

**CIA HISTORICAL REVIEW PROGRAM
RELEASE AS SANITIZED**

18 SEPT 93

TITLE: Geographic Intelligence

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VOLUME: 3 **ISSUE:** Spring **YEAR:** 1959

STUDIES IN INTELLIGENCE



A collection of articles on the historical, operational, doctrinal, and theoretical aspects of intelligence.

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*Difficulties and new proposals
[redacted] in a dozen
military geographic fields.*

GEOGRAPHIC INTELLIGENCE

K. C. Duncan

Geographic intelligence is one of the oldest forms of military intelligence, and one of the most important. From earliest times, when man first conspired against man, through ancient history and mediaeval conflict to the most recent wars of our own time, an accurate knowledge and appreciation of geographical factors has been an essential part of strategy and tactics. But today, instead of merely giving some simple information on what lies beyond the neighbouring hill, geographic intelligence is required to provide knowledge on a world-wide basis and in infinitely greater variety, detail, and (above all) precision than ever before.

In the face of unlimited conceivable demands from planning and operational staffs it is essential that our geographic activities should be carefully guided and controlled, so that none may be wasted on aspects which, though previously important in military thinking, have now lost their importance in modern strategy and tactics. It is in the light of this thesis that I propose to examine several fields of geographic intelligence and discuss problems encountered in each.

Cross-Country Terrain

Assessing the suitability of terrain for cross-country movement has been a major problem in modern warfare. Of the many instances when failure to appreciate this factor has proved disastrous, one is perhaps outstanding. In 1917 Lord Haig launched his Flanders offensive in disregard of his engineers' warning that the ground would revert to bog under the necessary preliminary bombardment and his weather experts' advice that the autumn rains, then due, would further aggravate conditions. His failure to take into account the terrain requirements for cross-country movement led to the

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costliest battle in British military history, Passchendaele, involving the sacrifice of some 400,000 men.¹

The suitability of cross-country terrain is today in some ways more critical than ever because of heavier equipment, increased speed and mobility, and probable need for dispersal off surfaced roads as a precaution against tactical nuclear attacks. Its assessment, however, is a most difficult matter, involving a matching of the characteristics of various types of military vehicle to a wide range of detailed information on the terrain—local or seasonal variations of bearing capacity, width and depth of water obstacles, height and steepness of their banks, and the effect of day-to-day or seasonal climatic influences. The task is rendered especially difficult when no practical precedent exists: take for example the movement of tanks across ricefields.

The military geographer really has two major tasks—first, to acquire and collate the necessary mass of factual data on the terrain, and second, to apply those data to foreseeable military operations on the basis of proved vehicle performance. For both, I suggest, careful liaison with planning staffs is essential. It is beyond our resources to acquire and collate detailed information on all areas; we must concentrate on areas where the planners consider movement most likely to occur. And we must keep aware of movement plans for particular vehicles in order to spot the need for experimental maneuvers as basis for an adequate assessment of the practicability of these movements.

Ports and Beaches

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The importance of beaches for military operations has probably increased since the war. Modern weapons seem likely to damage seaports more effectively and thus delay their rehabilitation for longer periods, while improved equipment for beach landings will probably permit the movement of tonnages far in excess of the figures achieved in World War II. In these circumstances, I suggest that our organizations should consider carefully whether they are over-concentrating on detailed studies of ports and their capacities to the neglect of beaches.

We should at least aim at a high standard in respect of those beaches which the planners consider may be used in operations. Experience in Melbourne indicates that accumulated beach intelligence is generally sufficient as a guide to planners, but lacks the detail required for mounting specific operations with confidence. It is a fallacy to suppose that observations made years ago are necessarily accurate today and adequate for present requirements. The characteristics of some beaches can change surprisingly overnight in a storm, and the heavier equipment available today poses problems not previously encountered. Factors such as bearing capacity (involving assessment of the sub-strata), slope at various tides, variations of surface and slope at different seasons, effects of tide and local currents on inshore approaches—these are typically deficient in our present information.

These deficiencies could be reduced, I suggest, by carrying out special technical reconnaissance, whenever practicable, in respect of those beaches which are of interest to our military planners on the evidence of present information. Where this reconnaissance is not possible (e.g., beaches in potential enemy territory) our procurement channels should be activated far more than at present. If this is not done, we can only continue to plan on imperfect data, risking uncertainties and perhaps jeopardizing the success of vital amphibious operations.

Railways

An important problem in the study of railways is the assessment of route capacities. In ideal circumstances this assessment would be made by analyzing the physical characteristics of the lines—gauge, number of tracks, weight of rail, length and spacing of passing loops, speed or weight restrictions, and so on—to arrive at a theoretical physical capacity. The practical operational capacity would then be determined by such factors as size and type of locomotive and rolling-stock park, fuel availability, quality and location of repair shops and engine sheds, etc.

