CHAPTER XII

MISCELLANEOUS THEATRES

The following maps are relative to this chapter:—

SECTION 1. ICELAND (*See* Sketch map No. 13)

Strategical Background

Early in April, 1940, German forces invaded Norway. A small British Expeditionary Force which was sent over to assist the Norwegians had, by early May, been forced to evacuate, and the enemy was left in control of Norway and its seaboard.

The maintenance of sea communications between the United States and the United Kingdom was vital to the prosecution of the war and, with Norwegian ports under German control, it was essential that the enemy should not be permitted to occupy Iceland and establish air-bases there, from which the convoy routes would be threatened.

In May, 1940, a British force landed in Iceland where, in conjunction with U.S. forces, they ensured its protection from German occupation.

Survey and mapping data available

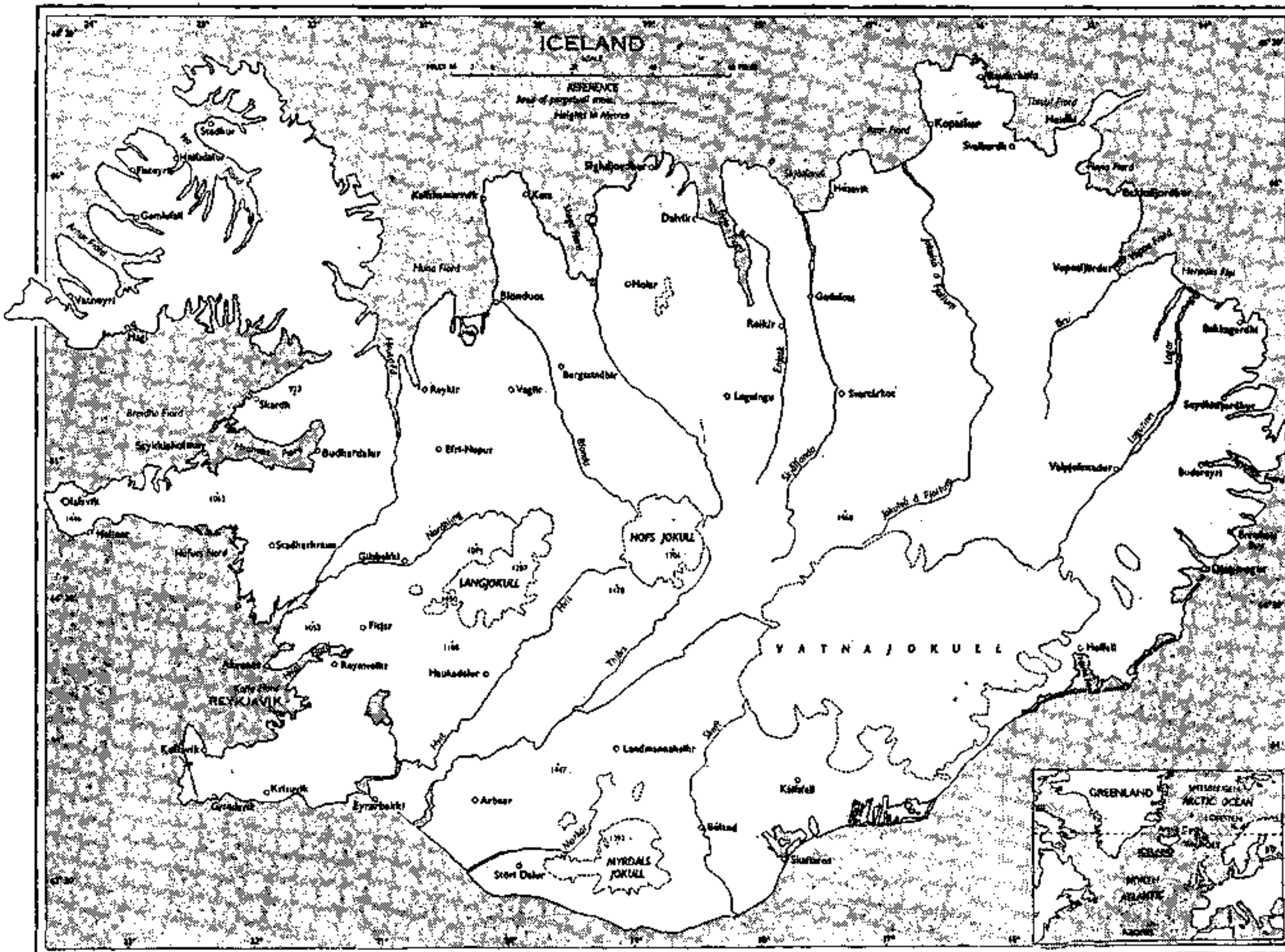
There was little available in the way of maps or survey data. Some copies of Icelandic maps on 1/50,000 and 1/100,000 scale had been reproduced by the War Office in one colour from multi-coloured originals.

The origin of the projection used by the Icelandic Survey was known, but otherwise there were no triangulation data in our possession. The War Office had prepared tables so that the geographical co-ordinates of trig points, when they were known, could be converted to the rectangular grid system which was to be adopted for the island.

Arrival of 19 Field Survey Company R.E. in Iceland

In view of the lack of maps and other survey data, it was decided to send out a survey unit. At that time 19 Field Survey Company, which had been serving in France as a G.H.Q. (Army type) survey unit, had been evacuated from Dunkirk with the remainder of the B.E.F., and was being re-formed. It was reorganized on a reduced establishment for duty in Iceland, and landed there at the end of July, 1940, under the command of Major R. H. Denniss, R.E.

SKETCH MAP 13



Drawn by Ordnance Survey 1951

The unit was organized as follows:—

Headquarters

2 Topographical sections.
1 Drawing section.
1 Printing section.

Transport

1 Utility car.
5 Motor-cycles.
22 Cycles.

Accommodation was scarce, and there was much competition for what little there was. Eventually a suitable building with a concrete floor was obtained and, as soon as the technical equipment arrived, the printing machines and ancillary plant were installed. For some time the personnel of the unit lived under canvas. Later on they erected Nissen huts on an open site adjoining their working accommodation.

Triangulation data and field surveys

Early contact was made with H.M.S. *Challenger*, which was engaged on survey work off Reykjavik, the capital, and a most useful liaison was established. Through the Commander, access was obtained to a book which contained a complete list of all trig points on the island, with their positions given in latitudes and longitudes. These values were converted to rectangular co-ordinates on the local grid, and they proved to be a sound basis for all subsequent survey work.

A conference was then held with the artillery staff to decide on a programme of survey work which would be of assistance to them. The fixation of gun positions, and the lay-out of bearings in terms of the map grid, was the first task undertaken by the topographical sections. Survey and levelling were also carried out in connection with airfield construction and the development of Naval Base projects and artillery ranges.

Most of the trig points listed in the book were well marked by cairns, were easily found, and their reliability and accuracy were found to be satisfactory. Unfortunately, some of the cairns were tampered with and damaged by the occupying troops, who did not realize their significance, and orders were issued from H.Q. warning all concerned not to interfere with them.

Mapping

1/25000 *maps of the Reykjavik area.* The first task was to produce 1/25,000 maps of the Reykjavik area. For this work the trig control formed a sound foundation, and the topographical sections surveyed the area, mainly by plane-table methods. The personnel of these sections, as was found in most other theatres, had little skill or experience in plane-tabling work, and progress on the first two sheets was very slow. The contouring in somewhat difficult country seemed to be the main source of difficulty and delay. The experience gained whilst doing these first two sheets was, however, invaluable, and succeeding sheets went much more quickly.

The drawing section was employed at first on hut erection until field sheet material became available from the topographical sections, after which they were fully employed on fair-drawing and map compilation.

Air photographs. When 19 Field Survey Company first arrived in Iceland, there were no R.A.F. units. There was, however, a detachment of the Fleet

Air Arm which undertook a small programme of air photography for mapping purposes. After covering the town of Reykjavik itself, they photographed other small areas including the site for a proposed airfield. These photos were used for the preparation of a town plan of Reykjavik and, in combination with the plane-table field sheets, greatly assisted in the compilation of the 1/25,000 maps of the area around the capital.

1/100,000 *maps of eastern Iceland.* The H.Q. staff was anxious to have maps covering the eastern coastal area of the island. While on a visit to the State Engineer's office, the O.C. 19 Company saw some new-looking map sheets lying on a table. These were proofs, which had been received from Denmark, of a survey covering the area in question which had not yet been published. After some persuasion the State Engineer lent him the material, and this enabled two 1/100,000 sheets to be prepared. When the State Engineer was given proofs of these new sheets, he was so delighted with them that any previous hesitation there may have been to co-operate was at once removed, and material for about 20 more 1/100,000 sheets was forthcoming immediately.

Other mapping projects. Once the unit had got into its stride, and had shown what it was capable of doing, there was the usual demand for the production of special maps, overprints, administrative diagrams, technical sketch maps, etc.

Amongst the many topographical maps published were the following, additional to those referred to above:—

1/50,000. 13 sheets, gridded.
1/250,000. 5 sheets (ungridded).
1/600,000 (Air). Compiled by the Air Ministry.
1/1,000,000. Compiled, printed and issued.
1/5,000. Town plan of Reykjavik.

Reproduction

When the printing equipment was received, it was found that the driving motors were not suitable for the local power supply. Apparently the unit did not take its own power generator with it, and was not, therefore, independent of local variations of voltage. A new starter coil had to be ordered from the United Kingdom and the unit electrician was able to carry out the necessary adjustments to the motors.

In the case of the guillotine, which was packed up in two separate cases, it was found that the parts contained in each case belonged to two different types of guillotine with the result that it could not be assembled.

Graining marbles proved a source of difficulty. The small quantity taken out with the equipment soon wore small, none could be obtained locally, and a new supply obtained from home arrived only just in time to prevent a complete breakdown in the printing programme.

Transport

The transport with which the unit was equipped was quite inadequate for the tasks it had to undertake in Iceland. The push-cycles certainly served a useful purpose for local recreation and for work on the town plan of Reykjavik, but they were quite useless otherwise. The R.A.S.C. were most helpful, and did their utmost to provide truck transport when it could be spared. In a country where the weather was very uncertain and where, in winter, the days

were so short, the provision of suitable transport for quick movement over difficult country was essential.

Eventually the unit received further transport though, by the time it arrived, most of the work had been completed.

