CANADIAN Army JOURNAL

VOLUME 4 NUMBER 10 MARCH 1951

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The Cover

Heavy engineering equipment employed in the construction of an air strip in Northern Canada.

CANADIAN Army JOURNAL

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

TOPOGRAPHICAL MAPPING FOR DEFENCE

By
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PART 1

It is only within the last few years that Canada has started to take her place with other countries of the world in the task of topographical mapping. Work has been carried on by both civil and military survey organizations for more than half a century, but until recently the scale of the operations was so small in relation to the total task that by 1946 only about 25 per cent. of the country had been covered at medium scales (1/250,000 and larger), and only about 7 per cent. at large scales (1/50,000 and larger); moreover, such topographical maps as did exist were principally of the easily accessible portions of the country.

In relation to the defence of North America it was immediately apparent that this was a highly unsatisfactory state of affairs, and a plan was approved in 1947 which will provide, within a reasonable number of years, for the minimum requirements of defence. These are, in brief, complete 1/250,000 coverage with 1/50,000 maps of the more important routes and localities. To readers of this article who are familiar with the 1/25,000 maps available for all of Western Europe, this will probably seem somewhat inadequate, but available resources hardly permit a much more ambitious plan.

The Army Survey Establishment is responsible for all defence maps but owing to the magnitude of the task, practically all of the resources of the Department of Mines and Technical Surveys have also been conscripted to assist in this mapping. Photographic coverage is obtained from the RCAF and to some extent

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A Sikorsky helicopter which is used for transporting survey parties to stations.

from private companies. The photographic plan includes vertical photography of the whole country so that in areas not covered by large scale maps the 1/250,000 map may be supplemented by the aerial photograph.

Historically speaking, military mapping in Canada dates from the early 19th century when units of the Royal Engineers stationed in Canada produced a few large scale topographical maps in the immediate vicinity of garrison towns, but it was not until 1903 that the Militia Department set up a small permanent mapping section manned chiefly by topographers of the RE's loaned by the War Office for the field season each year. This section started a programme of 1 inch to 1 mile mapping of Southern Ontario and Quebec which was carried on steadily until by 1939 some 60,000 square miles had been covered. In 1926 this section became the Geographical Section, General Staff, and during the latter part of the inter-war period, under the command of Major E. L. M. Burns (later Major General), the tendency was to emphasize training of personnel and development of mapping techniques suited to active service conditions.

During the Second World War the GSGS was engaged in training personnel for overseas survey units and at the same time was called upon to produce emergency maps of the many military areas and defence zones.

In the post-war reorganization of the peacetime army the survey branch was expanded and renamed the Army Survey Establishment, RCE.

In addition to its primary task of defence mapping, the Army Survey Establishment is required:

1. To train military survey personnel for war.

2. To supply maps to the three Services and maintain a mobilization stock of maps.

3. To prepare special maps from time to time as may be required for planning and training purposes.

4. In time of war to supply a nucleus of trained personnel for field survey units, to be the base map production unit for the three Services and to be responsible for the training of reinforcements in Survey trades.

The establishment includes both military and civilian personnel. Civilians employed by the Department of National Defence occupy senior technical posts on the staff and provide the continuity not normally found

Breaking camp.

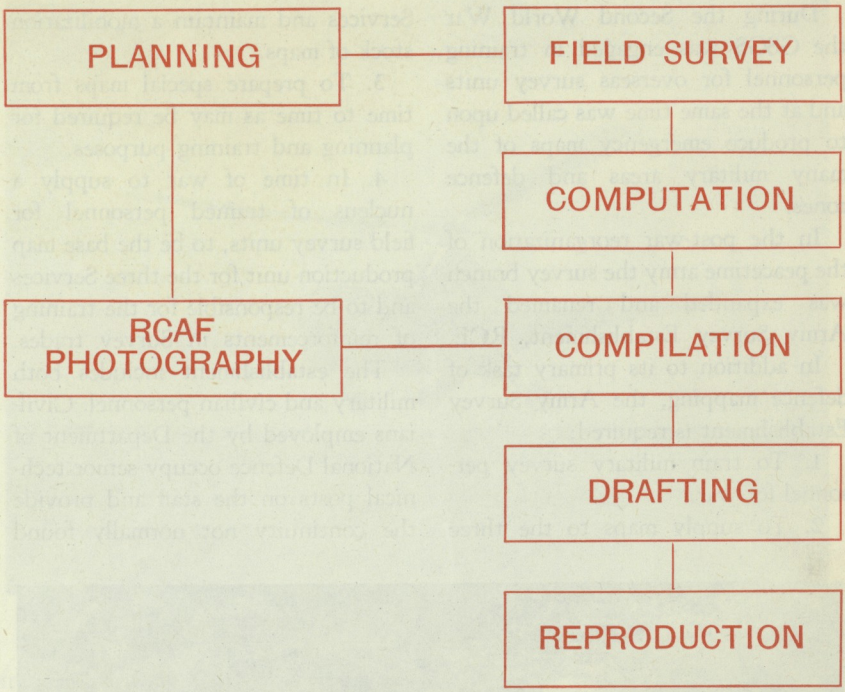


FIG. 1

in a purely military establishment. Junior civil servants are employed on certain routine tasks, mainly in the drafting and reproduction sections.

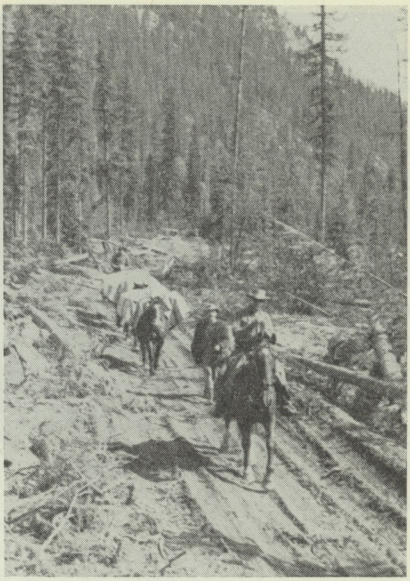
The unit is divided into sections, and in broad outline there would be three separate groups: fieldmen, photogrammetrists and those employed in reproduction. A more detailed breakdown of operations is given in Fig. 1.

The methods used in phases of map making shown in Fig. 1 differ widely depending on the scale required. This article will deal with methods used in the making of a 1/250,000 map of mountainous country. However, in the section dealing with compilation, mention will be made of methods used in compiling 1/50,000 maps.

Planning is the first step in the process and is based entirely on priority requirements. In theory it is known well in advance which areas are to be mapped and at what scale. A year in advance of the planned survey the RCAF is given an outline of areas that we intend to map. They photograph these areas in the

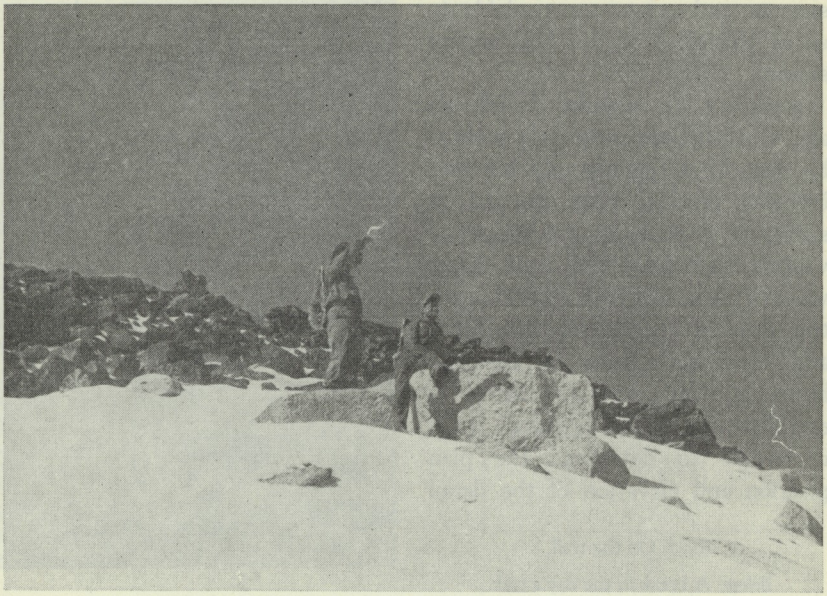
summer and prints are available to us at the close of the field survey season.

Contrary to popular belief, an area that has been completely covered by vertical air photographs has not, by this process, been mapped or surveyed. A photograph is subject to various distortions and scale errors which vary in size with ground relief, tilt, lens errors, field of view, etc., and until such time as adequate horizontal and vertical control is established on the ground it is impossible to determine the plan position and elevation of the detail



Right: On the trail.

Below: A break in the day's trek.



Pointing out a mountain feature.

depicted thereon. However, after ground survey has been done air photographs become another tool by which precise measurements can be made to produce maps.

Having obtained photographic coverage, we are ready to plan field operations to establish the necessary surveys on the ground.

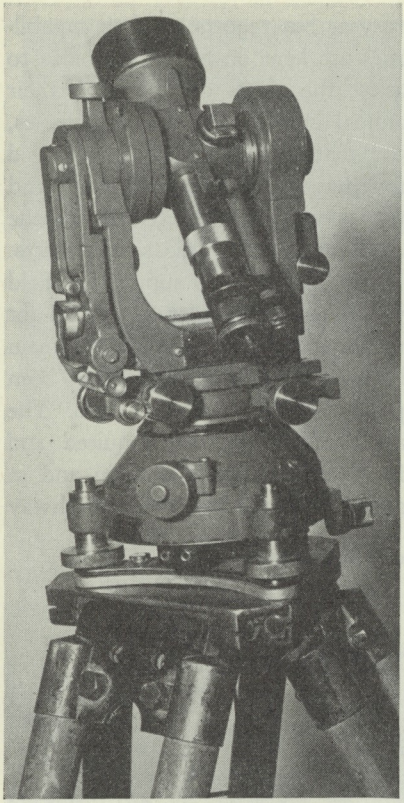
Survey parties are made up from Army Survey personnel in Ottawa with an officer or warrant officer in charge. From a general knowledge of the area in which they will work, the best method of tackling the job is decided. Travel routes, transportation and other general factors are considered. In some cases trucks are used where the work is on or around highways. Horses are used in the bush and in conjunction with trucks where it becomes necessary for the party to move off the road. All previous survey data is assembled and sifted to find which portion of it will be useful in producing the map. Old maps of the area are studied, field notes collected and the whole project is generally discussed. A decision is finally made from which points the fieldwork should be initiated and how much of the previous work can be accepted without question or which part of it

should be checked and securely tied in to the proposed net.

A study of vertical photographs generally indicates the best travel routes with the approximate location of lakes at which supplies for the party can be brought in. Here, also, arrangements are made before the field season with local charter airplane agencies, giving approximate dates, so that a general idea can be formed of what is required, where and when. The cook and packer for the horses, in the case of a horse party, are civilians. Such of these as prove satisfactory are generally re-engaged from year to year but reports on their capabilities are kept on file in the office to assist the chiefs of parties in their annual choice of personnel. Horses, too, that are to be rented are arranged for during the planning stage and the owner is instructed as to the rendezvous before the season starts.

The problem of supply for field parties is not restricted to food for the men. Trucks used off the main highway use fuel that has been previously taken in for them. The approximate quantity required and its location is decided upon and in recent years the Northwest Highway

Tightening a shoe on a packhorse.



A Wild transit.

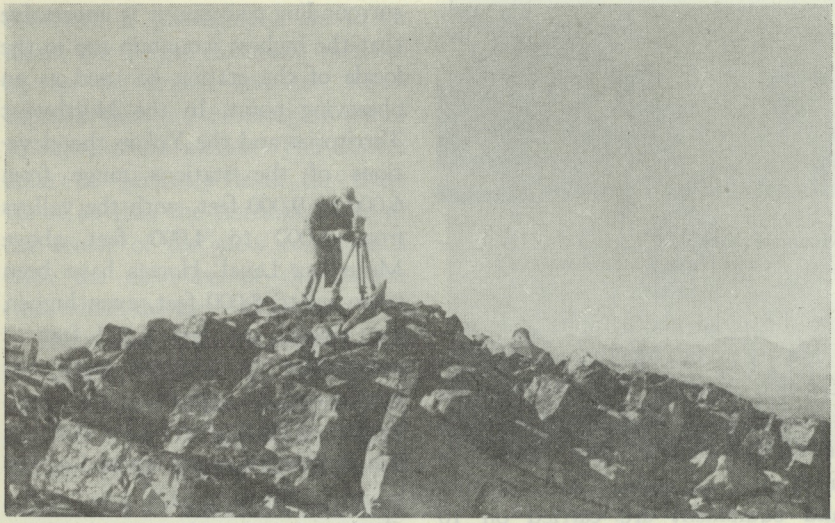
System units along the Alaska Highway and at Whitehorse have been of great assistance to our parties working in those areas. Helicopters present a totally different problem with regard to supply. Fuel and oil are their primary need. Maintenance crews come with the aircraft and keep it conditioned for use on every day of good weather.

Finally, equipment for parties is issued from the unit stores in Ottawa. It is packed and shipped to a collection point at or near the area in which it will be used. The equipment includes tents, cooking utensils, clothes, sleeping bags and, most important of all, instruments for the season's work.

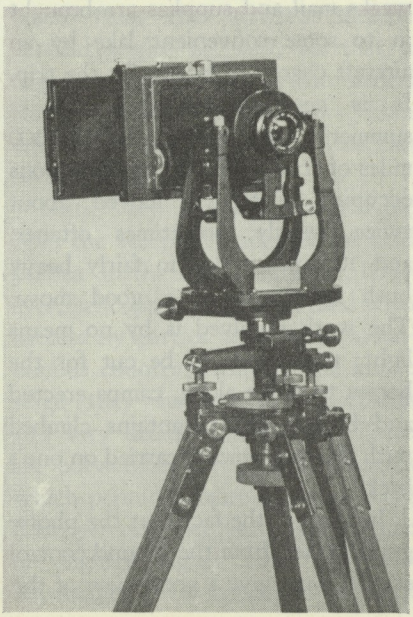
The instruments used in the field range from steel tapes, clinometers, barometers to the more technical instruments, such as transits, levels and so on. The precision of the instrument to be used for a particular type of work is determined by the accuracy required so that high precision instruments, costing more and requiring expert handling, can be used where they are most needed. This criterion determines the use to which any instrument is put in all phases of mapping, including field work, compilation and reproduction.

The Wild T-2 transit is used for higher order work and is capable of angular measurement reading to 1″ of arc (approximately 3/10 inches at 1 mile). It has proved itself to be ideal in mountainous country where compactness and comparative lightness with no sacrifice of accuracy are the fundamental requirements.

The Berger Mountain theodolite with camera attachment is used on lower order work. It is graduated to read to 1 minute of arc but on subdivision readings to 30″ can be taken. The camera is separate from the



Setting up the transit on a mountain-top station.



Berger mountain theodolite with camera.

telescope but is made to fit the standards, so that the telescope can be removed and the camera clamped in to take photographs where required.

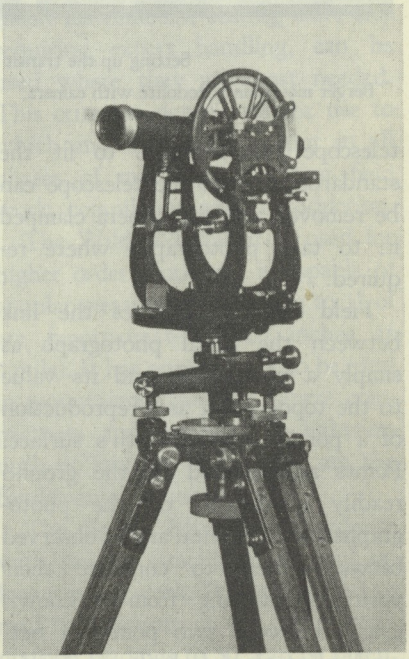
Field work constitutes the link between the aerial photograph as simply a photograph and its value to the topographer as a reproduction of a portion of the earth's surface. Points are selected on the ground readily identifiable on the photographs and horizontal angles observed between them to correlate their positions. Starting from a known length between two points, a network of stations is built up on the selected area to form ground control

Mountain peaks photographed with the Berger camera from a control station.

for the aerial photographs.

Survey parties working in Northern Canada generally leave Ottawa at the end of May and start working in their respective areas during the first week in June. Their supplies and equipment are carried on 10 horses, making the party self-sufficient for a month at a time. Every four weeks mail and supplies are brought in to some convenient lake by an aircraft chartered locally for the trip. It is generally accepted that a summer's work should include 300 miles of travel with 20 to 30 stations occupied. Camp is moved about twice weekly, sometimes oftener, and 10 miles a day in fairly heavy bush is considered a good move. The work involved is by no means light: trails have to be cut for the horses to move along, camps erected and broken and mountains climbed with the instruments carried on one's back.