In foreign countries, however, particularly those which are behind a "curtain," acquisition of all the detailed information necessary for these analyses is most difficult, and present assessments of the practical capacities of railways in those countries can at best be regarded as approximations based on very imperfect data. Unfortunately, there is little prospect of obtaining the detailed information required to fill our gaps, and it is therefore worth considering whether some short-cut method might improve our assessments.

One such method might be to make an all-out effort to acquire working timetables of those lines which have importance in planning. These working timetables—not to be confused with passenger timetables—contain details of all classes of traffic, both passenger and freight, and are available in one form or another on all railways. An analysis of them in conjunction with other textual and photographic information might give reasonable accuracy in the assessment of practical capacities. It would not be easy, but if our agencies agreed on a standard approach it seems likely that the assessments achieved would be more soundly based and adequate at least for the purposes of war potential appreciations.

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the basis of road standards in their own, so that their assessments tend to vary inversely with these standards.

The effect of inaccurate reporting can best be shown by a practical example. Let us take a road across undulating country with an overall width of 20 feet and a waterbound macadam surface in bad condition. Applying the standard NATO Road Capacity Table to these details, we arrive at an estimated capacity:

$$550 \times \frac{30}{100} \times \frac{80}{100} = 132 \text{ vehicles per hour.}$$

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But if the reporting officer, because of the bad condition of the surface, mistakes the waterbound macadam for crushed rock, our calculations would be:

$$280 \times \frac{25}{100} \times \frac{80}{100} = 56 \text{ vehicles per hour.}$$

With 3-ton vehicles and a 10-hour running day, the estimated capacity is only 1,680 tons per day. A simple mistake on the nature of the surface has thus resulted in an error of 57% in the capacity of this particular road. Cumulative errors in the NATO Table factors, applied to a number of roads in a given area, might seriously affect logistic planning.

But the full assessment of a road's potential requires also consideration of the maximum live-load capacity, i.e. the weight of the heaviest vehicle that can use it. This involves other technical reporting, in particular on the strength of bridges and culverts, which not infrequently impose strict limits on traffic. In the example we gave just now I assumed that 3-ton vehicles were used, but planners might well want to know whether they could move 10-ton trucks or even 50-ton tanks along a given road. This problem is one of educating reporting officers so that the technical details they supply are far more accurate than at present, or of obtaining this necessary information in some other way.

A secondary problem in this field, as in many others, is to ensure that procurement and research are conducted in accordance with the priorities of planning requirements, for the potential areas to be covered are so vast that with the

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limited resources available we cannot hope to achieve detailed results on everything. If this control is not exercised, there is a real danger that essential work will be neglected.

Inland Water Transportation

Compared with railways and roads, inland water transportation is being neglected by intelligence. This, I believe, stems largely from a natural tendency to think first of rail and road transport for military movement because of their greater speed. Moreover, railways and roads, being able to traverse natural obstacles such as mountain ranges, can link widely separated regions and provide local access in any direction. Rivers and canals cannot provide the same through access or choice of direction, and the capacity of rivers normally decreases as one proceeds upstream. Another reason for the preoccupation with rail and road transportation systems has been the relatively large reporting on them in connection with Western aid to backward countries, in which the construction or rehabilitation of these systems has loomed large.

This neglect of waterways has meant that we have acquired insufficient detail to permit a rational reconsideration of the validity of our preferential emphasis on railways and roads. The situation, in short, presents a vicious circle. The vulnerability of rail and road transportation networks, particularly around major cities and ports, to modern techniques of attack suggests that greater attention should be paid to the capabilities of waterway systems as a means of moving supplies inland. They merit at least sufficient procurement and research that their role may be more accurately assessed in those areas which have the highest priority in over-all planning.

Airfields

The basic problem of airfield intelligence is the assessment of the capabilities of a given airfield, i.e. to decide what aircraft can operate from it, and in what circumstances. Before this assessment can be made it is necessary to know in detail such physical characteristics of the airfield as the dimensions, surface, and weight-bearing capacity of the runways, taxi-tracks, and dispersals, the nature and disposition of supporting facilities, the location and height of obstructions to the approaches,

the altitude, and the temperature. It is necessary to know, too, the seasonal variations in some of these factors.

Except when photoreconnaissance and detailed reporting are available, it is extremely difficult to get this information with the required accuracy, and even then a full knowledge of bearing capacity is practically impossible. Detailed tests have been conducted at a negligible proportion of the airfields in which we are interested, and we are therefore compelled to base our opinions largely on a knowledge of what aircraft have operated from the fields, without any real means to assess their surplus of bearing capacity. In addition, we all too often have no knowledge of how a runway will stand up to intensive or prolonged usage, or of how its capacity will vary at different seasons.