Final remarks

19 Field Survey Company returned to the United Kingdom from Iceland in the spring of 1941. During its short stay in the island it had, by its working achievements, and by establishing cordial relations with other units, won its rightful position as an essential and popular unit of the occupational force.

There was no survey officer on the staff of Force H.Q., and at first there was, somewhat naturally at that early stage of the war, a certain amount of ignorance and doubt about why a survey unit had been sent there, and what were its functions.

Some of the early difficulties might possibly have been avoided or eased if the unit commander, in addition to his duties as such, had been nominated as a survey staff officer at Force H.Q.

SECTION 2. MALAYA (*see* Sketch Map No. 14)

Introduction

Until the Japanese occupation in February, 1942, Malaya consisted of the following:—

(*a*) The Straits Settlements—Singapore, Penang, Malacca, and Province Wellesley.
(*b*) The Federated Malay States—Perak, Selangor, Pahang and Negri Sembilan.
(*c*) The Unfederated Malay States—Johore, Kedah, Perlis, Kelantan and Trengganu.

Pre-war survey organization

PERSONNEL AND FUNCTIONS

The Federated Malay States and Straits Settlements Survey Department, under the Surveyor General, was responsible for all Title Surveys.

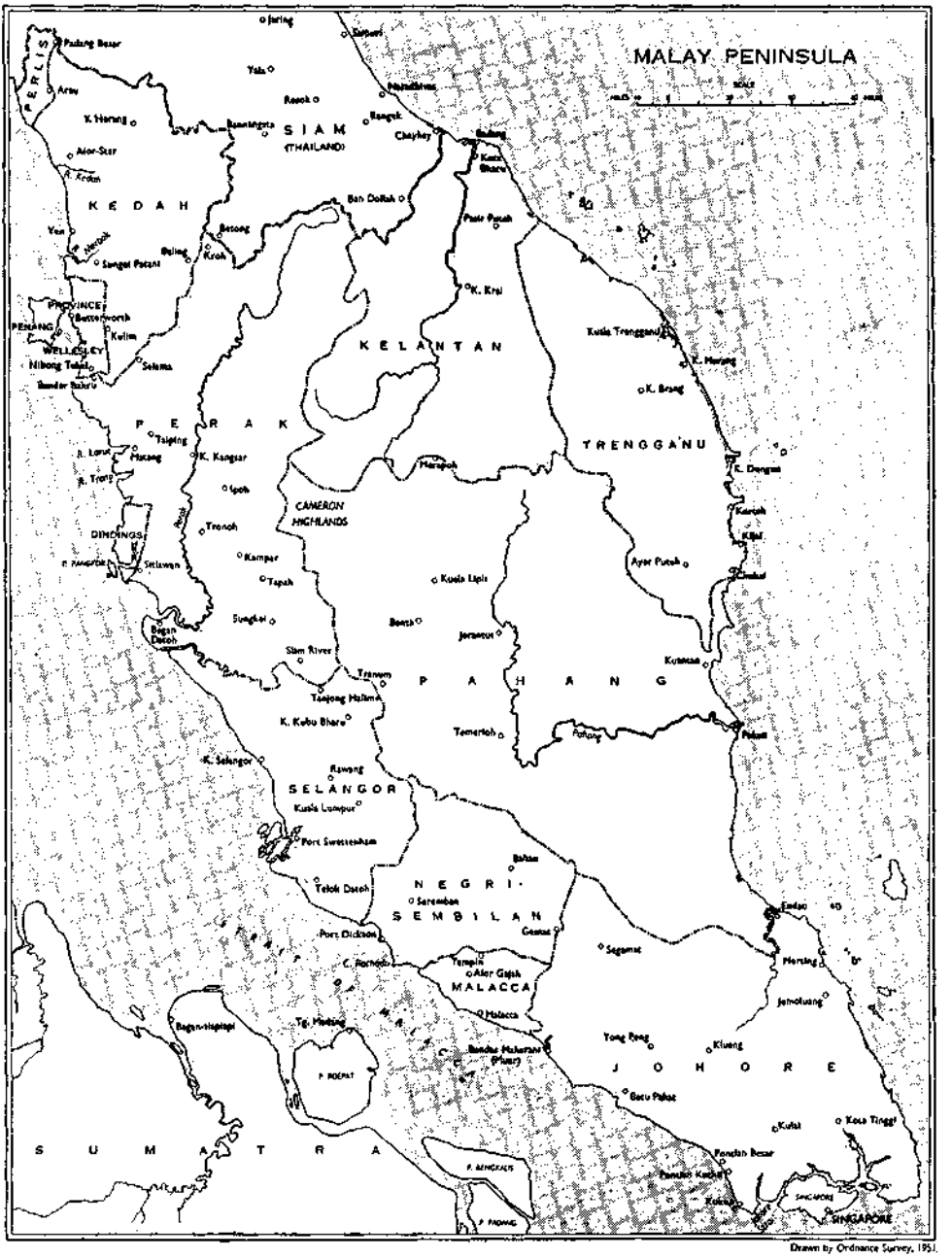
For each of the Unfederated Malay States an officer of the Survey Department was appointed by the Surveyor General as Chief Surveyor. As a result, all surveys in Malaya were, in effect, controlled by the Surveyor General who had his H.Q. at Kuala Lumpur.

The personnel of the department consisted of some 65 Europeans, about 800 locally recruited personnel, and nearly 2,000 temporary employees and coolies.

The principal functions of the department were:—

(*a*) The execution and maintenance of the trigonometrical framework.
(*b*) Cadastral and topographical surveys.
(*c*) Map production.
(*d*) Provision and custody of survey records for land administration.
(*e*) Meteorological service.
(*f*) Security printing (bonds, currency notes, stamps, etc.).

SKETCH MAP 14



TRIANGULATION AND TOPOGRAPHY

Most of the geodetic work had been completed before 1941, and the department was chiefly engaged in cadastral and revenue surveys and topographical mapping.

The completed geodetic work had left well-constructed beacons on all the prominent hill and mountain tops, and permanent marks along many roads and railways, thus providing an accurate and fairly dense framework control for local surveys.

About 60 per cent of the country had been topographically surveyed and covered with published maps.

PREPARATIONS FOR WAR

In 1939, when war in Europe seemed to be a foregone conclusion, the Surveyor General issued a memorandum outlining action that should be taken in the event of hostilities spreading to the Far East.

The Military Command in Malaya was notified with regard to the following:—

(*a*) The existing map position for military purposes.
(*b*) The potential production output of the map production branch.
(*c*) The situation regarding stocks of paper and other printing requisites.
(*d*) The steps planned to be taken, if necessary, to deny maps and reproduction material to an enemy.
(*e*) The Department's resources in the way of instrument repair and recovery.
(*f*) The proposals to form a military survey section from personnel of the Department.

SURVEY CONFERENCE AT NEW DELHI

In January, 1941, the Surveyor General attended a Survey Conference in New Delhi where plans were discussed for co-operation and the co-ordination of survey and mapping resources between India, Middle East and Malaya. The Surveyor General agreed to send mapping material to India for the production there of certain maps on various scales and of certain types not produced locally. He stated at the conference that, unless extensive military reinforcements arrived in Malaya, it could be regarded as entirely self-supporting in respect of Malayan maps.

Survey activities during the campaign (December, 1941–February, 1942)

The Japanese opened hostilities against the United States when they launched their air attack against Pearl Harbour on 7th December, 1941, and declared war against Britain. During succeeding days they attacked many British and American possessions in the Far East, and Dutch possessions in the East Indies. Japanese forces landed in north-eastern Malaya on 8th December, and started their drive to the south.

Allied operations in Malaya and the Dutch East Indies were co-ordinated by South West Pacific Command with Headquarters in Java, to which Colonel G. Bomford (from Survey of India) was appointed as D.D. Survey. The following gives a brief summary of the principal survey activities in connection with the short campaign which ended with the surrender of Singapore on 15th February, 1942.

(*a*) Various surveys were undertaken for the Army including the fixation of a large number of bearing pickets for artillery use. These pickets were numbered and tabulated so that bearings could be rapidly obtained.

(*b*) Practically all the senior officers of the Survey Department were members of the local volunteer force, local defence corps, or other auxiliary service.

(*c*) Four senior survey officers were sent to India to study air survey mapping methods, and an air survey expert was recruited who undertook the training of selected locally engaged survey officers.

(*d*) Towards the end of December a Malayan Field Survey Company was formed. This was recruited from personnel of the Survey Department and was intended to serve as a unit of the F.M.S. Volunteer Force.

The establishment of the unit was as under:—

H.Q. section,
General section,
2 ground survey sections,
Air survey section,
Reproduction section,

numbering 10 officers and about 400 other ranks.

Embodiment and training began in December, but the rapid development of the campaign at that time prevented it from being used in its intended capacity. However, with an officer establishment specially increased to 20 and some 200 O.R.s, it served efficiently with the British force in Malaya during the fighting retirement through the mainland. On reaching Singapore, a detachment worked on co-ordinating anti-aircraft battery positions, and manned observation posts for flash spotting and counter-battery work.

Map production was carried on in Kuala Lumpur until the tide of war necessitated a withdrawal to Singapore. At Singapore, maps were rolled off the presses until a few days before the surrender, when production was stopped so that the plans for denying maps and machinery to the enemy could be carried out.

The Survey Company was then disbanded, and a large number of the native O.R.s found their way back to their homes on the mainland and managed to evade the prisoner-of-war camps. Almost all the officers were taken prisoner.

In January, 1942, an attempt was made to set up a map production branch in Java, and certain senior officers were sent there for that purpose. Some seven tons of survey records were crated, loaded and despatched to Java. But the end came too quickly, and fortunately the survey stores and records were never uncrated. They were sent to Australia for safety, and were handed over to the Australian forces. At the end of the war in 1945, they were returned to Malaya, and their preservation was of inestimable value towards the post-war reconstruction of the Survey Department.

SECTION 3. GREECE (*see* Sketch Map No. 15)

Summary of survey activities during the campaign

The Italians attacked Greece in the autumn of 1940, and during the winter months of 1940-41 the Greek Army put up a gallant fight. Then, in the first

week of April, 1941, just at a time when the German counter-offensive was launched in the Western Desert, German forces invaded Yugoslavia and moved through into Greece. A small British Expeditionary Force had, at that difficult moment, to be sent across from Egypt to assist the Greeks.

