A PREFERRED APPROACH TO THE MILITARY PHOTO INTERPRETATION OF INDUSTRIES*

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ABSTRACT

The military photo interpreter may again be forced to cope with the difficult problem of correctly and rapidly identifying and describing the more important potential targets among a wide variety of industrial installations, with which he may have only a cursory acquaintance. He should have as a particularly valuable aid a photo interpretation key to the various aspects of the geographic region which will then be the theater of operations. Within such a key should be a section presenting groups, types and variations of factory industries indigenous to or characteristic of the region.

The dichotomous type key, when found both feasible to construct and applicable to the photo images of a given region's industries, provides the military photo interpreter with optimum aid in reaching a consistently rapid and valid solution. Its use, together with selected photo illustrations and amplifying textual material, is recommended both for the speed with which it can be applied in situations where time is a vital factor, and for the ease with which it may be handled by any qualified photo interpreter whose knowledge of industry has hitherto been limited.

AMONG the most pressing needs in the over-all requirement for new photo interpretation keys is a fast, accurate means of identifying the many and varied forms of industrial installations which appear on aerial photographs throughout the world.

The term "industrial" as used here, connotes the broad grouping of "factory industries," that is, those having sufficient manpower, machinery and other material to require either special housing in factory or mill-type buildings, or special servicing and handling equipment of sufficient size and scope to appear distinctive from the surrounding urban or rural pattern when viewed from the air; installations, therefore, which by their intrinsic nature would become of immediate interest to our military strategists in time of war.

Because of their more specialized experience, as well as the wider variety of tangible aids available to them, such as photo-industrial studies, flow charts and blueprints, as well as personal inspection of domestic plants, it is assumed that most civilian analysts specializing in industry will have less occasion to use such a key than will military photo interpreters, who are frequently called upon in wartime for fast, accurate and reliable identification and analysis on which significant command decisions may be based.

A military photo interpreter's wartime training is often rapid, intensive, widely inclusive and seldom at all specialized. Industry will comprise but one of many complex fields with which he is trying to familiarize himself within a few brief weeks or months. In the field, lack of time to carefully study the photographs and to prepare his report will be the rule rather than the exception. If interest in his work once leads him to forget the inexorable passage of time, his belated information may cease to be valuable photographic intelligence.

In addition to unspecialized training and lack of both time and experience, there may be other unfavorable factors. In the Navy, for example, the highly functional nature of an aircraft carrier has often resulted in extremely limited working area for the photo interpretation officer and his assistants. Furthermore, unless a military photo interpreter is assigned to a major headquarters, his reference library may be limited to the basic handbook, supplemented perhaps with certain strictly military material, until such time as anticipation becomes reality and he is provided with a regional key to all militarily important aspects of the geographic area of immediate concern.

Forming an important section of such a regional key should be that portion of the

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study dealing with factory industries. In view of previously discussed time elements, lack of specialized training, limited reference material and space available to the potential military user, the industries section should be comprehensive yet concise; thorough, yet easily and readily applicable to any foreseeable industrial analysis problem.

It is my opinion that the dichotomous-type key, when found feasible and applicable to those particular categories and types of industries indigenous to, characteristic of, or occasionally occurring in, a selected geographic area, will provide the military photo interpreter with optimum assistance in approaching a rapid, accurate conclusion. The dichotomous key is defined as "one in which the graphic or word description assumes the form of a series of pairs of contrasting characteristics which permit progressive elimination of all but one object or condition of the group under consideration."

Because of page size limitations it will usually be most practicable to treat the ramifications of the complete key in a series of subdivisions, presented in descending order from industry as a whole to generalized branches, from branches to specific types, and from types to their subunits.

Each subsection of the key thus formed should be accompanied by a textual description and by the best available graphic illustrations at various scales of groups and types. Verticals should be supplemented with obliques, and in some instances by sketches and plans.

