

XIV. *Conclusions.*

We may therefore conclude that although much yet remains to be done to develop the materiel employed in the photogrammetric operations, we now have in existence an adequate force of trained technicians properly supplied with usable tools, together capable of doing much useful work. We face the first faint stirrings of a possible awakening of this nation to its domestic and foreign mapping needs. We must work in complete harmony to a common end lest those stirrings lapse again into the sleep of the former complete indifference or result in ill considered, restrictive legislation actually harmful both to the science of photogrammetry and the mapping results desired by all of us. The job in the immediate future is immense. The tasks to be performed by each individual agency within the field of its statutory and customary specialities are more than sufficient to occupy fully all the efforts that that agency can bring to bear. In short, the map and map-related needs of this nation are so great that there is more than enough work for every federal mapping agency within the proper field of its activities. There remains, then, the necessity for achieving concert in awakening the nation to its needs and in continuing coordination of effort in achieving the results to supply those needs.

To provide maps for the military efforts of this nation during the war, both governmental agencies and private firms participated in the finest conceivable example of whole-souled cooperation between individuals and between agencies. I speak for the continuation of these personal and official attitudes so that twenty years hence we may look back on the post war period with the same deep satisfaction as we do when we view the past emergency, with mutual felicitation and admiration for the efficient planning, organization, and accomplishments of each of us who were concerned. I thank you.

PRESIDENT MILLER: Thank you very much, Colonel Matthews, for an extremely interesting talk. I am sure there will be people who will want to ask some questions of Colonel Matthews. Are there any questions? That shows that Colonel Matthews covered the ground pretty thoroughly. We are keeping on schedule pretty well.

Our next speaker is Mr. Guillermo Medina, Head Engineer of the Hydrographic Office of the United States Navy. To members of this society of more than two or three years' standing, Mr. Medina needs no introduction whatsoever. Mr. Medina was President of this Society in 1941, and he has always shown and taken a most active part in the affairs of the Society. It was due to his foresight and initiative that the Society of Photogrammetry came into existence. During the war period Mr. Medina has not been able to take as active a part in the affairs of the Society as we would have liked. The reason for that is that his war responsibilities have been very great, indeed. I need say no more than this: He was in full charge of all chart production for the Navy. I have a great privilege in introducing Mr. Medina.

MR. GUILLERMO MEDINA: Members and Guests of the American Society of Photogrammetry: At no time in our history have the American people been as map conscious as in the past four years. It is no secret that, until recently, we have shown but little interest in the matter of having adequate map coverage for our country, a coverage which is absolutely essential not only for the efficient and maximum development of our natural resources and the conservation of our land, but equally as important for our national security.

As the clouds of war grew more threatening, the same state of unpreparedness existed with regard to the availability to us of adequate map coverage of

other nations. We became cognizant of our deficiency in this respect shortly after it became apparent that only a miracle would prevent our involvement in another world conflict.

It is, therefore, a tribute to the mapping agencies of the government that, having started practically from scratch, a maximum of production was achieved in record time to provide our fighting forces with the charts and maps without which total victory would not have been achieved.

The Navy was no exception to the prevalent map inadequacy. We needed better nautical and aeronautical chart coverage for the world. Yet, despite the fact that the Hydrographic Office had to increase its output more than forty times practically over night, we too feel somewhat proud of our accomplishment.

Although maps are the cheapest commodity and form of insurance any nation can have, they do cost money to produce. Until now every mapping agency in the nation has been living a hand to mouth existence despite the earnest pleas of those in charge. Funds allotted for this purpose have always been totally inadequate. Although we are the most insurance-minded people in the world, when it comes to map insurance we have been content to buy the cheapest type of policy. We can expect returns only in direct proportion to the funds that we invest. That so much has been done with so little is a tribute to the loyalty, determination and efficiency of the map makers in America.

Leaving aside the peace time necessity for good charts and maps, which I am sure all of us concede to be true, let us, in broad terms, enumerate their importance in war—

First, they are essential for planning and carrying out offensive and defensive operations by land, sea and air;

Second, they are essential for the transportation of troops and material by land, sea and air;

Third, they are essential for study of the enemies' resources and in determining their vulnerability, and;

Fourth, they are essential in winning the peace, both at home and abroad.