The mapping preparations which were undertaken for the campaign, and the arrangements for map distribution, are described in later paragraphs. Colonel M. Hotine, who had been D.D. Survey with the force in East Africa, was assigned to the Greek Expeditionary Force for survey duties and the following survey units were included in the order of battle:—

Survey Directorate.
Mobile Echelon, 512 (Army) Field Survey Company R.E. (less two sections).
517 (Corps) Field Survey Company R.E.
9 Field Survey Depot R.E.
1 Australian (Corps) Field Survey Company.

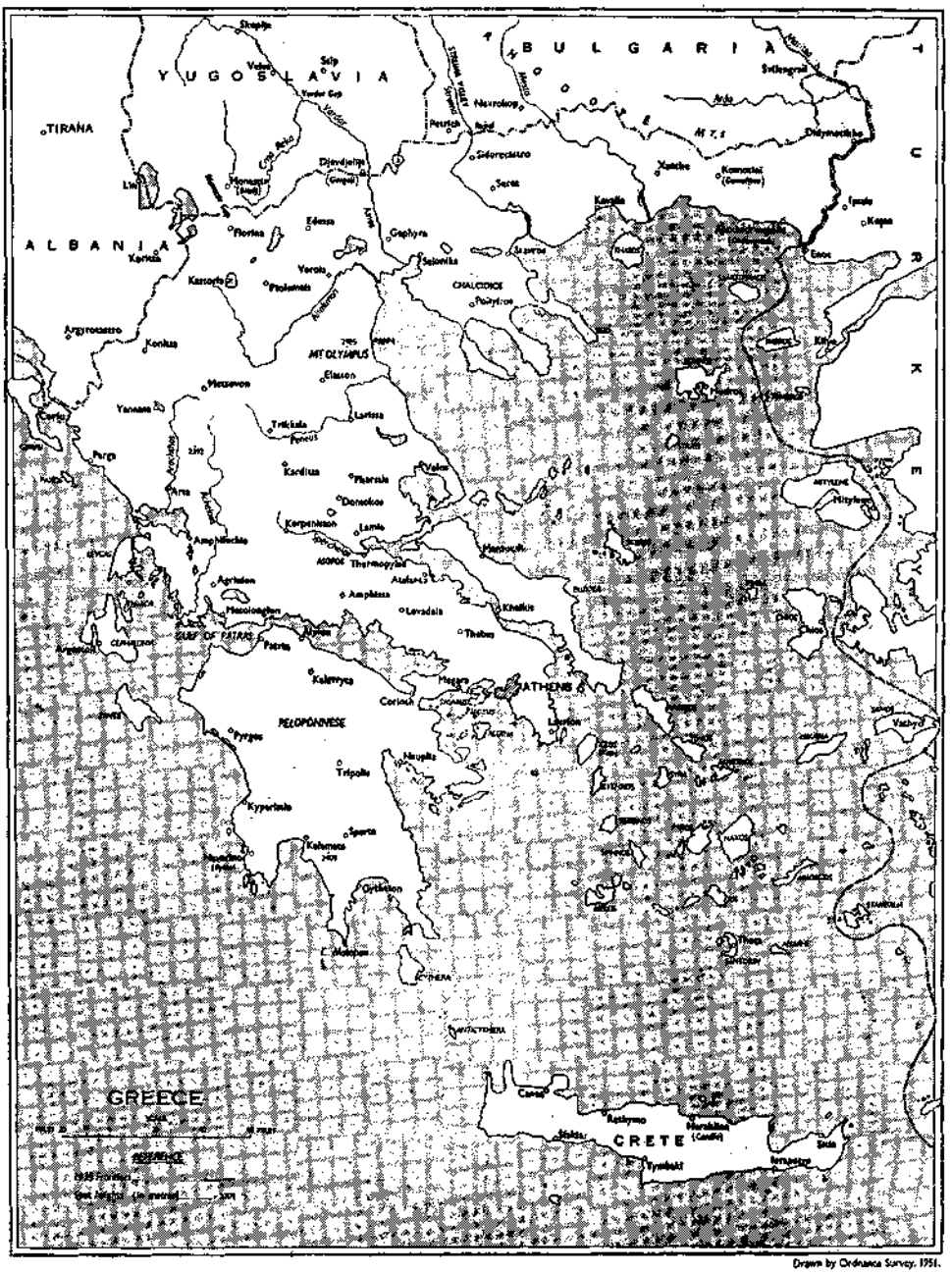
1 Australian Field Survey Company, though it never actually reached Greece, was intended to function as Australian corps troops, but it was agreed in principle that it should remain in the base area under Force control. The reasons for this decision were the inadvisability of sending heavy trailer-borne printing equipment forward on bad roads in a campaign which was most likely to prove very mobile, the necessity for spreading survey resources over the needs of the whole Force, and the fact that local map production would require material at very short notice from the Greek Survey Department in Athens. Actually this unit, which arrived in Egypt too late and without full equipment, did not sail to Greece which, as events turned out, was just as well.

Preceded by a small advanced party, the main body of the Mobile Echelon of 512 Field Survey Company landed in the Piraeus at the end of March. The topographical sections were employed on anti-aircraft gun-position surveys near Athens and the Piraeus, Greek officers assisting in the identification of trig points. Miscellaneous drawing and computing tasks were undertaken, and some of the personnel was used as reinforcement to the map depots. Air photographs of the Struma Valley were sorted out and indexed, and existing maps were revised. Photographic mosaics of selected areas were made up. If the personnel of these topographical sections had been given fuller training as draughtsmen and air-photo plotters, more could have been achieved during the campaign. Continued experience during the war in other theatres indicated that trig surveys, though often essential, do not as a rule provide full-time employment, and a wider basis of training for topographical section personnel on less specialist lines was found to be necessary.

512 Field Survey Company packed up for evacuation on 23rd April, but the German advance was so rapid that many of the personnel were taken prisoner.

517 Field Survey Company R.E. had arrived in Egypt without its printing equipment, but provisional arrangements were made for the use of local plant in Athens. The unit (less conductors for the technical lorries) sailed in one of the later convoys to Greece. Unfortunately, the technical stores of the printing and drawing sections were loaded in another ship and were lost at sea by enemy action. Leaving its topographical sections to continue work in Greece, the unit was sent back to Egypt a few days before general evacuation was ordered. Many of the topographical section personnel were taken prisoner.

SKETCH MAP 15



Mapping preparations by the War Office

For possible operations in Greece the following maps had been included by the War Office in their mapping programme:—

(*a*) International 1/1,000,000.
(*b*) GSGS 4088 (1/250,000). 23 sheets covering the Balkans between approximately the latitudes of Volos and Sofia.
(*c*) GSGS 4087 (1/100,000). 31 sheets between the latitudes of Volos and the northern frontier of Greece.
(*d*) 1/500,000 air maps covering the Balkans.

Preparation of the 1/250,000 and 1/100,000 maps was started in December, 1939, and it was proposed to forward initial stocks of 3,000 copies of each sheet to the Middle East, together with black pulls for local reproduction. Some of the sheets and reproduction material had not arrived when the operations in Greece began.

Local mapping investigations in the Middle East

When the Italian offensive started in the autumn of 1940, it seemed possible that Greece, and perhaps the Balkans as a whole, might become a major theatre of operations with German forces coming down from the north.

A British Military Mission was sent to Greece to study conditions and collect information. It was unfortunate that no survey officer accompanied this mission. G.H.Q. Middle East did, however, send over a survey officer on short hurried visits to enquire into the latest Greek mapping situation. He obtained some valuable data from the Greek General Staff and Service Géographique, but a good deal of essential information was necessarily missed in the course of these short visits for which the officer could with difficulty be spared from the overworked Survey Directorate in Cairo. It seems a pity that a qualified survey officer could not have been sent out from the United Kingdom to accompany the Mission to Greece. He could have thoroughly examined the mapping situation, and eventually have been appointed to the Survey Directorate which operated there during the campaign. Wisdom after the event is easy, but the lesson should not be overlooked on future similar occasions.

The visiting officer from Cairo obtained reproduction material for four sheets of the 1/400,000 Greek staff map covering Albania, East and West Macedonia, and western Thrace. Material for local reproduction of the Greek 1/100,000 series was also acquired. It should be noted here that the GSGS 4087 edition of the 1/100,000 series was made up on sheet lines which were different from those used by the Greeks themselves. This aspect will be enlarged upon later.

The Greek maps were, of course, printed with the names in Greek characters. As, however, British forces might have to use these maps, arrangements were made to have the names transliterated. This work started in November, 1940, under a specially appointed gazetteer officer who had experience of similar work in Greece. He completed the four 1/400,000 sheets before being transferred to other duty. The work was then carried on by local Greek personnel.

In January, 1941, a signal from the War Office stated that revised name-traces had been completed and were being flown out. G.H.Q. Middle East

was asked to adopt these transliterations so as to avoid differences in names on published maps. The maps for which revised name-traces were being sent out from the War Office included three sheets of the 1/400,000 series and the 1/250,000 series. The name-traces arrived in Cairo at the end of January, 1941, by which time many copies of the current printed stock had already been issued. It was obvious that many corrections were necessary but the late arrival of the black pulls delayed the start of the revision programme.

In the meantime, at a conference between the General Staff at G.H.Q. and the Director of Survey, it was decided that the map policy for any operations which might take place in Greece would be as follows:—

(*a*) To use reproductions of the Greek maps as the main supply. These were to include the 1/400,000, 1/100,000 and 1/50,000 (where the latter were available).

(*b*) Names would be transliterated into English. The War Office version would be used when time permitted, but the Survey Directorate version would be adopted to save time in emergency.

(*c*) Until the local reproductions from the Greek maps were ready, the War Office 1/100,000 and 1/250,000 series would be used. These would be superseded by the Middle East edition when published.

The action taken in Cairo to reproduce the Greek maps consequent on the above decisions will be described later.

Comments on the G.S.G.S. maps of Greece

The following comments may afford some lessons for future guidance.

Comparison between the G.S.G.S. map series and the mapping material obtained from Greece itself showed much discrepancy in detail, and the situation was disturbing even before the operations started.

As in the case of Belgium and Holland, who before the German invasion in 1940 preferred the myth of neutrality to co-operative action, it seems that the War Office found that Greece also was unwilling, before the war, to supply up-to-date mapping material. The G.S.G.S. maps, which were begun late in 1939, had therefore to be compiled from whatever Greek maps were available in the War Office map library and these were in many cases sadly out of date.