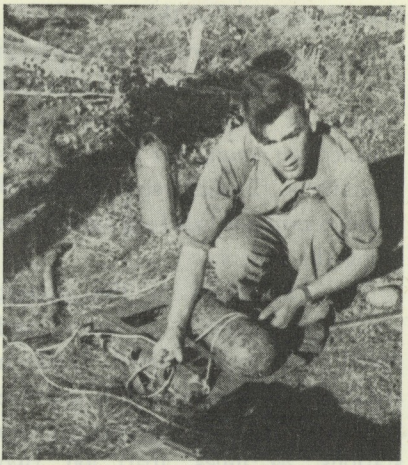
In view of the fact that the photographs taken from the ground control station must give a good view of the surrounding country, it is imperative that the highest mountain top in the locale of the station be used as an observing point. In the Northwest Territories and the Yukon the elevations of the stations range from 6,000 to 9,000 feet, with the valleys from 2,000 to 4,000 feet above Mean Sea Level. Horses have been taken up to 5,000 feet, even higher, but always the last 1,500 feet at least must be climbed with the instruments on a packboard on one's shoulders. Having arrived at the top, the instrument is set up and angles



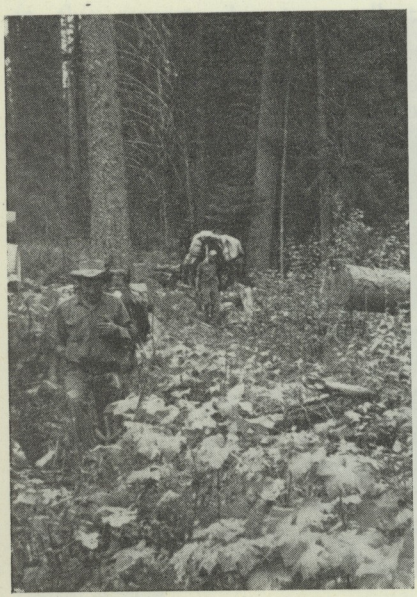
Berger mountain theodolite with telescope.

observed. If photographs are to be taken, the Berger camera is then set up on the tripod and ten views exposed, each one covering an arc of 36° around the station. The camera must be perfectly level for these views so that the horizontal line in the centre of the view corresponds with the elevation of the station from which the views are taken.

The photographs are shipped back to Ottawa as soon as possible so that they may be developed and the Chief of Party informed as to their quality. This process of observing angles and taking photographs is repeated over and over again, moving from station to station until the field season is completed. The angles taken from the stations include vertical angles as well, so that a trigonometric level net is also carried through the triangulation from which elevations of the stations can be determined.



The Wild T-2 transit being strapped to a packboard.



Moving through wooded country.

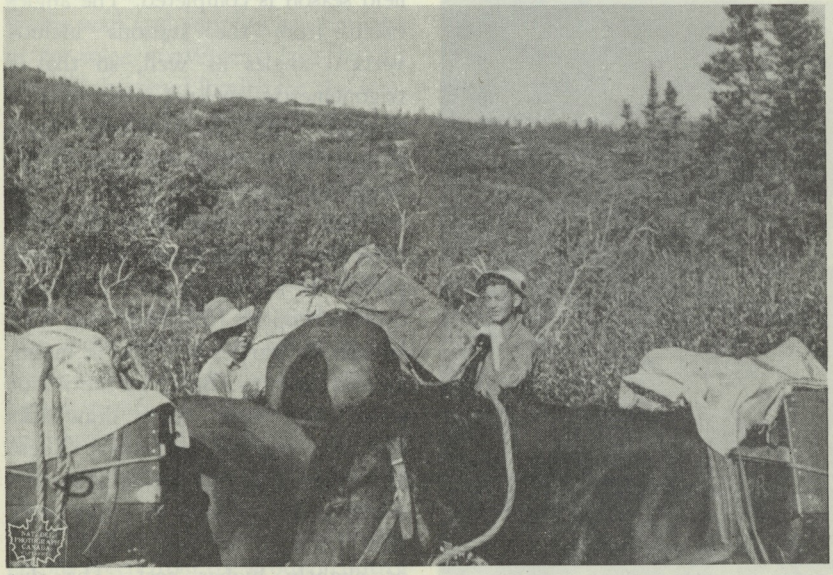
Until very recently horses have been the accepted transport for field parties. In the last three years, however, helicopters have been used with success by parties working in mountainous country. Being in the infant stage they have their drawbacks and very decided limitations. These are outweighed by their advantages which permit of more mapping being done per man per year, at the same or slightly higher cost. The disadvantages of a helicopter are not

insurmountable but they will remain, even though the overall efficiency in the use of the aircraft will increase. Supply of fuel and general maintenance are among the more obvious limitations, landing space, temperature conditions, altitude and so on being the others.

The advantages of the aircraft are increased range of work, and speed and time gained between stations. For example, it is possible from a base camp to occupy two stations 20 miles apart on two consecutive days or even on the same day, whereas with horses it would take two days to move between stations, with a day each for climbing them. Camps are more static, less moving around in the course of a season is done, three or four camps being the most that would be required for the summer's work. And finally, the fieldwork done for the number of maps that can be produced per man is considerably more than could be turned out by a horse party in the same period.

The field season closes in September, the parties returning to Ottawa during the first week in October, to set about compiling the data to produce the maps.

(To be continued)



The end of the trail.

Rommel versus Montgomery

By
MAJOR GENERAL KAZIMIERZ*

One of the interesting by-products of almost every war is the creation of legends and myths, not only about events, but also about the participants. The last War broke all records in this respect, due to excellent propaganda and reporting techniques. From out of the galaxy of outstanding leaders on both sides — aside from General Dwight D. Eisenhower — Field Marshal Bernard L. Montgomery and Field Marshal Erwin Rommel became the most legendary.

It is worthwhile to attempt to understand and compare these two figures and their ways of command. In attempting to present an accurate account of both these famous commanders and their operations, one cannot confine himself solely to an analysis of their battles. It is necessary, although superficially, to examine their military preparations, personalities, and attainments in the non-objective periods of their "duel."

Military Backgrounds

Although Montgomery was four years older, and became an officer two years earlier, both climbed the military "ladder" in almost the same length of time. Advancement for both was slow during their early careers. Rommel, due to *Reichswehr* restrictions, was obliged to wait a long time for promotion to the ranks of major and lieutenant colonel. To illustrate, while Montgomery became a lieutenant colonel in 1930, Rommel did not become a major until 1933, and he had to wait until 1935 to achieve the rank of lieutenant colonel. They became generals at about the same time: Montgomery at the end

** This article was translated and digested by the Military Review from "Bellona", a Polish language military quarterly published in England.—Editor*

of 1938 and Rommel a week before the invasion of Poland (1939). The interval in their advancement to corps commanders was reduced to six months. In their advancement to marshal, Rommel preceded Montgomery by two years, receiving the marshal's staff in 1942.

From the standpoint of practical infantry operations in the line, Rommel, unquestionably, had the advantage. Rommel remained in the line, without interruption, from 1912 to 1935, while Montgomery, during that time, spent a good many years in hospitals, on staffs, and either as a lecturer or student in schools. This does not mean that Montgomery did not climb the "ladder" to the position of a line commander. He commanded at all stages; but he commanded for shorter periods.

Rommel had a greater advantage from the standpoint of combat experience. He spent the whole of World War I at the front (French, Rumanian, and Italian) as a company commander, distinguishing himself through his bravery. Montgomery saw action for only a few weeks in 1914—being wounded early in the War and spending most of the time in hospitals near the front. Likewise, during World War II, Rommel acquired considerably more combat experience before he "crossed swords" with Montgomery. In 1940, Rommel commanded an armoured division in combat; and from February 1941 to August 1942 he commanded a corps in Africa.

Montgomery had experienced only a short tour as a division commander in France during 1940 before going to Africa. However, from the standpoint of staff and scientific preparation, Montgomery undeniably surpassed Rommel. Montgomery had attended higher military schools, had more staff experience, and had commanded larger army organizations during peacetime.

Military Achievements

Despite general opinion, Montgomery and Rommel measured their forces and capabilities against one another over a relatively short period of time. In Africa, they opposed each other for only seven months (from 13 August 1942 to 8 March 1943). This period was too short to compare adequately the two leaders, particularly Rommel. In order to understand Rommel, it is necessary to go back further in his career, not to World War I nor to the September campaign, but rather to examine his operations in France in 1940 and in Africa before the arrival of Montgomery.

In France, as the commander of the 7th Armoured Division, he displayed determination and bravery. On 14 May, he was slightly wounded and almost made a prisoner of war. His division, which he had been com-

manding for only three months, forced its way far ahead of the adjoining 5th Armoured Division and achieved great success at Clairfay, Ovesnes, Landrecies, Le Cateau, St. Eloi, and St. Valery. In the second phase of the campaign, Rommel took Cherbourg which was weakly defended by 30,000 French troops. In this engagement Rommel's division took many thousand prisoners, 458 tanks and armoured vehicles, and 340 guns. In the same engagement, he lost only 42 tanks and 2,500 men. These successes, as well as special considerations on the part of Hitler, constituted the beginning of Rommen's fantastic career.

Operations in Africa

When Rommel arrived in Africa, on 6 February 1941, with the first contingents of the *Deutsches Afrika-Korps*, he was given the mission of covering and defending Tripoli. With this in mind, he had to assemble his corps, which was attached to the Italian Army. When the Italian forces were routed by Wavell, Rommel's mission was changed. Despite the fact that he was short one armoured division, and had not yet established his lines of communication, he sent out detachments immediately in the direction of Agedabia and, on 31 March, conducted a deep reconnaissance which developed into true offensive action.

He operated audaciously and violently, as he had in France. In spite of the warning of the Italians, he pushed the main body of his forces over the trackless terrain to Mechili and Derna, cutting off considerable British forces in the Bengasi province. In a single move, he reached the Egyptian frontier, although Tobruk had not been taken and his lines of communication were drawn out hundreds of miles. At Halfaya and Sidi Omar, he repelled British attacks, consolidated his positions, established a gasoline supply base, and began plans for the conquest of Tobruk. There he experienced his first defeat.

In mid-November, he was attacked on the east by Cunningham, who at that time was commander of the British Eighth Army. In spite of the British numerical superiority in tanks and aircraft, Rommel held off the British counter-offensive until 6 December 1941, by thrusts of the 15th and 21st Armoured Divisions against the British rear. Finally, however, he withdrew, leaving behind, in the border fortifications, tank detachments which defended themselves until mid-January. Pressed rather lightly by the British, he held a position back of Marsa El Brega on 11 January 1942.

Use of Initiative

Although Rommel lost more men and matériel here (about 60,000 men

and 386 tanks) than he did later in the battle of El Alamein, he went over, 8 days later, to the counter-offensive—without the knowledge or approval of the German or Italian high commands. He achieved complete surprise and threw back the British forces to the line Gazala—Bir Hachem.

All credit must be given to the part played by Rommel's workshop-repair service. This organization helped to provide a flow of tanks to Rommel's forces when delivery from Germany slowed down. Tanks at his disposal increased from 200 to 560 during the period March to the middle of May—332 of them being of German origin. Thus strengthened, he attacked, on 26 May, the new British-French line, jumping ahead on Ritchie's contemplated attack. He met with stubborn resistance, and it was only after hard fighting that the balance of victory was tipped in his favour. He conducted the pursuit with exceptional energy and audacity. On 17 June, he took Tobruk which, at that time, was weakly defended by South African forces. In spite of the complete exhaustion of his forces, and possessing only 50 tanks, he reached the El Alamein "narrows" by 4 July. During this action, he captured 45,000 prisoners, 1,000 armoured vehicles, and 400 guns.

Pinnacle of Success

This was the zenith, the culminating point of his successes. Although he had arrived inexperienced in desert fighting, he learned its secrets and peculiarities and skillfully exploited them.

It seemed as though no one could check the German avalanche, and that the gate of the Near East was wide open to it.

The Allied forces quickly closed the gate leading to the delta of the Nile and changed over to the counter-offensive. They received four new divisions (the 8th and 10th Armoured Divisions and the 44th and 51st Infantry Divisions) plus artillery, anti-tank, and armoured matériel. At the same time, the Allied air forces in the area were increased and the British shifted their high command. Alexander replaced Auchinleck as commander in chief of the British forces in the Middle East and Montgomery succeeded Ritchie as the Eighth Army Commander. The British were bringing in an ever increasing flow of supplies, while German-Italian transportation could provide only a trickle. Although Malta was paralyzed and threatened, deliveries from Italy were cut 50 per cent. It was during this period that Montgomery assumed command of the British Eighth Army (13 August). He attempted to establish order, heighten morale, and further training. Rommel, however, did not give him much time to complete his plans.

On 30 August, Rommel launched a new attack. He struck on the south as Montgomery had anticipated, although the British had the advantage not only in the air but also on the ground. After initial successes, Rommel's forces arrived at a point about 18 miles southeast of El Alamein, but they could not continue toward Alexandria without taking the El Halfa range.

Rommel's attempts to take this key range failed, due to the stubborn resistance of the defenders, supply difficulties, and bombing attacks by the Royal Air Force.

On 3 September, the Germans drew back to their former positions. Montgomery ordered that they be contained, but not pursued. Montgomery did not believe that his forces were trained sufficiently to permit offensive action, so he did not attempt a counter-offensive at this time. Also, he was afraid of a trap and did not have a sufficient reserve of supplies on hand to take such a gamble. He knew that his chance would come, and that time was playing in his favor.

At this time, he sent a dispatch to Churchill, stating: "If the attack occurs in September, it will not succeed. If we wait until October, I guarantee great success and the destruction of Rommel's Army. Am I to attack in September?"

Preparing the Attack

Montgomery wasted no time in getting everything ready for the planned attack. Alexander gave him a free hand and, in addition, fully satisfied his matériel requirements. Thus, by 15 October, Montgomery had three armoured divisions, three armoured brigades, and seven infantry divisions, as well as 2,100 guns and 1,114 tanks. Rommel had 530 tanks, five German armoured divisions, and 7½ Italian infantry divisions. Rommel, seemingly, did not estimate correctly the strength of the enemy for, on 24 September, he went to Germany to see Hitler, check on supplies, and receive medical treatment. (He suffered from a liver ailment.) Rommel's apparent unconcern about the enemy situation was indicated by the fact that he left General von Stumme in command of the German forces without giving him any plan of action in case of a British attack. He also consented, at the same time, to a leave of absence for his chief of staff, Bayerlein.

On 24 October, Rommel received word of a powerful British attack. Although he had been offered the command of a group of armies in Russia, Rommel asked Hitler if he could return to Africa. Rommel returned to Africa where he assumed command on 26 October. However, he soon discovered that he had only

358 tanks available for action and that all of his reserves had been committed.

The British forces had more than 800 tanks, as well as air superiority. The fate of the battle of El Alamein was already decided, although it continued until 4 November, when Hitler consented to Rommel's breaking off the hopeless and bloody battle. Hitler's delay sealed the fate of the Italian divisions which, for the greater part, had been taken prisoner.

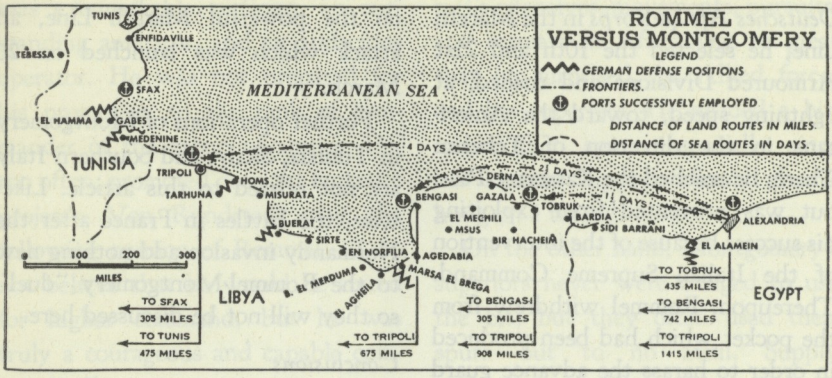
In spite of heavy losses and the growing British superiority, Rommel carried out his retreat in a masterly fashion. Rommel returned to the line back of Marsa El Brega, from which he had set out for the conquest of Egypt. This time, however, he did not have the capacity for counter-offensive action. Bastico, the Italian commander, had organized a weak defence of this line with inexperienced divisions. Rommel had available only 38 usable German tanks, 20 armoured vehicles, 50 guns, and 70 anti-tank guns. Montgomery apparently did not realize the weakness of his opponent, for he did not attempt a rapid pursuit of the German forces.

Rommel, who counted on an immediate British attack, wished to draw back, without delay, all foot units to the Buerat line and to hold only mechanized units at the advanced positions. This plan met with stiff opposition from the Italian and German high commands. Rommel, therefore, flew to East Prussia and Rome, in order to obtain additional reinforcements and an approval for a retreat as far as Gabes in Tunisia.

Hitler, at first, was furious, pretending to regard him as a coward and a defeatist. Afterward, however, he agreed to a withdrawal of the foot units and promised enormous deliveries. He would not permit, however, a withdrawal to Tunisia.

Loss of Manoeuvre

Montgomery attacked, 13 December, and enveloped Rommel's right wing. Rommel fell back as soon as he noted the enveloping movement, but his situation became hopeless. The British and Americans had made a landing in Algeria, in his distant rear area, and he lacked gasoline. Due to the gasoline shortage, armoured divisions were stranded at Mugar and eventually were overtaken by the British forces. A few vehicles escaped —thanks to the timely slipping through of a small gasoline convoy— but they lost freedom of manoeuvre and striking force. Montgomery had supply difficulties, for his communications lines stretched all the way from El Alamein, nearly 1,000 miles. Because Montgomery knew that the Germans could not escape, he did not hasten the tempo of his pursuit. He did not attack the Buerat line, which



was weaker than the El Agheila line, until 15 January 1943, after he had accumulated sufficient ammunition for 10 days of firing by four large units, and had organized the occupied airfields in the region of Merduma, en Nofilia, and Sirte.

Holding Action

When Rommel became aware of the enveloping movement, he drew back immediately in order to take up a position at a natural terrain obstacle in the Homes Tarkuns region. Although he had only 39 tanks in operation, he had to hold this position "for 3 weeks at any cost" in order to assist in the evacuation of Tripoli. Rommel abandoned Tripoli on 23 January and, almost without battle, reached the Mareth Line in Tunisia.

On the Mareth Line, Rommel held at last. Although he was resupplied, he was unable to save the situation. The injection of additional men and matériel only served to prolong his resistance. Rommel, therefore, became disgusted and asked for release, motivating his request with the insertion that: "I do not feel well and have no inclination for the task." At the same time he asked Hitler's consent for the evacuation of the *Deutsches Afrika-Korps.*

Change of Command

On 23 February, General Messe, who had led the Italian forces in Russia, succeeded Rommel, who was given command of the group of armies.