The rated requirements of aircraft which use the field, moreover, may bear only a very indirect relation to operational requirements. For example [REDACTED] publications state that the MIG-17 requires only 2,640 feet to take off and clear 50 feet. Yet intelligence research shows clearly that the Communists, having built their runways for these aircraft to an original length of 6,560 feet, subsequently lengthened them to at least 7,200. For the MIG-19 the technical handbooks give a requirement of 2,240 [REDACTED] and 3,000 feet [REDACTED], whereas research indicates that the Communists are lengthening some runways for these aircraft from 7,200 feet to at least 8,200. There is thus a wide margin between the minimum length of take-off run and the length of the runway itself.

There is no easy solution, but I feel that considerable improvement would be achieved if our respective air forces and airfield intelligence could reach some agreement on the total lengths of runway from which enemy or friendly forces would be prepared to conduct both sustained and limited occasional operations. If lists could be agreed, showing on a country-by-country basis the full runway requirements for the operation of various aircraft likely to be used by that country, then the airfield intelligence branches would at least have a basis for their assessments and could write with far greater unanimity than at present.

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Climate

Climate of course affects most other aspects of geographic intelligence, but some applications of its study in modern warfare may not yet be generally appreciated. For example a full knowledge of *local* wind variations is necessary for the study of the movement of radioactive fallout from nuclear explosions. Important as this is in strategic nuclear attack, it is even more so in tactical applications, when friendly forces are relatively close to the point of impact or may have to advance towards it. The same principle applies to chemical or bacteriological warfare. The study of local temperature inversions and local rains will also be very important should gases be used by either side in a future war.

You will note my repetition of the word "local." Intelligence is on the whole fairly well provided with generalized data on climate, normally based on long periods of observation, which gives a reasonably accurate basis for regional appreciations. What is lacking—and I suggest it is the main deficiency in this branch of geographic intelligence—is information on local peculiarities or variations within the broad regional pattern.

Mapping

The need for accuracy in mapping has always been important, but today this need is greater than ever before. Whereas minor inaccuracies can reasonably be corrected by visual observation in conventional air operations, the concept of guided-missile warfare highlights problems which have hitherto been only marginal. One of the greatest limitations to ICBM accuracy is the present inadequacy of intercontinental geodetic survey. The use of any guided missile which is not equipped with some terminal-guidance system requires precise knowledge of the relation between launching point and objective, and though some margin of error may be allowed where area damage is acceptable, no such margin is permissible if it is desired to hit a single objective with the minimum of damage to surroundings. If a terminal-guidance system is fitted to the missile, a prerequisite is often a knowledge of the radar return from the target area. In peacetime or in the early stages of a war, when it may not be possible to acquire this

knowledge by prior reconnaissance, the only alternative is the simulation of the return by a careful analysis of maps.

Since mapping represents graphic collation of many aspects of intelligence, it is pertinent to examine briefly our role vis-a-vis that of the map-producing authorities. Procedures no doubt vary between our countries, but certain fundamental principles are valid irrespective of their detailed application. First, there must be a system for feeding our information to the map producers, and for checking their drafts. This assumes particular importance when no recent photography is available to the mappers, but even when it is, there is inevitably a time-lag between it and the map compilation, and in that interval changes may occur. A map becomes out of date all too quickly; we must at least ensure that it is as accurate as possible when issued.

Second, there must be a system for informing the mappers of inaccuracies detected after issue, and for letting them know when certain series or individual sheets have become obsolete. Many of us, noting inaccuracies on maps, have done nothing to draw attention to them because there was no routine procedure for doing so. Third—and this applies primarily to areas over which peacetime photoreconnaissance is not practicable—there must be a system whereby doubtful map details noted in everyday research are recorded, so that procurement agencies may be briefed to check them.

Fourth, there must be a system whereby mapping priorities are related to planning. This is primarily a matter for liaison between planning staffs and the mappers; the responsibility of intelligence organizations lies mainly in drawing attention to the deficiencies and inaccuracies in existing maps of the priority areas so that new editions may be put in hand.

Photography

Photography is a basic requirement in mapping, in most forms of intelligence research, and in operational planning; and any deficiencies of photography must adversely affect these activities. Of the two forms of photographic coverage, print coverage and negatives backing it up, the need for the former is well recognized, but the need for film is not so generally appreciated. Film is required to meet the demands of various sections and organizations in peacetime and in war.

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and the alternative of copying from prints, besides being slower and more costly, does not provide first-class quality, especially when, as frequently, the original prints have deteriorated through age.