As a result the maps were inaccurate with regard to communications. Not only were several important roads omitted, but certain roads were included as apparently important ones which never existed at all. In any country, especially the Balkans, where good roads are not numerous, it is obvious that accurate road information is of particular importance. The G.S.G.S. sheets had apparently not been subjected to any road revision based on recent intelligence information.

The first troops to move forward to the concentration area in Greece were an armoured brigade, which commented unfavourably on the 1/100,000 maps, and asked that they should be supplied with copies of the national Greek series. There is often a tendency for British troops operating in a foreign country to jump to the conclusion that the local maps must necessarily be better than those specially prepared for them. Generally speaking this criticism is quite unjustified. In this particular case, however, the complaint, which soon became universal, was a fair one. In fact the G.S.G.S. 1/250,000 and 1/100,000 maps of the same area often disagreed between themselves.

It is probable that many of the defects were caused by using provisional one-colour editions as basic material, when clearer material in colour was available in Greece. The peace-time system of relying solely on the open map market, or the part-time service of a non-technical Military Attaché, to obtain cartographic material of a foreign country was also probably to blame. This is a lesson which will, no doubt, be taken note of when considering post-war policy for collecting map material.

With regard to the sheet-line system for a map series, there have always been two schools of thought on the subject. One opinion favours an alteration of the sheet lines bounding the national map sheets so as to conform to the grid system adopted for the British military maps. By this means the shape of the sheet is recast so as to become truly rectangular and bounded by exact grid lines. This conversion from graticule to grid sheet lines undoubtedly has certain conveniences, and amongst these is the fact that large sheets can be made up which economize in paper and printing time. The opposite school of thought favours the retention of the original national sheet lines as they stand. This means that, in some cases, uneconomically small sheets have to be used, and the grid, when incorporated or overprinted on the face of the map, will often lie askew to the sheet edges.

Considerable experience during the war has shown that, generally speaking, it is better to retain the national sheet lines. The overriding advantage is that, if and when a more recent edition of a national sheet is obtained, it can be rapidly reproduced and used in conjunction with the other sheets of the G.S.G.S. series by simply suppressing the out-of-date sheet concerned.

The decision to discard the national Greek sheet lines made it very difficult to improve the series by the rapid substitution of newer and better sheets when they became available. The arguments in favour of altering sheet lines, namely the convenience of grid as opposed to graticule edges, and the saving of paper and machine-time by making up larger sheets, do not work out in practice. There is no convenience in being forced to use out-of-date maps for military operations, nor is there any economy in drawing, printing and shipping an entire series of maps which may have to be almost immediately superseded. In Greece, the effects of this error of judgment went even deeper than mere waste. Until a sufficient extent of the area of operations had been completely covered by the newly reproduced Greek sheets, it was necessary to keep both series in issue concurrently which, as may be imagined, involved much confusion.

The order in which the sheets were received in the Middle East did not, unfortunately, conform to the changing military situation. Maps of western Thrace were available early, although operations in that area by British troops were not contemplated, and those of the Struma, Vardar and Aliakmon valleys were either not in time, or only just so. For southern Greece no G.S.G.S. maps were produced at all.

Production of Greek maps in the Middle East

When active preparations for the campaign in Greece were initiated, the discrepancies between the G.S.G.S. maps and those obtained from Greece were not at first fully appreciated. This was owing to the fact that some of the most important sheets of the 1/100,000 series had not been received from the United Kingdom.

A comparison between available G.S.G.S. sheets and the latest obtained Greek material was not reassuring. For this reason, as well as to ensure that

maps of some sort should be available to cover the areas of those War Office sheets which had not yet arrived, local production started on a new 1/100,000 series, on Greek national sheet lines, by direct reproduction from black pulls obtained from the Greek Survey Department. These new sheets carried transliterated names and the British grid.

It was decided to extend this new series rapidly so as to replace the G.S.G.S. maps in all likely operational areas. Although this was not done in time for the concentration period, it was, for the most part, completed in time for active operations.

Action was also taken by the Survey Directorate to cover southern Greece with three new 1/250,000 sheets, priority being given to a large sheet extending the G.S.G.S. 1/250,000 series south-eastwards to include Athens. Until this sheet could be made available, stocks of tourist and motor maps were purchased locally in Athens for the forward moves of units to the concentration area. There was no time to grid these, which were intended solely for unopposed movement.

Road sketch maps on a scale of 1/750,000 (with certain forward areas on 1/100,000) had been prepared in Athens immediately before the despatch of the Expeditionary Force to Greece, and they were reproduced in Cairo. They were naturally assumed to be correct and were widely issued. When complaints about these maps from the armoured brigade had been investigated, it was found that they had not been based on actual reconnaissance, either by the Military Attaché or by the Military Mission. Road information had been obtained from the Greek Survey Department who, apart from hearsay, did not claim to possess any positive information later than the last topographical revision. Immediate action was then taken by the Survey Directorate in Athens to obtain all available stocks of the Greek Ministry of Communications road maps on 1/500,000 scale, and to issue these maps, in necessarily limited quantities, to all headquarters pending reprint with the British grid. This map was compiled from annual reports of road engineers and could have been brought up to date by calling for special reports. By then, however, it was too late to take such action.

On future similar occasions it would seem advisable that a competent survey officer should be included in any Military Mission which may be sent to effect liaison with an allied government. Not only would he be well placed to obtain the most up-to-date road information possibly checked by personal reconnaissance; he would also, by close continuous touch with the local Survey Department, be able to secure information and material vital to the formulation of a proper mapping programme and survey plan. It has been proved from much war experience that these matters are outside the sphere of the normal Intelligence organization, and the importance of obtaining the most reliable technical survey information both for planning and for the subsequent conduct of operations can hardly be over-emphasized.

Air photography and large scale mapping

A few odd strips of vertical photographs had been taken for general reconnaissance purposes before the arrival of the Survey Directorate in Greece. Copies of these were sent to Cairo to assist map revision, and strip-maps were plotted from them in Cairo.

Arrangements were made for 113 Squadron R.A.F. to photograph probable target and counter-battery areas in accordance with the original plan to occupy a defensive position behind the Aliakmon River between Veroia and the sea.

1/25,000 maps were plotted from these photographs in Cairo, and were distributed just in time. They were not, however, much used because, owing to the main axis of the German offensive being directed through the Monastir Gap, no serious attempt was made to defend this position. Arrangements had also been made for photography in the Ptolemais area and for certain sections of the Olympus–Aliakmon position, which was seriously defended. But although some of the photographs were taken before the outbreak of active hostilities they were not available in time.

The sudden change in the Yugoslav political situation resulted in preparations being ordered for a defensive position west of the R. Struma covering Salonika, and photography of this area was about half-completed. 1/25,000 plotting from these photographs in Cairo was, as it turned out, rightly given priority below the Aliakmon area and was not taken up. The photographs were, however, used for the revision of 1/100,000 and 1/50,000 maps. Photographs astride the Axios River, which had been extensively canalized, were also used for map revision.

The above photography was carried out by a bomber squadron. The pilots had not been specially trained for the special type of strip navigation that is required for survey photography, and there was, in consequence, the usual waste of effort on this account. The ground organization of the squadron also was inadequate to deal with large areas of photography. If a suitable and properly equipped unit had been available for survey photography at the proper time, that is, well before the emergency arose, all likely areas could have been efficiently photographed long before the despatch of the Expeditionary Force. As it was, photography had to be improvised too late, and no amount of keen and willing co-operation, which was most certainly afforded in full measure by the squadron, could make up for this. This lesson was a recurrent one in all operational theatres.

In Greece there were no resources for local mapping from air photographs. In any case it would not have been right to have included heavily equipped survey units in the early convoys.

Provision of 1/50,000 maps

As an insurance against lack of photography for 1/25,000 mapping and possible non-arrival of new 1/100,000 sheets, it was decided to attempt the provision of a 1/50,000 series. The original Greek surveys were carried out on a scale of 1/50,000, with some areas at 1/20,000. Some of the 1/50,000 sheets, mainly in the frontier areas had already been drawn in various styles and issued in limited quantities to the Greek Army. These were reprinted, where required, by the Greek Service Géographique, with an overprint of the British grid, captions, and a few transliterated names, the overprint drawing being done by the few draughtsmen available to the Survey Directorate. Where the sheets were in one colour only, considerable clarification was obtained by red overprints on a steel-grey base. Where no 1/50,000 sheets had been drawn, the original plane-table sheets were assembled and photographed. In all cases, revision from any available photographs was added either on the base map or on the overprint.

About 50 sheets on 1/50,000 scale were produced in five weeks, and, for the most part, were used in active operations. They were an instant success. Much praise and credit was due to the spirit of co-operation and technical skill

displayed in the publication of this makeshift series by the Greek Service Géographique, in spite of its poor equipment.

Air maps

The Air Ministry 1/500,000 series of the Balkans had been prepared primarily for navigational purposes. Topographical detail had been simplified and generalized almost to diagrammatic form. In war, however, there is more than ease of navigation to be considered. Pre-war ideas regarding the employment of air forces, particularly in connection with army co-operation, were, by 1941, undergoing radical changes. It was necessary, at little notice, to identify small villages or minor cross-roads, whether as targets for air attack, or as keys for reconnaissance. In France and Belgium, during the B.E.F. operations of 1939–40, the air component had largely discarded the use of the 1/250,000 Air Series of north-western Europe in favour of ordinary detailed topographical maps. Largely for this reason the 1/500,000 Air Ministry maps were not used in Greece. Another reason was that they carried inaccurate air information, and showed Greek and Turkish airfields, which was prejudicial to security.

The 1/400,000 Greek air map had been reproduced in Cairo and supplied to the Air Force during the Albanian campaign, since this was the only up-to-date map of Greece on small scale that was then available. For operations against the Germans, however, ordinary military maps on scales ranging from 1/1,000,000 to 1/50,000 were mostly used by the R.A.F.

Map distribution

For security reasons, no initial distribution of maps of any sort whatever was allowed before the embarkation of units from Egypt during the first week of April, 1941. Consequently, it was necessary to arrange for initial issues to be made immediately the units disembarked in Greece, and before the headquarters of subordinate formations were installed. The initial plan covered disembarkation at the Piraeus, Volos and Salonika; but this was altered, and the force landed principally at the Piraeus, making map issue somewhat easier. If early disembarkation had taken place at Volos and Salonika as well as at the Piraeus, map distribution would have offered a very difficult problem, and it might have been necessary to press for initial pre-embarkation issues in sealed bundles at Alexandria, as was done for later operations involving a sea journey. Later, however, owing to heavy air attacks on the Piraeus, certain units did have to be diverted to Volos and Khalkis, and the necessary arrangements to issue them with their maps on landing were made by the Survey Directorate and No. 9 Field Survey Depot. Neither organization was then up to strength, and the dispersion of effort was a heavy strain on their resources at a time when, owing to air attacks on the ports, map consignments had to be cleared quickly, and duplicate map depots established to minimize the risk of total loss of stocks.