Rommel soon recovered his former buoyancy. He did not wait for the approach of the British Eighth Army from the east and the cutting of his communications by the Americans approaching from the west.

Leaving the main body of the

Deutsches Afrika-Korps in the Mareth Line, he selected the 10th and 21st Armoured Divisions and rushed, at lightning speed, toward the Americans in the direction of Tébessa. There, he reached the Kasserine Pass, but was prevented from exploiting his success because of the intervention of the Italian Supreme Command. Thereupon, Rommel withdrew from the pocket which had been produced in order to harass the advance guard of the British Eighth Army which was cautiously approaching the Mareth Line. He formed a new manoeuvring group, under the command of Cramer, composed of remnants of the German 10th, 15th, and 21st Armoured Divisions, and gave it the task of attacking Medenine, where three British divisions were stationed. This attack ended in defeat at Metamaur.

There was no surprise this time. On the contrary, the Germans lost 52 of their 140 tanks to the powerful and well-camouflaged British anti-tank defence forces.

After this defeat, and before the attack on the Mareth Line, Rommel flew (8 March) to Rome and East Prussia, never to return to Africa. Whether he had abandoned his forces for reasons of health, or whether Hitler held him back for future action is not known.

Montgomery, at that time, was methodically preparing for an attack on the powerful Mareth Line, an attack which was launched on 20 March.

Further operations of Montgomery in Tunisia, Sicily, and Southern Italy are not related to this article. Likewise, the battles in France after the Normandy invasion add nothing new to the Rommel-Montgomery "duel" so they will not be discussed here.

Conclusions

1. The battle itself, and the result of the operations of Rommel and Montgomery, which have been compared, do not answer the question, "Which of them was the greater leader?" Their African "duel" was a victory for Montgomery, even though Rommel was not surprised by the attack at El Alamein, and even though Montgomery conducted his operations less prudently. Rommel would have been able to maintain the initiative only by occupying Alexandria and by extending his communications lines to Greece. Without Alexandria, and in the face of the Anglo-American landings in Algeria, he had no alternative but defeat. This defeat would have occurred earlier if Montgomery had pursued him more energetically.

2. The calibre of the two leaders was not equal. Montgomery was a strategist and a planner, and above all, a brilliant organizer and technician. Rommel, on the other hand,

was a remarkable tactician, an outstanding animator, and an audacious operator. He was not prepared for his promotion to the rank of commander of the group of armies. He, too often, promoted outright fantastic projects. Von Rundstedt gave the following opinion of Rommel: "I do not believe that he would be suited for higher command, but he was truly a courageous and capable commander."

3. During his preparations for battle, Montgomery definitely surpassed Rommel in knowledge, thoroughness, and versatility. During the battle, he did not equal him in sense of terrain, or even tactical preparation. However, he surpassed him in judgment and methodicalness in shaping and executing decisions.

4. Rommel, it is true, was a blind "Draufganger" (go-getter), disregarding the importance of supply and air power. It is equally true that, above all, he believed in surprise, speed, boldness, and skill. He was a ruthless follower of the maxim, "The offence is the best defence," and believed that "Soldiers are not counted, but weighed." The fact that the majority of the formations under his command did not belong to the "heavy weight" category rendered his operations much more difficult, and led to the excessive use of his armoured units. In spite of this, the tempo of Rommel's offensives, movements, pursuits, and retreats in Africa was so great that he surprised the Allied forces and his superiors. He needed a bit, rather than spurs—especially since his logistic support almost always hung on a thread.

On the other hand, Montgomery's superiors never were obliged to use the bit, but they often used their spurs—but to no avail. Supply problems, the tendency toward the exclusion of risk, and the saving of troops (by the massed employment of matériel as well as precise preparation of movements and camouflage) influenced his plans and actions.

5. Both commanders were hampered in the execution of their operations by the narrowness of the coastal zone, lack of cover, scarcity of ports, and low efficiency of land communications.

6. Montgomery's masterpiece was the preparation and waging of the battle of El Alamein, while Rommel's masterpieces were his first three offensives and his final retreat.

Summarizing, it may be stated that although the calibre, style, and temperament of the two commanders were different, and to a certain degree even in opposition to each other, both were great soldiers and commanders. They proved repeatedly that, under suitable conditions, it is possible to win by different methods.

EXERCISE SUN DOG TWO

PREPARED BY THE DIRECTORATE OF MILITARY TRAINING,
ARMY HEADQUARTERS, OTTAWA

Exercise Sun Dog Two, a joint Canadian Army-Royal Canadian Air Force Exercise, was held in February 1951 on the barren lands of Northern Canada approximately 85 air miles north of the Canadian Army's Experimental and Training Station located at Fort Churchill, Man. The locale chosen for the exercise was representative of true barren, Arctic Canada which comprises approximately 25 per cent. of the Dominion.

In order to obtain realism in training the exercise was a two-sided operation. A ground force of one platoon of the First Battalion, Royal 22nd Regiment, was attacked by parachute troops consisting of a subsidized company of First Battalion, The Royal Canadian Regiment, together with detachments of Artillery and Signals.

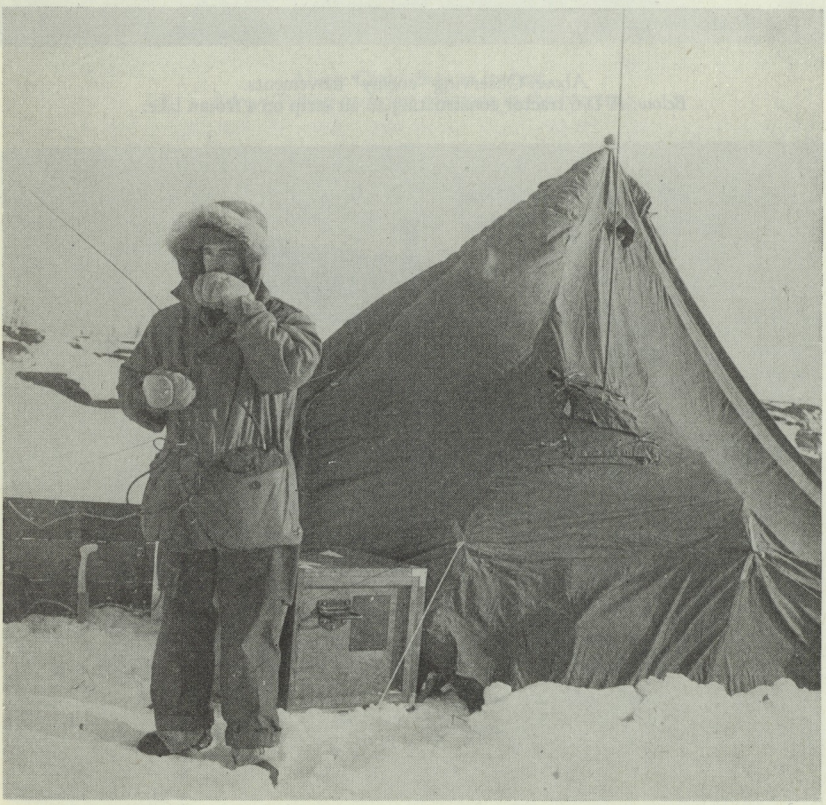
The exercise commenced with long-range aerial reconnaissance by the RCAF and was followed by an air-ground reconnaissance party of both RCAF and Army personnel. After having determined the whereabouts of the "enemy" position, the paratroops of the 1 RCR and a portion of the Light Battery (Para), RCA, were then flown from Rivers, Man., and dropped by parachute and glider. The aerial attack was most effective and, although the "enemy" was skillfully concealed, camouflaged and widely dispersed, they were quickly flushed out and the position cleared. On the conclusion of the exercise the troops were flown back to Churchill by the RCAF, thence by rail to their unit home stations.

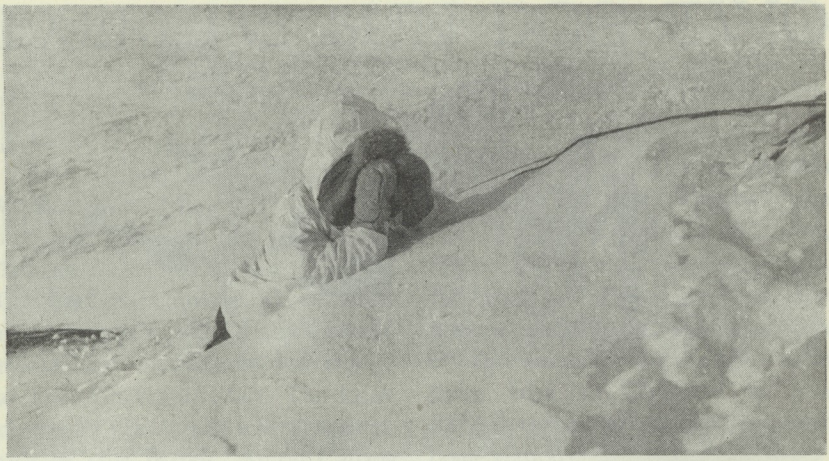
The troops comprising the enemy force were moved from Churchill to their position by RCASC tractor train. The trail was a difficult one to break, but having been made formed a convenient overland highway. The RC Signals detachment assured success by furnishing an elaborate communications system. The exercise provided much factual data on Arctic airborne operations in the winter, trained joint staffs, and in addition to testing a number of new equipment familiarized many personnel with Arctic Canada.

National Defence photographs on the following pages depict various phases of the exercise.

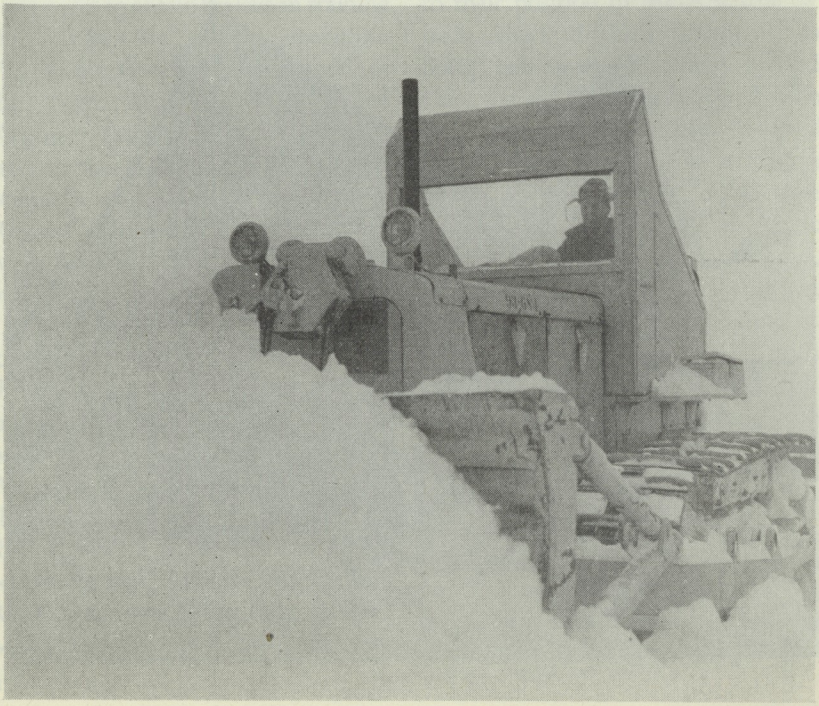
Right Top: Erecting a 5-man Arctic tent in a strong wind.

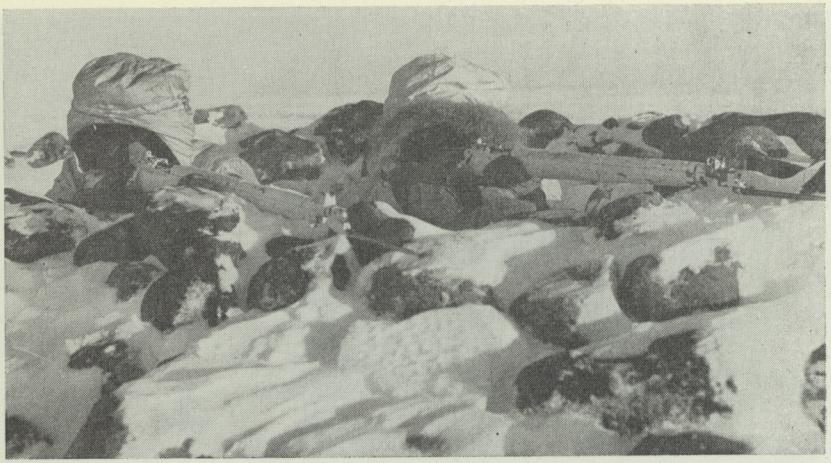
Bottom: An Arctic tent being used for living accommodation, also as a wireless shelter.



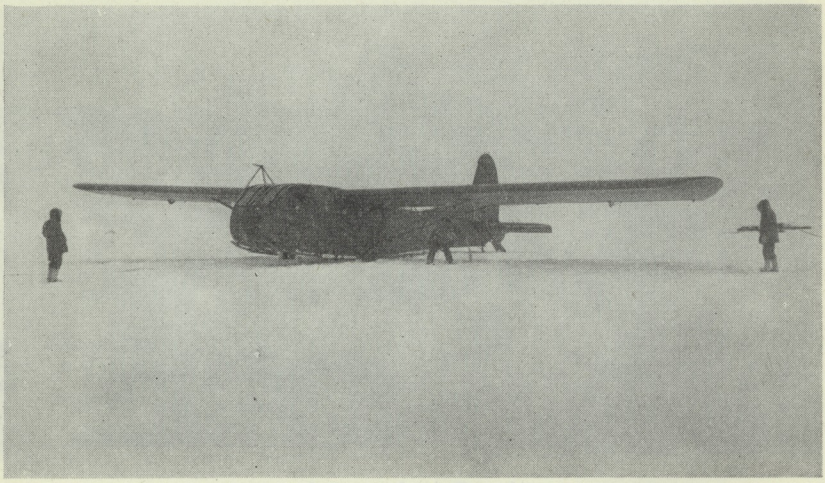


Above: Observing "enemy" movements.
Below: A D-6 tractor constructing an air strip on a frozen lake.



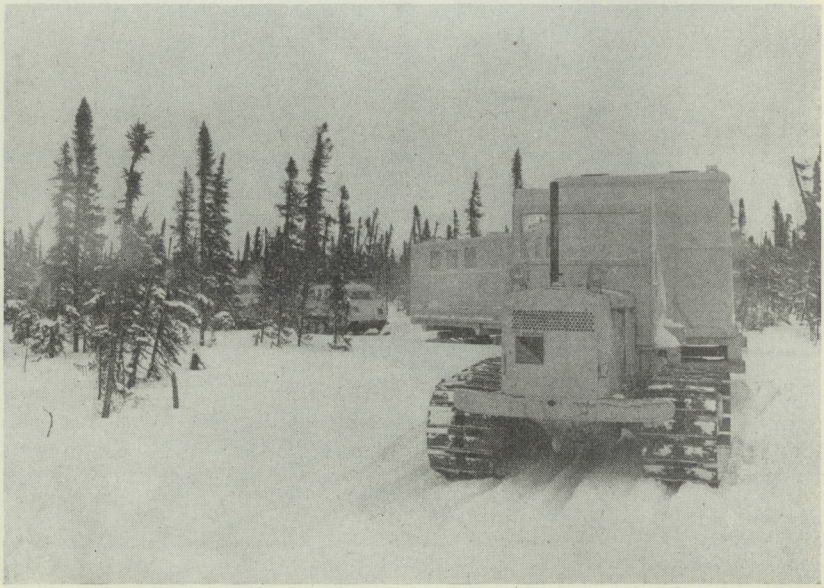


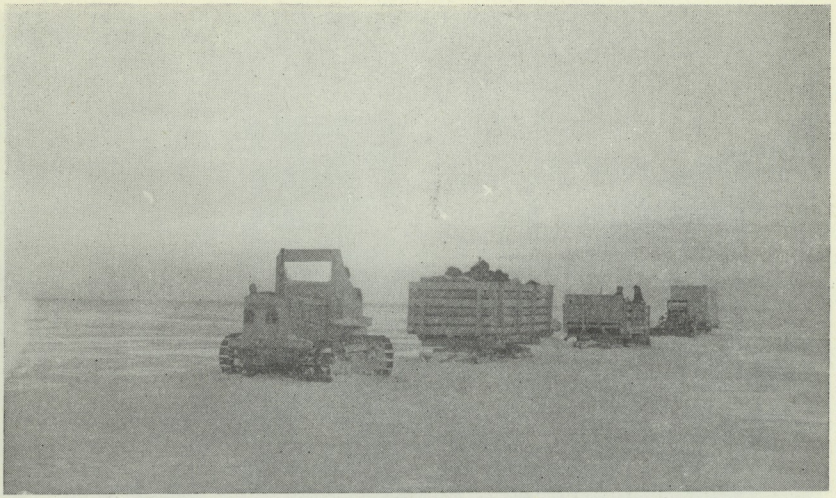
Above: Camouflage at its best.
Below: Taking up firing positions in the barrens.