It seems somewhat illogical that whereas the exchange of textual information between our agencies has been developed to a high degree, the exchange of photographic prints and film has been comparatively neglected. In addition to the direct advantages of such an exchange to peacetime intelligence research, we should not overlook its importance in those "hot" situations which occur from time to time and in the period of extreme military activity which would immediately precede the next war. At such times it is clearly a complicated and inefficient procedure to be obliged to signal [REDACTED] for urgently required photographs and film, and then to await their arrival "by best possible means." Once the war had started, it is reasonable to suppose that fresh photographs would become available, but in the pressure periods in the meantime we have to depend on existing holdings.

One appreciates, of course, that clauses in peacetime reconnaissance contracts may preclude the exchange of the resultant photography, but this restriction applies to a very small proportion of overall available holdings and does not invalidate my thesis that much more could, and should, be done in the matter of exchange.

[REDACTED]

[REDACTED]

Geographic Names

Much painstaking work has been done by the U.S. Board on Geographic Names [REDACTED] towards the standardization of place names and generic terms, and this has been of particular value where transliteration from a non-roman to a romanized form is required. Difficulties are still encountered by the in-

telligence community, however, in applying the authorities' decisions.

The main difficulty arises from the fact that the decisions, being based on academic principles, are sometimes ahead of popular usage, and in such cases the "preferred" (or decision) name tends to make the text less readily intelligible to the non-specialist reader. In current intelligence reporting, it is desirable to use a style which permits the easiest comprehension by a wide range of usually high-level generalists; any irritant which interrupts their concentration on the subject matter is undesirable, and might even result in failure to appreciate the importance of the intelligence. A few examples of what I term irritating preferred names are Krung Thep (Bangkok), Kuang-chou (Canton), Chin-men Tao (Quemoy Island), Sulawesi (Celebes), Shen-yang (Mukden) and Hsia-men Tao (Amoy Island); there are many others which, being less common, are perhaps all the more irritating when they are encountered.

The problem is complicated by the fact that some of these preferred names may, in course of time, become more commonly accepted in daily usage throughout the world. This raises the question whether we are to concentrate on ease of comprehension at the present time or should tolerate irritating names with the object of gradually educating ourselves and our readers to accept the academic decisions. The decisions of the two boards are progressively being incorporated in new map series, and therefore confusion is likely to arise in basic or long-term reporting if we do not adhere rigidly to them. One can imagine, for example, the frustration of a commander in the field when he realizes that he has the task of reconciling the "preferred" names used on his basic maps and the "conventional" names used in a detailed study of the region's topography.

Another aspect of the decisions which brings complications is the retention of many indigenous generic terms for such topographical features as capes, rivers, islands, mountains and lakes. The topography of foreign lands is sufficiently difficult for generalists to comprehend without the added difficulty caused by the use of these terms, and there would appear to be a strong case for the substitution of English-language equivalents. Although we, the peacetime elite of

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intelligence activities, can perhaps overcome the difficulties by acquiring familiarity with new terms, the problem would assume increased significance in wartime, when a large body of untrained recruits would be unfamiliar with our nomenclature.

Air Targeting

While the production of air targets material is primarily a Service responsibility, the intelligence organizations must provide the basic information required and play an important part in writing the appreciations on which the priority of target systems and individual targets are based. It is therefore relevant to examine whether we are devoting our resources to any non-vital aspects of targeting, or on the other hand are neglecting others of importance.

Let us look first at strategic targeting. In World War II the basic documents for operations were detailed information sheets and annotated photographs of individual targets, and similar, usually more generalized, graphics on important concentrations of targets. These were necessary for attacks by manned aircraft, since visual recognition of the target and of the selected detailed aiming point within it played a major part in such attacks. With the concept of nuclear and guided-missile strategic attack, it should be examined whether it is still necessary to devote a major part of our targeting activity to detailed graphics on individual targets; in view of the area damage attainable by modern weapons, should a greater proportion of effort be devoted to urban and industrial complexes?

There is probably no aspect of aerial warfare on which more has been written than target selection. It is fairly easy to be wise after the event, as we have seen from the spate of criticisms of allied bombing policy published since World War II. It is very difficult to be equally wise before the event, and to be sure that the golden rule of targeting is observed—hit the enemy where it hurts him most. In a future war, because of the striking power of weapons likely to be held by both sides, it is more than ever essential that target selection be right, and from the very beginning of hostilities. There may be no opportunity to experiment with priorities as in the last war. We in intelligence have, therefore, a responsibility to

ensure that our recommendations in this field are based on sound principles.