With respect to the first point just mentioned, our strategists, as well as those who put their plans into action at Guadalcanal, in the invasion of Africa, at Tarawa, Bougainville, throughout the Solomons, New Guinea, and nearly all the other stepping stones in the early brilliant campaigns that paved the way to victory, had to be content, for part of the time, with either obsolete maps or charts, or with some substitute totally inadequate for modern warfare. It is needless to again remind this audience of the woeful inadequacy of charts and maps in the South Pacific at the time our forces were fighting desperately to stop further Japanese expansion and aggression. Obviously aerial photography offered the only means of rapidly obtaining map substitutes. It must be regretfully stated that the Navy, at that time, was wholly unprepared to render this service when so urgently required.

That despite this severe handicap our Arms were able to win every battle is an additional credit to their brilliance, their temerity and their belief and trust in every man under their command. Also to the fact that besides good fighting equipment, we had two fine weapons at our command—the aerial camera and radar. Although we won in every case we paid a heavier price than should have been, if long ago we had adopted a more enlightened policy towards the value of surveying and mapping.

I just mentioned that the aerial photographic camera and radar were able to

partially substitute for the sad deficiency in the maps and charts for many of the areas in which we had to fight. In war however, the aerial camera should be used for intelligence and photo-revision purposes and not for basic mapping. Basic mapping should be done in peace time, not when manpower is at a premium. When it is done beforehand instead of under the pressure of war, such work is done at less cost, more efficiently and totally eliminates duplication of effort. Radar, to achieve maximum utilization, must be used with maps or charts of unquestionable accuracy, not relegated to the role of searching for map errors. Such errors in maps cost lives and equipment which may well be the margin between victory and defeat.

In outlining briefly our Navy's accomplishments in photogrammetry during the war, I wish to stress that their achievement is more remarkable due to the fact that, although we were totally unprepared in this most important adjunct to modern warfare, we trained a corps of experts in aerial photography, photo-reconnaissance, photo-interpretation and charting in the field, and in our home offices whose work played a major part in the conduct of every campaign waged in the field.

Few of us, before the war, had ever heard of military photographic interpretation which is the science of extracting intelligence data from factual evidence contained in reconnaissance photographs of enemy installations, and the presentation of these data in a coherent, practical and readily understandable form. The Germans had tried and found its application effective. The British had likewise, especially after Dunkirk when their channels were closed to the normal flow of intelligence from agents on the continent. Trial proved the camera to reveal a great deal more information than an aerial observer who was only over a pin-pointed land area for a fleeting instant. The intelligence potentialities of aerial photography were at last being recognized.

I believe that all of you are familiar with the work of Lieutenant, now Captain Quackenbush of the United States Navy. His was the job of the pioneer, for after studying the photo-reconnaissance and interpretation techniques developed by the British, to him and other brother officers of the Navy and Marine Corps fell the difficult task of organizing a school to train men for the United States Navy in this specialized requisite of modern warfare. It is a credit to their vision and leadership that from such a small beginning a permanent school developed whose graduates earned the respect and admiration of the entire Fleet. All of our top men in the Army, Navy and Air Forces learned to realize the value of aerial photography and photo-interpretation in war and used them to the fullest advantage in every campaign.

One of the first problems to confront the school's staff was the selection of personnel. It was agreed that young men between the ages of 21 and 29 with degrees from accredited colleges or universities and having a specialized knowledge of architecture, geology, engineering, or any other similar and closely related field would make the best candidates. Only a small percentage of those commissioned had ever had any training in photogrammetry, a condition reflecting the lack of interest in this recognized method of surveying and mapping on the part of our engineering schools. With but a few outstanding exceptions, engineering colleges and universities throughout the land have failed to realize the wide applications of photogrammetry and the dire need for at least teaching the fundamentals of this science even as part of a surveying course. Due to the impetus given photogrammetry by the war, it appears likely that this science may now be accorded its deserved recognition in an increasing number of schools.

