AERIAL PHOTOGRAHY WITH THE NAVY AND MARINE CORPS

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Early History

WAR destroys! It destroys lives and material resources, but out of each war some benefits are salvaged. Aviation and Aviation Photography are benefited as war provides an opportunity for the demonstration of inherent values.

Photography under the Navy Aeronautics Organization was only in its infancy when World War I was declared. Two or three poorly designed aerial mapping cameras had been tested and found unsatisfactory. A hand-held aerial camera had been developed, tested and found suitable for current requirements, and a recommendation had been submitted to the Navy Department for the construction of a roll-film mapping camera. This recommendation was submitted after oblique exposures had been made from a hydroaeroplane at Pensacola with a privately owned Kodak, and a strip mosaic assembled from overlapping prints.

No aircraft mapping cameras were available until some time after the Naval School of Photography had been established at Miami early in 1918, and the first group of students graduated. For training purposes, a Graflex press camera was fitted in an improvised mount and exposures made through an opening in the bottom of the fuselage of a twin pontoon seaplane. The lens was locked at the proper focus and exposures made and plates changed at predetermined intervals. Photographic mosaics were assembled from prints made from these 4 by 5 inch plate negatives. Later the "L" type mapping camera was manufactured and made available. This also accommodated 4 by 5 inch plates and was a step forward, but the camera had many idiosyncrasies and mechanism jams were frequent.

World War I boosted the stocks of Aviation and Aerial Photography considerably. Soon after the Armistice was signed, the late Admiral N. E. Irwin, Director of Naval Aviation, told a class of midshipmen and officers of the Naval Academy that aerial photography was one of the most valuable developments resulting from the war. But aerial photography still had many rough and rugged roads to travel.

The Interdepartmental Committee on Aerial Surveying was organized through the initiative of the National Advisory Committee for Aeronautics and held its first meeting on May 2nd 1919. Its purpose was to bring representatives of the Army Air Service, Naval Aviation and Governmental Departments, interested in mapping, together to determine the application and possible value of aerial photographs to mapping and chart compilation, to improve equipment and devise suitable procedures. Immediately following the first meeting of this committee, both the Army and Navy undertook experimental mapping in the vicinity of Atlantic City, N. J., for the U.S. Coast and Geodetic Survey. Later Naval Photographic units photographed sections of Cuban Coastline for the Hydrographic Office of the Navy Department, the Mississippi River Delta for the U. S. Coast and Geodetic Survey, approximately 25,000 square miles of terrain in Alaska for the departments of Interior and Agriculture, and various other projects.

Gradual improvements were made in the equipment utilized and methods

employed, but this movement forward was slow and often discouraging due to the limited funds made available for photographic equipment and lack of aircraft suitable for photographic mapping. Considerable progress had however been made prior to 1934 when the American Society of Photogrammetry was founded.

1934–1944, A Decade of Activity And Progress

Photographic Services for the Hydrographic Office

During the past ten years a considerable volume of aerial photographic work has been accomplished by Naval and Marine Corps Aviation Units for the Hydrographic Office of the Navy Department. Approximately 40,000 photographs have been made of terrain in North, South and Central America, of Caribbean areas, and in the Aleutian Islands. These photographs, embracing areas totaling over 100,000 square miles, have been used in connection with the compilation of Hydrographic Office Navigational and Air Navigation charts and coast Pilots and Air Pilots publications. Approximately 25,000 photographs, embracing terrain in Pacific areas totaling 20,000 square miles, have been used in connection with reconnaissance mapping.

Photogrammetric Equipment and Technique in Use by the Hydrographic Office

At the time of the founding of the American Society of Photogrammetry in 1934, the Hydrographic Office was compiling topographic information from aerial photographs for Nautical and Aeronautical Charts by using "Overlay radial method." The general types of cameras used were the old K-3B, $8\frac{1}{4}$- or 12-inch focal length lens, and the T-3A five-lens. The photogrammetric equipment was a simple mirror stereoscope (the old Smith type) and a parallax bar for spotting heights on stereoscopic pairs of photographs by measuring differential parallax. The "spot" heights were then used as a guide for sketching form lines on the photographs from under a stereoscope.

Gradually the overlay radial method for controlling the photographs has been replaced by the use of slotted templets, metal templets, or hand templets, depending on the type of photography, the amount of control, and the accuracy required. In all the survey areas, the Hydrographic Office specified that a K-17, 6-inch metrogon lens, or a 12-inch lens camera will be used. However, the Office has to be, and is prepared to use any type of photograph coming in from the different war theaters. The parallax bar which is used to obtain form lines from vertical aerial photographs has been replaced by the stereocomparagraph which in turn is being replaced by the KEK plotters. Other photogrammetric instruments in use at the Hydrographic Office at the present time include the Saltzman reflecting projectors, a very good grade of mirror stereoscopes such as Fairchild F-71 and Rykers M-11 photoalidades for use in oblique mapping, as well as rectoblique plotters, oblique stereoscopes, and photo-angulators for trimetrogon mapping.

The plans for the future are to continue the present method of using vertical, obliques, and trimetrogon photographs and to utilize the equipment now available, supplemented by a multiplex in order to obtain vertical control for the KEK plotters. The multiplex that the Hydrographic Office has in mind is one with a 14-foot bar taking 20 projectors.

Miscellaneous Services

In addition to work accomplished for the Hydrographic Office, aerial photographs have been made by Naval and Marine Corps Aviation Units for the

Department of Justice, the Maritime Commission, the Army, the Marine Corps, the various bureaus of the Navy department, and miscellaneous activities as required within the several Naval Districts. To this, of course, is added the vast volume of aerial photography now being accomplished by photographic squadrons and various photographic units for the Naval and Military commands in combat areas.