Owing to scanty supply, the initial issue was at the rate of about 15 per cent of the then current War Office scale of map issues. This allowed about one copy of each map sheet to each officer. When units had moved forward, issues of fresh sheets were made through headquarters of formations in the normal way. An advanced map depot was set up in the Australian Corps area and was controlled from Corps H.Q. where there was survey representation. This

facilitated a decentralization of distribution to the forward troops, and worked satisfactorily during the period of initial contact, the retirement to the Olympus–Aliakmon position, and the ensuing battle. With the prospect of a further withdrawal to the Thermopylae position a fresh problem arose. Units were not in possession of tactical maps of southern Greece, as these were only just coming into production. Roads were congested and, even if bulk supplies could have been got through to the advanced map depot, it seemed unwise to rely on this procedure with the situation changing so rapidly. The moral effect of issuing tactical maps of back areas in the middle of a battle also had to be considered. It was felt that the proper time and method for issue should be decided, probably at very short notice, by the General Staff at Advanced Force H.Q.

A mobile map depot was therefore improvised from personnel and transport of 517 (Corps) Field Survey Company R.E. and placed under the direct control of the General Staff at Advanced Force H.Q. This mobile depot was provided with bundled maps of the rear positions ready for rapid emergency issue. While the operations were in progress, new and better maps were being produced to replace the orginal issues, and stocks of these new editions were arriving at the base depot. Contact was maintained with Advanced Force H.Q. so that it should receive consignments of these new maps, but provision was also made for a floating detachment of 517 Company to proceed forward to a focal point on the lines of retreat, so that direct issues could be made to the units as they passed through. To provide for further emergencies, 517 Company was authorized to despatch forward, if considered necessary, further personnel and transport of the unit with fresh consignments of maps as they arrived. Under the circumstances this worked as well as might be expected, but it involved throwing in most of the surveyors and their transport available in the country. This temporary misuse of technical survey personnel and its transport was fully justified here, as elsewhere, on an occasion when map issues to the fighting troops were of such vital importance.

No. 9 Field Survey Depot, which accompanied the Survey Directorate to Greece to handle bulk map stocks and storage, was partly overrun during the later stages of the German advance into southern Greece, and lost many of its personnel as prisoners-of-war.

Triangulation (*see also* Chapter 5, Section 4)

Values for the Greek triangulation stations in northern Greece had been made available to G.H.Q. Middle East some months earlier. Those for southern Greece were obtained early in the campaign. These were based on independent azimuthal projections for each 1/100,000 sheet. Lists of co-ordinates on the British Mediterranean Grid had been compiled in Cairo under G.H.Q. arrangements and were available in time for operations.

The density of the trig control supplied to R.A. headquarters was such that it was unlikely that any assistance from R.E. survey units would be required. 4 Survey Regiment R.A. had trained their flash spotters and sound rangers to undertake minor triangulation observations, with the result that 60 pairs of good observers were available in that unit alone during the initial occupation of defensive positions.

SECTION 4. SICILY (OPERATION "HUSKY")

JULY–AUGUST, 1943

Strategical background

Soon after the launching of operation "Torch" by allied forces in North West Africa, and taking into consideration the rapid advance of Eighth Army through Libya towards Tunisia, it was necessary to come to a decision regarding subsequent strategical policy when enemy forces had been driven out of Africa.

At the Casablanca Conference in January, 1943, the following basic major issues were considered:—

(*a*) It was agreed that the defeat of the enemy in Europe should hold first priority, and that all possible allied resources should be devoted to this object before concentrating on the defeat of Japan.
(*b*) It was essential to open up the Mediterranean for allied convoys, and to make secure the lines of communication to the Middle and Far East.
(*c*) Italy should be defeated as soon as possible, thereby reducing the threat of hostile naval and air action in the Mediterranean.
(*d*) It was necessary to cause a diversion of German troops from the Russian front so as to reduce pressure against the Russian armies.

As a first step to attain the above objects it was decided that Sicily should be captured, and that planning for such an operation should be started without delay.

On the assumption that Tunisia would be freed by the end of April, 1943, a provisional target date for the Sicily operation was set. This was to be in July on a date when moon conditions would be favourable.

Operational considerations

The Sicilian operation was under the command and control of General Eisenhower at A.F.H.Q. in Algiers. Brigadier R. Ll. Brown, the Director of Survey at A.F.H.Q., controlled the mapping and survey arrangements for the operation and had at his disposal the technical survey resources of the Middle East under its Director of Survey, Brigadier R. E. Fryer.

In February, 1943, an allied planning headquarters was set up at A.F.H.Q. known as Force 141. This was the embryo of what eventually became H.Q. 15 Army Group, and to start with was a sub-section of G–3 (Operations) at A.F.H.Q. It became an operational staff headquarters on 15th May, independent of, but subordinate to, A.F.H.Q., and a Survey Liaison Section was attached to look after its mapping interests.

Meanwhile a British planning staff was set up in Cairo and was known as Force 545. Unfortunately it was not found possible to attach its own Survey Directorate to Force 545 in the early stages. D.D. Survey Eighth Army was not able to join the planning staff until 29th April, as Eighth Army was engaged in operations in Tunisia. He was joined later by his A.D. Survey. Until then, survey planning for "Husky" was organized and controlled by the Survey Directorate, G.H.Q. Middle East.

There were to be two Task Forces. The eastern force (545) was to be the British Eighth Army, and the western force the U.S. Seventh Army (Force 343). The original plan was that Force 545 should assault in the south-east of the island, and that this would be followed a few days later by an assault by

Force 343 in the south-west to secure the port of Palermo. Shortage of landing craft was, however, a vital factor, and eventually the plan was altered so as to concentrate the whole force for an assault landing in the south-east of the island. This plan embodied a series of simultaneous seaborne assaults which would be assisted by airborne landings to seize the ports of Syracuse and Licata, and airfields near the south-east coast. These latter would establish a firm base for subsequent operations against Augusta, Catania and Gerbini airfields. The landings were to cover about 100 miles of coastline extending from Cap Murro di Porco (south of Syracuse) westwards to Licata. The airborne operations were to include parachute and glider landings by a brigade of 1 (British) Airborne Division just south of Syracuse, and a parachute drop by 82 (U.S.) Airborne Division in the area behind Gela.

The projected operation involved complicated organization and co-operation between various widely separated theatres, as it was necessary to employ formations which would come from the Middle East, from North West Africa, and also from the United Kingdom. This wide dispersal of mounting added greatly to the difficulties of mapping up the force, as may be realized from the mounting plan given below:—

Eastern Force (British)

Assault—5 and 50 Divisions and 231 Brigade to be mounted in the Middle East, the mounting ports including Port Said, Alexandria, Haifa, Beirut, and Benghazi.

1 Canadian Division to be mounted from the United Kingdom.

51 Division to be mounted from Tunisia, partly staging in Malta.

1 Airborne Division to be mounted from Tunisia.

Follow-up—78 Division and Canadian Army Tank Brigade to be mounted in the Sousse-Sfax area in Tunisia.

Western Force (U.S.)

1, 3 and 9 Divisions to be mounted from North West Africa.

2 Armoured Division and 82 Airborne Division to be mounted from North West Africa.

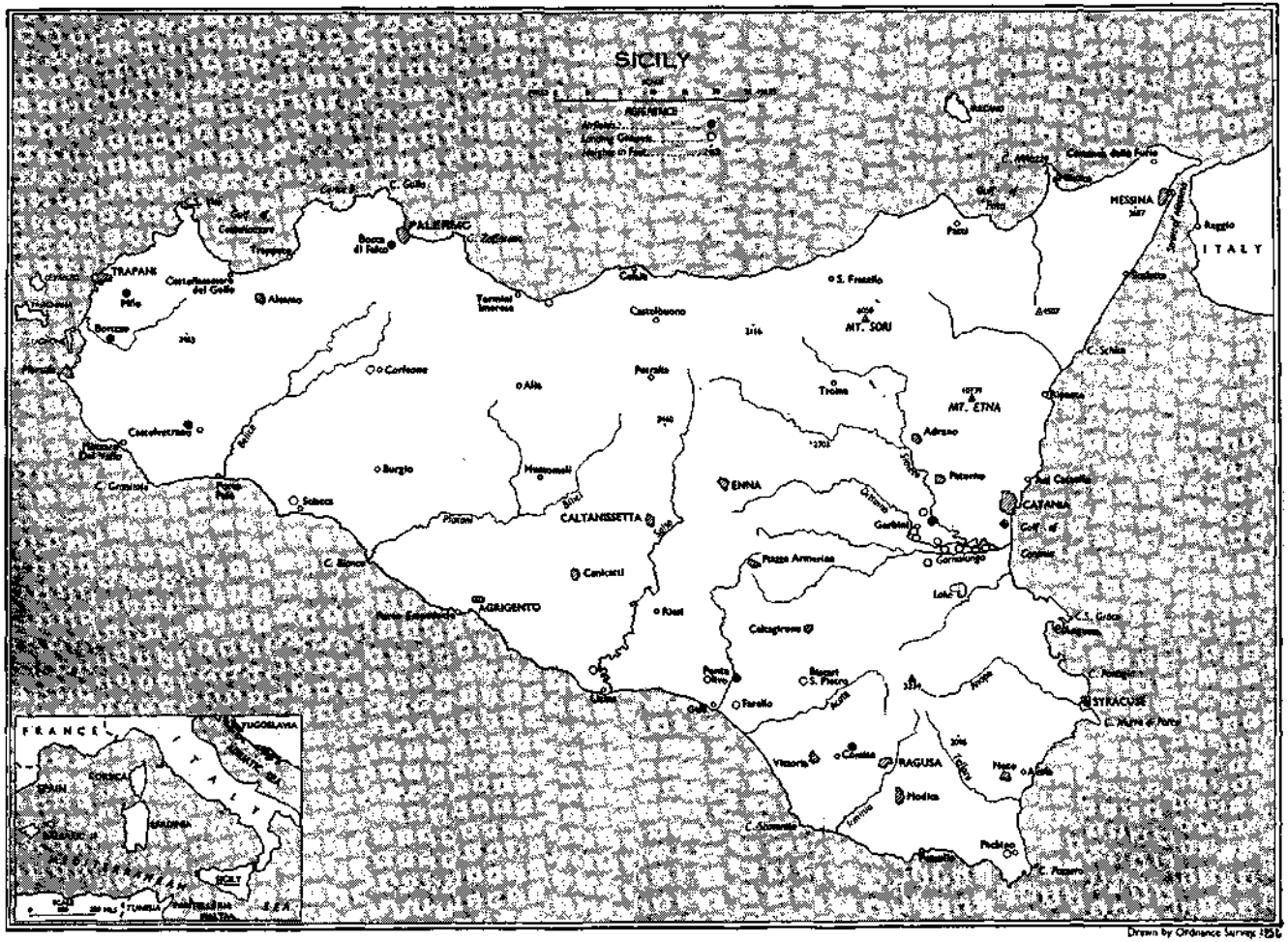
45 Division to be mounted from U.S.A. but staging in North West Africa.