At the first glance it might seem strange to place knowledge of architecture, geology or engineering ahead of photographic experience; yet on reflection the reasons are obvious. Since photo-interpretation would have to be done from air photographs, the men needed were those with plan-view training that would help them to recognize objects from above. We wanted men who would, by their professional training and general background, be able to differentiate between man and nature's handiwork, men who would be capable of working against time deadlines, under the most difficult of conditions, and above all, men who knew the spirit of good team play.

I desire to stress time and again that there is no science which calls for more team play and coordination of effort than photogrammetry. From the time an aerial photographic operation is planned, through its execution to the final phase, every participant in this complex process has to strive for the best and be mindful of the final end product—whether that product be a detailed map, a study of enemy defenses or the all-important data required for an assault. Team play in photographic operations in time of war is doubly important for weather has to be used to the fullest advantage.

Teaching procedures, texts, working material and photographs were patterned after British techniques due to lack of any other comparative medium. As rapidly as possible emphasis in training for the Pacific theatre was adopted with the idea of familiarizing the student officer with detailed knowledge of Japanese installations, coupled with the conditions and problems that they would encounter when later assigned to duty in the Pacific.

The first graduates of the Navy Photographic Interpretation School were assigned to aircraft carriers and to patrol wing squadrons. Proof of their need and immediate recognition of the ability of these first emissaries on photo-interpretation was shown by an increase of the original quota of 150 for the school and urgent requests for graduates. That a total of 831 officers completed the basic course indicates a "must" in the planning and execution of operations against the enemy.

Early in 1943 an informal photographic interpretation unit was organized as an adjunct to the school to do strategic photographic intelligence work heretofore performed by the school staff. Though informal as this unit was, it became the only naval unit within the United States where strategic photographic interpretation reports were made from flash reports and tactical reports received from the field. This unit, coupled with the Photographic Intelligence School, was called the Photographic Intelligence Center, or P.I.C.

Within six months the unit had expanded its scope so as to make special publications available to the school and to interpreters in the field. The U. S. Navy Photographic Interpretation Handbook was one of its first publications.

Research was carried on in numerous branches and phases of photographic interpretation. Amphibious operation demanded that research be made of beach studies and underwater depth determination. Publications were prepared and made available to all photo interpreters and to other intelligence organizations. These increased the photo-interpreters' ability to know and to accurately report the enemy's installations and capabilities.

In addition to research the Photographic Intelligence Center prepared special studies for other military organizations in Washington, such as terrain and defense analysis of potential invasion beaches for the Joint Topographic Subcommittee of the Joint Chiefs of Staff. Officers were detailed to evaluate and select photography and photographic intelligence material for the Navy Department in general.

About the same time the Photo Interpretation Section of the Intelligence Center, Pacific, commonly known as PRISIC, was established. All naval photography in the Pacific Area was channeled through this organization which also served as a personnel pool and as an additional training ground for P.I. officers.

Another unit was formed and assigned to the Advanced Intelligence Center, North Pacific Area. This unit originally established at Kodiak, Alaska, later moved to Adak in the Aleutians and furnished the military intelligence for the Attu and Kiska invasions and the surface and aerial bombardments of the Northern Kuriles.

Another unit was established and dispatched to the Commander of the South Pacific Area. This unit was part of an organization known as Photo Group ONE. This group, comprised of two squadrons—one for photography and the other for interpretation—had the completeness, mobility and self-sustaining qualities which characterized Navy compositions during the war. Interpron ONE had its headquarters at Guadalcanal from where photo-intelligence material was furnished from the early Solomon Islands Campaigns up to and including the invasions of the Palau Island Group in the summer of 1944.

After the invasion of the Marianas it was moved from its base at Eniwetok to Guam where its personnel furnished military intelligence material for the invasions in the Bonin and Nansei Groups, and in the final phase of the Pacific War for the aerial and surface strikes against the Japanese mainland.

In describing the value of photo intelligence and mapping from aerial photographs, I wish to stress the work of the intrepid personnel of our special Navy and Marine Corps photographic squadrons and our fighter photographic reconnaissance planes operating from carriers where men risked, and many gave their lives, to bring back the data that made it possible to reveal and then destroy the enemy's installations and war potentialities throughout the Pacific.