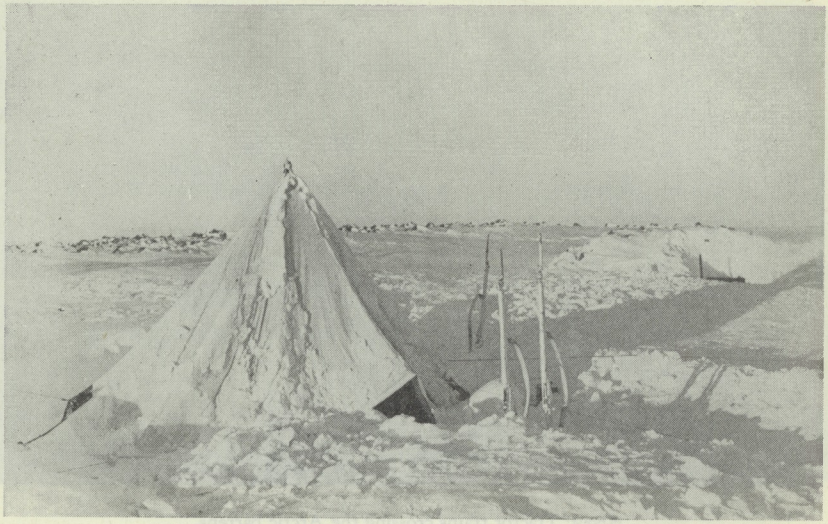
Above: An artillery detachment arriving by Hadrian glider.

Below: A tractor train leaving a wooded area.





Above: Tractor trains crossing the Arctic barrens.
Below: A motor toboggan which is used to tow ground reconnaissance party stores.



Above: Camouflaged 5-man Arctic tent.
Below: Tractor train recovery on the trail.

Troops entraining at Fort Churchill at the conclusion of the Exercise.

AUTOMATIC PILOT

The United States Navy has developed the first successful automatic pilot for helicopters—a device that is expected to increase the utility of rotor wing aircraft. Routine operation of helicopters at night or during "instrument" weather heretofore has not been considered safe because of the difficulty of maintaining constant stability.

The new automatic pilot will make possible normal instrument flight, and will decrease pilot fatigue during long fights.

In tests recently conducted on two types of Navy helicopters the new devices demonstrated that the aircraft could be automatically controlled throughout their speed ranges in manoeuvres and while hovering. Further tests in the programme are being continued by the Navy Bureau of Aeronautics.

The first tests were made at the Naval Air Matériel Centre, Philadelphia, in a Sikorsky *HO3S-1* single rotor helicopter with an automatic pilot developed by the Naval Aeronautical Instruments Laboratory at the Philadelphia centre. For the second test, a Sperry auto pilot was installed in a Piasecki *XHJP-1* twin rotor helicopter.—*Army-Navy-Air Force Register.*

THE MEANING OF SEA POWER

R. G. Worcester in "the Fleet" (Great Britain)*

Of all the various equipment which goes to make up what we call military strength, there is (excluding the field of atomic energy) only one class in which the Western Nations can claim a numerical superiority and that is in the size of surface fleets.

There is less incentive for Russia to build a surface fleet as it is essentially a land power, and as America and Britain are sea powers, there is less incentive to build undersea craft. However, the essence of sea power as a way of retaining military strength in the political struggle is to keep a surface strength which will match the size and operations of the merchant fleets upon which the communications between the friendly democracies depend. The South Atlantic must be kept open for the supplies of vital strategic materials such as carnotite for uranium production and cobalt, which is used in the turbine blades of jet engines.

And, of course, the North Atlantic is the embodiment of the direct ties between Europe and the New World. There is a real danger of a third underestimation of the importance of undersea operations against nations which depend upon the open sea lanes. The Germans in World War I and again in World War II had Britain by the throat (Goebbels was, on that occasion, quite right) with but a few dozen submarines. The Russian fleet of submarines is several times larger than Germany's at the beginning of the War, and is probably larger than Germany's at the height of the War, and such vessels are more difficult to hit with their *snorkels*. It is true that with improved radar equipment, our aircraft can pick up the *snorkel* on the screen, but the ship has a shorter distance to dive in order to attain protection.

Again, it may be claimed that with sono buoys tracking the underwater course of the submarine, it becomes more vulnerable, but on balance the task of hunting these prey is probably harder than it ever was.

So the problem which faces us is the old one of defending our lines of communication against destructive powers more cunning and numerous than at any time in history. The atomic bomb is a weapon of great

*This article was digested by the Military Review (U.S.), from which publication the Journal reprints it.—Editor.

strategic significance but it is not decisive even if sufficient numbers of plutonium bombs are now available to justify their use in tactical warfare, leaving hydrogen bombs for strategic destruction. The war of attrition would still continue and might successfully beat us to our knees after the initial phase of unprecedented destruction. But apart from its operations during a future war, the Navy is now the bulwark of stolid resistance to aggression.

Sea power at this time, then, means the ability to develop new types of radar, the introduction of new types of anti-submarine aircraft like the *Fairey* 17 and the new U.S. Navy version of the Lockheed *Neptune* and the use of small and large carriers to take these aircraft.

But this is not all—sea power can also be interpreted as the proven ability of the Royal Navy to work closely with the French, Dutch, American, Australian, and Indian navies, and to show that units of each fleet understand the problems of the other and can take their places in an emergency side by side. It is evidence of the democracies' ability to work together on military planning and the ability to work as a team.

The arrival of the American air reinforcements of Superfortresses becomes a matter of headline interest. But true solidarity is not the spectacular action but starts in the small ways of collaboration between men in foreign ports and the exchange of ideas and standardization of weapons which has for so long been a feature between, say, the British, French, and Dutch ships.

The trouble is always to make this show of strength when we are trying at the same time to build up the types of weapons for the future. It is always difficult to set aside the appropriations which must be an insurance for the future. To do so without denuding the present strength requires careful consideration of the time the new equipment takes to perfect and the degree of war potential which exists in the equipment which is being used in service. So far as aircraft are concerned, there is a steady flow of new types of high performance machines coming along gradually to replace the existing equipment and at the same time radical changes like the under-carriageless fighter are being developed. This shows a healthy service condition.

The Italian Navy has ordered work to begin on nine new warships—two heavy destroyers, three escort destroyers, one submarine chaser, and three fast motor launches. The vessels will be laid down as part of Italy's five-year naval building programme, within limits authorized by the World War II peace treaty.—*The Christian Science Monitor.*

ARMS FOR WARRIORS

By
Lt. Col. F. E. Anderson, RCOC, Deputy Director of Army Budget,
Army Headquarters, Ottawa.

Introduction

Speculations concerning possibility of war, and Canada's part in it, have filled the newspapers and radio news summaries for months. Our Government is devoting a major portion of its time and energy to formulation of Defence policy.

We must, nevertheless, be mindful of the fact that the outbreak of war in 1914 and again in 1939 found the democracies largely unprepared to meet the threats of aggressor nations. Eventual victory in those wars was possible only because we were granted several years of grace in which to adequately mobilize and equip our armed forces. Today's weapons, and the global nature of any future major war, will most likely preclude any respite in which to organize war production in relative safety following the start of hostilities.

The successful waging of modern warfare is the result of team work, and especially team work between the Armed Forces and Industry. Industry, factory buildings, workers' homes, and farms have become an integral part of the war machine; the line of distinction between soldiers and civilians has become blurred, and the line between military and non-military production has virtually disappeared. Weapons have become larger in size and number, more mechanical, and more complex with the result that more man-hours, more raw materials, and more facilities are needed in their manufacture. The ratio of the men behind the guns to the men manning the guns is ever expanding.

Bernard N. Baruch has summarized the situation in these words: "Wars are fought and won—or lost—on the land, on the water, in the air, and on those battle lines behind the front where the civilian forces stand. It is not enough to mobilize the Nation's military strength. There must be a mobilization of her full economic resources—industrial, agricultural and financial. These must be organized, co-ordinated, and directed with the same strategy that governs the operations of the purely military arms of service."

The President of the United States in his recent radio address when announcing his intention to declare a National Emergency sketched his plans for mobilization of American

industry: . . . higher taxes . . . longer hours of work . . . cutbacks on civilian production . . . sharper controls over the whole economy . . . stabilization of prices . . . "not as a sacrifice, but as an opportunity to defend the best kind of life that men have ever devised on this earth."

Today's soldier is effective only to the extent that the nation he fights for has been successful in so marshalling industry that the Army's operational needs are promptly and adequately supplied. Nor can factory workers provide us with our weapons unless the whole national economy is geared to meet industrial requirements while ensuring the essentials of civilian life.

Let us analyze the basis of experience that leads us to accept such concepts without doubt or criticism.

The processes of Industrial Mobilization, or Economic Mobilization, have evolved as warfare itself has changed in this twentieth century.

During the First Great War few if any nations realized the implications of total war. Inadequate plans for military and industrial mobilization resulted in faulty apportionment of the industrial load and in lack of co-ordination of the national effort generally. There were delays in the procurement of supplies and equipment, disturbances of prevailing price levels, unequal distribution of the economic burdens of war, and waste of resources. It was made apparent that a peacetime economy, unsupported and uncontrolled, could not stand up under the tremendous strain imposed by modern war. With war conditions of unlimited demand and unlimited purchase funds, opposed to limited materials, limited facilities, and limited manpower, the normal relationships and functioning of the economy inevitably broke down.

The necessity for military and industrial preparedness prior to the outbreak of war was not, however, wholly accepted by the Canadian Government in the years before the Second World War, though our failure to prepare for that war can perhaps be excused because of Canada's subordinate position to the United Kingdom in international relations and in mobilization planning generally. Neither Great Britain nor the United States took adequate steps to meet the mounting crisis.

Canada's expenditures for national defence totalled only $13,000,000 in 1924–25, $22,000,000 in 1929–30, $22,000,000 in 1934–35, and $126,000,000 in 1939–40. As a measure of comparison, the amount provided in Department of National Defence Estimates at the war peak, 1944–45, totalled $2,938,000,000 and amounted to $567,200,200 in 1950–51, with an additional $300,000,000 made

Stocks of vehicles held by the Royal Canadian Ordnance Corps.

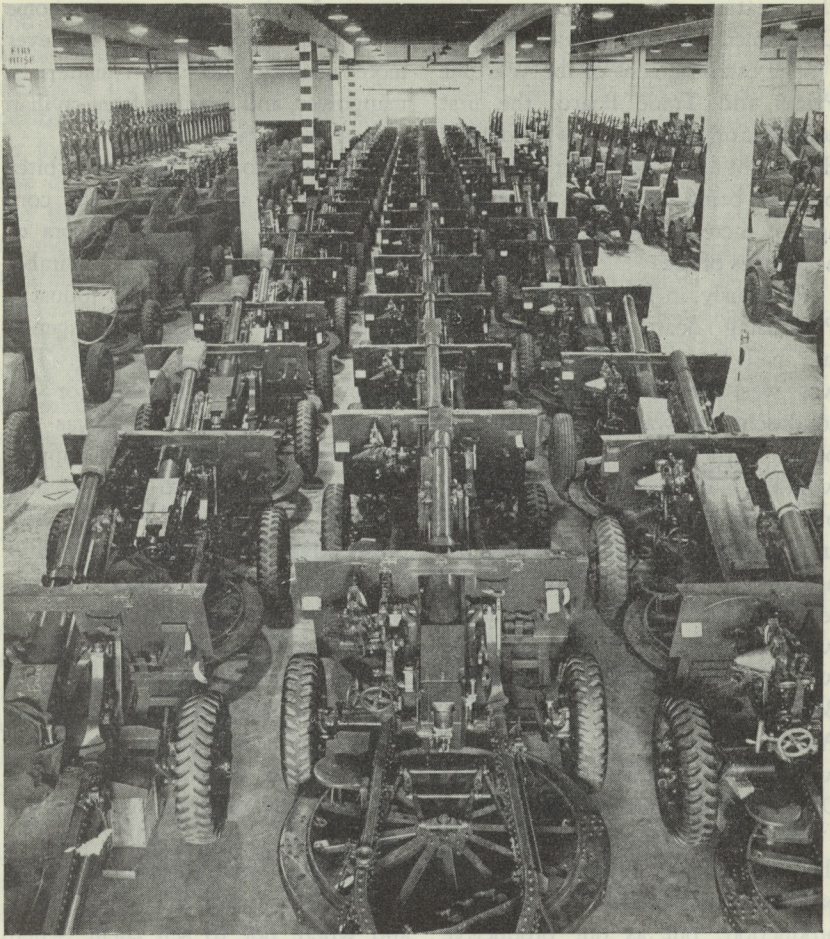
available for Canadian assistance to other North Atlantic Treaty nations.

The Canadian rearmament programme prior to the Second World War was certainly modest in scope. However by September 1939 Canada, although by no means adequately prepared, was at least in a better position to provide her own protection than on the eve of any previous war. Prior to the outbreak of hostilities, also, study had been made of wartime requirements for control of the national economy. The effectiveness of that planning is apparent from the speed with which the Government initiated measures for control during the earliest weeks of the war.

Second World War Controls

The War Measures Act of 1914, which had never been repealed, was brought into operation on August 2, 1939, and authorized all measures deemed "necessary or advisable for the security, defence, peace, order, and welfare of Canada," thus making available to the Government all necessary power to meet such circumstances as the outbreak of hostilities precipitated.

On September 1, 1939, when the German armed forces invaded Poland and a general war seemed inevitable the Prime Minister of Canada announced that Parliament was being summoned to meet in Emergency Session on September 7th and that, if the United Kingdom became in-



More "arms for warriors": Rows of 25-pounders are shown in the centre of the photograph.

volved in war, the Government would seek authority from Parliament for effective co-operation by the side of Great Britain.

By September 10 Parliament had assembled and acted. A state of war between Canada and Germany was proclaimed by his Majesty the King. The "Defence of Canada Regulations" and other emergency regulations under the War Measures Act were brought into force and provision was made for

the creation, when necessary, of a Department of Munitions and Supply.

The establishment of the Wartime Prices and Trade Board, the first economic organization, was announced the night of September 3rd, its purpose being to protect the public against increases in the costs of the necessities of life.

Previously, in July 1939, a Defence Purchasing Board was established and had begun to function before war was declared. Under wartime conditions it was realized that a board with wider powers, which would include not only purchasing but, when necessary, the organizing and directing of supply would be needed. As a result, the Government set up a War Supply Board with these wider powers, which took over the work of the Defence Purchasing Board on November 1, 1939. On April 9, 1940, the War Supply Board was in turn superseded by the Department of Munitions and Supply.

In the early months of the war the Government adopted an expansionist programme to stimulate production; but as our productive capacity was developed and the national income rose, heavier taxes and government borrowings were used to drain away enhanced earnings. This was done to retard the mounting demand for consumer goods, so that full use would be made of Canada's increasing productivity for war purposes. As the tempo on the home front was stepped up it became ever more necessary to divert materials, manpower, and facilities from civilian to war production.

The need for an impartial arbiter or umpire to decide upon the conflicting claims of various sectors of the war economy made it desirable that the controls affecting industry be placed in a non-military agency with strong Cabinet backing. The agency primarily responsible for Canadian wartime production was the Department of Munitions and Supply, which was directed to "explore and estimate the needs, present and prospective, of the Government and the community in respect thereto, and generally to take steps to mobilize, conserve, and co-ordinate the economic and industrial facilities available in respect to munitions, supplies and defence projects for the effective prosecution of the war."

Under this all-covering Act the Department could tell Canadian businessmen what to make and how to make it, where to sell raw materials and where not to sell them, when to deliver the goods it ordered made, and for failure to carry out the orders, it could commandeer factories and schedule production as it saw fit.

The Department was unique; no similar body existed in any other of the united nations. Nowhere else was all purchasing for the national

and allied armed forces carried out by one central organization. Nowhere else was there an absence of competition between the army, navy and air forces for supplies, and nowhere else did the agency which supplied the three services have the power to mobilize industry and resources to attain maximum production.

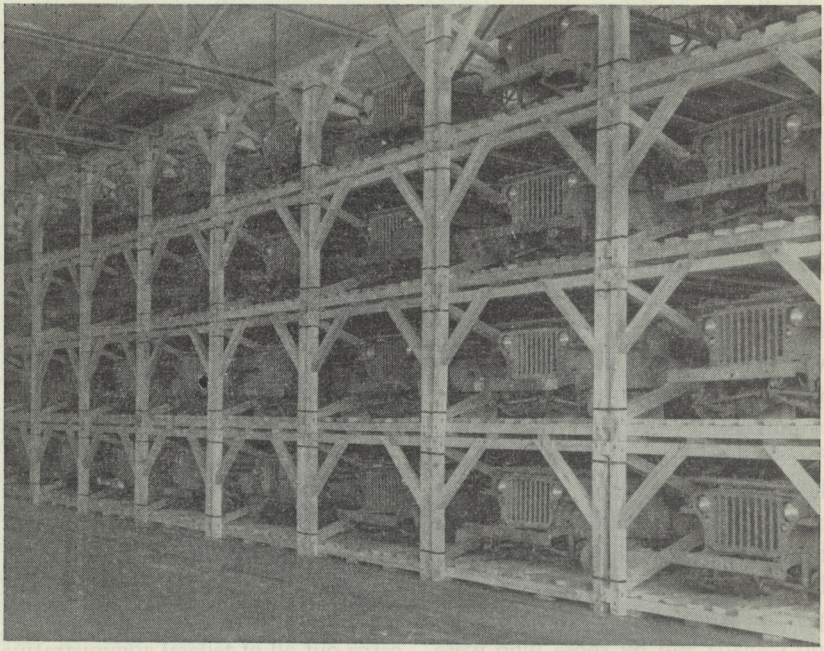
However, it should be noted that the Department itself did not decide what goods and materials were to be purchased, but rather it acted as purchasing agent for the Armed Forces. Furthermore, the Department did not inspect nor receive the munitions of war and supplies that it purchased, nor did it pay for them. The former was done by the Inspection Board of the United Kingdom and Canada and by those who were to use the equipment purchased, and the latter was done by the Treasury officers in the department concerned.

With effect from December 1, 1941, an over-all ceiling on retail prices was imposed by the Wartime Prices and Trade Board and from that date maximum prices could not legally exceed those that had prevailed during a specified basic period.