The discharge of this responsibility is rendered more difficult, in my opinion, by the lack of any sound system for assessing the relative priority of complexes as targets. This is quite a different task from assessing the priority of a single installation relative to others of like function. One complex may, for example, contain a transportation target of major importance to the country's war potential, a steel plant and oil refinery of medium importance, and so on. How can the priority of this complex be determined in relation to that of other complexes which contain various other combinations of installations, each with their own relative importance within their functional systems? This is too critical a matter to be left to haphazard methods, and merits some close examination.

I have long felt that the solution may lie in some sort of point system. What I have in mind is that within each country for which strategic targeting is undertaken a factor should be agreed on for each functional system (*e.g.* oil-refining, transportation, steel industry, administration), the factor being based on the characteristics of the war potential of the particular country. Then within each system a factor should be agreed on for individual installations in accordance with their various degrees of importance. A combination of the two factors would give a points value for each installation, and the sum of these values would give the total value of each complex, thus providing an indication of its relative priority for attack. It would, of course, be necessary to keep all the factors under periodic review, and to adjust them in the light of changes in the war potential of the country concerned. While this method would not be without its difficulties, it provides the basis for a positive approach to the matter and should, I suggest, be investigated.

One important aspect of graphics on complexes is a representation of the anticipated radar return from the various installations, buildings and natural features. In the absence of actual radarscope photos—and this must at present apply to vast areas which might be attacked in war—it is necessary to simulate the return, basing the simulation on an analysis of such factors as the height of buildings, their type of con-

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struction, their lay-out, the density of built-up areas, and the configuration of such features as rivers, lakes, and woods. All this information must be provided by the intelligence agencies.

I doubt whether our procurement policies take sufficient account of this requirement. Are we equipped to provide such information with the degree of detailed accuracy which is required? In respect of a country such as China, for example, I am fairly sure we are not, particularly when the constant development of existing and new centers is borne in mind. I suggest that this deficiency is worth examination, with a view to the better briefing of procurement agencies active in the field.

In World War II probably as much activity was devoted to tactical targeting as to strategic, and the allied tactical air forces played an important part in the victory. Today, the tendency to talk in terms of a short, decisive nuclear attack or at least an air offensive conducted at long range with guided missiles has given rise to a feeling that in the next war little in the way of tactical bombing will be needed. But this is not necessarily so. In some areas where our forces might be engaged it is still probable that for various reasons tactical attacks would be required, even if they did not actually predominate. Because of this, some effort directed towards the preparation of tactical target material can still be justified, but we must ensure that the effort is commensurate with the use that will be made of the material, bearing in mind that on the outbreak of war photoreconnaissance would quickly provide completely up-to-date information.

Conclusion

The field of geographic intelligence, as we have seen, is a very wide one, affecting either directly or indirectly most forms of military operations and planning. If there is any common factor in the problems I have indicated, I believe it to be this: priorities for procurement and research must be more closely related to planning requirements than they are at present, not only in respect of the degree of detail but also in respect of the areas covered. For geographic intelligence is not an end in itself; it is a means to an end—military operational efficiency.

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But if the reporting officer, because of the bad condition of the surface, mistakes the waterbound macadam for crushed rock, our calculations would be:

$$280 \times \frac{25}{100} \times \frac{80}{100} = 56 \text{ vehicles per hour.}$$

With 3-ton vehicles and a 10-hour running day, the estimated capacity is only 1,680 tons per day. A simple mistake on the nature of the surface has thus resulted in an error of 57% in the capacity of this particular road. Cumulative errors in the NATO Table factors, applied to a number of roads in a given area, might seriously affect logistic planning.

But the full assessment of a road's potential requires also consideration of the maximum live-load capacity, *i.e.* the weight of the heaviest vehicle that can use it. This involves other technical reporting, in particular on the strength of bridges and culverts, which not infrequently impose strict limits on traffic. In the example we gave just now I assumed that 3-ton vehicles were used, but planners might well want to know whether they could move 10-ton trucks or even 50-ton tanks along a given road. This problem is one of educating reporting officers so that the technical details they supply are far more accurate than at present, or of obtaining this necessary information in some other way.

A secondary problem in this field, as in many others, is to ensure that procurement and research are conducted in accordance with the priorities of planning requirements, for the potential areas to be covered are so vast that with the

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limited resources available we cannot hope to achieve detailed results on everything. If this control is not exercised, there is a real danger that essential work will be neglected.

Inland Water Transportation

Compared with railways and roads, inland water transportation is being neglected by intelligence. This, I believe, stems largely from a natural tendency to think first of rail and road transport for military movement because of their greater speed. Moreover, railways and roads, being able to traverse natural obstacles such as mountain ranges, can link widely separated regions and provide local access in any direction. Rivers and canals cannot provide the same through access or choice of direction, and the capacity of rivers normally decreases as one proceeds upstream. Another reason for the preoccupation with rail and road transportation systems has been the relatively large reporting on them in connection with Western aid to backward countries, in which the construction or rehabilitation of these systems has loomed large.