The carriers, by virtue of the operational tactics employed, found themselves in virgin photographic territory on many occasions. As an example of how carrier reconnaissance was carried on, it should be pointed out that their planes accomplished the initial photography on Okinawa in October 1944, whereas the invasion of Okinawa did not take place until March 1945. On such assignments as this in areas which had not been reached by the long range land based photo-reconnaissance planes, it was necessary for the carriers to produce the aerial photography throughout the field of requirements. In the case of Okinawa, this involved trimetrogon, high altitude large-scale single lens verticals, low altitude large-scale verticals, obliques of practically the entire Island area, dicing photography and off-shore horizontals, in addition to pin-point photographs of military installations.

As the war progressed northward toward the Empire, better maps were available, therefore, carriers were required to do less of the general reconnaissance type of photography. For the most part, requirements were confined to large scale verticals of very limited target areas such as flying fields, factories, ship-yards, harbor installations, and other pin-point military objectives. Obviously this type of photography was not intended for photogrammetric compilations, but merely for an interpretive study of definite target areas, followed by repetitious post-attack coverage for damage assessment.

Although far away from the field of battle those of us at home engaged in mapping were contributing in no small measure to every operation against our enemies. Without exception every mapping agency of the government and every commercial concern engaged in mapping or reproduction did a magnificent job. The cooperation and team play which characterized our forces in the field were similarly displayed on the home front.

Again I wish to state that all of us had a hard time to make the grade. Cartographers, photogrammetrists and technicians in this specialized field cannot be turned out in an assembly line. They have to be trained and to do their best they must love the painstaking art of creating and producing charts and maps.

I believe it appropriate at this time to quote from a recent speech of General Eisenhower, in which he brings out strongly the value of preparedness.

"Our weapons must be better on the day an enemy attacks," he said. "Our resources must be promptly available and above all—*our manpower must have already been trained.*"

"This training must be given in time of peace. The only difference now, and the great lesson of World War II, is that it must be done before, not after the first shot is fired."

Although the Hydrographic Office recognized the value of aerial photography as early as 1923 when they utilized this method in conjunction with hydrographic surveys of the island of Cuba, they had only three men engaged in photogrammetric work when war broke out. Realizing the potentialities of photogrammetry in war, additional personnel were assigned to this work as soon as the limiting personnel barriers were lifted with the result that by the summer of 1945 a total of 126 men and women were employed in the Photogrammetric Section.

The first real test of war work came in the spring of 1942 just prior to the Japanese invasions of the Aleutians. This strategic area, one of the most important outposts in our continental defense, was little known except for some areas surveyed by the Hydrographic Office between 1933 and 1935 in the Andreanoff and Rat Island groups and the area surveyed by the U. S. Coast and Geodetic Survey between Unalaska and Atka Islands. Fortunately, the Hydrographic Office had had the foresight of photographing the entire chain with five lens cameras supplemented by single lens coverage of certain areas, and in addition had obtained complete oblique photographic coverage. All of these served as the basis for constructing a series of view charts which proved of inestimable value. These charts designed by Mr. P. G. McCurdy, Chief of the Photogrammetric Section of the Hydrographic Office, earned a commendation from General H. H. Arnold, Commanding General, Army Air Forces.

In the spring of 1943 the Hydrographic Office was called upon to prepare operational charts for Sicily. Similar charts were prepared for Kiska, Bougainville, New Britain, the Admiralty Islands and certain areas in the Philippines. In August 1944 the Commander in Chief, United States Pacific Fleet and Pacific Ocean Areas called upon the Hydrographic Office to construct a series of approach and bombardment charts for use in amphibious operations in the Pacific. A minimum of 60 charts per month which were requested necessitated the curtailment of other projects and the re-assignment of a large percentage of the available force to this program. Despite the size of the Photogrammetric Section, it would have been a physical impossibility for the Hydrographic Office to handle the work without some outside assistance. Accordingly, arrangements were made with the U. S. Forest Service to perform under contract a large amount of photogrammetric work which was used jointly by the Hydrographic Office and the Army Map Service in the compilation of Amphibious charts which, as a prime requisite, had to be in complete cartographic agreement regardless of the scale or agency responsible for the work. Those prepared by the Navy were on a scale of 1:72,000 for approach and on a scale of 1:36,000 for in-shore bombardment purposes. The Army charts were on a scale of 1:25,000 and 1:50,000 especially designed for land warfare.

