

Survey. Dr. Nolan is a geologist by training and background, but such are his administrative abilities that he now has over-all direction of the numerous and important mapping activities of the U. S. Geological Survey. I have great pleasure in introducing Dr. Nolan.

DR. THOMAS NOLAN: Mr. Chairman, Ladies and Gentlemen: Dr. Wrather, I am sure, is most unhappy not to be present to talk to you today. I think I can say that with full confidence because I know the very deep and very great interest that he has in mapping activities and the Survey and his hopes for them in the future.

It is generally known that vast sums of money and effort have been expended during the war on mapping. It is also known that this tremendous program was seriously retarded, in the early stages, because of the lack of adequately trained personnel and the nonavailability of proper equipment and because research and development in the field of photogrammetry and mapping had been somewhat neglected in this country. In spite of these handicaps, much has been accomplished through joint and coordinated efforts of the military organizations, the federal mapping bureaus, and the commercial companies engaged in aerial photography and photogrammetry. The Geological Survey has made every effort to contribute its full share to this war program in research, development and production, but in so doing has greatly retarded its own domestic mapping program.

Since 1879 the Survey has been engaged in topographic surveying and mapping and has long been recognized as the principal mapping agency of the Federal Government. The magnitude of operations has, of course, been determined by the amount of state and federal funds appropriated. Years ago, speed was the prime requisite; in recent times, however, accuracy has become more important; consequently, the publication scale and the unit costs have both become much larger than they were originally.

During the years that followed World War I, several attempts were made to inaugurate a long-range federal mapping program. The Temple Act was passed by Congress in 1925 and called for an initial appropriation of approximately one million dollars to be increased yearly until the United States was completely mapped. Although the Act was approved in principle, the necessary funds were not provided. Deeply concerned with the bogging down of the mapping program, the principal map-using agencies of the Federal Government in 1934 appealed to the National Resources Committee to support a national map-making program. This committee in turn requested the Federal Board of Surveys and Maps to submit a plan by which the mapping of the United States could be speeded up. The plan submitted called for a ten-year program at a total cost of \$117,000,000, and provided for control surveys by the Coast and Geodetic Survey and topographic mapping by the Geological Survey. However, direct appropriations of federal funds for 1935 was less than \$200,000 for topographic mapping or about the same amount provided by the Congress in 1885. The average for the past ten years has been approximately \$1,000,000 a year. Total funds appropriated by Congress to the Geological Survey for topographic mapping from 1880 to 1946, inclusive, amount to \$30,000,000, or an average of about \$450,000 a year. In terms of money or any other yardstick, our National investment in mapping has been entirely inadequate to meet the minimum requirements of our map-using agencies, the Armed Forces, or the public.

The failure to provide for the further implementation of the Temple Act twenty years ago, or even ten years ago, resulted in a shocking lack of maps

necessary to plan for the defense of this Nation against invasion when the war started. It was, therefore, necessary at that time to produce maps as rapidly as possible for military use by utilizing the aid of all available federal agencies. Since trained technical personnel did not exist in sufficient numbers, and modern equipment was not available, many of the maps prepared as a part of this emergency program are sub-standard. We shall eventually have to remap many of the areas mapped during this period. It is inconceivable that we shall ever permit a recurrence of this deplorable situation with its inevitable waste of public funds. Intelligent planning on a National scope for both civilian and military considerations requires good topographic maps; and the realities demand a long-range program to accomplish this objective.

The Geological Survey is fully aware that the war revitalized an active interest in all mapping and has for many months been preparing the ground work for a greatly expanded postwar mapping program. Detailed plans have been made and are now being carried out to reorganize the Topographic Branch in order to insure greater efficiency in both planning and operations. Its technical personnel, skilled in modern map-making methods, is not the product of an emergency war program, but the result of more than 60 years of actual experience in topographic mapping through various stages of development from the mule-back traverses of the 1880's to modern aerial photogrammetry. Its equipment, developed slowly throughout the years, has been service tested under all conditions in an honest effort to produce better maps at lower cost. This personnel and this equipment can be used to train the hundreds of young men and women who will be required to implement a substantial postwar program of topographic mapping.

This domestic topographic mapping program of the Survey provides for work in the 48 states of the Union, Alaska, Hawaii, Puerto Rico, and the Virgin Islands, a total area of 3,618,809 square miles, of which 1,649,844 have been mapped on various scales. A considerable amount of the older mapping, however, is on a small scale and of reconnaissance quality; such maps are quite obsolete. Another large group are on intermediate scales and can be made serviceable by cultural revision.

You may be interested in some of the plans and policies that have been formulated to guide us in carrying out this program that we hope to undertake. New mapping will be done by photogrammetry or plane table, or a combination of both, on scales ranging from 1:24,000 to 1:250,000 with the larger scales covering areas of immediate economic importance, and the small-scale reconnaissance mapping limited to Alaska. The requirements and specifications for these maps will be coordinated with the map-using agencies and the states in an effort to provide maximum utility and to prevent needless duplication. Special-purpose mapping for limited use will not be encouraged, since the over-all national interest must be our primary objective. To meet more immediate demands, depending to some extent on both requirements and terrain, photogrammetric base maps and mosaics should be prepared on various scales. For general utility and wide public use, some, and perhaps if the innovation is popular, the majority of topographic quadrangles will be prepared with shaded relief as a result of new techniques developed by the Survey during the war. The present force of about 650 trained topographers, and photogrammetrists will be augmented by the reinstatement of Survey personnel now serving in the Armed Forces and by the recruitment of a large number of additional technicians. Included in this group will be topographers, photogrammetrists, cartographers, geodetic engineers and radar technicians. Indications are that many

of these people, both men and women, can be recruited from the service veterans who have had some training during the war in mapping and related fields. Training programs will be enlarged to provide both elementary and advanced courses covering all phases of surveying and mapping. The work of the Section of Photomapping of the Survey, originally set up in 1921, will be greatly enlarged and special emphasis will be placed on research and the development of new photogrammetric techniques and equipment. Maximum use in production will be made of multiplex, aerocartograph and other plotting devices now in use by the Survey, and at the same time, new instruments will be service tested with the hope that new photogrammetric developments will produce better and more accurate topographic maps at all scales, faster and cheaper.