The reduction of the island of Pantellaria, which contained important enemy air bases, formed an essential preliminary to the main operation.

The course of operations

The seaborne assault was successfully carried out early in the morning of 10th July, and beach-heads and airfield were established. The planned objective for Eighth Army was Messina, the U.S. Seventh Army protecting its left flank by a limited advance only. Within ten days, however, the roles of the two armies were reversed. Eighth Army was held up at the east end of the island on the Catania plain, while Seventh Army pushed rapidly to the north and north-west, cut the island in two and, by 22nd July, had captured Palermo.

Early in August, Eighth Army were on the move again and captured Catania and Troina. Seventh Army meanwhile was pushing east from Palermo along the northern coast road and carried out a series of amphibious landings towards


SICILY
REFERENCE
PALERMO
TRAPANI
MARSALA
MESSINA
ITALY
CATANIA
ENNA
CALTANISSETTA
AGRIGENTO
SYRACUSE
RAGUSA
MT. ETNA
MT. SORU
Drawn by Ordnance Survey 1956

Messina. Finally, on 17th August, American and British forces entered Messina, and within 38 days of the initial landing, the whole of Sicily had been secured.

Survey organization

Full details of the Survey organization at G.H.Q. Middle East (Brigadier R. E. Fryer), where so much of the planning and other preparations were carried out, are given in Chapter V.

The Survey organization, apart from that in Cairo, was as follows:—

A.F.H.Q.	Survey Directorate (Brigadier R. Ll. Brown). 649 Engineer Topographical Battalion (U.S.). 516 and 518 Field Survey Companies R.E. 11 and 12 Map Reproduction Sections R.E. 7, 10 and 12 Field Survey Depots R.E. Detachment 46 Survey Company (South African Engineer Corps). Atlantic, Mediterranean and Eastern Base Sections (U.S.).
H.Q. 15 Army Group	Survey Directorate (Colonel R. P. Wheeler).
Eighth Army (British)	Survey Directorate (Colonel V. E. H. Sanceau). 13 and 517 Field Survey Companies R.E. 20 (Army) Field Survey Depot R.E.
Seventh Army (U.S.)	Engineer Section. 62, 66 and 661 Engineer Topographical Companies. Engineer Map Depot Detachments.

In the case of Eighth Army, each staff branch of Army H.Q. was split before the landing. Colonel Sanceau and Lieut.-Colonel Hudson (A.D. Survey) were with the planning staff in Cairo till the end of June. On 24th June, the D.A.D. Survey went to Malta as survey representative with Army H.Q., followed later by Colonel Sanceau, Lieut.-Colonel Hudson and a small H.Q. detachment. Three days after the assault Colonel Sanceau accompanied advanced Army H.Q. to Sicily, the remainder of the Malta detachment arriving two days later. Main H.Q. of the survey branch went over from Tripoli by instalments.

With H.Q. Seventh U.S. Army there was no separate survey staff organization. In accordance with American practice, the Engineer Section at Army H.Q. was responsible for all mapping and survey activities.

Map production and supply

(*a*) *War Office.* Though the invasion of Sicily was mounted mainly from North West Africa and the Middle East, 1 Canadian Division, plus certain British elements, sailed direct from the United Kingdom, and their map supply was handled by the Directorate of Military Survey, War Office. The procedure followed the same pattern as that for the invasion of North West Africa ("Torch"), and the experience gained in that operation resulted in very smooth working. Unfortunately, however, some of their map stocks were lost by enemy action on the way out, and had to be made good.

(*b*) *Middle East.* With certain small exceptions, all maps for units of

Eighth Army which were mounted in the Middle East were printed in Cairo, and details are given in Chapter V, Section 2. Printing of stocks started on 10th April, about three months before "D"-day, but the bulk of the printing was done during June. Distribution offered many problems. Not only had sheets of the normal series to be put on the right ships for distribution after sailing, but special arrangements had to be made to deliver late editions of defence overprints to ships at sea.

All maps were in sealed and coded bundles, and distribution for Eighth Army was made to units and formations in almost every port from Suez to Algiers and also to units in Malta. There were many anxious moments, but all went well, the only troops who were at any time really short of maps being those of 1 Canadian Division, who sailed from the United Kingdom direct, who lost a great part of their map stocks by enemy action on the way out. This loss was quickly replenished.

The total number of maps printed in the Middle East for the operation was approximately 4,000,000, of which issues to troops before "D"-day numbered about 400,000.

Maps were made up in rolls of 50 and, for security, the rolls were completely wrapped in old linen-backed maps and securely gummed at the ends and in the centre. The top map of each roll of 50 was put face downwards so that, in the event of the linen-backed covering coming off the end of the roll, it would not be easy to detect what the map was.

The rolls were then taken in sacks to a coding hut at G.H.Q., the sacks being labelled so that the coding officer could identify the contents. This officer then allotted code letters for each sheet, and these were clearly marked on the rolls by personnel who had not previously handled the maps. The rolls were again placed in sacks and taken to a special issuing department some ten miles from G.H.Q. and four miles from the base map depot. For this journey, both transport and escorts were found from non-survey sources. At the issuing depot, the rolls were taken out of the sacks and stacked by sheets according to the code-list to facilitate the rapid and accurate making up of the consignments. The personnel of the issuing depot and coding hut were kept apart, and were not changed during the course of the work.

The details of distribution to ships were compiled by the survey planning staff in conjunction with the formations concerned, and lists of requirements were passed to G.H.Q. Middle East for executive action by the Survey Directorate. These lists gave details of the maps required for each ship and the ship's official code number, the latter being marked on the sacks to assist the distributing officer at the port.

No attempt was made to prepare consignments for individual units owing to constant changes in the allocation of troops to ships because of enemy action, breakdowns and delays in ports.

A total bulk consignment was prepared for each ship, to be distributed subsequently by the O.C. troops on that ship. Distribution was based on the table of "Scales of Issue," the figure for each ship of any one sheet being rounded off to the nearest "50." Except in the case of defence overprints, in which there was some variation, all ships carried the same maps in varying quantities, irrespective of their place of landing.

G.H.Q. Survey Directorate coded the lists of map requirements and gave them to a "security depot," who made up each ship's consignment from the coded rolls, which were put into good-quality double sacks, one inside the other

and sewn up at the mouths. No binding or banding was used and no wood crates were available.

The safe movement of maps from the security depot to personnel ships was effected under the control of survey officers using their own transport. Fortunately the South African Survey Company had just arrived in Cairo from the Tunis battle, and was able to assist greatly with both officers and transport. The conducting officers were, as usual, given precise instructions that they must obtain receipts for their consignments from the O.C. troops on each ship. With high security at stake no risks could be run, and it was vital to check up thoroughly to ensure that every consignment reached its destination complete and in order.

Some of the ships were small, and the issue of all maps in rolls of 50 was wasteful. A proportion of rolls of 20 or even 10 would have been advisable.

Bulk consignments for stocking map depots in Sicily were put on slow maintenance convoys. The Movements Branch at G.H.Q. called them forward for loading ten days or more before the ships actually sailed. It was found essential for a survey officer to "live almost in the pocket" of the movements officer concerned so that the dates could be ascertained in plenty of time. The fact that the Survey Directorate was located some eight miles from G.H.Q. was a disadvantage.

The following are some of the lessons which were learnt regarding map distribution during the mounting stage:—

(*a*) Survey representatives of the formation carrying out the operation should be included as an integral part of the planning staff at the earliest possible date.

(*b*) Survey Directorates should be located close to the General Staff which they serve.

(*c*) Security measures must be kept simple, and map distribution to ships should be handled centrally by the minimum number of officers. Formations can seldom be called on to provide either transport or escorts, and survey units will frequently have to assist. Map code lists should be made out as early as possible and copies given to all officers of the survey planning staff.

(*d*) Adequate arrangements for mapping up all units in follow-up convoys must be made. There is a tendency to forget the late starters.

(*e*) A table of "Scales of Issue" must be prepared well beforehand. Such tables are a great help when forecasting printing requirements in the production stage.

(*f*) To save printing and freight, and to avoid waste, it is desirable that a certain number of rolls containing less than 50 maps should be made up, say a proportion of rolls of 20 and of 10.

(*c*) *In North West Africa.* Both 649 U.S. Engineer Topographical Battalion and 516 Field Survey Company R.E. were employed under A.F.H.Q. control on the revision of 1/25,000 maps of Sicily, and 649 Battalion completed a programme of 1/25,000 photo-maps of the island so far as photo-cover allowed, and also a 1/500,000 road map.

Bulk stocks of the standard series were sent out from the United Kingdom by convoy, but there was also a great amount of reproduction and printing done by units within the theatre, partly in the form of new original production, and partly to guard against, and make up for, late arrivals or losses by sea.

The forces which had to be mapped up in North West Africa under A.F.H.Q. control included:—

Force 141 (H.Q. 15 Army Group).
That portion of Force 545 (Eighth Army) which was mounted from North West Africa, including 1 Airborne Division.
Force 343 (U.S. Seventh Army) including elements of U.S. Navy.
North African Air Force.
Western Desert Air Force.

Initial issues, which were expected to serve until "D" + 30, amounted roughly to the following:—

Force 545	50 tons (Tunis).
Force 343	150 tons (Constantine).
,,	30 tons (Algiers).

The organization available for the distribution of bulk stocks comprised the A.F.H.Q. Survey Directorate and 7 Field Survey Depot, the latter being augmented by pioneers and elements of two topographical sections of 516 Field Survey Company. Road, rail and air were used to transport consignments from the main depot in Algiers to the depots where unit bundling was to be done.