One fundamental point that should be kept in mind about the price ceiling is that it applied to each store or retail establishment individually. It did not standardize prices for any commodity or for any community. It simply required that no retailer sell any specific item at a price greater than his highest selling price for that item during the basic period.

Thus the Government placed almost all primary and secondary materials under a system of controls operated jointly by the Department of Munitions and Supply and the Department of Finance (Wartime Prices and Trade Board). In the process of organizing the country's productive resources these two departments supervised virtually the whole range of our economy. However the normal peacetime business of government could hardly be suspended nor could just two departments carry out all of federal administrative duties; other departments and agencies obviously played their part. The unifying influence and authority of the Canadian Government had to be constantly exerted in almost every field of activity which was even remotely connected with the war.

An outstanding feature of the Canadian wartime control organization was the great reliance placed upon voluntary co-operation. It should also be noted that although a wide variety of measures were imposed over different sectors of the economy, no two industries were subjected to precisely the same



Stacks of jeeps.

pattern of control. The particular measures instituted in each case were dictated by the peculiar characteristics of the industry, such as production processes, pricing practices, the number of producers, marketing practices, use of strategic materials, dependence upon foreign sources for raw materials, and adequacy of manufacturing facilities.

There are, of course, many factors essential to an effective industrial war effort—productive equipment, natural resources, research, managerial ability—but the limiting factor in the long run is manpower.

Following the collapse of France, in June 1940 the National Resources Mobilization Act was passed authorizing the Governor in Council to require "persons to place themselves, their services and their property at the disposal of His Majesty in the right of Canada as may be deemed necessary or expedient for securing the public safety, the defence of Canada, the maintenance of public order or the efficient prosecution of the war, or for maintaining

Examining shell fuses.

supplies or services essential to the life of the community," with the exception that persons could not be compelled to serve in the Army, Navy or Air Force outside of Canada or her territorial waters.

When war broke out Canada was almost completely disarmed. There were in the Navy only 1,700 all ranks, in the Army 4,500, and in the Air Force 4,000; a total permanent force strength of only 10,200. At December 31, 1943, when total strength of the Armed Forces was greatest, there were in the Navy 75,350, in the Army 481,500, and in the Air Force 206,350; a total of 763,200, of whom 33,950 were women volunteers. More than a million Canadians served in the Armed Forces during the war of whom only 70,000, only 7 per cent., failed to volunteer for service anywhere in the world.

Manpower policy in Canada developed gradually. In the first year or so of war the mere absorption of the unemployed into productive work through the normal operation of the labour market sufficed to

meet most manpower requirements. Positive action by the Government, however, soon became necessary, and the programme was expanded steadily until by 1944 it applied to the whole labour force, active and potential, and was designed to secure the organization and allocation of all Canadian manpower in such a way that it would most effectively contribute towards victory. It remained the policy of the Government, however, to employ compulsion only when voluntary methods failed, and to rely on the public to do all in their power to swell the ranks of those in the three Services or doing some form of war work.

The civilian side of National Selective Service dates from March 23, 1942, when the Prime Minister announced the passing of two Orders-in-Council designed "to effect the orderly and efficient employment of men and women for the varied purposes of war." This marked the beginning of a programme to do under National Selective Service Civilian Regulations what the National Selective Service Mobilization Regulations were to do for the military war effort. The principal purposes of the Orders-in-Council were to estimate civilian manpower requirements, restrict the entry of men into certain specified occupations, stabilize employment in agriculture, and co-relate military and civilian manpower problems.

An important part of the Government's anti-inflationary programme was the wartime policy of controlling wages. Wage rates were stabilized at the level in effect on November 15, 1941, but with cost-of-living bonuses added to form part of the basic wage rates, and with Administrative Boards empowered to adjust rates so as to remove any "gross inequality or gross injustice."

Canada reached the peak of war production in the Fall of 1943 when total employment also reached its peak of 1,166,000, on October 1st. At that date 13.3 per cent of our total population 14 years of age and over were employed directly or indirectly on war work.

Post-War Planning

It has been demonstrated that the successful conclusion of a modern war effort entails not only the mobilization of all national resources but the efficient co-ordination and controlled utilization of those resources as well. The task is far from simple. There can be listed at least twenty-eight elements each of which is essential to economic mobilization:

Favourable public opinion.

Price, profit and wages controls, and rationing.

Priorities, and allocations.

Military, civilian and foreign claimant requirements.

Manufacturing facilities, public works, food and housing.

Manpower, civilian protection, public health and morale.

Power, fuel, transportation, and communications.

War finance.

Foreign economic relations, intelligence, and security.

Technological progress.

Over-all co-ordination.

Considerable time and effort could profitably be spent on detailed study and evaluation of the controls and administrative machinery involved in organizing, co-ordinating, and directing each of these elements of a war economy. However, it would seem that three of the most important basic tools or mechanisms required to convert the nation from a peacetime to a war economy in the Second World War were favourable public opinion, price control, and a well-defined priority and allocation system. Experience shows that it would be futile to make plans which vitally affect the lives of our Canadian people without their full support and approval. In wartime, too, there must be provision for control of prices so as to prevent or minimize the disruption of our economic structure because of the rapid increase of demand on limited facilities and resources. There also has to be provided some mechanism to establish and indicate the relative urgencies within or between requirement programmes, whether they be for the military forces, essential civilian use, or for foreign claimants—the development and functioning of an adequate priority and allocation system.

The organization and administration of the Canadian industrial and economic effort during the Second World War was not without error, nor does it contain a finished blueprint for a future emergency. It does contain, however, much experience that can profitably be studied, and it demonstrates the strength of a free people, able and disposed to adjust their institutions and methods quickly to meet a threat to national security.

Our war economy had this much in common with a totalitarian economy—it was a centrally planned, centrally directed, and a centrally controlled economy. The normal controls of the market place could not safely be relied upon to meet wartime requirements. Indeed the principal mechanism of peacetime control—the price system—was during the war itself a major object of control. Yet in spite of the much-talked of inefficiency of bureaucracy, we succeeded in organizing and running a highly complex system of war government. Administrative personnel were brought from business and industry, from the colleges and universities, and from the permanent civil service

to staff Canada's wartime control agencies, and proved the existence of a reservoir of organizing and supervisory talent superior to that of the dictatorships.

During the past four years the control agencies have for the most part ceased their activities, and would have to be recreated if to function in any future emergency. However, in some cases a nucleus exists, as for example, for a Department of Munitions and Supply in the form of the Canadian Commercial Corporation which operates under the Minister of Trade and Commerce as the purchasing agent for the Armed Forces. (The most recent development is the creation of the Department of Defence Production which will absorb CCC).

The status and functions of two organizations which since 1946 have given constant attention to the problems of industrial mobilization planning — the Industrial Defence Board and the Canadian Industrial Preparedness Association — were discussed in a previous article by this writer entitled *Industrial Mobilization*, which appeared in the March and April 1949 issues of the *Canadian Army Journal.*

Major-General G. B. Howard, CBE, Wartime Controller-General of the Inspection Board of the United Kingdom and Canada, and now Manager of the Canadian Industrial Preparedness Association, in an interesting article *Industrial Preparedness*, published in the July 1950 issue of *The RCOC Quarterly*, stressed the value and importance of industrial mobilization planning and in the following manner developed his thesis concerning industrial preparedness:

The Armed Forces have become more and more dependent on the industrial and economic potential of the country they serve. No longer can we think of three defence Services; we must now consider at least five—the Navy, the Army, the Air Force, Scientific Research, and Industry. None of them can operate independently; all are interdependent and each equally essential.

It may take six months to train a sailor, a soldier or an airman to fighting efficiency, but it takes much longer, perhaps eighteen months, to commence production of the gun, ship or plane he needs for combat. That much time is needed to provide the machines, the buildings and tools, to do the production engineering necessary, and to secure the essential materials and components before those types of equipment not normally produced in peacetime can start rolling off the assembly lines.

We in Canada have in the past, and can produce in the future, much more of some items—such

as explosives, artillery and its ammunition, radar and signals equipment, and many other items—than the Canadian Armed Forces are likely to need. We must find external sources of supply for many requirements which it is uneconomical to manufacture in Canada. But the increased cost of relatively small peacetime orders placed in Canada should be weighed against the educational value of establishing an internal source for large volume wartime requirements.

These and other problems are constantly being studied by the Defence Committee of the Cabinet, the Principal Supply Officers' Committee, the Defence Research Board, Canadian Arsenals Limited, Canadian Commercial Corporation, the Joint U.S.-Canadian Industrial Mobilization Planning Committee and the Supply Board of the North Atlantic Nations, as well as by the Industrial Defence Board and the Canadian Industrial Preparedness Association previously mentioned.

No plan can be hard and fast or complete. Flexibility is a "must" in modern conflict. Changes in requirements, in designs, and in materials and methods of production must be expected. A sound knowledge of our capabilities and limitations is the essential basis of any plan.

The importance of this field of study to serving officers is evidenced by the stature of another recent writer on the subject, Major-General N. E. Rodger, CBE, Quarter-Master General, now attending the Imperial Defence College. His article was entitled *Armed Forces and Industry*, (*Canadian Army Journal*, January 1950) and is certainly worthy of rereading in its entirety. Only a portion can be repeated at this time:

Without attempting to forecast the future, there are certain factors and trends which are very likely to apply in any future war as in the past. They are:

Canadian industry will be bigger and more diversified than before.

Because of the inevitability that the United States will participate in any future war from the beginning and because of lessons learned the last time, there will probably be a much greater integration of our industry with that of the United States.

Because our armed forces will likely again be elements within the larger forces of our major allies, and will therefore not be supplied by a special Canadian pipeline, we can expect to see much of Canada's war production being arranged in consultation with those major allies and not directly for our own forces.

Thus we are likely to have to base our plans for industrial mobilization largely on assumed over-all requirements made up of those of

Guns (25-pounders) being loaded on flat cars.

our own forces, plus estimated allied needs.

Similarly, efforts to develop better equipment will be hampered by the fact that in the long run our armed forces can hope to use only equipment of a type also used by our major allies. This, however, should not prevent us from making a useful contribution to improvement of equipment by proving the merit of those improvements to other countries.

General Rodger concluded:

It is important that we in Canada exert our efforts to achieve maximum preparedness in planning for the mobilization of Industry as well as of the Armed Forces. Industrial preparedness in peacetime is just as important to prevent war or to win victory as is military preparedness. Furthermore, in spite of the fact that we soldiers would have a full partnership with industry in war, we should take every opportunity to improve mutual understanding and co-operation with industrialists to ensure that the over-all Canadian contribution will be given early, efficiently and effectively.

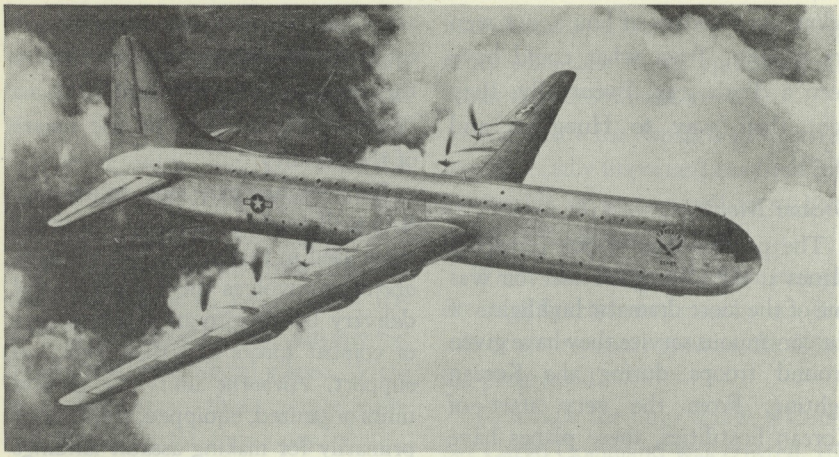


Photo by courtesy of Officers' Call

The XC-99, above, can carry 400 fully equipped troops or about 100,000 pounds of cargo.

AIR TRANSPORT

REPRINTED FROM OFFICERS' CALL (U.S.)

PART 1

A Bridge Is Blown

The time is December 1950; the place is Changjin Reservoir in North Korea. Slugging their way from Changjin Reservoir to Hungnam's seaport are soldiers of the Army's 7th Infantry Division and marines of the 1st Marine Division. Ahead of them is a reservoir once crossed by a bridge. Now the bridge is destroyed. In the hills about them are thousands of communist soldiers awaiting an opportunity to destroy our troops.

There is one way to regain the road to Hungnam without crossing the reservoir. But this means making a detour of several miles over rugged mountain trails in the teeth of enemy fire. It means our men will have to abandon their tanks and vehicles, many of them filled with wounded. It means, at best, a delay of days for our weary and frostbitten fighting men. It could mean annihilation.

Fortunately, our troops do not have to make this detour. Even before the main body of the withdrawing column has reached the reservoir, C-119's of the United States Combat Cargo Command are over the bridge site. They parachute eight spans of a 16 ton-bridge to engineer troops

below. In a matter of hours, our men are escaping from what could have been a death trap. Eventually, they fight their way to Hungnam and safety.

Greater Mobility

The performance of our transport planes at the Changjin Reservoir was one of the more dramatic highlights of the continuous service they have given ground troops during the Korean fighting. From the very start of Korean hostilities, these planes have helped carry troops and equipment.

In Korea we are building on air transport know-how gained in World War II. During that war we came to look upon the air as a military highway giving our ground forces a mobility never known before.

Mobility on the battlefield and to the battlefield is a "must" in our concept of fighting. It is largely because we can move men and equipment where they are needed at the decisive time and place that we feel confident we can defeat the probable greater mass of any future enemy's land forces.

As Army Chief of Staff, General J. Lawton Collins, puts it, "It is our hope that through increased air mobility, each of our divisions eventually can do the work of several present-day divisions."

Some military experts feel that air transport has altered the maxim of Napoleon that "the strength of an army, like the power in mechanics, is estimated by multiplying the mass by the rapidity [of movement]" . . . to "multiplying the mass by the *square* of the rapidity."

Because they may seem to overlap, it is well to define some of the terms most used in this article. An *airborne operation* involves the movement and delivery by air into an objective area of combat forces and their logistical support. *Airborne units* are ground units organized, equipped, and trained primarily for making assault landings from the air.

Air transport refers to the moving of supplies, equipment, men, and vehicles by air, usually in transport airplanes or gliders. *Air transportable* means the state of being suitable for transport by air. And *air-transportable units* are ground units, other than airborne, which are trained and whose equipment has been modified, when necessary, for movement and delivery into an objective area by transport aircraft.

Why Air Movements

With our scope limited to air transport, let's first consider the reasons for moving by air. When do we use air transport and why?

We find our answers in past and current military operations and considerations for the future.

Let's look first at our current test of air transportation—the Korean air-

lift. Actually, this is two airlifts. One is from the United States to Japan; the other from Japan to our troops in Korea.

Almost with the start of the Korean fighting, Military Air Transport Service (MATS) began flying vitally needed men and matériel from the West Coast to Japan. Some 100 MATS transports were augmented by about 60 commercial planes. Within a short time, these planes were carrying about 100 tons a day.

This airlift carried material needed now, not soon. An example of getting critical items to the far-off battlefield in a hurry was the case of the 3.5 inch bazookas. Seventeen days after United Nations Commander General Douglas MacArthur first called for them, these new anti-tank weapons, ammunition, and an instruction crew were in the Korean combat area. Delivery was from factory to battlefield—direct.

Other critical items have been speeded to Japan by air. These include troops, ammunition, and fighter-plane engines—to name but a few essentials of combat.

Critical Items Fast

Thus, we see air transport moves critical items in a hurry—even though great distances are involved. Impressive as the tonnage carried has been, this airlift has not replaced sea transportation. It has augmented the more normal transportation by delivering many essentials to the fighting front when they are needed most.

The airlift has worked in reverse, too. Especially important has been the evacuation of war casualties to hospitals in the States.

With the first American troops entering Korea from Japan by air, the role of air transport grew as the fighting progressed.

To handle the huge traffic, a Combat Cargo Command was created. Its job was to fly materials from Japan to Korea, often to improvised landing strips near the fighting units which needed the supplies most. Most supplies were airlanded; others were dropped.

After our breakout of the Pusan beachhead, transport planes helped to supply our advancing forces. As we moved up the peninsula, we found some of the sea ports could not handle all the traffic that was planned for them. The harbors at Inchon and Pohang were inadequate. To keep supplies moving to the fighting troops, air transport continued to help normal sea delivery.

Advancing troops were supplied by air when they had overrun normal supply lines. Instead of stopping for matériel to catch up, our troops kept driving, depending on transport aircraft to keep them supplied.

Photo by courtesy of Officers' Call

Marked "special delivery, airlift," vital supplies have been flown to men fighting on the ground since the first days in Korea.

Something New in Air-Transportable Items

Items not generally considered air transportable were brought in by air. These included pontoon bridges, steam shovels, a complete asphalt paving unit, three-ton generators, and an equipped fire-crash truck.

The Air Force's new C–119's carried the larger items; the C–82's and C–47's the smaller.

The Combat Cargo Command dropped some 6,000 troops of the 11th Airborne Division (187th Regimental Combat Team). Many of the things learned in Operation Swarmer and developed since then paid off on the "money" run in Korea. Supporting the paratroopers were artillery pieces as large as 105-mm howitzers, 90-mm anti-tank guns, vehicles, and other large items dropped by parachute.

Then, when the tide of battle in Korea turned against us and we were forced back by the Chinese communist hordes, air transport continued its vital role. Withdrawing units received supplies in regularly scheduled air drops and by planes which often set down on improvised strips. Cut-off units got emergency drops. Bombers and transports landed on small strips to bring out wounded men.

This reverse part of the airlift to Korea was exploited to the utmost in salvaging matériel. Air strips were held to the last to bring out supplies—particularly ammunition. Pilots were

often under small-arms fire as they took off with the loaded planes.