The Forest Service Photogrammetric Unit, located at Gettysburg, Pa., with a force ranging between 40 and 80 men, compiled in less than one year, a total of close to 10,000 square miles and in addition photo-revised 9,700 square miles from aerial photographs taken by units of the Army and Navy.

Besides these combat charts the Hydrographic Office provided complete air navigation chart coverage for the world and special aviation charts and pilots for all the strategic areas of interest to the Navy. Loran charts and tables provided the best system of long-range navigation thus far developed and played an important part in combating submarines in the Atlantic and in the long range bombing of Japan by the Army's B29's.

Our surface charts were used by every American and allied vessel that carried men, supplies and fighting equipment to our far-flung fighting forces and those of our allies deployed throughout the globe.

They were used in the planning of every operation, in every strike, in every battle, for charts as well as maps are indispensable. Throughout 115 years of its existence the Hydrographic Office of the Navy has served primarily the mariner. In this war it won the recognition of our fighting men, and of America as a whole, for a job well done.

Summarizing my very general statement of the Navy's Photogrammetric contribution in the war, several factors should be mentioned for study and consideration. These are the importance of preparedness; the fact that the age of map substitutes is past—for accurate portrayal of topographic and hydrographic features will be essential in the future in view of the advances made in waging total war. This accuracy too is demanded as a foundation for peace and in the interest of safety at sea and in the air. To accomplish this vast program of surveying and mapping, global in scope, we need governmental backing in the true sense and above all the coordination which will totally eliminate wasteful duplication of effort. In the furtherance of such a program it is essential that research work commenced during war does not die for lack of interest or appropriations. America now leads the world in this important branch of engineering. Let us strive to keep her in that commanding place by never being fully satisfied with what is at hand, but always striving for further improvements in equipment and methods. Improved cameras and photographic emulsions, more stable films and paper, oblique photography and its maximum utilization in mapping and exploration, photogrammetric equipment light and accurate enough for field operations, the use of radar and other electronic devices for aerial photographic control, the "Sonnet" camera, depth determination, photo-reconnaissance and photo-interpretation, and many other interesting developments, deserve our full recognition as well as the support from all of us to keep these accomplishments from being forgotten and becoming stagnant.

We in the Navy intend to keep them alive. A division of photogrammetric research and development is being established which will be well staffed and well equipped not only to develop new procedures but to see that they are adequately tested either at the Hydrographic Office or by VD Squadrons and units of the Fleet. The work of this division properly coordinated with that of similar organizations in the Army, and other governmental agencies and institutions of learning throughout the land, should insure that photogrammetry is here to stay for the purpose of doing a better job of mapping more efficiently and at less cost than was possible heretofore.

Time does not permit me to do justice to the outstanding contribution to Victory made by scores of U. S. Naval and Marine Corps aerial photographic or mapping activities at home and on every fighting front during the war. Ac-

counts of their organization, operational methods and individual contributions should be made the subject of separate papers as only in this manner will we be able to fully realize how much was done, how many obstacles had to be overcome, how little prepared we were to wage a global war and thus to profit by their experience.

The future is in our hands. We have a moral responsibility, as experts in a field which is basic to all human progress, to enlighten Americans on the value of mapping as the first step to our continued material growth and as the best safeguard to our heritage. As in everything, we have to start with fundamentals by a more enlightened approach to the teaching of geography in our schools and universities. A proper understanding and love of geography are the foundation of real friendship among nations and the spark that foments international trade. It paves the way to a fuller realization of the value of maps in general and a sounder understanding of the problem when appropriations for expenditures come for justification.

The mapping job that America has to do is worldwide in scope. Let us convert the war time map substitute which contributed so much to final Victory into a real monument of strength which will be a credit to America and to the principles for which we fought and won.

PRESIDENT MILLER: Thank you very much, Mr. Medina. If there are any questions to be asked, we have a few minutes left, and we will still be keeping up to schedule.

Ladies and gentlemen, I think we should adjourn. Very soon it will be eleven-thirty, which is the time we had planned to adjourn. Might I ask every body to try to be back promptly at one o'clock.

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