This neglect of waterways has meant that we have acquired insufficient detail to permit a rational reconsideration of the validity of our preferential emphasis on railways and roads. The situation, in short, presents a vicious circle. The vulnerability of rail and road transportation networks, particularly around major cities and ports, to modern techniques of attack suggests that greater attention should be paid to the capabilities of waterway systems as a means of moving supplies inland. They merit at least sufficient procurement and research that their role may be more accurately assessed in those areas which have the highest priority in over-all planning.

Airfields

The basic problem of airfield intelligence is the assessment of the capabilities of a given airfield, *i.e.* to decide what aircraft can operate from it, and in what circumstances. Before this assessment can be made it is necessary to know in detail such physical characteristics of the airfield as the dimensions, surface, and weight-bearing capacity of the runways, taxi-tracks, and dispersals, the nature and disposition of supporting facilities, the location and height of obstructions to the approaches,

the altitude, and the temperature. It is necessary to know, too, the seasonal variations in some of these factors.

Except when photoreconnaissance and detailed reporting are available, it is extremely difficult to get this information with the required accuracy, and even then a full knowledge of bearing capacity is practically impossible. Detailed tests have been conducted at a negligible proportion of the airfields in which we are interested, and we are therefore compelled to base our opinions largely on a knowledge of what aircraft have operated from the fields, without any real means to assess their surplus of bearing capacity. In addition, we all too often have no knowledge of how a runway will stand up to intensive or prolonged usage, or of how its capacity will vary at different seasons.

The rated requirements of aircraft which use the field, moreover, may bear only a very indirect relation to operational requirements. For example, both Air Ministry and USAF publications state that the MIG-17 requires only 2,640 feet to take off and clear 50 feet. Yet intelligence research shows clearly that the Communists, having built their runways for these aircraft to an original length of 6,560 feet, subsequently lengthened them to at least 7,200. For the MIG-19 the technical handbooks give a requirement of 2,240 (RAF) and 3,000 feet (US), whereas research indicates that the Communists are lengthening some runways for these aircraft from 7,200 feet to at least 8,200. There is thus a wide margin between the minimum length of take-off run and the length of the runway itself.

There is no easy solution, but I feel that considerable improvement would be achieved if our respective air forces and airfield intelligence could reach some agreement on the total lengths of runway from which enemy or friendly forces would be prepared to conduct both sustained and limited occasional operations. If lists could be agreed, showing on a country-by-country basis the full runway requirements for the operation of various aircraft likely to be used by that country, then the airfield intelligence branches would at least have a basis for their assessments and could write with far greater unanimity than at present.

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Climate

Climate of course affects most other aspects of geographic intelligence, but some applications of its study in modern warfare may not yet be generally appreciated. For example a full knowledge of *local* wind variations is necessary for the study of the movement of radioactive fallout from nuclear explosions. Important as this is in strategic nuclear attack, it is even more so in tactical applications, when friendly forces are relatively close to the point of impact or may have to advance towards it. The same principle applies to chemical or bacteriological warfare. The study of local temperature inversions and local rains will also be very important should gases be used by either side in a future war.

You will note my repetition of the word "local." Intelligence is on the whole fairly well provided with generalized data on climate, normally based on long periods of observation, which gives a reasonably accurate basis for regional appreciations. What is lacking—and I suggest it is the main deficiency in this branch of geographic intelligence—is information on local peculiarities or variations within the broad regional pattern.

Mapping

The need for accuracy in mapping has always been important, but today this need is greater than ever before. Whereas minor inaccuracies can reasonably be corrected by visual observation in conventional air operations, the concept of guided-missile warfare highlights problems which have hitherto been only marginal. One of the greatest limitations to ICBM accuracy is the present inadequacy of intercontinental geodetic survey. The use of any guided missile which is not equipped with some terminal-guidance system requires precise knowledge of the relation between launching point and objective, and though some margin of error may be allowed where area damage is acceptable, no such margin is permissible if it is desired to hit a single objective with the minimum of damage to surroundings. If a terminal-guidance system is fitted to the missile, a prerequisite is often a knowledge of the radar return from the target area. In peacetime or in the early stages of a war, when it may not be possible to acquire this

knowledge by prior reconnaissance, the only alternative is the simulation of the return by a careful analysis of maps.

Since mapping represents graphic collation of many aspects of intelligence, it is pertinent to examine briefly our role vis-a-vis that of the map-producing authorities. Procedures no doubt vary between our countries, but certain fundamental principles are valid irrespective of their detailed application. First, there must be a system for feeding our information to the map producers, and for checking their drafts. This assumes particular importance when no recent photography is available to the mappers, but even when it is, there is inevitably a time-lag between it and the map compilation, and in that interval changes may occur. A map becomes out of date all too quickly; we must at least ensure that it is as accurate as possible when issued.