The importance of helicopters as a means of transportation has been demonstrated in Korea. Men wounded so critically that it was unsafe to move them by vehicles were brought out by helicopters. They rescued downed pilots. They carried critical supplies to isolated units. They did jobs that other planes, or any other transport, for that matter, couldn't touch.

Operations in Korea have shown that air transport is used where other means can't do the job or can't do it fast enough.

Early Air Transport

Of course we found out the advantages of air transport long before Korea. Before World War II many nations, including Russia, experimented extensively in the use of airborne and air-transported troops.

In their conquest of Crete in the Spring of 1941, the Germans showed what air-transported troops could achieve. Some 1,200 German transports flew in 35,000 fully equipped troops. In this operation it became evident that if the attacker has air support and aerial supply, his forces may well overcome a strong defence lacking air superiority.

Most of us are familiar with our airborne operations during World War II. We will not go into them here. But it is well to point out that a good part of the success of most of them depended on efficient and timely resupply—both of men and matériel —by air.

Realizing that air transport was to play an important role in our operations in Europe, we established before the Normandy invasion a joint operations agency to handle airlift requests. This Combined Air Transport Operations Room (CATOR) continued through the war. It received requests for air transport and allocated them among the American and British units which could fly the missions.

Our ability to fly matériel to our troops was a turning point in many of our World War II battles.

For instance, our troops at Bastogne received more than 1,000 tons of equipment and supplies, about 300 artillery weapons, and about 8,000 gallons of gasoline by air transport. Much of it was by air drop with a 94 per cent. drop effectiveness. Most important, it came when needed most. On Christmas Eve 1944, the troops were virtually out of ammunition. But by day-break the next morning the sky was clear for the first time in days. With the sun, came transport aircraft bringing in supplies to continue the fight.

General George Patton's march across Germany shows how that extra punch delivered by air transports can speed victory. The Third Army be-

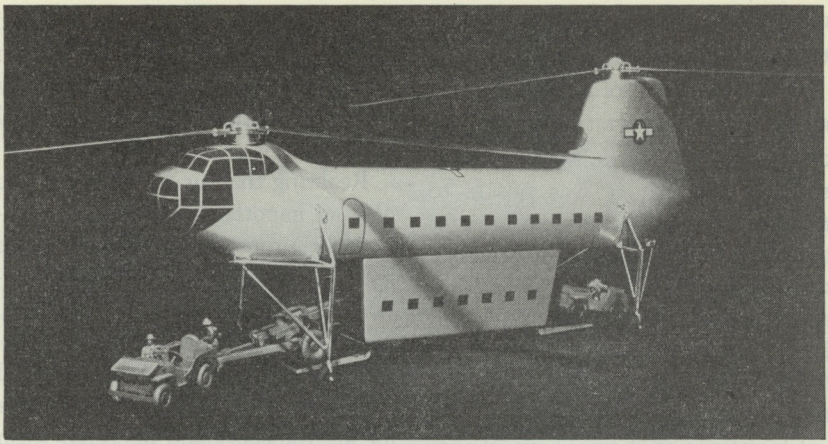


Photo by courtesy of Officers' Call

This scale model of the XH-16 represents one of the largest helicopters currently being developed. Its all-metal fuselage has the general shape and dimensions of the C-54 transport. It is expected the large detachable compartment and the main cabin space can carry about the same number of troops as the normal Army bus.

came so conscious of air supply that combat units put emphasis on taking airfields and clearing them for transport aircraft.

Although trucks carried most of the supplies in the Third Army's march, air transport played no small part in the drive. In 48 days, airplanes delivered more than 6,000,000 gallons of gasoline—about 22 percent of all that the Third Army used—and 11 percent of the Third Army's rations. On return trips, these airplanes, brought out 20,000 casualties and 134,600 prisoners of war.

In the closing days of the fighting in Europe, the evacuation by air of repatriated allied military personnel became a big job. From April through May 1945, American and British planes flew some 350,000 former prisoners of war out of Germany.

Major Supply By Air

Thanks to several well-known comic strips, many Americans think of the "Hump" as the ultimate in flying war supplies. And the tonnage and type of cargo flown was impressive. By July 1945, the Air Transport Command was flying more than 71,000 tons per month in support of the China war effort.

Supply in the British reconquest of Burma in 1944 and 1945 was primarily by air. To overcome the obstacles of difficult terrain, miserable weather, tropical diseases, and lack of roads, 96 per cent. of the supplies went in by air. About 100,000 casualties were flown

out. During the entire Burma campaign more than 1,000,000 tons of supplies and equipment were moved by air.

That we can maintain large military forces by air transport is apparent from our operations in the past.

In fact, we supplied more than 2,000,000 people of Berlin almost entirely by air from June 1948 through September 1949. During this period some 225 American Air Force and Navy planes and 128 British planes delivered 2,325,509 tons of fuel and food to blockaded Berlin. On one day, 16 April 1949, almost 13,000 tons of supplies were brought in. More than 200,000 passengers were flown in the Berlin airlift. This tremendous cargo was carried in all kinds of weather and in spite of the fact that loading and unloading largely was done by hand.

We know, *if we control the skies*, we can supply large groups strictly by air—be they military or civilian.

No Other Means Possible

If we fight in areas of large waste lands and other undeveloped spots in the world devoid of adequate land transport systems, we will rely largely on air transport. Such, for example, are our concepts if we fight in the arctic.

Although partisans largely "live off the land and the enemy," they also need other supplies. They may be supplied by air drops, particularly of critical items. During World War II, for example, French resistance groups received matériel in this manner. The very nature of guerrila operations are such that stealth is mandatory. And if supplies from the outside must be brought in, air transport is one of the best means available.

Summing it up, we have used, are using, and will use air transport when other forms cannot do the job; cannot get a needed item some place quickly enough; or the item is so critical, so short in supply, or so expensive that we cannot afford to fill the normal supply pipeline. Additionally, with other transportation carrying the bulk, air transport will augment the normal system. There will always be times when something is needed in a hurry. And air transport is our fastest way to get it there.

Limitations

In pointing out what air transport can do and has done, we must remember its limitations.

First, we must have air superiority for the mass movement of air transports. We must be able to protect our transports from interception and destruction by enemy planes, missiles, and gunfire. And we must have air superiority over our airhead and departure bases.

Second, we need plenty of the right kind of planes. We don't have enough now—either in quantity or in variety

—to support a major campaign solely by air transport.

If we have the planes and we can get them to and from the objective area, the other limitations are not too bad. Here are some obstacles hampering movement by air:

As much as the cargo-carrying capacity of aircraft has been improved, airplanes still can't match sea or land transports in tonnage moved. An airlift still must be regarded as expensive transportation.

We can't carry the items by air that we should. For example, an infantry division is still not completely air transportable. This means that an air-transported division goes to combat lacking some of its needed punch.

If the cargo is to be airlanded—and that is the most efficient method of delivery—we need strips and fields capable of handling the landing aircraft. We need planes that can land and take off in small areas. Once the planes are on the ground, we need faster methods of loading and unloading cargo.

Distances may be prohibitive for mass air travel. Adverse weather may be a serious handicap.

Fuel is a problem. Planes flying from the United States to Japan, for instance, are expected to fly back. Some other form of transportation carries fuel to Japan for the planes' return trip. If, however, planes are flying to a new airhead, the problem of bringing in sufficient fuel for the return trip is a large one. In other words, part of the tonnage carried would have to be fuel for the return trip of all the planes.*

Most of these limitations are logistical rather than tactical or strategic. And the tactical and strategic considerations in an airborne or air-transported operation are many. Indeed, the preplanning, conferences, and co-ordination efforts within and between units and services that are part of such an operation seem endless.

But despite all limitations, we have come a long way in a short time in the use of air transport.

**We have flying tankers that can carry large quantities of fuel. These planes also can be converted to regular transports.*

(To be continued)

ARMY HELICOPTER PILOTS

Under present [U.S.] Army plans, helicopter-pilots assigned to the new Transportation Helicopter Companies will hold warrant officer rank. The Chief of Army Field Forces has been charged with responsibility for setting up courses to train Army enlisted men and warrant officers for assignment as helicopter pilots with the Transportation Corps. The likelihood is that other Army helicopter pilots, serving with Signal Corps, Engineer and other branches will be officers.—*Army-Navy-Air Force Journal* (U.S.).

SURPRISE

An Essay by Lt. Col. G. M. C. Sprung, MC*, Canadian Intelligence Corps, Army Headquarters, Ottawa

Part 2

III

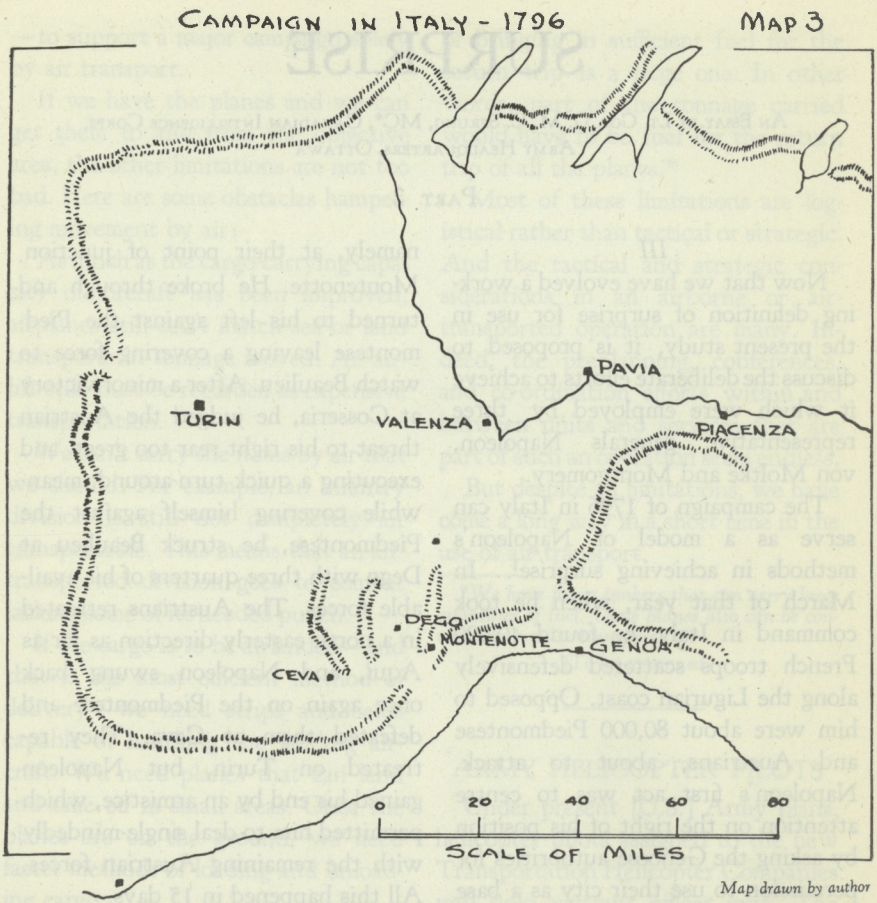
Now that we have evolved a working definition of surprise for use in the present study, it is proposed to discuss the deliberate efforts to achieve it which were employed by three representative generals Napoleon, von Moltke and Montgomery.

The campaign of 1796 in Italy can serve as a model of Napoleon's methods in achieving surprise[1]. In March of that year, when he took command in Italy, he found 40,000 French troops scattered defensively along the Ligurian coast. Opposed to him were about 80,000 Piedmontese and Austrians, about to attack. Napoleon's first act was to centre attention on the right of his position by asking the Genoese authorities for permission to use their city as a base of operations against the Austrians to the north. The stratagem was successful and determined the Austrian commander, Beaulieu, to advance in strength on Genoa.

Screened by this deception, Napoleon drew his divisions together in the centre and on 12 April struck his enemies where they were weakest, namely, at their point of junction, Montenotte. He broke through and turned to his left against the Piedmontese leaving a covering force to watch Beaulieu. After a minor victory at Cosseria, he judged the Austrian threat to his right rear too great, and executing a quick turn-around, meanwhile covering himself against the Piedmontese, he struck Beaulieu at Dego with three quarters of his available forces. The Austrians retreated in a north easterly direction as far as Aqui, and Napoleon swung back once again on the Piedmontese and defeated them at Ceva. They retreated on Turin, but Napoleon gained his end by an armistice, which permitted him to deal single-mindedly with the remaining Austrian forces. All this happened in 15 days.

Beaulieu had in the meantime retreated to the Po at Valenza covering Pavia. Napoleon employed his second great deception in turning this position. One of the published terms of his armistice with the court at Turin had been the right to use Valenza as a crossing place over the Po. Napoleon ostentatiously sent a force to encamp there and let it be known he was

[1] *See Map 3.*



Map drawn by author

collecting a fleet of boats for the attack. In fact, however, he organized a small force of six battalions and 1500 cavalry and moved it swiftly eastwards about 50 miles to Piacenza and crossed the Po there in rear of the Austrians. The main French force followed. The crossing was effected and the entire surprise manoeuvre failed to cut off all retreat only because the necessary bridging equipment was not at hand and the Austrians escaped to the east before a sufficient French force could be laboriously ferried over to the north bank. An unbalancing of the enemy sufficient to annihilate him had failed due to this (unavoidable) flaw in the plan. The surprise was great enough to panic the Austrians into a with-

drawal out of Lombardy and, eventually, as far as Lake Gardia. This opening month of Napoleon's first campaign was not surpassed by anything he subsequently achieved.

In preparing this series of surprises Napoleon was acutely aware of the importance of secrecy. Under the prevailing circumstances the only sure secrecy was deception, and this he achieved with elaborate effort both with respect to Genoa and crossing the Po at Valenza. The same awareness is evident in nearly all of his latter campaigns until his caution was dulled by success. He ignored the need to deceive at Pultusk in 1806, at Eylau in 1807 and, of course, most flagrantly in 1812, when all his preparations to attack Russia were open to public view. The subsequent campaign likewise lacked all the prerequisites of manoeuvring his enemy into an ineffective position. In 1800, however, his surprise crossing of the Alps was concealed behind a deceptive concentration at Dijon. In 1805, his march on Ulm was preceded by effective demonstrations in front of the Black Forest, and in 1806 while he was concentrating in the south for the advance on Jena, his forces along the Rhine as far north as the Netherlands were simulating offensive movements against Prussia from the west. In extricating his force of 150,000 from the Island of Lobau in the Danube before Wagram in 1809, Massena's feint crossing with one corps to the west made possible the brilliant crossing of the remainder of the force in the opposite direction.

Despite the instances where it was disastrously lacking, Napoleon's conviction of the importance of consummating a plan in secrecy by the bold use of deception is clearly a major characteristic of his generalship. The other prerequisites of surprise are present in varying degrees. His sense of the importance of supply seldom failed him, and his plans were as sound as their success indicates. The factor of efficiency was the one most neglected. His earlier armies were veteran and sufficiently well tempered to provide the necessary mobility for surprise. The later masses of conscripts were not highly trained, nor did Napoleon devote much time to the schooling of his marshals and their staffs. This lack of flexibility in his instrument contributed to many of his later disasters.

If deception was Napoleon's greatest aid in preparing surprise, audacity was the thing which carried it through. In 1796 the Austrians planned to attack and were, in the first instance, surprised by the fact that they were attacked. This is the essence of audacity. That they were attacked in a place (Montenotte) and at a time which left them temporarily helpless is just the form which Napoleon's audacity took. It is equally

true that in each move he ensured a local superiority sufficient to give him the tactical victory. The motivating force behind this superiority, however, was not mere quantitative calculating, but the spirit of audacity which conceived the assemblage of superior forces in surprising directions and at unexpected times. Coupled with it was always the courage to be weak at other points. In each successive action—Montenotte, Cosseria, Dego, Ceva, Piacenza, it can be said that the Piedmontese and the Austrians were surprised by Napoleon's audacious concentrations, first against one, then against the other, which struck at their dispositions whilst these were temporarily ineffective.

The same general traits are evident in later campaigns. The move across the Alps in 1800 was a bold conception which resulted in a concentration surprising both in time and place. In 1805 the sweeping march to surround Mack at Ulm shows more emphasis on weight of force arriving at an unexpected time, than on audacity, yet Napoleon's willingness to reverse his front for the battle was not lacking in high courage. The defensive surprise at Austerlitz was essentially audacity. Napoleon was slightly inferior in numbers, he was at the end of his communications, he had everything to lose, and yet he turned on his enemies in a counter-attack with the viciousness of a rattlesnake. The resolution with which he directed his army onto the communications of the Prussians at Jena in 1806, whilst temporarily surrendering his own, should not be overlooked, although the main factors here are weight of force, direction and timing.

Nothing has been said of surprise by method or weapons in Napoleon's campaigns and indeed it is difficult to find examples where they were important. Napoleon was, after all, but a part-time general and did not have the opportunity of training his armies or of devoting much thought to novel equipment for them. Though understandable, this was perhaps his greatest weakness and sharply distinguishes him from a later general who in other ways owed so much to him—Von Moltke.

In studying Moltke's campaigns with the narrower concept of surprise in mind, it is difficult to see that he placed much value on it. The word surprise occurs only two or three times in his writings, and then in a tactical context. This is not astonishing, however, for Moltke professed to place little value on any strategical principles. In truth his confidence in his own genius for command was so strong that he took such things as surprise, timing and superiority of force for granted, and directed his energies to the practical task of perfecting his instrument—the Prussian Army. It is only when we study his

campaigns with the broader concept of surprise that it becomes clear to what extent it underlay his strategic planning as well as his manner of command in battle.

Among the prerequisites of surprise Moltke was fully aware of the importance of secrecy. For him, secrecy was largely security of information. He became notorious and even unpopular for his tight-lipped answers to all unauthorized enquiries. Active deception was not important. The only major example to be found is the demonstration by the Silesian Army in 1866. VI Corps was to cross the border in rear of the Austrian concentration in northern Bohemia and threaten the railway to Vienna. This was not effective, and I can find no later instance of any outstanding stratagem or ruse which Moltke employed.