Undoubtedly photogrammetry will have an important role in the rehabilitation of war torn areas, and Naval Aviation may be called upon to do its part in this constructive work.

Photographic Equipment

There has been close cooperation between the Army and Navy in matters relating to the design and procurement of photographic equipment. Due to this fact and the greatly increased volume manufactured, the cost of aircraft cameras and many items of equipment has been cut almost in half.

The "F-56," a combined aircraft mapping and oblique camera was developed by the Navy and is the result of several years of research, study, and service tests. It is available in focal lengths ranging from $5\frac{1}{4}$ inches to 40 inches. The negative size is 7 by 7 inches and the camera accommodates roll films up to 200 exposures. Cameras of this type are now available with practically all Naval and Marine Corps Aviation Photographic Units.

The small "K-20" hand-held oblique camera is used extensively by both the Army and Navy and was derived from the "F-48" camera developed by the Navy.

Some types of cameras developed by the Army are now being used extensively by Naval and Marine Corps Aviation Units in combat areas.

In order to increase the accuracy of aerial photographs made by Naval and Marine Corps units for photogrammetric purposes, a precision mapping camera is being procured by the Photographic Division of the Bureau of Aeronautics. This camera will have an immediate war time value but will also increase considerably the value of aerial photographic mapping to be accomplished by the Navy after peace time operations have been resumed.

Experiments

Research and development work is constantly being accomplished for the improvement of equipment, supplies, and photographic technique. Considerable progress has been made by the Army, Navy, and the manufacturers in color and three-dimensional photography.

A few years ago, it was necessary to send color film to the manufacturers for processing. Today, as the result of extensive research, color film can be processed by photo units in the field. Use of color filters, and film that distinguishes between the cholorophyll green in green paint and the natural green of foliage, breaks down enemy camouflage. Camouflage may fool a pilot so he hesitates too long in that split second for bomb release, but it cannot fool the camera's eye.

Training

The increased number of airplanes made available for the School of Photography at Pensacola has added considerably to the flight time of each student and thereby greatly increases his knowledge and improves his aerial photographic technique prior to graduation.

Photographic Squadrons and many Naval and Marine Corps Air Stations provide valuable additional training in aerial photography. Schools are con-

ducted for the training of pilots in remote control photography and advance training is provided for color and three dimensional photography, aerial photographic interpretation, and photo-lithography. All photographers flying in combat areas are also required to be thoroughly trained in aerial gunnery.

Combat Aerial Photography and Photographic Interpretation

An officer from the Bureau of Aeronautics visited England in 1941 and studied British methods relating to aerial photography and photographic interpretation, and engaged in actual operational work with the RAF. Upon his return to the United States, he directed the establishment of a school of Aerial Photographic Interpretation at the Naval Air Station, Anacostia, D. C. The school's first classroom was a lean-to built against a hangar.

One of the difficulties encountered during the early days of the school was the shortage of instruments. This condition was soon corrected and the school well equipped for the work required.

Officers in the photo interpretation school are taught to read maps, to identify aircraft and ships of all countries, to recognize types of enemy equipment, transportation systems, industrial installations, and other subjects likely to be encountered in a photograph of enemy territory.

If, for instance, a photograph of a bomb-blasted aircraft factory turns up, the photo interpreter first must recognize it as an aircraft factory, next be able to tell whether the damage will cause a shut-down for several weeks, or if repairs can probably be effected and operation resumed within a matter of hours or a few days.

Railroad systems must be thoroughly understood so that troop movements can be detected. Harbor capacities must be known in order to determine the potential size and strength of any force the enemy might choose to assemble. This type of detection also applies to airfields.

Before the campaign started at Munda Point in the South Pacific, a reconnaissance flight was made with no expectation of finding military activity there. However the photographs brought back showed that there was work going on in the midst of an innocent looking cocoanut grove under the coverage of the trees. Only two bare spots were visible through the trees, but they were sufficient to arouse the suspicion of the interpreters, and more photographic coverage was ordered. Within a week, our interpreters were able to tell positively that the Japs were building an airfield on Munda Point.

Before the Navy undertakes any amphibious operation, photographers are sent on reconnaissance flights. Beaches and surrounding terrain are photographed and the photographs carefully studied to determine the slope of the beach, approximate depth of water, the location of underwater obstructions, pill boxes, machine gun nests and general obstructions which may be encountered by landing forces.

Speedy fighter-type reconnaissance planes often follow close on the heels of bombers to record the damage to enemy installations.

When aircraft return from a photographic mission, the film magazines are often out of the plane before the engines die. The films are quickly processed and prints made immediately for the scrutiny of photo interpreters and transmission to all interested commands.

A large percentage of the photographs used for interpretation are produced by the Navy's photographic squadrons. Each squadron has several hundred officers and enlisted men, "B-24s" and fighter-type planes.

"B-24" photographic planes carry four cameras installed in the bomb bay In addition others may be used on each side for making oblique photographs Fighter-type planes carry fixed cameras which are operated by the pilot through remote control.

An officer who had been in command of an active unit in the South Pacific was recently in the States for a rest. He was asked what he thought of photographic interpretation. "It isn't a question of whether we like it or not," he said. "We never move without it."

Photo reconnaissance is a fascinating game of hide-and-seek and means much to our operating forces. Indicative of the Navy's high opinion of this activity and the ability and courage of the personnel involved, was the award of twenty-nine medals last fall to the members of a single photographic squadron.

Aerial mapping and reconnaissance photography is proving its worth in World War II, and, undoubtedly, the experience gained will work to the considerable advantage of Photogrammetry after all battles have been won and Peace takes over again.