Scale of photography is fully as important in industrial key preparation as it is in other specialized fields of photo interpretation. Acceptable lists have been published furnishing preferred and minimum scales for recognition and analysis of many industrial types; therefore exact scale limitations will not be discussed in this paper. It is stressed however, that the effectiveness of a photo intepreter's industrial analysis will be in direct proportion to the scale, and incidentally, the reproduction quality, of the photography made available to him for study in the key.

The graphic portion should prove of especial value to a photo interpreter approaching a region hitherto unfamiliar to him, by serving both as regional indoctrinative material, as a training aid and as a guide to actual field photo interpretation when used in direct conjunction with the dichotomous keys themselves.

In preparing a valid key to industries of a given region, thorough preliminary search should be made for good examples of all types, whether their occurrence be common or rare. In the absence of adequate photography, examples of analogous industries of other areas must perforce be shown. Relative military significance is a secondary consideration in the search phase, as good examples of nonmilitary industries will be necessary for eliminative purposes.

In theory, every example used should be positively identified and the identification verified; should positive identification prove impossible, reasonable doubt must then be shown by use of qualifying adjectives such as "possible" and "probable" in order to diminish the possibility of error within the key. One erroneous conclusion, if applied to an important industry in the theater of war, would tend to discredit the entire presentation.

Analysis normally should follow initial research. Types identified should be grouped together, their characteristic features noted, necessary measurements made and conclusions drawn from those measurements as to preferred terminology in order to refine such vague descriptive terms as "small area," "fairly broad buildings" or "medium-sized storage tanks." Component parts within a given industry should be studied and analyzed, and exceptional forms and deviations from the common pattern carefully studied.

A suggested method of analysis is to compile in columnar form a comprehensive list of major and minor recognition features such as distillation towers, basic raw material piles, conveyor belts, dust-catchers, scrubbers, silos, rail spurs, monitor roofs, overhead travelling cranes, visible gas mains and the like; then to check each listed regional industry for presence or absence of each of these features, adding any additional components not included in the list.

In some instances completely unique features will provide ultimate identification in keying out an industry; for example, a drydock will always indicate a capacity for shipbuilding or repair; a battery of vertical "hot-stoves" combined with a blast furnace, the iron industry;

characteristic engine test-block cells, aircraft engine construction or maintenance. More often a combination of features must be used. In some countries a flour mill and a nearby cement works may each have visible built-in storage silos; hence in addition to this feature other characteristics of both plants must be used, among them, building characteristics and site location. Limestone and its quarry source will not be observed at the flour mill, neither will a visible or housed rotary kiln. The flour mill however, will probably contain a central, elevator-type building several times taller than any structure at the cement works. It is fully conceivable that the area might contain another type of industry having some structures similar to those of either the cement plant or the flour mill, yet lacking the silos and containing some minor recognition features of its own, alien to either flour or cement manufacture.

From such analysis will evolve the dichotomous key, starting with the basic concept of factory industry, dividing through the presence or absence of characteristic general features into broad groups, such as Chemical Production or Fabrication and Assembly, further dividing within these groups into specific types such as the coke industry, synthetic rubber plants or railroad car manufacturing, and conceivably into smaller final components such as newsprint (as a component within the paper industry) or trucks, as a unit of automobile manufacturing.

Although certain relatively easily-recognizable heavy industries can be identified at scales as small as 1:30,000, many light fabrication and assembly plants are so similar in their external appearance that the analyst constructing a key will be forced to consolidate them in a "miscellaneous" category. Use of such a general grouping seems completely justified in view of the rapidity with which a nonmilitary peacetime industry can be converted into a producer of weapons or component parts for military use with no changes to the exterior building structures. When studying photos of such an industry the military photo interpreter, having finished his initial "keying-out" and placed the industry within the correct miscellaneous group, must rely on further comparative coverage, preferably including large scale, low altitude "dicing" obliques, and continuous-strip photography at scales of 1:3,000 or larger in hopes that a particularly timely run will discover an exposed group of identical, recognizable finished objects (for example, machine guns awaiting shipment) and so permit final identification of the industry concerned.

The various potentials, especially military, of any miscellaneous group, should be explained in the text accompanying that particular section of the key.