The importance of a sound plan with adequate supply arrangements stood much higher in his estimation. The initial deployment of his armies in 1866, extended for defensive purposes, yet so balanced that by a few simple moves they could be drawn in and concentrated forward, was as sound as a plan ever was. The same was true of his deployment against France in 1870. This time he held his armies together on a sixty-mile front against the French forces scattered loosely on a 130-mile front because his intention was offensive. In both cases the plan was possible because of a meticulous study of railway capacities and the careful dumping of supplies well forward.

The distinctive Moltke touch in the preparation of surprise must, however, be found in the years of care he devoted to the perfecting of efficiency in the Prussian Army. Tactical doctrine for the various arms, the problems of road and rail movement, equipment questions, all these things absorbed him professionally. Beyond this, he worked to perfect the technique of command and the methods of staff duties. He taught his officers that orders must be brief and contain direction only on these points which the subordinate cannot better decide for himself. He taught that commanders, in the absence of orders, must act on their own initiative and follow the sound of the guns. In everything, he strove to educate his senior officers to a basic pattern, whilst encouraging individual freedom. This gave Moltke a flexibility and a swiftness in manoeuvre which time and again caught his enemies off balance and was worth 100,000 men to him in battle.

The ways in which Moltke rendered his enemy's dispositions ineffective were in some respects equal to Napoleon's, and in one respect definitely inferior. In the use of timing, direction and weight of force he can stand comparison, but, perhaps in the

nature of things, his campaigns lack the crowning quality of Napoleonic audacity.

The concentric advance of the three Prussian armies into northern Bohemia, in 1866, the Second from Silesia through the Giant Mountains, the First from the northwest through the Lusatian Mountains, and the Elbe Army from the west through Saxony, is well known. The Austrian forces under Benedek were moving north to concentrate in the area of Koenigraetz and Josephstadt. The vital question was whether Benedek could move swiftly enough to defeat the separated Prussian armies singly, or whether Moltke could attack the Austrians with all his armies simultaneously. In the event, Moltke used the second Army to draw off Austrian strength facing the First and Elbe armies, and then in turn permitted the Second to advance by threatening with these. The critical decision was taken by Moltke on 30 June, when he deliberately held his forces separated to keep open the possibility of a concentric attack. By 2 July Benedek was caught in the Prussian net, and as the First and Elbe Armies attacked him in front from the west, the Second struck down from the north against his flank and rear. The victory was nearly total.

It is difficult to say whether timing or direction was the more important in this campaign, but, certainly, taken together, they were the substance of Moltke's surprise. Weight of force, while essential to success, was not in itself a surprise. Prussian strength barely exceeded the Austrian on the day of battle. There was nothing essentially audacious in this campaign except Moltke's initial dispersal, but this was forced on him by Prussia's extended frontier. The surprise which found Benedek's dispositions ineffective, was due to Moltke's skill in carefully playing his armies like pieces on a chessboard.

A glance at the main events of the first weeks in the War of 1870-71, will confirm the points already made. The Prussian mobilization and initial deployment were superior to those of the French, as was their command organization. Moltke advanced on a narrow front, his three armies in balance, fully equipped and up to strength. The French lay scattered from Belfort to Chalons in eight, partially equipped, under strength, corps. Looking back, the issue was certain from the outset. Given, as a prerequisite, the superior flexibility of Moltke's forces, then the ultimate entwining of the French in his octopus-like arms was inevitable. There is something genuinely Napoleonic in all this. I think Moltke's use of direction and timing to achieve concentrated force is probably superior to Napoleon's. Audacity is lacking, but it was not needed. Moltke

comes very close to achieving Jomini's ideal of ensuring victory before the battle by a skillful strategic combination.

In his careful attention to the prerequisites of surprise, Field Marshal Montgomery resembles Napoleon more strongly than Moltke does. He was not content with mere security of information, but elaborated measures of active deception with great effort. The tricks employed to mislead Rommel before the Battle of Alamein are well remembered. There was the dummy pipeline running to the southern sector of the front, so timed in its construction that the completion date would appear to be later than the date set for the attack in the north. There were false dumps of stores, likewise so placed that an attack in the south near the Qattara Depression was to be expected. There were the dummy vehicle parks in the rear to conceal the move of 10 Corps to the front, and the simulated wireless traffic for the same purpose. All these measures apparently did have some success in keeping 21 Panzer Division immobilized in the south until the attack in the coastal region was well launched. It is true that this success was, in the nature of things, short-lived and strictly local. It is not clear how much of the deceptive effort before Overlord was due to Montgomery's influence, but a strong similarity of technique can be noticed.

Montgomery's own narrative of his battles makes it forcefully clear how sensitive he was to the value of intelligence. He appears to have been very well served in this respect, and his willingness to act upon the intelligence given him is one of his strongest characteristics as a general. His well known concern for supply arrangements to back up a careful plan should also be mentioned among the prerequisites of surprise. Strangely enough, this characteristic of Montgomery became, at times, almost a hindrance to his achieving surprise. Clearly, if one insists on perfected administrative arrangements above all else, the likelihood of surprising the enemy will become remote and the scope left for audacity will be small indeed.

When we turn to the ways in which Montgomery in fact surprised his enemies, we note that the predominant factor was, in most cases, weight of force. It is true that tactical surprise in time and place was usually achieved and so the effective launching of the concentrated force was guaranteed. At Alamein Montgomery's superiority was 2 to 1 in tanks and in the assault sector more than that in men.[1] It was the sustained fury of the attack and Montgomery's willingness to accept casualties that defeated Rommel.

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[1] *Fuller The Second World War p 234.*

If the breakout operation in Normandy can be taken as a Montgomery plan, the same general pattern can be seen there. The most important factor was the overwhelming weight of the American attack. Over 1800 heavy bomber aircraft and seven army corps including about 800 tanks were used against an effective German strength of about four and a half divisions plus less than 200 tanks.[1] It is true that every effort was made to conceal the direction of the attack by centering German attention on the British sector. This was important, and yet it appears to have been but a contributing factor to the weight of force. In their finest efforts, Frederick the Great, Marlborough, Napoleon and Moltke used surperiority of numbers as a contributing factor in achieving surprise by direction and timing of attack. At Alamein and in Normandy, I think it is fair to say, the importance of these factors was reversed.

That it might have been otherwise had Montgomery commanded under different circumstances, can perhaps be inferred from one or two other battles which show rare flashes of audacity. At Mareth, where the prerequisites of surprise were not cultivated so elaborately, Montgomery's plan was based on surprising Rommel by the direction and timing of the New Zealand attack. This move around Rommel's right through the El Hamma gap was a stroke genuinely aimed at catching the enemy's main forces out of balance, not by its weight, but by its audacity. True, 10 Corps was ordered to follow, but the final attack on the El Hamma switch line still found 15 Panzer and 90 light divisions in the wrong place. The numbers employed were adequate or the plan would not have been sound, but, I repeat, this success was due primarily to direction and timing and not to numbers. The only partially effective parachute drop in Holland in September 1944 might be cited as another Montgomery operation which reveals a flash of audacity.

However true it may be that Montgomery might have made more use of surprise had he commanded under different material and geographical circumstances, his name will be more commonly linked with the use of concentrated force, insistence on meticulous administrative planning and ruthless maintenance of the initiative, rather than with his use of surprise. His achievement is outstanding in the field of tactical deception, but in the larger picture, where audacity tears up the very roots of the enemy's plan, he is not to be compared with Napoleon or Moltke.

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[1] *These strengths are taken from Montgomery Normandy to the Baltic p 141, and Eisenhower Report to the Combined Chiefs of Staffs p 34 and 38.*

IV

The course of our investigation thus far has provided an historical foundation for answering our central question, "How important is the factor of surprise in war?" It should be clear by now that the scope of my paper has been, perhaps arbitrarily, limited to that part of war which is played out in a theatre of operations. The underlying factors — national manpower, industrial potential, scientific and technical skills, political considerations—have been completely excluded in the belief that to use the word surprise in such spheres would distort its operational meaning. These factors do give rise to far-reaching "surprises" during a war, as witness British resistance in 1940 or Russian production during the years 1942–45, but such happenings belong more properly in the realm of the unpredictable and are clearly not of the same order of event as the deliberately planned military surprise.

Within the sphere of operations then, how does surprise compare in importance with other critical factors? There is, of course, no agreed list of such factors against which surprise can be held up for evaluation. If it can be taken that such things as strength, good equipment, high morale, adequate supplies, and skillful generalship must at least be included as important factors in war, what is the place of surprise among them?

It is clear that surprise is somehow not the same kind of factor as the others. Surprise must be counted a facet, and perhaps the brightest facet, of the art of generalship. Good troops, in adequate numbers and well equipped, are the instrument with which the general exercises his skill. They are fundamental; they must come first; only seldom are great things achieved without them. Surprise is not so much an additional factor as it is the result of the proper use of these other factors. Surprise is an end product which is realized only in the course of an operation. Other factors exist before the campaign begins, but surprise is something which happens to the enemy during the campaign. At the conclusion of an operation one can look back and place a value on the factor of surprise, but never beforehand, because it does not exist beforehand. It is, in this sense, more a factor in victory or defeat, than a factor of war itself.

An examination of victories and defeats in the past reveals the degree of importance which surprise deserves. I referred earlier to Napoleon's 1796 campaign in Italy. He was inferior in numbers to his enemies and occupied a defensive position. He deceived the Austrians, concentrated in secret and struck them at Montenotte, where they were unprepared. By his subsequent stratagems and swift moves, he denied his enemies the opportunity

of regaining their balance and deploying effectively against him, and achieved a nearly complete success. I think it is fair to say that in this campaign surprise was the decisive factor. Without it, the stalemate in northern Italy would undoubtedly have continued. Napoleon's campaign of 1812 illustrates by comparison how difficult victory can be without surprise. Relying on a crushing superiority of numbers and his own tactical skill, Napoleon assembled his forces without any attempt at concealment and lunged directly at his enemy. His inability to fix the Russians for a decisive blow shows that under certain circumstances surprise is essential to victory even though the factor of strength is overwhelmingly in favour of one side.

Montgomery's battle at Mareth illustrates a different value in surprise. It is highly probable that Rommel, with his rear threatened from Tunisia, would have been beaten at Mareth sooner or later, with or without surprise. As it was, thanks to surprise, Montgomery achieved a quick victory at low cost. I think it is fair to say that the same is true of the crossing of the Rhine in March 1945. It is inconceivable that this operation could have failed, given the thoroughness with which it was mounted. The efforts at tactical concealment—smoke screens, etc.—and the air diversions carried out, however, probably speeded the crossing and reduced the casualties.

It would be quite wrong, nevertheless, to argue that surprise is an indispensable factor in success. This is not so. The ultimate victory at Salerno was won in spite of the absence of surprise. Russian victories against the Germans in the Second World War were gained mainly through superiority of numbers. The Russian counter blow at Stalingrad, for example, contained no element of surprise. It was simply a case of Russian numbers crumbling the German forces. Moltke's victory at Sedan in 1870, while complete and perfect in its way, was in no respect dependent on surprise. His armies were sufficiently strong and cleverly enough disposed to make it inevitable that they would sooner or later bring MacMahon to bay.

Surprise, then, is not, in all circumstances, essential to victory. Where other factors are roughly in balance—and in long run and on the average they will be—surprise will decide the day. Even more, where a weaker force is victorious, surprise is the veritable key to victory.

V

The future trends in the technique of achieving military surprise is a subject which invites lengthy discussion. It is possible at this time, however, to glance briefly at only three or four salient points. In truth, the great

essentials of surprise will remain, as always, unchanged. Certain improvements in equipment and weapons will introduce new means of achieving old ends.

The only prerequisite of surprise which will be substantially affected in the foreseeable future is the efficiency of the force—particularly mobility. It will be more painfully true than ever in another war that we cannot expect to win battles by superiority of numbers, for we will not have the numbers. If we are to win battles we must make up in efficiency what we lack in strength. It is clear that our equipment and training must be superior if this is to be possible, but the main point affecting surprise appears to me to lie in the achievement of a vastly superior mobility. Leaving aside our traditional use of sea power, the principal means, in the large picture at least, of making ground forces mobile is the use of air transport.

I realize full well the great cost of large fleets of transport aircraft, but the same argument could have been used, and no doubt was, against Moltke's railroads in the nineteenth century. Yet it has been noted that the superior Prussian rail system gave Moltke a flexibility in deploying his forces both against Austria and France, which in itself was a cardinal advantage. The same will be true of air transport, only more so. The railway gave Moltke a degree of strategical mobility, whereas carriage by air can afford tactical mobility as well.

The principle must be to make one man count as two. Mobility is not merely a defensive advantage in allowing breaches to be hastily mended, but poses an offensive threat. The added speed of concentration at the scene of battle allows economy of force and hence concentration of force to be practiced to a degree otherwise impossible and imposes a caution on the enemy far greater than the same numbers by themselves would do. Numbers, in effect, are increased by mobility, for the same men do double duty. As surely as mobility was an essential prerequisite for Marlborough's surprise on the Danube, or for Napoleon's campaign of 1796 so it will be an essential in the future. As surely as Moltke's use of the railways gave him an advantage over the Austrians and the French, so a planned use of transport aircraft for moving men and equipment will give us an advantage over our enemies in the future.

In the smaller picture, mobility is an index of efficiency. It is not a miraculous achievement by itself, but is the result of many smaller things. It is the result of not congesting the roads by a senselessly lavish use of transport. It is the result of simple, or even harsh, living standards among all ranks. It is the result of efficient

staff work and courageous generalship. Tactical mobility will have to be one of our greatest advantages in another war. It is to be hoped that a return to our best tradition in this classic principle will be one of the trends of the future.

Among the ways in which surprise can be achieved, future trends will undoubtedly be most marked in the field of equipment and weapons. The next war will give the scientist a more prominent place than has ever been known in past wars. An intense and unceasing effort will have to be made to keep slightly more effective equipment in the field than our enemy can. Our machine guns, our anti-tank weapons, our armour, our mines and shells and fuses, will all need constant study and improvement. It is true that some degree of brief local surprise is usually achieved by an improved weapon, but this is normally short-lived. Unless the weapon is wholly novel, such as the tank or poison gas were, the effect should properly be counted to the credit of the efficiency of the force, rather than directly to surprise.

We are inclined to think of radiological, bacteriological and chemical warfare or perhaps of long-range rockets when new weapons are discussed today. It is absurd to mention such things in a few sentences, but their relation to surprise must be pointed out. I am inclined to think that atom bombs and things of that sort are basic to any enquiry into future methods of waging war, but that their relation to surprise is not as important as might appear at first glance. Technically there can be no fundamental surprise, as the major nations are all familiar with the general scientific implications of these agents and weapons. In as much as delivery will be affected by air in most cases, the natural attribute of flexibility, which is inherent in all air operations, will be added to the other advantages of these weapons. But flexibility is relative, and there is no reason to expect that penetration into an enemy country by air will be easier in the future than it has been in the past. In fact, air defence appears to be improving rather faster than air offence. In the early stages of a future war there may well be many local surprises in time and place of air attack with mass destruction weapons but this will probably level out, leaving the importance of the new weapons resting mainly on their unpreventable destructiveness rather than on their surprise value.

It is to be hoped that the most important future trend in surprise will be the re-study of its essentials. Surprise is not a device or a trick or even merely a skill. It is an attitude to battle and it is important for us at this time in our military history to recapture this attitude. There was a

pervasive tendency during the last war for our staffs and at least some of our commanders to forget that war is a fluid series of events which must be met with a flexible mind. The principle of maintaining the object was allowed, all too often, to degenerate into an excuse for making unimaginative plans. "Phase lines" became a habit which lulled us into believing that all our thinking had been done before the battle began. We tended to forget that the enemy is an independent factor in war and that the course of battle is an unpredictable thing resulting from the interplay of his will and our own plans. Whether or not this is to be counted a vanishing legacy of the Great War, I do not know. It is to be hoped so.

I do know that it is time we restudied the fundamental attitude to battle of both Napoleon and Moltke. The former is reported to have said that he never had a plan of operations. Certainly his campaigns, though well studied logically, were conducted from stage by his inspiration. Moltke taught as a doctrine, that one could never plan a campaign beyond the first contact of the main forces. Both kept themselves poised at all times, with minds open to the shifting facts, ready to strike at their enemy the moment he revealed an unbalanced disposition. This attitude to battle was so important to both Napoleon and Moltke that they seldom mentioned it. They took if for granted as an integral part of generalship. They would have been astonished had anyone questioned its value.

In its integral relation to the art of generalship lies the importance of surprise for the future. It is, in its widest reach, the execution of that "great strategic combination" which renders an enemy's dispositions faulty before the battle is joined. It is the transcending of the material and numerical through superior mind and spirit. It is an achievement of human skill and audacity. It is a crowning facet of generalship. As war is the art of generalship, so surprise lies at the heart and centre of war. Wherever the true tradition of arms is kept alive, surprise will endure as one of the few genuinely essential factors in its prosecution. In a future where weight of material and mechanical excellence threaten to overshadow the importance of classic military virtue, the spirit which breeds surprise is one strong promise of salvation.

(Concluded)

KIDNAPPING A GENERAL

A Book Review by Lt. Col. J. W. Ritchie (The Royal Canadian Regiment),
Directorate of Military Training,
Army Headquarters, Ottawa.

The kidnapping of a general while motoring between his headquarters and his billet is an unusual incident. It is even more unusual when the general is commanding the occupation forces of an island, and his abductors land secretly on that island, seize him, march him across it on foot and then leave by ship from a strongly patrolled coast.