Second, there must be a system for informing the mappers of inaccuracies detected after issue, and for letting them know when certain series or individual sheets have become obsolete. Many of us, noting inaccuracies on maps, have done nothing to draw attention to them because there was no routine procedure for doing so. Third—and this applies primarily to areas over which peacetime photoreconnaissance is not practicable—there must be a system whereby doubtful map details noted in everyday research are recorded, so that procurement agencies may be briefed to check them.

Fourth, there must be a system whereby mapping priorities are related to planning. This is primarily a matter for liaison between planning staffs and the mappers; the responsibility of intelligence organizations lies mainly in drawing attention to the deficiencies and inaccuracies in existing maps of the priority areas so that new editions may be put in hand.

Photography

Photography is a basic requirement in mapping, in most forms of intelligence research, and in operational planning; and any deficiencies of photography must adversely affect these activities. Of the two forms of photographic coverage, print coverage and negatives backing it up, the need for the former is well recognized, but the need for film is not so generally appreciated. Film is required to meet the demands of various sections and organizations in peacetime and in war,

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and the alternative of copying from prints, besides being slower and more costly, does not provide first-class quality, especially when, as frequently, the original prints have deteriorated through age.

It seems somewhat illogical that whereas the exchange of textual information between our agencies has been developed to a high degree, the exchange of photographic prints and film has been comparatively neglected. In addition to the direct advantages of such an exchange to peacetime intelligence research, we should not overlook its importance in those "hot" situations which occur from time to time and in the period of extreme military activity which would immediately precede the next war. At such times it is clearly a complicated and inefficient procedure to be obliged to signal from, say, Washington to Melbourne for urgently required photographs and film, and then to await their arrival "by best possible means." Once the war had started, it is reasonable to suppose that fresh photographs would become available, but in the pressure periods in the meantime we have to depend on existing holdings.

One appreciates, of course, that clauses in peacetime reconnaissance contracts may preclude the exchange of the resultant photography, but this restriction applies to a very small proportion of overall available holdings and does not invalidate my thesis that much more could, and should, be done in the matter of exchange. A plan has been started for comparing the print and film holdings of the United Kingdom, RAF/FEAF (Singapore), and JIB (Melbourne), and it has been agreed that the respective deficiencies revealed should be made good as quickly as possible. But, as far as I am aware, the survey has not yet been extended to the United States, and it would seem that such an extension would be of mutual benefit to all our agencies.

Geographic Names

Much painstaking work has been done by the U.S. Board on Geographic Names and the U.K. Permanent Committee on Geographical Names towards the standardization of place names and generic terms, and this has been of particular value where transliteration from a non-roman to a romanized form is required. Difficulties are still encountered by the in-

telligence community, however, in applying the authorities' decisions.

The main difficulty arises from the fact that the decisions, being based on academic principles, are sometimes ahead of popular usage, and in such cases the "preferred" (or decision) name tends to make the text less readily intelligible to the non-specialist reader. In current intelligence reporting, it is desirable to use a style which permits the easiest comprehension by a wide range of usually high-level generalists; any irritant which interrupts their concentration on the subject matter is undesirable, and might even result in failure to appreciate the importance of the intelligence. A few examples of what I term irritating preferred names are Krung Thep (Bangkok), Kuang-chou (Canton), Chin-men Tao (Quemoy Island), Sulawesi (Celebes), Shen-yang (Mukden) and Hsia-men Tao (Amoy Island); there are many others which, being less common, are perhaps all the more irritating when they are encountered.

The problem is complicated by the fact that some of these preferred names may, in course of time, become more commonly accepted in daily usage throughout the world. This raises the question whether we are to concentrate on ease of comprehension at the present time or should tolerate irritating names with the object of gradually educating ourselves and our readers to accept the academic decisions. The decisions of the two boards are progressively being incorporated in new map series, and therefore confusion is likely to arise in basic or long-term reporting if we do not adhere rigidly to them. One can imagine, for example, the frustration of a commander in the field when he realizes that he has the task of reconciling the "preferred" names used on his basic maps and the "conventional" names used in a detailed study of the region's topography.

Another aspect of the decisions which brings complications is the retention of many indigenous generic terms for such topographical features as capes, rivers, islands, mountains and lakes. The topography of foreign lands is sufficiently difficult for generalists to comprehend without the added difficulty caused by the use of these terms, and there would appear to be a strong case for the substitution of English-language equivalents. Although we, the peacetime elite of allied

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intelligence activities, can perhaps overcome the difficulties by acquiring familiarity with new terms, the problem would assume increased significance in wartime, when a large body of untrained recruits would be unfamiliar with our nomenclature.