In summation, the need is again stressed for satisfactory keys to the industries of those various regions of the world which might conceivably become theaters of wartime operations. Such keys should be designed to be of particular adaptability to the requirements of the military photo interpreter in the field, as his will be the first eyes to scan aerial photography of such industries, and his report will therefore present the first opinion expressed as to their identity.

Although it is widely recognized that there is no substitute for personal experience in industrial photo interpretation, it is believed that a dichotomous key prepared by the methods discussed, when applied together with its accompanying textual and graphic reference material, will provide such a military photo interpreter with optimum aid in reaching a rapid, valid solution to photo interpretation problems of an industrial nature.

Discussion of Mr. Bigelow's Paper

QUESTION: Is this key also to be made available to camouflage officers?

MR. BIGELOW: I believe that it should be made available to them, if they are using photography in their work, and I understand they are. I think it might be useful to them. I have seen quite a few examples of camouflage in my work.

DR. ROSCOE: I am reminded of a system once used by the Navy Interpretation School. The early classes in World War II spent six weeks going over all the major industries. Then for the final examination, they were given a very important looking industry on a river. The students came up with all kinds of answers and were much chagrined to find out that it was the Scott tissue plant. It is important to be able to recognize the industries which are not perhaps the most vital to an economy, as well as to recognize those which are.

MR. BIGELOW: The hardest part in industrial interpretation is to tell what is happening inside the building. In New England, for example, there are many large, old-fashioned textile mills that have gone out of business and have been taken over by a number of smaller companies which may be manufacturing anything from collar buttons to shoe horns; there is frequently no way of telling the kind of business unless one can actually read the signs on the outside.

CONSIDERATIONS IN THE PREPARATION OF KEYS TO NATURAL VEGETATION*

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ABSTRACT

Photo interpretation keys to natural vegetation are discussed in terms of objectives and manner of presentation. It is pointed out that keys should be constructed for a specific purpose, and the advantage of subdividing an area into regions is discussed. Several keys are reviewed from the standpoint of presentation. The problem of terminology and consideration of the reproduction process are also presented.

A DISCUSSION of considerations entering into keys to natural vegetation inevitably covers problems common to keys in general. A key to aircraft and a key to tree species of Maryland involve many common problems. In this paper we will attempt to relate these considerations to natural vegetation and to emphasize those of special importance in this field.

The preparation of photo interpretation keys involves two major groups of considerations. First, there are those related to the *purpose of the key:* what are its objectives? Second, there are those related to the *presentation of the key:* how can its objectives best be fulfilled?

PURPOSE

Purpose of a key involves consideration of *what*, *where* and *who*. What vegetation species or species groups will the key recognize, where will the key be applicable, and who, in terms of training and experience, will use it?

Natural vegetation is one of the most complex of universes. It comprises nearly 250,000 species, most of which are identifiable only after close, detailed examination. Limiting this universe to trees of the United States we find about 845 species. The range in shapes of vegetation species is infinite, and heights may vary from less than an inch to more than three hundred feet, depending on species, age and growing conditions. Distribution is also a complicating factor, varying from patches of a single species to areas wherein dozens of species are thoroughly intermingled.

Although *natural vegetation* comprises a broad and complicated universe, *certain characteristics facilitate its analysis* on aerial photographs. Because of its demands for sunlight and growing space, most vegetation is exposed to aerial view and consequently can be photographed with the aerial camera. Even seaweed may be sufficiently exposed for photographic inventory as described by Cameron (1950). The components of natural vegetation, whether considered as individual species or as plant associations, are more or less consistent in their physical appearance and site requirements, thus providing features and clues useful for their recognition on aerial photographs.

Since a key is never an end in itself but is merely a training or reference tool to be used on a particular job, it should be constructed to *illustrate the specific information* required for that job. It is seldom necessary, and usually would be impractical, to identify all species in a given area; therefore the interest of an individual investigator generally is limited to certain species or groups of species. For example, a forester is primarily concerned with

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