In order to take full advantage of local conditions, our planned program contemplates that the present policy of decentralized field operations will be continued. The three principal divisions of the Topographic Branch (The Atlantic, Central, and Pacific) must be provided with permanent quarters and equipped with the most up-to-date mapping and photogrammetric instruments. In addition, temporary local project offices will be set up in each of the three divisions to facilitate and expedite local operations. Under the proposed program it will be possible to maintain much closer relations with state officials, with map-using agencies in the field, and with the general public.

One of the major projects of the postwar program calls for the revision of existing quadrangles through the full use of photogrammetry. In most cases cultural revision alone will be sufficient to bring up to date hundreds of quadrangles now considered obsolete. This program for both large and small-scale sheets will require new photographic coverage. Revision work can be handled expeditiously by use of some of the simpler and less complicated techniques of photogrammetry. It will also provide immediate employment for personnel who have not had the advantage of advanced training in some of the more complicated photogrammetric methods. I might diverge here to express a personal opinion. This phase of our program, calling for a considerable amount of revision, is to my mind one of the most important features in that program. I think the country and the Survey have both suffered from the large number of out-of-date maps that we have continued to distribute to an unsuspecting public.

Projected plans also call for a continuation of the trimetrogon compilation program to provide reconnaissance maps and charts for the Army Air Forces Aeronautical Chart Service. This method, which applies the basic principles of photogrammetry to the problem of rapid small-scale mapping, was developed by the Geological Survey to meet the urgent requirements of the Army Air Forces for terrain information of the vast unmapped areas of the world for which no adequate maps or charts were available. With the production capacity of more than a million square miles per year, this Survey unit will continue to improve its original methods and will operate as long as there is a demand for this type of photogrammetry.

These are our plans: to carry them out will first of all require that funds be made available for the work. At the present time we feel justified in assuming that the Congress will support this long-delayed program so vital to the National interest. It is gratifying to record the fact that the Bureau of the Budget views these plans sympathetically and has recommended, both for the current fiscal year and for the next one, markedly increased appropriations. The successful accomplishment of this job will also depend on the cooperation of other Federal Agencies engaged in related work, on the manufacture of our surveying

and photogrammetric equipment, and on commercial firms engaged in aerial photography.

The American Society of Photogrammetry has an active interest in this program. Its membership includes the men and women who will have the responsibility for doing the job. Their interest promises progressive improvement in the technique of photogrammetry, which means progressively better maps.

PRESIDENT MILLER: Thank you, Dr. Nolan.

Our next speaker will be Brigadier General Dwight F. Johns. He is Assistant Chief of Engineers and is the Director of Military Operations in the Office of the Chief of Engineers of the Army, in Washington. During a long career of service as an engineer and officer he has had frequent contact with the problems of mapping, but never more intimately than now, since he is responsible for the Corps of Engineers' activities in connection with both domestic and foreign postwar mapping. I have great pleasure in introducing Brigadier General Dwight F. Johns.

GENERAL DWIGHT F. JOHNS: Mr. Chairman, Ladies and Gentlemen of the American Society of Photogrammetry: I should like to say that General Wheeler, the Chief of Engineers, regretted very much that he was unable, by reason of a previous engagement, to appear and talk to you at this meeting today, and it was therefore necessary for him to designate me as a substitute. He knows of your work, he is very much interested in your work, he realizes the importance of your work to his job and to our job in the Army, and he would have liked very much to be with you today.

It gives me great pleasure to speak to you at this time and on this subject. I believe that the United States is starting an era of intense mapping activity. The American public in the past has shown far too little interest in maps and mapping. It is evident that the war has improved that situation a great deal. The accomplishment of any mapping program depends on the backing of the public at large as well as the technical mapping personnel. Without that strong backing of the public, we cannot hope to become well equipped with map information for defensive purposes or any other purposes. It is a job for all of us, therefore, to foster the interest in maps and to make and keep the American people map-conscious.

Although the literacy of the American people is among the highest in the world, I believe their use and knowledge of maps is among the lowest. Part of this is due to the lack of map information available to the public. For example, in most of the European countries, large-scale maps of the territory surrounding a town can be purchased at the local bookstore. It is true that the European people spend much more time walking and cycling, requiring large-scale maps, while the American public enjoys its leisure hours in an automobile, using the conventional road map. All of us, I am sure, are well aware of the lack of map information in the United States and its possessions, but are the American people equally aware of that situation? We must all be disciples for the furtherance of mapping. I suggest that that be one of the aims of your excellent Society. I presume it is.

As background for this general plea in the interest of improving our mapping effort, I should like to interject here the thought that my viewpoint is born from considerable personal experience in mapping. My first responsible contact with the mapping game was twenty years ago when it was my good fortune to have the job of directing the military survey of Panama for three successive working seasons. It was through that that I first became conscious of the great possibilities of the aerial photograph in mapping. With the developments in