Air Targeting

While the production of air targets material is primarily a Service responsibility, the intelligence organizations must provide the basic information required and play an important part in writing the appreciations on which the priority of target systems and individual targets are based. It is therefore relevant to examine whether we are devoting our resources to any non-vital aspects of targeting, or on the other hand are neglecting others of importance.

Let us look first at strategic targeting. In World War II the basic documents for operations were detailed information sheets and annotated photographs of individual targets, and similar, usually more generalized, graphics on important concentrations of targets. These were necessary for attacks by manned aircraft, since visual recognition of the target and of the selected detailed aiming point within it played a major part in such attacks. With the concept of nuclear and guided-missile strategic attack, it should be examined whether it is still necessary to devote a major part of our targeting activity to detailed graphics on individual targets; in view of the area damage attainable by modern weapons, should a greater proportion of effort be devoted to urban and industrial complexes?

There is probably no aspect of aerial warfare on which more has been written than target selection. It is fairly easy to be wise after the event, as we have seen from the spate of criticisms of allied bombing policy published since World War II. It is very difficult to be equally wise before the event, and to be sure that the golden rule of targeting is observed—hit the enemy where it hurts him most. In a future war, because of the striking power of weapons likely to be held by both sides, it is more than ever essential that target selection be right, and from the very beginning of hostilities. There may be no opportunity to experiment with priorities as in the last war. We in intelligence have, therefore, a responsibility to

ensure that our recommendations in this field are based on sound principles.

The discharge of this responsibility is rendered more difficult, in my opinion, by the lack of any sound system for assessing the relative priority of complexes as targets. This is quite a different task from assessing the priority of a single installation relative to others of like function. One complex may, for example, contain a transportation target of major importance to the country's war potential, a steel plant and oil refinery of medium importance, and so on. How can the priority of this complex be determined in relation to that of other complexes which contain various other combinations of installations, each with their own relative importance within their functional systems? This is too critical a matter to be left to haphazard methods, and merits some close examination.

I have long felt that the solution may lie in some sort of point system. What I have in mind is that within each country for which strategic targeting is undertaken a factor should be agreed on for each functional system (*e.g.* oil-refining, transportation, steel industry, administration), the factor being based on the characteristics of the war potential of the particular country. Then within each system a factor should be agreed on for individual installations in accordance with their various degrees of importance. A combination of the two factors would give a points value for each installation, and the sum of these values would give the total value of each complex, thus providing an indication of its relative priority for attack. It would, of course, be necessary to keep all the factors under periodic review, and to adjust them in the light of changes in the war potential of the country concerned. While this method would not be without its difficulties, it provides the basis for a positive approach to the matter and should, I suggest, be investigated.

One important aspect of graphics on complexes is a representation of the anticipated radar return from the various installations, buildings and natural features. In the absence of actual radarscope photos—and this must at present apply to vast areas which might be attacked in war—it is necessary to simulate the return, basing the simulation on an analysis of such factors as the height of buildings, their type of con-

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struction, their lay-out, the density of built-up areas, and the configuration of such features as rivers, lakes, and woods. All this information must be provided by the intelligence agencies.

I doubt whether our procurement policies take sufficient account of this requirement. Are we equipped to provide such information with the degree of detailed accuracy which is required? In respect of a country such as China, for example, I am fairly sure we are not, particularly when the constant development of existing and new centers is borne in mind. I suggest that this deficiency is worth examination, with a view to the better briefing of procurement agencies active in the field.

In World War II probably as much activity was devoted to tactical targeting as to strategic, and the allied tactical air forces played an important part in the victory. Today, the tendency to talk in terms of a short, decisive nuclear attack or at least an air offensive conducted at long range with guided missiles has given rise to a feeling that in the next war little in the way of tactical bombing will be needed. But this is not necessarily so. In some areas where our forces might be engaged it is still probable that for various reasons tactical attacks would be required, even if they did not actually predominate. Because of this, some effort directed towards the preparation of tactical target material can still be justified, but we must ensure that the effort is commensurate with the use that will be made of the material, bearing in mind that on the outbreak of war photoreconnaissance would quickly provide completely up-to-date information.

Conclusion

The field of geographic intelligence, as we have seen, is a very wide one, affecting either directly or indirectly most forms of military operations and planning. If there is any common factor in the problems I have indicated, I believe it to be this: priorities for procurement and research must be more closely related to planning requirements than they are at present, not only in respect of the degree of detail but also in respect of the areas covered. For geographic intelligence is not an end in itself; it is a means to an end—military operational efficiency.