and other electronic devices, a punch card system of demanding and accounting within the logistical command, and connected to the main support area, would ensure delivery within a few days direct to the demanding unit.

Food logistics have also undergone a drastic change. Experiments are being carried out in the "irradiation" treatment of food. This process involves the penetration of food by gamma radiation. It destroys all spoiling agents and can result in a process similar to dehydration. Its main advantage is that refrigeration is not necessary, and food can be held in the air without spoiling, in temperatures from 20°F to 120°F. The present experiments are being concentrated on producing a pre-cooked unitized ration.

The logistical advantages of irradiated food are:—

(a) Cost reduction in food handling.

(b) Decrease in refrigeration requirements.

(c) Reduction in maintenance support.

(d) Reduction in food losses and carrying of waste.

(e) Improvement in acceptability.

(f) Greater variety of menus.

(g) Increased use of fresh foods.

(h) Saving in catering personnel, fuel and equipment and water required for cooking.

(j) Eradication of multiple handling processes.

It is expected that the pre-cooked "irradiated" ration will only require to be immersed with its expendable plastic container in hot water to bring it to the required form. Instead of mess tins, an expendable food platter will be included with the ration. Containers will permit palletization. Thus the soldier will not require water to clean his mess kit, fuel to light cooking equipment (except for hot water), ration trucks to transport rations which produce up to 25% in bulk waste, cooks to incur the wrath of fastidious gourmets or mess duty personnel to prepare vegetables or perform other culinary tasks.

The size range of clothing will also be reduced, thus eliminating large stocks of clothing items necessary to satisfy varying bodies of

diverse shapes and weights. The each-way stretch sock and a similar application to clothing will make this possible.

Land transportation will also have a new look and must be capable of cross-country performance never previously thought possible. Land vehicles will probably be equipped with wheels up to 10 ft in height. The huge double-tubed, self-sealing tyres will contain fuel, thus increasing the vehicles' own range as well as transporting fuel for other purposes. When not carrying fuel the tyres will be air or liquid filled. Vehicles are already in operation where each wheel is driven by an electric motor operated by power supplied from a Diesel motor. The large land vehicles will carry a frontally located blade capable of making a track or filling in trenches, etc. They will also be capable of towing sleds filled with stores. A forerunner to this type of vehicle is already in operation in Australia on dam construction work and in the lumber industry.

Despite all these innovations necessary to improve logistics, personnel in a future war will enjoy less amenities than previously. Night duties will be normal, and movies and other entertainments will be possible to a far less degree than formerly. Communication Zone troops will be far worse off than Combat Zone troops in this regard, as it is the Communication Zone that will receive the greatest thermo-nuclear attention. The front line use of nuclear weapons seems doubtful except for the laying down of radioactive waste materials as a defensive barrier behind which to locate defensive posts.

Such a type of warfare requiring dispersion and austerity will also require a high standard of discipline. We should, therefore, give thought now to two prime requirements, namely, competent and audacious junior leaders and trained logisticians. World War II type of training is not sufficient, and if we intend to institute a School of Logistics we should start now to cultivate our logisticians of the future.