Captain W. Stanley Moss, Coldstream Guards, has published his diary* describing such an operation. A mixed group of British officers and Greek partisans stopped the car in which Major General Karl Kreipe, of the 22nd Panzer Grenadier Division, Commander of the German forces in Crete, was driving and spirited him away. Before the car was abandoned it had passed twenty-two sentry posts, which paid the usual compliments to the general, who was probably more concerned about the gun in his ribs than the smartness of the sentries.

Captain Moss has described this episode as it occurred, most of the narrative being taken directly from his own diary. Since the party travelled only at night, the long daylight hours during which they remained in hiding gave the author the opportunity to write his diary in great detail. He has interlarded it with italicized notes which explain or clarify certain events and conjecture. These complete the narrative and present an enjoyable account of an adventure which should appeal to civilians as well as soldiers of all ages.

The photographs reproduced in this book add immeasurably to its interest. They give the reader an excellent idea of the stage and the principal actors in this exciting drama. As one reads of the actions or exploits of the more colourful characters who are so well described, there is a great tendency to turn back to the pictures and study them to make the narrative even more life-like than it is.

The story opens with the approach of the abduction party by sea to a beach on the south shore of Crete. The description of the approach and the tension, until the landing has been made, are vivid and exciting.

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* *Ill Met By Moonlight* (1950). By W. Stanley Moss. Published in Canada by Clarke, Irwin & Company Limited, Toronto. $2.50.

When the strain is relaxed the amusing minor difficulties become apparent and the attitude of those taking part becomes almost more careless than carefree.

The trip across the island to the final hide-out near the German general's headquarters is described in a most readable way. Together with the description of the hard overland trail, one reads of the rumours, speculation and definite information which may affect the plan to snatch this high-ranking officer from the midst of his own troops. Throughout the planning stage and right up to the moment when General Kreipe's car is halted by the allied band (no other collective noun seems to suit this heterogeneous group), the reader is always conscious of the flexibility of the entire operation and the alternative action which is planned to the last detail.

The cool efficiency of the actual kidnapping and the trip through the various sentry posts until the car is abandoned are amazing examples of nerve, bluff and a thorough knowledge of the German military mind. The pennants on the car and the effrontery of one of the main actors, who wore the general's cap, passed them through twenty-two barriers manned by sentries.

The trip back across the island to the south coast was not without excitement. The general's disappearance and the note sent by his captors to the German headquarters to prevent reprisals against the inhabitants, stirred the activity of the German troops like a stick thrust into a hornet's nest. The going was rough and the general had to move, as did his captors, on foot. As they approached the beach to wait for a boat to take them off the island, enemy troop activity forced the selection of an alternative beach. After several delays, the launch approached and the dinghies came ashore to carry out the final act of the drama. The greetings on the beach and the farewells to the partisans are simply and movingly told; the fact that the job has been finished and the excitement over seems almost to be regretted.

The story ends with the general leaving by car for his new home—a PW camp. The expedition was planned and carried out for its psychological and moral effect; its audacity and execution earned the grudging admiration of the Germans and the wholehearted praise of the allied Press. Now that the War Office has lifted the restrictions on the publication of the author's diary, readers may enjoy one of the greatest adventure stories the war has produced.

A United Nations Commander's View

WHAT WE ARE FIGHTING FOR

The following recorded statement by Lieutenant General Mathew B. Ridgway, CG Eighth Army [U.S.],[1] was broadcast on the Department of Defence radio program "Time for Defence" over the American Broadcasting Network on January 25, 1951:

In my brief period of command duty here I have heard from several sources, chiefly from the members of combat units, the questions, "Why are we here? What are we fighting for?".

What follows represents my answers to those questions:

The answer to the first question, "Why are we here?" is simple and conclusive. We are here because of the decisions of the properly constituted authorities of our respective governments. As the commander-in-chief, United Nations Command, General of the Army Douglas MacArthur[2] said publicly yesterday: "This command intends to maintain a military position in Korea just a long as the statesmen of the United Nations decide we should do so." The answer is simple because further comment is unnecessary. It is conclusive because the loyalty we give, and expect, precludes any slightest questioning of those orders.

The second question is of much greater significance, and every member of this command is entitled to a full and reasoned answer. Mine follows:

To me the issues are clear. It is not a question of this or that Korean town or village. Real estate is, here, incidental. It is not restricted to the issue of freedom for our South Korean allies, whose fidelity and valour under the severest stresses of battle we recognize; though that freedom is a symbol of the wider issues, and included among them.

The real issues are whether or not the power of western civilization, as God has permitted it to flower in our own beloved lands, shall defy and defeat communism; whether the rule of men who shoot their prisoners, enslave their citizens, and deride the dignity of man shall displace the rule of those to whom the individual

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[1] *Now Supreme Commander of United Nations' forces in the Far East.*

[2] *Since removed from his Command.*

—Editor

and his individual right are sacred; whether we are to survive with God's hand to guide and lead us, or to perish in the dead existence of a Godless world.

If these be true, and to me they are, beyond any possibility of challenge, then this has long since ceased to be a fight for freedom for our Korean allies alone, and for their national survival. It has become, and it continues to be, a fight for our freedom, for our own survival, in an honourable, independent national existence.

The sacrifices we have made, and those we shall yet support, are not offered vicariously for others, but in our own direct defence, wherein certain principles mean more than life.

In the final analysis, the issues now joined right here in Korea are whether communism or individual freedom shall prevail, and, make no mistake, whether the next flight of fear-driven people we have just witnessed across the Han River, and continue to witness in other areas, shall be checked and defeated overseas or permitted, step by step, to close in on our own homelands and at some future time, however distant, to engulf our own loved ones in all its misery and despair.

These are things for which we fight. Never have members of any military command had a greater challenge than we, or a finer opportunity to show ourselves and our people at their best — and thus be an honour to the profession of arms, and a credit to those who bred us.

HIGH-SPEED TARGET

The U.S. Navy has a new target designed to be towed behind airplanes at speeds up to 450 miles an hour. It's good at any altitude, as far up as the tow-plane can go.

This target differs greatly from the fabric sleeve-type target well known in military flying. It looks like an airplane, is made of metal, and has wings with a span of 24 feet. Metal construction makes the target good for radar tracking and provides strength for high-speed flight.

The winged targets have been towed at more than 450 miles an hour and at altitudes above 35,000 feet.

The target can be taken into flight by normal drag take-off or by "snatch pickup." Sufficient strength is built into the device to sustain the shock of a snatch pickup. A parachute is carried in the target's tail. This is released when the flying target touches the runway upon landing, and brings the target to a stop within 200 feet.—*All Hands.*

HISTORY OF PRIMERS AND PRIMING

By
MAJOR J. W. HOULDEN, WINNIPEG LIGHT INFANTRY

PART 2

"Leaden messengers that ride upon the violent speed of fire."

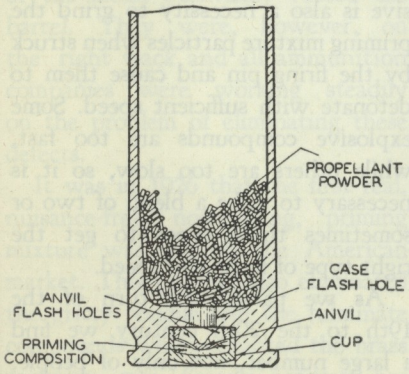
There were so many patents issued in the 19th century covering primers and priming mixtures it would be impossible to give a detailed history. Around 1850 when ingenuity was running rampant on firearm inventions, Flobert in France had an idea that he could make a totally enclosed cartridge with a case of thin metal. By making an overhanging ridge around the head he filled this ridge or cavity with priming mixture and arranged a hammer on his gun to fall in such a manner as to pinch this edge against the barrel. This caused the priming mixture to fire and thus we had our first "rim-fire." They were originally called "Bullet Breech Caps" and later, also today, called "BB" caps. Around 1860 the .22 Short Rim-fire was produced in the U.S.A., followed by a large assortment of rim-fire cartridges both big and small which were added to the procession of improvements.

We show herewith a cross-section cut (see page 71) of a modern rim-fire cartridge illustrating how the various components are assembled. Note particularly the position of the priming mixture. This rim-fire cartridge was popular from its inception and is even more so today. It was the first really totally enclosed separate cartridge, since it eliminated the pin sticking out of the side as in pin-fire cartridges. The rim-fire cartridge was also safer to handle. Consequently, due to economy and portability, no less than 10 military rim-fire cartridges ranging from .41 to .58 calibre were listed in the Winchester Catalogue of 1870. In 1939 no less than 80% of all cartridges manufactured and sold in Canada were .22 calibre rim-fire. Quality of accuracy and performance reach its top point in today's .22 Long rifle match cartridge.

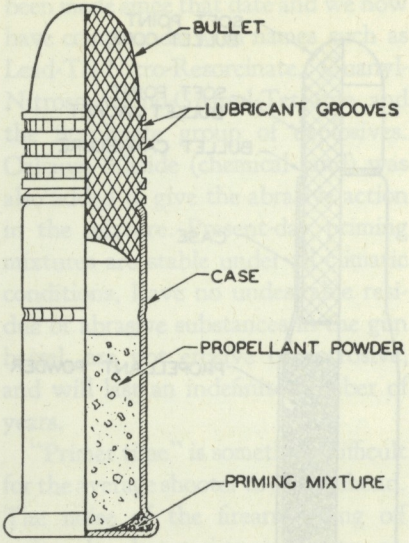
Separate primers, at the same time, were also receiving considerable attention in the English-speaking

world and a Colonel Boxer of the English Ordnance Department developed a "Boxer-Type" primer with a separate self-contained anvil to replace the pin in the pin-fire. The priming was placed in a cylindrical flat-bottomed cup with the anvil pressed in on top of the priming mixture. A cross-section cut is shown (bottom) of a modern cartridge with separate disc-type anvil. This construction has varied very little from the early types.

In both the Berdan and Boxer types of primers we have the priming mixture in a cup where it can be easily crushed up against an anvil and the resulting flame flashes through flash holes in the bottom of the case to ignite the powder charge. The strange thing about these two types of primers is that the one invented in the U.S.A. became popular in England and the European invention became universal in America. Distant



Cartridge with separate disc-type anvil.



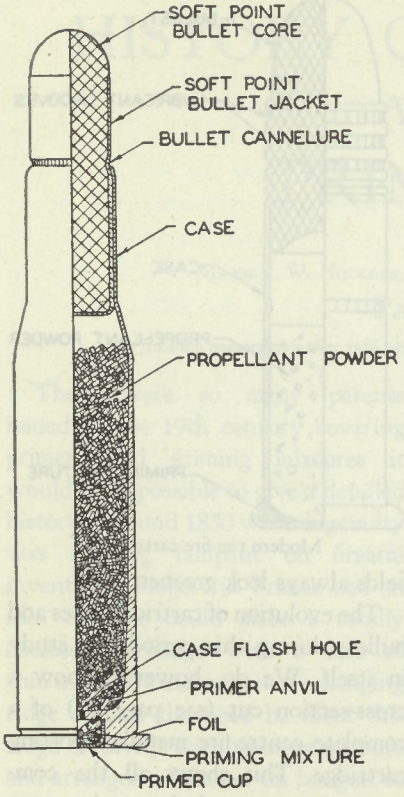
Modern rim-fire cartridge.

fields always look greener.

The evolution of cartridge cases and bullets during this period is a study in itself. We do, however, show a cross-section cut (see page 72) of a complete centre-fire metallic sporting cartridge. This shows all the component parts and how they are assembled.

Now let's look at the percussion or priming mixture itself. As mentioned in Part I of this article, the first compounds contained fulminates and chlorates both of which are erosive and corrosive and cause metal failure. The actual mixture used about 1860 was as follows:

Potassium Chlorate 6 parts
Antimony Sulphide 4 parts
Mercury Fulminate 6 parts



Complete centre-fire metallic sporting cartridge.

Later, other ingredients were added, principal of which were sulphur and mealed black powder. As can readily be seen, we have here a mixture of compounds which do an excellent job of igniting the powder but leave a residue which absorbs moisture, forms weak acids and causes rusting and pitting of iron or steel. The fulminates attack brass cartridge cases even before they are fired. Also, some of the ingredients were not always too pure and chemical reaction set up, within the primer, and with age, caused the priming mixture to deteriorate to the point where the priming failed even before the fulminate ruined the brass cartridge case. On top of all this we still have only black powder as a main charge.

With the introduction of smokeless powders between 1867 and 1888 it was realized that primers had to be more exact and also had to be matched to the type of powder being used. The problem of ignition was now important. It was not only necessary to have a flame to light smokeless powders but the flame had to be hotter than that necessary for black powder. Also, since the primer is completely enclosed it could get no oxygen to make it burn so this had to be included in chemical form to maintain constant heat. An abrasive is also a necessity to grind the priming mixture particles when struck by the firing pin and cause them to detonate with sufficient speed. Some explosive compounds are too fast, while others are too slow, so it is necessary to make a blend of two or sometimes three types to get the right type of flame and speed.

As we passed the turn of the 19th to the 20th century we find a large number, not only of people, but of countries, all working to

improve primers and powder. Around 1910 the Germans introduced non-rusting rim-fire priming in .22's. They combined explosive compounds which left alkali substances when fired and did not absorb moisture. Thus they reduced the rusting hazard in the gun barrel. They did, however, still contain the enemy of brass and copper, namely fulminate. One of the early formulæ is as follows:—

Mercury Fulminate	55%
Stibnite	11%
Barium Peroxide	27%
T.N.T.	7%

The barium peroxide is the oxygen supply to support the flame of the other three explosives. However, even though these early compounds were non-rusting, they had another disadvantage. The products left in the barrel after firing were hard, gritty substances and this caused the barrel to be scored and scratched by succeeding bullets. This erosion of the metal eventually ruined the barrel. They were, however, on the right track and all ammunition companies were working steadily on the problem of eliminating these defects.

It was in 1926 that the first real, nuisance-free, non-rusting, priming mixture was put on the American market. This priming also eliminated the gritty residue and the fulminate compounds which attacked the brass cartridge case. Steady progress has been made since that date and we now have compounds with names such as Lead-Tri-Nitro-Resorcinate, Guanyl-Nitroso-Amino-Guanyl-Tetrazne and the Styphnate group of explosives. Calcium Silicide (chemical sand) was also added to give the abrasive action in the mixture. Present-day priming mixtures are stable under all climatic conditions, leave no undesirable residue or abrasive substances in the gun barrel, are not erosive or corrosive, and will last an indefinite number of years.

"Primer time" is something difficult for the average shooter to comprehend. The noise of the firearm going off makes it almost impossible to remember whether there was any lapse of time in the firing cycle. In old muzzle loaders there is often a distinct lapse of time after the hammer falls before the gun fires. As mentioned in Part I, "The primer is the spark plug of the cartridge." It must be fast to be efficient.

In a modern cartridge the priming ingredients are of such a fineness that they will pass through silk screens as fine as 100 to 200 mesh. The time cycle is well known. The average shooter takes 1/10 to 3/10 of a second for the eye to signal the trigger finger to "pull." When the trigger is released it requires approximately 0.005 seconds for the hammer to strike the firing pin. From the instant the primer is struck

till the bullet leaves the muzzle of the rifle it is 10 to 15 ten-thousandths of a second. Therefore, we have a complete lapse of 3/10 to 4/10 of a second before the bullet leaves the muzzle after the eye has signalled the brain the "go" sign. This time is enough to allow a poor shooter to move the gun and spoil his aim unless he can hold the gun steady and follow through. In older times there was sometimes a pause of two or three seconds before the gun fired.

Another factor that was a nightmare in the early days was sensitivity or the resistance to shock or impact. Fulminate is extremely sensitive to handle and sometimes even a slight jarring will cause it to detonate. Early primers were usually exposed in paper caps or with exposed pins touching the mixture and if a cartridge or a box of cartridges was dropped the whole box usually went off. There were many accidents, a large number of which were fatal. Therefore, it was necessary to not only get sensitive compounds, which would give a hot flame, but they also had to be safe to handle. The design and construction of the early rim-fire cartridges were such as to make them much safer than any previous design.

The search for better compounds goes on steadily but handloaders and home experimenters continue to handle primers as though they were blocks of wood. The very nature of the explosives used, which are made to detonate on impact, should be sufficient warning to handle them with due respect.

Factories make priming mixture a *few ounces* at a time. A *few pounds* would cause terrific damage in case of a "blow." The average primer contains about 0.6 to 0.8 grains of mixture but if you have enough primers you can easily have a bad explosion. Primers are still little cups containing extremely sensitive high-power explosives. Handle them carefully!

Priming compounds as a result of The Second World War have undergone a great amount of research and experiment. Dozens of new compounds are now known and available to loading companies. The fitting of a primer, not only to a cartridge but to a powder, is now a very exact science. The quality and efficiency of our modern cartridges are a tribute to this constant research and improvement back over the past 200 years.

Editor's Note: We are indebted to the "RCMP Quarterly" for the use of their cuts and to E. I. DuPont de Nemours & Co. for data from their book on "Smokeless Shotgun Powders"; also the Ammunition Division of Canadian Industries Limited for additional reference data.

(Concluded)

INDEX

This index has been prepared for the convenience of readers who want a ready reference for all the subjects dealt with in the 12 issues of Volume 4 of the Journal—April 1950 to March 1951, inclusive. Many subjects have been cross-indexed; e.g., the title "Infantry Section in Defence" is also listed under "Section" and "Defence". In a like manner, the subject "Books For Military Reading" is also listed under "Military Reading" and "Reading." It is suggested that this compilation be preserved as a convenient guide to articles published in Volume 4. The indices for Volumes 1, 2 and 3 were published in the March 1948, April 1949, and March 1950 issues, respectively. — **Editor**

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Printer to the King's Most Excellent Majesty
1951

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H.Q. 223-C-3