For that part of Force 545 which was mounted from North West Africa, bulk stocks were sent to 12 Field Survey Depot at Tunis. There they were broken down into unit bundles under the control of D.D. Survey First Army, who was also given technical direction of a detachment of 20 (Army) Field Survey Depot at Sousse.

For Force 343 (U.S. Seventh Army) the original plan envisaged sending all bulk stocks to a U.S. Map Depot Detachment established at Constantine. It was intended that Force 343 should arrange for unit bundling to be done there and to distribute from there to sub-formations. On 12th June, this plan was put into action and large consignments were sent by rail from Algiers to Constantine. On 18th June, however, representatives of Forces 141 and 343 sought the assistance of the Survey Directorate at A.F.H.Q. as their own arrangements under Engineer Section control had not been satisfactory.

A plan was therefore evolved whereby the Force 343 Depot at Constantine remained as a bulk stock depot, and breakdown depots were located at convenient sites for the various ports of embarkation. Force 343 was asked to supply detailed distribution tables and eventually distribution was effected up to schedule, but only just in time for the operation.

Map depots move to Sicily

The main body of 20 Field Survey Depot (Eighth Army) was in Tripoli when operations started with detachments in Malta and Sousse. A Sicily detachment opened up at Syracuse on 16th July which was reinforced by the Malta detachment. The remainder of the main depot arrived from Tripoli on July 23rd. The rear depot (Palestinian Wing) remained in Tripoli temporarily, but was under notice to move to Sicily to take over the Syracuse depot when the main depot moved further forward.

Control and ground survey in Sicily

Trig information was sparse, being limited mainly to primary points. The 1/25,000 maps, however, proved to be good and accurate, and it was found best to use map co-ordinates as the basis of the artillery grid, accurate bearings being observed and carried forward with frequent checks to guard against swing.

The field survey plan for the initial operations was to send forward a joint R.A.-R.E. survey reconnaissance party with the assault troops, followed by other elements of the composite batteries and by the rest of the topographical sections. On 13 Corps front, where 3 Survey Regiment R.A. and 13 Field Survey Company R.E. were operating, this plan worked well, but on 30 Corps front one topographical section of 517 Field Survey Company was, unfortunately, left behind owing to a last-minute change in shipping priorities. The R.E. reconnaissance party consisted in each case of one officer, one trig surveyor, a driver and a jeep.

After the initial landing the battle moved too fast for much survey to be required in view of the good quality of the maps, but to the north of Catania, sheets of the 1/25,000 series ceased to be available and, in preparation for a move into less well-mapped country, a chain of triangulation covering the whole of Eighth Army front was begun.

Early in August, the topographical sections of 517 Field Survey Company were withdrawn for service elsewhere, but the campaign was then drawing to a close, and as the army front was reduced to that of one corps, the topographical sections of 13 Field Survey Company had no difficulty in meeting all requirements.

Printing in the field

Printing resources in Sicily were limited to those of the field survey companies. Their chief task was the printing of the large scale maps and any other maps or overprints of a special nature which might be asked for not exceeding demy size.

Air photography

As far back as 1941, when D. Survey, Middle East, first began to consider mapping plans for Sicily, requests were made for systematic photography of the island. At that time the R.A.F. was preoccupied with the vital task of fighting and bombing, and was too ill-equipped to be able to spare suitable aircraft for the job. By early 1943 the situation had improved and the allied air forces were in the ascendant.

Early in March, 1943, D. Survey, realizing that the air-photo situation was unsatisfactory, represented the facts to No. 1 Planning Staff (Force 545) in Cairo. Force 141 (Algiers) were asked if they could arrange for suitable aircraft to photograph Sicily for survey purposes. At the end of March, it was stated that no aircraft suitable for survey photography were available in North West Africa, but that the Intelligence Branch had ordered reconnaissance photo-cover over the island. This task was undertaken by U.S. "Lightning" single-seater fighter aircraft equipped with 6-inch cameras. These were not suitable for air survey work as their view forward was poor, making navigation difficult, and they were easily "jumped" by enemy aircraft. This resulted in short random sorties with much variation in height and considerable tilts. They did, however, obtain a very useful amount of photography which was used for revision. It was estimated that the photography of the south-eastern corner of Sicily would be completed by 14th April, but there were delays, and the hold-up of

the mapping programme was so serious that a request was made for the two Mosquitoes which were operating with 60 Squadron (S.A.A.F.) in Tunisia. On 20th May, Mediterranean Air Command (M.A.C.) threatened to re-equip the two Mosquitoes for normal photo-reconnaissance work and this action was only prevented by the personal intervention of General Leese (Acting Army Commander) with General Alexander. The two Mosquitoes were returned on 10th June, and operational sorties began for air survey photography over Sicily on 13th June and were successfully completed.

SECTION 5. THE PACIFIC (*see* Sketch Map No. 17 facing p. 528)

Introduction

The conduct and control of operations against Japan in the Pacific was in American hands and, by agreement between the War Office and the War Department, Washington, responsibility for mapping policy, design, and initial production for the Pacific area was allocated to the United States.

Australian forces took a prominent share in the South West Pacific operations and an account of their survey and mapping activities is given in Chapter XIII, Section 2.

The following is a brief summary, compiled from the limited records and data available, of the U.S. topographical organization and its mapping and survey activities for supporting the operations in the Pacific resulting in the Japanese surrender on V.J.-day. It is added for general interest to complete the global picture and touches only the fringe of the extensive mapping problem that had to be solved.

Topographical control

Survey control in the Pacific was at first more complex than it ever was in Europe largely because of the splitting of the vast zone into multiple theatres of operations.

In the South West Pacific the Chief Engineer directed the work of the topographical units, but in the Mid-Pacific area, the Chief Engineer and the Navy shared control and the Joint Army and Navy Intelligence Staff exercised a general overall control by formulating a comprehensive mapping plan.

Towards the end of the war, the need for centralizing the control of all survey activities was realized when General Loper was assigned as Chief of the Intelligence Division of the Office of the Chief Engineer, Allied Forces in the Pacific Area (A.F.P.A.C.). All topographical responsibility throughout the Pacific was then placed under his direction.

Topographical units

So far as available records show, it would appear that, at the peak of their strength, the following American topographical units were available in the theatre:—

China–Burma–India Theatre

1 Topographical Battalion (Army).
1 Topographical Company (Aviation).

1 Map Depot Team.
1 Air Force H.Q. Company.
Total strength about 800 *all ranks.*

The Pacific Theatre

3 Topographical Battalions (Army).
8 Topographical Companies (Corps).
3 Topographical Battalions (Base).
1 Reproduction Company (Base).
1 Lithographic Reproduction Platoon.
1 Photo-mapping Platoon.
2 Survey Platoons.
8 Map Depot Teams.
4 Model-making Teams.
1 Reproduction Team.
3 Survey Liaison Teams.
5 Aviation Topographical Companies.
3 Air Force H.Q. Companies.
1 Aviation Reproduction Detachment.
Total strength about 6,800 *all ranks.*

Early mapping situation

The pressing need for the many and various types of maps essential for effective planning and operations will be apparent when consideration is given to the military situation in the Pacific at the time when U.S. forces were ready to take the offensive.

Pearl Harbour and after. The Japanese attack on Pearl Harbour took place in December, 1941, and was followed by campaigns against the Japanese in South East Asia and Melanesia. U.S. naval forces in the south-western and southern Pacific then turned the tide in Papua and the Solomon Islands. The Japanese penetration into Burma was held by British forces and, at the close of this period, an aggressive strategy by allied forces was under consideration.

The Planning Stage during 1942. While planning for an offensive, the planning staffs were handicapped by lack of adequate map coverage in critical strategic areas. In the Solomons, New Guinea and the numerous islands of the Pacific the available maps consisted principally of hydrographic charts which were out of date and unreliable.

For Java, Sumatra, Malaya and Indo-China there were good maps available and for these areas the U.S. Army Map Service and British map production organizations took action to print bulk stocks. The A.M.S. in Washington obtained mapping material at 1/50,000 scale covering most of Japan, from which maps were reproduced.

American Mapping Unit in Australia. In March, 1942, 648 Engineer Topographical Battalion took up permanent quarters at Melbourne, Australia. Only a limited amount of low-grade reconnaissance photography was available at that time, and this restricted their mapping output, but they quickly compiled and printed bulk stocks of hasty sketch maps and photo-maps for use during the campaign in Papua and the Australian operations in north-eastern New Guinea during 1943.

Mapping organization in Hawaii. For the Central Pacific Area 64 Engineer Topographical Company was established in Hawaii in June, 1942. This unit prepared maps and compiled topographical intelligence material for amphibious operations amongst the Pacific atolls and, in conjunction with an engineer unit operating in Portland, Oregon, they were engaged on map production for the U.S. forces in the northern Pacific, including operations in the Kurile Islands.

Air photography (1942–44)

When mapping units first began to operate in the Pacific, it was apparent that the procurement of suitable aerial photography for mapping purposes was going to be a difficult problem. Distances were enormous and, with only very limited quantities of suitable aircraft available, there was difficulty in obtaining sanction for long-distance missions to obtain only a few photographs when there was a critical need for air reconnaissance to meet immediate tactical demands.

In 1944, however, a directive was issued from Washington stressing the vital need for obtaining long-range photography, and this directive specified definite objectives and laid down priorities.

As a result, aircraft from the China Theatre procured valuable photo-coverage of Formosa from which the A.M.S. produced and distributed map stocks to support any operation that might be undertaken to capture the island.

Carrier-borne aircraft also procured photography of Saipan and Guam from which the 29th Engineer Battalion produced topographical maps by Multiplex methods.

Late in 1944, some rather poor photo-coverage was obtained of Okinawa and other parts of the Ryukyu Islands by the use of carrier-borne aircraft, and long-range aircraft based on Saipan.

Long-range photographic reconnaissance aircraft also began to amass considerable coverage of the southern shores of Japan itself when the strategic bombing of Honshu and Kyushu began at the end of 1944. Arrangements were made for 21 Bomber Command to procure mapping photography in conjunction with bomb assessment.

Mapping plans for 1945

A comprehensive mapping plan was drawn up for 1945 in which all areas of likely operations were considered, and provision made for long-range planning. 21 Bomber Command were to follow this plan as a basis for procuring mapping photography, and the Chief of Staff authorized the plan as representing official policy, and outlined specific operations for the mapping of Japan and its approaches.

In the Pacific Ocean Area (P.O.A.) good co-ordination was built up between the staff sections who dealt with aerial photography and mapping. Both the theatre photographic officer and the theatre mapping officer were responsible direct to the Assistant Chief of Staff. Photographic specifications and target dates, which were recommended to the theatre mapping officer by the Engineer, were immediately acted upon by the theatre photographic officer, who had authority to assign missions to the appropriate land-based or carrier-based air units.

Early in 1945, when the Pacific Commands were reorganized into the Naval Forces and the Army Forces, the need for establishing a closer relation-

ship between the mapping programmes laid down by the Headquarters of the Army Forces in Manila and the Pacific Area Command on Guam became an urgent one. A Pacific mapping conference took place therefore, at Oahu in the Hawaian Islands on 25th May, attended by air, engineer, naval and marine representatives. The requirements and commitments of all the parties involved for the remainder of 1945 and into 1946 were considered and included in the report, and it became the governing plan until it automatically lapsed upon the cessation of hostilities.

The build-up of topographical resources in the Pacific

By the middle of 1942, U.S. topographical units were being established in overseas theatres. The A.M.S. had been organized to replace the former Engineer Reproduction Plant, and it concentrated on the production of small scale series of important areas on the assumption that local resources within the theatres could produce the large scale mapping required for tactical operations. There was little or no co-ordination of the various mapping procedures adopted in different areas each under separate control Each individual mapping organization tended to develop its own particular methods and line of approach to a problem.

In the South West Pacific, the topographical units were working under a great handicap. Ground and height control for mapping was practically non-existent. Photographs were usually available only just before the target date of an operation, and even then were generally of poor quality. These delays in acquiring photographs were, of course, owing to the fact that, in almost every case, the next operation was at the extreme range of the aircraft. Headquarters and mapping groups were slow in moving forward owing to shortages of transport, men and material. The work produced by these topographic units consisted mostly of map substitutes (photo-maps) and hasty-type maps of somewhat doubtful accuracy. Long-range mapping, the theoretical ideal, was not possible at the time of these early operations.

Stereo compilation by Multiplex equipment was not practicable in the South West Pacific owing to a lack of the special type of photography needed.

In the Pacific Ocean Area, with certain exceptions, the situation was much about the same. The planning was more comprehensive, and conformed to the mobility of the fleet. It was possible to obtain better and more numerous photographs of it because the fleet was able to organize air-strikes over an objective considerably in advance of an operation over that particular area. There was also a limited amount of specially flown photography for Multiplex compilation. To meet the three-sided character of operations in the Pacific Ocean Area, mapping suitable for all three forces, land, sea and air, was provided. Multiplex compilation methods were employed whenever possible and, as a result of proper planning, maps for the whole of the Pacific forces were eventually provided.

Mapping projects and comments

During the first six months of the war the Engineer Reproduction Plant (the forerunner of the A.M.S.), assembled and packed all available maps that could be utilized by the various Task Forces which were being deployed

to the Pacific. Bulk consignments were assembled to stock the first map depot overseas, and these were shipped to Australia with the Task Force.

There were many mapping problems to be met and resolved before the A.M.S. was in a position to provide adequate quantities of suitable maps of critical Pacific areas. Some of the mapping projects undertaken are referred to briefly below:—

1/500,000 *of Japan.* This was a facsimile reproduction of shaded relief originals, and it offered many difficult technical problems in production. The methods used produced a bottleneck in the negative-cutting department, and required a high standard of press-work and press-room conditions to give a satisfactory result. The absence of a standard transliteration procedure adversely affected legibility. The finished production was useful only for emergency and planning use.

1/1,000,000 *Netherlands East Indies.* This involved a similar technique for facsimile reproduction to that referred to above, and produced a map which was available to the planning staffs and the air forces.

1/50,000 *Java and Madura* (*Dutch series*). The original Dutch maps were of excellent quality, printed in ten colours. It was decided to copy them by process colour-reproduction methods using the Bloom technique of continuous tone plate development, and process colour negatives. This method had, however, to be discontinued half-way through the series because the necessary materials for it were not available for equipping field units. Colour-separation by hand was then adopted.

Reproduction of British maps of the East Indies. By late 1941, some hastily reproduced black and white map coverage of the East Indies was available for distribution. In addition, a substantial quantity of large scale sheets of selected areas of the East Indies were reproduced from kodalines supplied from British sources. These gave a half-tone grey base of the detail, overprinted in colour to accentuate streams, roads and names.

Other new series produced early in the war. During the early months of the war, several new map series were initiated. Amongst them was a 1/500,000 compilation of Japan for the air forces, and a limited emergency edition covering part of Japan at 1/50,000 scale for planning purposes. There followed a 1/500,000 series of New Guinea, and 1/250,000 maps of the Netherlands East Indies.

Compared with later productions these early maps were not of a very high standard mainly owing to a shortage at that time of experienced cartographic personnel. There was also little efficient cartographic planning, specifications were not tight enough, there was very little policy regarding place-names, and there was some misinterpretation of original material.

Mapping projects for the Pacific in 1942–43. During the latter part of 1942 and early 1943, a number of medium and small scale series of various Pacific areas were being compiled at the A.M.S. to meet planning needs. Conditions were now rapidly improving, with better map design and specifications, a firm policy regarding place names, and a higher standard of cartographic personnel.

Compilation was started on maps of Korea (1/250,000), China (1/250,000), Sumatra (1/250,000), the Philippines (1/500,000), and Eastern Asia (1/1,000,000).

In order to speed up completion of mapping projects, and to prevent a growing tendency to continue work on a given task indefinitely by incorporating every piece of new material as it came along and continually changing procedure and technique, a more decisive policy was instituted. Stringent target dates were laid down, after which no new compilation data were to be included unless materially vital, and technical procedure, once approved and laid down, was strictly followed. By this means backlogs were eliminated.

Mapping projects for the Pacific during 1943-44. Mapping projects for the Pacific were assigned third priority throughout 1943 and well into 1944. By July, 1943, the A.M.S. had published approximately 15,000 different maps, of which half were of Pacific areas. By 1st July, 1944, the number had risen to nearly 28,000, and the 50 per cent quota for the Pacific area was maintained by producing emergency editions and reprints of British publications of South East Asia.

Cover plans, and the effect of leap-frogging tactics, involved numerous mapping projects which were never wanted or used. Amongst these were the large scale maps of Sumatra initiated late in 1943, the Formosa project started late in 1944, and the Chou Shan undertaking.

The Philippines. In 1944 representatives from the South West Pacific Area visited Washington to discuss plans for mapping requirements in the Philippines. These involved the preparation of maps at 1/25,000 and 1/50,000 scale for specified operations. These requirements were supplemented by the Chief of Engineers and the A.M.S. who added further publications on lower priority which proved invaluable during subsequent operations.

To meet the particular needs of beach-landing operations, offshore data were incorporated in the topographical maps. Most of the original source-material for the Philippines was of poor quality, suitable mapping photography was practically non-existent, and there was little ground or height control.

Formosa. Concurrently with the Philippines project there was a demand from Pacific Ocean Area for maps of Formosa at 1/25,000 and 1/50,000 scales. These were produced by Multiplex compilation. The project was much impeded by the transfer of 29th Engineer Topographical Battalion to the South West Pacific Area, and the work had to be allotted to other agencies.

Okinawa. Late in 1944, there was an urgent request for maps of Okinawa on 1/25,000 scale. Lack of suitable photographs was once more the chief factor which hindered the progress of the work.

The Chou Shan project. This requirement was sandwiched in between the Formosa and Okinawa projects and the many European mapping commitments on which the A.M.S. was so heavily engaged. Progress was much speeded up by the fact that a good deal of work had already been done in areas included within this task.

Build-up of "cushion-stocks." In accordance with the policy drawn up at the Oahu mapping conference in 1945, the A.M.S. built up "cushion stocks" of all critical areas. During the month of June, 1945, the A.M.S. produced and shipped 27,000,000 maps. These proved invaluable to meet occupational requirements subsequent to V.J.-day.

Map styles. Styles and scales did not differ materially from those used in Europe except that the air maps were of the fluorescent type as used by the U.S.A.A.F., and a target area designation grid was extensively used.

Size of editions (1/25,000 *scale*). In preparation for the final assault on Japan, requisitions for 1/25,000 maps reached a figure of approximately 90,000 copies of each sheet. In Europe there was, especially during the close fighting in Normandy, an increasing demand by all arms for large scale maps, which had originally been produced primarily for artillery use. The large demand for this type of map for the Japanese operations gives food for thought. There were, of course, a large number of troops involved, a number of different places from which the assault operations would be mounted, and an uncertainty of the exact assignment of missions until a date when it would be too late to effect an amended distribution. There was also a need for insurance against loss on a long sea-voyage where the use of air transport for bulk stocks was out of the question.

British share in the Japanese mapping programme. In accordance with the British-United States mapping agreement, the latter were primarily responsible for the production of maps of Japan and the Pacific in the same way as the British were primarily responsible for the European Theatre. As regards Japan, the War Office Survey Directorate undertook a portion of the mapping project at the request of Washington. This programme was not completed, nor were the results required owing to the sudden cessation of hostilities.

Beach-gradient determination

So far as is known, the determination of beach gradients was not a responsibility of topographic units in the Pacific, but was largely a naval task. A great deal of general information on beaches was provided by the Office of the Chief of Engineers, with the help of the Beach Erosion Board, and further detail studies were made in the field by intelligence agencies of the Army and Navy.

Personal reconnaissance by special naval teams was sometimes possible, and aerial photography in various forms was extensively used during the latter stages of the war. Special beach intelligence units, organized for the purpose of deriving the best possible information on beaches from available data and aerial photographs, were set up towards the end of the war, but never got into full play. It is understood that they would have operated under G–2 (Intelligence), and the topographical units would have participated only in drawing and reproducing the results.

Map distribution

For the early "island-hopping" operations, map distribution was effected by using improvised methods to fit in with the operational plan and the resources available. Re-supply was handled by using every available form of transportation, from aircraft to refuelling vessels.

For the final operations against Japan it was the intention to adopt a systematic map supply scheme on the European pattern, strengthened by an improved organization. It was recommended that at least one base map distribution company should be used, containing at least eight map distribution platoons and a transportation platoon with approximately 88 tons of truck-lift. There would have been extra facilities for map distribution at all levels.